

Article

Exploring Vulnerability Indicators: Tourist Impact on Cultural Heritage Sites in High Arctic Svalbard

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Abstract: This article reports findings from two research projects that aimed to understand the vulnerabilities of cultural heritage sites in Svalbard and investigated factors that influence tourism-induced pressures and site degradation. It draws upon fieldwork conducted at ten selected historic locations, including interviews with tourists and guides, consultations with regional and central cultural heritage management authorities, on-site observations, and condition assessments. The primary goal was to explore indicators rendering cultural heritage sites susceptible to the impacts of tourism and human visitors. These indicators were common denominators and encompassed the sites' physical state/degree of decay, legibility, accessibility, and quantity and quality of objects at the sites. This article seeks to enhance the understanding of these sites' vulnerabilities and provide insights for effective heritage site management and sustainable tourism development. The principal findings highlight key factors contributing to cultural heritage sites' vulnerability. These factors encompass intensity and frequency of visitor traffic, suboptimal visitor management strategies, tourists' limited awareness of proper site behaviour and conservation practices, and restricted resources for site maintenance and protection. These findings can guide policymakers, site managers, and tourism stakeholders in formulating strategies to balance tourism promotion with site conservation, ensuring the long-term preservation of cultural heritage in this unique and vulnerable environment.

Keywords: cultural heritage; heritage site conservation; High Arctic Svalbard; sustainable tourism; tourism; visitor management; vulnerability



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1. Introduction

Since 1925, Svalbard has been under Norwegian jurisdiction, transitioning from being international “common ground” [1]. This Arctic Archipelago exhibits no traces of an indigenous population. Rather, over the past 400 years, the archipelago served as a location where Russian, Western European, and American hunters, scientists, adventurers, and industrial stakeholders extracted resources and resided for varying durations [1]. Consequently, the present-day cultural environments are acknowledged as part of international cultural heritage [2]. Hunting and mining served as prominent activities and permanent settlements emerged in the early 20th century with the initiation of large-scale coal mining by Norway and Russia. The Svalbard Environmental Protection Act automatically safeguards all structures and artifacts tied to human activity preceding 1946 [3] (§ 39). The limited spectrum of activities on Svalbard has resulted in distinct typologies of conserved cultural heritage. Presently, approximately 2200 cultural environments, which house historical remnants predating 1946, benefit from automatic protection under the

Svalbard Environmental Law [3] (§ 39). These cultural environments represent historical epochs, each of which is characterised by unique features [1,2]. Vulnerable remains of blubber processing equipment and numerous graves containing wooden coffins and human osteological traces testify to the presence and activities of European whalers (app. 1600–1750) [1,2]. In the next two historic periods, Russian trappers (app. 1700–1850) and Norwegian trappers (app. 1800–ongoing) wintered for fur hunting. From these periods, various small Russian and Norwegian fur hunters' cabins can be found randomly scattered throughout the archipelago, ranging from ruins to fully functional structures [1,2]. The hunters also left behind graves, fox traps, and self-shooting mechanisms designed for polar bears. Commencing in the late 1800s, industrial endeavours, primarily mineral extraction, engendered numerous substantial facilities [1,2]. These encompass remnants of edifices, expansive cable car systems, remnants of mine tramways, mountainous mine tunnels and infrastructures with mine portals and surface installations, coal-sorting infrastructures, and voluminous coal silos. The logistical aspects of transportation to and from Svalbard were characterised by a diversity of challenges, marked by brief and frenetic seasons. Due to small deposits and low earning potential, the economic viability of numerous projects was compromised. Disassembly and transportation costs often exceeded the residual value of equipment, causing the forsaking of facilities and equipment on site [2].

Scientific research and adventurous expeditions have left cultural imprints that are currently evident in activity-marked base camps [2]. One example is Virgohamna, where remnants from the Andrée and Wellmann expeditions aiming for the North Pole using a balloon lift and an airship are displayed. This site showcases environments with remains of the hot air balloon house and airship hangar, in addition to gas production equipment, including iron filings and huge amounts of construction materials. Ny-Ålesund, which is another example evolving from a mining town to a research hub, has been a pivotal base for significant expeditions, leaving lasting traces, including the airship mast used by Amundsen, Nobile, and Ellsworth in their historic North Pole journey [2].

These historic remnants often constitute the primary attraction at visitor sites, capturing attention and recounting captivating tales of human resilience in harsh conditions [4,5]. The cultural remains endure significant impacts from the Arctic's rugged climate and physical environment, further exacerbating their vulnerability to contemporary human use. Restoration risks compromising their authenticity, while neglect would inevitably lead to their disappearance over time.

Tourism in Svalbard began in the late 1800s following Arctic exploration, but for a long time, visitor numbers remained low [6]. However, the modern tourism industry initially took shape in the late 1980s. From 1990 onwards, the Norwegian government has actively prioritised tourism development, leading to substantial growth in commercial activities and tourist numbers [2,7–10]. Apart from the two pandemic years, the growth has been significant in the last 10–15 years. Thus, the pressure on vulnerable cultural heritage sites has increased, amplifying the degrading effects of climate change [9,11]. The number of visited sites has also risen in this period [11,12]. As the historic sites are amongst the most popular landing sites in the Archipelago, the combination of impacts from tourism and climate change degrade the historic remains at an ever-increasing pace [13–15]. With this increase, significant European cultural heritage is affected. Presently, the visitors leave visible traces of impact on the heritage sites. If this trend continues, important cultural heritage values will be lost [5,14,16].

While vulnerability assessments are common in heritage conservation, there is no standardised methodology specifically designed to assess the risks and vulnerabilities of cultural heritage sites due to visitors [4,14]. To implement effective measures, it is crucial to understand the factors that contribute to the degradation of cultural heritage sites by tourists [17]. Identifying what makes these sites vulnerable to visitor impacts serves as a fundamental basis for evaluating and implementing appropriate interventions. Despite ongoing research, the key indicators accurately describing the vulnerability of historic sites to human use, traffic, and visitor activities remain indistinct [18].

The literature acknowledges that cultural heritage sites are recognised as tourist attractions, and their values are appreciated by the public, i.e., [14,19–21]. However, on Svalbard, it appears that most tourists are primarily interested in experiencing the natural environment and wildlife, with cultural heritage sites being secondary attractions [4,7]. The visits to these sites have resulted in pronounced wear and tear, prompting the implementation of various management measures [4,5,8,14,22]. Previous research conducted in the field has explored the consequences of heritage-based tourism on socio-cultural, physical, and economic environments, i.e., [4,5,14,23–25]. Furthermore, studies in the High Arctic and Antarctica have examined changes in heritage sites over time, considering both cultural and natural processes, i.e., [13,15,26–35]. However, many historic sites in these regions remain unmanaged and are gradually deteriorating [8,34,36]. Despite the efforts to protect and manage cultural heritage sites, some of the suggested or implemented measures have faced opposition and challenges from local communities and the tourism industry [4]. Partly, the criticism pertains to the fact that the management is based on the precautionary principle and is not sufficiently knowledge based.

Sánchez-Hernández and Maldonado-Briegas [37] examined the debates on the preservation and advancement of rural areas. They observed that natural resources, which are now recognised as a crucial driver of creative development, are confronted with the challenges posed by emerging commercial initiatives, potentially jeopardising the sustainability of the region.

As stated by Butler [38], the task of restraining the volume of tourism is challenging and unlikely to be achieved. Instead, Butler [38] proposed a solution that involves shifting the emphasis from attempting to alter tourism patterns to enhancing the resilience and long-term sustainability of fragile areas.

García-Hernández et al. [39] contemplated the prospects and constraints associated with addressing over-tourism through the implementation of capacity management strategies. This involves not restricting the number of visitors, but rather adopting measures to effectively manage the influx of tourists. Dragovich and Amiraslani [40] discussed how high visitor numbers can lead to increased deterioration, emphasising the crucial role of managing historic sites, especially in the context of tourist interest and the subsequent risk of accelerated degradation of cultural heritage.

In Svalbard, Norwegian authorities have, in various parliamentary reports, consistently emphasised that the cultural heritage of the archipelago should be preserved as integral parts of its wilderness nature and as valuable glimpses into Svalbard's cultural-historical development [41–45]. Furthermore, ambitious goals have been set for environmental management, aiming to maintain the best-managed wilderness (including cultural heritage sites) in the world. Concurrently, there is a clear objective to enhance tourism as a key element of Norway's presence in the archipelago. These conflicting goals impose high demands on the management of both tourism and cultural heritage sites.

According to Akova et al. [46], a broader exploration of the socio-cultural impacts resulting from tourism development is imperative to comprehend sustainable tourism in heritage sites. Hagen et al. [4] emphasised the need for increased knowledge to effectively address management challenges and highlight the necessity of developing criteria to assess site vulnerability. Furthermore, Alazaizeh [47] pointed out that more attention should be given to the role of interpretive tour guides in promoting sustainable behaviour, especially in cultural heritage sites. However, when guides themselves lack understanding or prioritise other aspects over cultural and natural values, they may not adequately prepare visitors for the preservation of vulnerable cultural heritage sites [4].

Our analysis related to and further developed this ongoing discussion by taking inspiration from a triparted set of theoretical approaches: cultural heritage management, visitor impact, and conservation theories, as shown in Section 2.

Based on this background and previous and ongoing research, the main aim of this study was to identify key vulnerability indicators for cultural heritage sites prone to visitor impacts. This was achieved through the following sub-objectives:

1. To map and analyse visitor behaviour at the sites;
2. To understand and analyse the reasons behind their behaviour;
3. To assess the visible signs, traces, and damage caused by this behaviour to the cultural environments.

The findings were analysed to identify the main common indicators across the sites and to collate the interview findings with the observations of the visitor's behaviour. By accomplishing these objectives, the findings will contribute to the understanding and future administration and management of Svalbard's cultural heritage. In addition, the results have transfer value for other vulnerable heritage sites worldwide. This encompasses vulnerable cultural heritage sites facing similar challenges to those in Svalbard, such as indigenous cultural sites, industrial heritage, and small and inconspicuous sites. Ultimately, this research sought to fill the existing knowledge gaps and provide insights into the preservation and sustainable management of cultural heritage sites in the face of increasing tourism.

2. Theoretical Framework

Deriving the theoretical framework for the study of what makes a cultural heritage site vulnerable to visitors involved identifying the key concepts, theories, and perspectives that guided the investigation. It is self-evident that the susceptibility of tourism at cultural heritage sites is context-dependent and contingent upon a complex interplay of variables. Drawing inspiration from various perspectives, a multi-tool for theoretical triangulation was employed to comprehend the intricacies of tourism vulnerability. This cross-theoretical perspective allowed for a multilevel analysis that spanned from the material/natural to the socio-cultural. It was not the intention to probe the theoretical debates in each of the theoretical perspectives. They are described at an overall level and used practically in accordance with the conditions given by the data material. This framework encompasses relevant theories such as heritage management, visitor impact, and conservation theories. It served as the lens through which the vulnerability of cultural heritage sites was examined, allowing for conceptualising and interpreting the factors contributing to their susceptibility to visitor-related issues.

2.1. Cultural Heritage Management

Cultural heritage management involves organised efforts to preserve the cultural significance of heritage assets for the benefit of current and future generations [19]. The primary objectives of cultural heritage management in Svalbard are outlined in management plans [2,8,48] and white papers [41–45] aiming to safeguard a diverse collection of both physical and intangible heritage for future generations. This includes the conservation and protection of heritage values, with the intention of making most assets accessible and interpreted for the public [8].

Cultural heritage management theories play a critical role in guiding practitioners, policymakers, and researchers to make informed decisions that ensure the preservation, sustainable use, and meaningful interpretation of cultural heritage for present and future generations. Such informed decisions encompass how to safeguard and utilise heritage sites, artifacts, and traditions, and include the following: Sustainable cultural heritage management, as described by Job et al. [49], involves evaluating and overseeing the level of change that a cultural environment can withstand without jeopardising its essential heritage values. It also entails establishing thresholds for acceptable change [17]. Values-based heritage management involves recognising a wide spectrum of values and stakeholders that should be considered within the realm of conservation practice [50]. Sustainable visitor management means assessing how many visitors can be accommodated before significant heritage values are compromised or lost, as outlined by Alazaizeh et al. [47]. Balancing preservation and use encompasses theories that tackle the dilemma of safeguarding cultural heritage while enabling its meaningful utilisation and appreciation, as discussed by

Carter et al. in [51]. They explored how to strike a balance between preservation objectives and the potential benefits of tourism, education, and community engagement [17].

2.2. Visitor Impact

The impact of visitors on cultural heritage sites is examined through the lens of theories related to behavioural studies. This provides a significant understanding of how tourism influences the site's surroundings, both physically and socially, along with how visitors engage with cultural heritage elements and information. Additionally, it might shed light on the roles of guides within the group in informing, leading, and overseeing tourists.

The theory of reasoned action (TRA) and the theory of planned behaviour (TPB) are psychological models that aim to explain and predict human behaviour by considering individuals' attitudes, beliefs, and intentions [52,53]. The TRA suggests that people are more likely to engage in a behaviour if they view it positively and if they believe that important people in their lives also support it. The TPB seeks to explain and predict human behaviour by considering the roles of beliefs, attitudes, intentions, and perceived behavioural control [54]. In addition, the TPB also incorporates the concept of behavioural intention, which describes an individual's willingness to perform a specific behaviour.

In the context of cultural heritage and sustainable tourism, these theories can help us to understand and predict visitors' behaviours, such as whether they will follow guidelines to protect cultural sites or engage in environmentally friendly practices. By identifying and addressing the factors that influence intentions, interventions can be designed to encourage more responsible and desirable behaviours among tourists.

2.3. Conservation Theories

Authenticity and heritage values, as highlighted by Avrami et al. [55], are crucial for preserving cultural heritage. The emphasis on value categories in heritage preservation has deep roots in scholarly traditions and expertise [56]. These discussions aim to link conservation values with societal values for informed decision making rather than creating rigid categories. Authenticity in cultural heritage refers to considering the true essence of sites, artifacts, and experiences when assessing their remaining originality [57,58]. However, authenticity varies depending on the context. The Venice Charter [59] originally focused on material culture, while post-modernism highlighted the anthropological aspect, broadening the definition of cultural heritage. The Nara Document on Authenticity [60] acknowledges diverse cultural perspectives and serves as a guide for heritage conservation decisions. In summary, authenticity is context-dependent, requiring individual assessment for each object [55,61].

Cultural heritage values are clarified to prioritise the most significant ones for conservation and management [55]. Due to the automatic preservation date limit set on 1 January 1946, in the Svalbard Environmental Act [3] (§ 39), a larger proportion of younger cultural heritage sites in Svalbard are automatically protected compared with other areas [2]. As a result, value assessments are primarily used for prioritising actions on already protected sites and individual elements, with the governor defining the primary cultural heritage values as historic value, source value, and experiential value [2,8,48].

When the concept of heritage value and authenticity was developed by pragmatic theorists in the late 19th century, the focus was primarily on grand architecture and how it should be treated in conservation and preservation efforts [62]. However, Svalbard's cultural environments cannot be described as grand architecture; instead, they consist of modest "everyday buildings", ruins, foundations, and industrial heritage. Drawing on Laurajane Smith's perspective, which emphasises treating cultural heritage as a "cultural process" rather than an object [63] (p. 44), it is still possible to establish an approach to Svalbard's cultural heritage rooted in theories of authenticity and heritage values. Understanding the value of Svalbard's cultural environments, along with their perception by visitors, is based on the theory that these environments hold both tangible and intangible values, including their unique essence known as "genus loci" [64]. Thus, in this article,

heritage values and authenticity are foundational factors underpinning assessments and discussions about the vulnerability and preservation of cultural environments.

3. Materials and Methods

To reveal the vulnerability indicators, a set of methods were combined. The analysis is based on a combination of case studies, with documentation; assessments of the sites' conditions; and interviews and observations of tourists, guides, locals, and researchers at the sites. These approaches were chosen to provide a comprehensive understanding of the sites and their dynamics, enabling a deeper exploration of their cultural significance and vulnerability. Each method provided different perspectives, allowing for method triangulation to support the validity of the findings.

To gather data on the factors affecting tourism-induced pressures and site degradation, a selection regarding which cultural heritage sites to study and who to interview was performed. The selection aligned with the process of "casing", which involves anchoring the study to one or more cases [65]. This ongoing process aimed to provide a comprehensive understanding of both the empirical and conceptual cases, such as the Cultural Heritage Sites and vulnerability indicators. We explored the primary case of "Cultural Heritage Sites vulnerability" through ten sub-cases or "embedded mini-cases" [66] (p. 451). Information from these individual sites offered insights into their vulnerability. This approach aligns with the idea that including atypical cases can provide valuable additional information rather than focusing solely on typical cases that offer little or no new insights [66] (p. 451).

3.1. Case Sites

Ten sites were selected for the study (see Figures 1 and 2 and Table 1). The sites were selected in collaboration with the governor based on statistical data regarding visitor sites and the number of tourists disembarking [9,12]. The chosen localities were among the most frequently visited. Other key criteria included the requirement that all case localities should be automatically protected under the Svalbard Environmental Protection Act [3] (§ 39). Further, the sites needed to be among the 100 high-priority cultural environments selected by the governor to undergo regular inspections. The sites were chosen to represent all historical epochs characterising Svalbard's cultural history, encompassing both expansive cultural environments featuring numerous individual structures and artifacts and smaller, uncomplicated cultural settings characterised by only a few individual structures. Given the dispersed nature of these localities across the archipelago, considerations were also given to their accessibility and the ease or difficulty for the research team to reach the various sites.

The sites were documented before and after visits. The factors contributing to site vulnerability were explored through interviews and field observations of visitors (see Table 2).

The Governor's Office tracks cruise ship activities [67]. Data indicate that Longyearbyen is a frequent destination for all cruise ships, with many of them visiting landing sites on the west coast of Spitsbergen. Most tourists exploring numerous sites across the archipelago opt for small-to-medium-sized cruise ships accommodating 12 to 500 passengers [67]. Considering this information, ten specific locations were identified within these areas based on visitor statistics provided by the Governor's Office [9]. Important criteria also included selecting sites with various characteristics, encompassing different historic periods, both large and small sites, sites with numerous details or remains, sites containing what may be perceived as "trash", sites with wooden remains, and sites in both good condition and a state of decay. Additionally, the selection process encompassed sites that were assumed to be difficult to perceive as cultural remains (see Figure 1 and Table 1).



Figure 1. Map displaying the case sites. All sites are automatically listed according to the Svalbard Environmental Protection Act [3] (§ 39). Map based on Norwegian Polar Institute.



Figure 2. Gnålodden at Hornsund on southwest Spitsbergen in Svalbard was the southernmost case site. The small hunter's cabin, which was erected sometime before 1935, is automatically protected and signifies a historic site. This cabin is a highly typical cultural heritage site in the archipelago. Photo: Anne-Cathrine Flyen.

Table 1. Case study sites: all automatically protected as cultural heritage, all amongst the 100 high-priority cultural environments on the archipelago, as defined by the governor, and set to undergo regular inspection [16] The sites were all situated on Spitsbergen, the largest island of Svalbard archipelago (see map Figure 1).

Site Name and Geographical Location	Site Type/Original Function	Site Description and Official Management Regime	Original Occupation Period	Current Function
Gnålodden, Hornsund Information is sourced from [68] (pp. 93–94), [8,69]	Norwegian wintering hunting station. Winter trapping and hunting of fur animals including polar bears, Arctic foxes, and Svalbard reindeer.	The hunting station consists of a small wooden cabin and a gangway for pulling up boats. Nearby are also remnants of a Russian trapping station, with a grave and a low mound with wooden remains from the lower part of a cabin. The cabin is periodically utilised by researchers and receives maintenance to a certain extent, which is governed by the Norwegian state as the owner.	1919–1969 (approx.)	Cultural heritage site.
Bamsebu, Van Keulenfjorden Information is sourced from [8,69]	Norwegian hunting. Summer hunting of beluga whales.	A trapping station comprising a small wooden cabin, the ruins of a small shelter constructed from an arched wooden boat, a small outbuilding, and significant quantities of skeletal remains from beluga whales. The cabin is privately owned, regularly utilised, and maintained as part of the owner's regular care.	1930–?	Private cabin.
Longyearbyen Adventfjorden Information is sourced from [8,70]	Mining/coal-mining city.	A historic mining town with historical remnants of 8 abandoned coal mines and their coal transportation system. Remains also include foundation traces of old Longyearbyen, which burned down during WWII. Some of these remnants are automatically protected, while others are legally safeguarded under the Svalbard Environmental Act. The town was gradually constructed as new mines opened, and the current layout of the city reflects this history. Presently, it is a contemporary community with a single operational coal mine closing down in 2025. Some protected buildings are in use and are regularly maintained. However, most protected structures in the city are not in use. A few of these are maintained, while others are abandoned and allowed to degrade naturally over time. All the protected structures except one building within the city are owned by the state.	1905–d.d.	"Capital" of Svalbard.
Hiorthamn, Adventfjorden Information is sourced from [71]	Mining/coal-mining city.	Old coal mining town with 19 remaining structures and remnants of the cableway system (which served as the coal transportation method), including the cableway station. The mine itself is located high up in the mountains. Today, several of the old buildings are privately owned and used by the locals in Longyearbyen as holiday homes. The privately owned cabins are maintained by their owners. Other structures and facilities are owned by the state. Some of these structures undergo maintenance, while others are intentionally left to undergo natural decay at their own pace.	1917–1921 and 1938–1940	Cultural heritage site. Partly holiday homes.
Russekeila, Adventfjorden Information is sourced from [8,72]	Russian and Norwegian hunting stations. Winter trapping and hunting of fur animals including polar bears, Arctic foxes, and Svalbard reindeer.	Remains of a Russian hunting station, including a vast complex of low mounds with wooden remains from the lower part of cabins, several graves, and remnants of a Russian cross. Nearby is also a wooden Norwegian trapper's cabin. The cabin is currently utilised and maintained by the Longyearbyen Hunter and Fishermen Association. The historical remnants of the Russian trapping station have been entrusted to nature and are intended to undergo natural degradation at the pace of natural processes.	Russian: 1650–1750 (approx.) Norwegian: 1914–d.d.	Cultural heritage site. Cabin used for private fishing.
Ny-Ålesund, Kongsfjorden Information is sourced from [68,73]	Mining/coal-mining city.	Old coal-mining city, with historic remains from several coalmines, all of which are deserted. The largest preserved cultural environment in Svalbard and features 29 automatically protected wooden structures and numerous remnants of the coal mining era's infrastructure. Today, it serves as an international research community that has expanded the town as required while also utilising several of the protected buildings. The research community is run by the Norwegian state-owned Kings Bay AS and Norwegian Polar Institute. Most of the preserved buildings are in use within the research community and undergo regular maintenance, whereas the mining area is not operational and will naturally decay at its own pace.	1916–1929 and 1945–1963	International research community.

Table 1. Cont.

Site Name and Geographical Location	Site Type/Original Function	Site Description and Official Management Regime	Original Occupation Period	Current Function
London, Kongsfjorden Information is sourced from [8,69]	Mining/marble mining establishment.	A small mining town established for marble extraction. The facility currently comprises two residential houses; six building foundations; rail track traces; a blacksmith's shop; a workshop building; and remnants of a machinery hall with steam boilers, a traction engine, and the marble quarry. Currently, the cabins are used by the Governor and by locals in Ny-Ålesund. The two cabins undergo regular maintenance, while the remainder of the facility is left to undergo natural decay, gradually decomposing at the pace dictated by natural processes.	1911–1920	Cultural heritage site. The cabins are used for recreation and security surveillance.
Gravneset, Magdalenefjorden, north-western Spitsbergen Information is sourced from [74]	Cultural environment with a whaling station and burial ground from a whale-hunting period. Summer hunting of bowhead whale.	Gravneset holds four blubber ovens and one of the largest whaling-era burial grounds in Svalbard. Dating from the 17th and 18th centuries, this area holds almost 130 graves. Also, four building foundations were identified, probably linked to whaling in the 17th and 18th centuries. Remarkably popular among tourists since the 1800s, this spot is Svalbard's top non-settlement tourist destination. No measures are taken beyond the installation of temporary fences during the summer season to prevent tourists from accessing vulnerable elements.	Ca. 1600–1750	Cultural heritage site.
Virgohamna, Danskøya, north-western Spitsbergen Information is sourced from [8,75]	Cultural environment with a whaling station, expedition sites, and wintering.	Mixed site with a diverse history and historic remains from Dutch whaling, the first wintering tourists in Svalbard (Pike's House), and the scientific and adventurous basecamps of Andrée and Wellman from their attempts to reach the North Pole. Within this location lie blubber ovens, graves, the wooden beams from Pike's wintering house and ruins, and a substantial number of materials and objects left behind from the expeditions. No actions are taken beyond the implementation of an existing information system with designated paths aimed at directing tourists away from the most vulnerable parts of the site.	1630–1660 (approx.) 1888–89: Pike's House 1896–1897: Andrée's basecamp 1906, 1907 and 1909: Wellman's base	Cultural heritage site.
Smeerenburg, Amsterdam-øya, north-western Spitsbergen Information is sourced from [8,74]	Cultural environment with a whaling station and burial ground from a whale-hunting period. Summer hunting of bowhead whale.	Smeerenburg was the most crucial whaling station for the Dutch. In 1928, there were eight blubber ovens recorded (today, only seven remain: six double ovens and one single), along with 19 house foundations and 101 graves. No measures are taken.	Ca. 1600–1750	Cultural heritage site.

Table 2. Semi-structured interviews were conducted on site with groups of tourists and with individual tourists and guides in depth. Observations were conducted on site. Semi-structured interviews were also conducted with stakeholders off site.

Site	Observations	Interviews with Tourists	Interviews with Guides
Gnålodden	2 groups, 25 persons each	In depth, individual: 4 persons Group: 2 groups, 5 + 7 persons	In depth, individual: 3 persons
Bamsebu	2 groups, 25 persons each	In depth, individual: 1 person	
Russekeila	1 group, 3 persons	In depth, individual: 1 person	In depth, individual: 3 persons
Hiorthhamn	2 groups, 5 + 4 persons	In depth, individual: 1 person Group: 1 group, 5 persons	
Longyearbyen	23 groups, 2–10 persons (total 115 persons)	In depth, individual: 2 persons Group: 14 groups, 2 × 4 + 1 × 3 + 11 × 2 persons	
London	7 groups, 12–23 persons (total 135 persons)	Group: 1 group, 7 persons	In depth, individual: 1 person
Ny-Ålesund	5 groups, 25–75 persons (total 225 persons)		In depth, individual: 1 person
Gravneset	3 groups, 52 + 5 + 47		
Virgohamna	10 groups, 14 + 13 + 13 + 12 + 12 + 12 + 12 + 12 + 12 + 11		
Smeerenburg	5 groups, 32 + 30 + 25 + 25 + 24		
In total	950 persons	In depth, individual: 7 persons 18 groups, 57 persons	8 persons

Table 2. *Cont.*

Site	Observations	Interviews with Tourists	Interviews with Guides
Organisation		Interviews, individual	Interviews, group
The Directorate for Cultural Heritage		In depth, individual: 3 persons	
The Governor of Svalbard		In depth, individual: 3 persons	In depth, group: 1 group, 2 persons
Kings Bay AS			In depth, group: 1 group, 2 persons
Polar Institute			In depth, group: 1 group, 2 persons
Store Norske Spitsbergen Kullkompani		In depth, individual: 1 person	
Visit Svalbard		In depth, individual: 1 person	
Isfjord Radio		In depth, individual: 1 person	
In total		9 persons	3 groups, 6 persons

3.2. Data Collection

Single elements and cultural artifacts within the sites and the surrounding environments were extensively photographed to document the sites and physically compare the situations before and after the visits. Traces on the ground around remains and ruins indicate that these areas had been frequently visited, thus thorough documentation of these areas was prioritised. Additionally, simple sketches were created.

To assess the condition of the cultural heritage, structural evaluations, material analyses, and deterioration assessments were conducted. The physical integrity of buildings and structures was evaluated by examining the overall structural stability, including load-bearing elements, connections, joints, and foundations. The structures were additionally examined for wood-weakening fungal decay. The inspections involved visual observations, gentle probing with a small awl, and the use of a decay-detection tool, which measures resistance by drilling into wood to identify decay or rot. Ruins, wooden building foundations, and remnants of wooden structures were visually and manually assessed for their ability to withstand visitor's foot traffic.

The factors contributing to site vulnerability were explored through field observations and interviews with visitors and guides (see Table 2). Semi-structured interviews were also conducted with stakeholders (see Table 2).

All interview subjects contributing to this article were presented with an information letter explaining the purpose of the interview. Additionally, they agreed to the utilisation of the interview findings within the research in an anonymised form. Thus, all findings are anonymised. The planning, execution of the research, and anonymisation in the article text have been conducted in accordance with the Guidelines for Research Ethics in the Social Sciences and the Humanities, provided by the National Committee for Research Ethics in Norway.

3.3. Analysis

The findings from the interviews and observations were analysed, structured, and coded in multiple stages. The coding of the interview and observation data was a systematic process that involved categorising and labelling qualitative information to identify patterns, themes, and insights [76,77]. The codes were generated with the intention of closely aligning the participants' statements or the specific observations. This approach is referred to as "in-vivo" coding, as coined by Saldaña [76] (p. 91). The process is described more in detail in Table 3. Finally, four indicators were identified, describing key characteristics of a cultural environment making it vulnerable to visitors.

Table 3. Methodical description of the coding process (informed by Saldaña [76], 2013, and Tjora [77], 2021).

Objectives	Tasks
Data preparation	Transcribe interviews and organise observation notes. Familiarise oneself with the data to gain an overview of the content.
Initial familiarisation	Read through the transcripts and observation notes to get a sense of the content and context. Note initial impressions, interesting points, and potential themes.
Open coding	Begin with open coding by assigning initial labels or codes to specific phrases, sentences, or paragraphs. Codes are descriptive and capture the essence of the content (e.g., “visitor engagement” and “interpretation preferences”).
Constant comparison	Compare codes across different interviews and observations to identify similarities and differences. Refine and adjust codes while encountering new data.
Emergent themes	While coding more data, common codes will begin to cluster into broader themes. Group related codes under these emerging themes (e.g., “visitor motivations” and “interaction with artifacts”).
In-vivo coding	Preserve the authenticity and richness of participants’ expressions by incorporating their exact words as codes. Generate codes based on the exact words or phrases used by participants in interviews and seen in observations.
Memo writing	Document the thinking process, interpretations, and insights while coding. Memos help to keep track of the analytical decisions and thought progression.
Data triangulation	Compare findings from interviews and observations to validate and strengthen interpretations. Look for convergence and divergence in the data.
Pattern validation	Cross-reference the coded data with the original transcripts to ensure accuracy and context. Double-check codes and themes against the actual content.
Theoretical integration	Connect the emergent themes and patterns to relevant theories or conceptual frameworks. Use theories to provide deeper insights and explanations for the observed tourist behaviour.
Reporting	Organise the findings by clearly presenting the themes, subthemes, and their significance. Provide examples from interviews and observations to illustrate the points. Consider including quotes to enhance credibility.

4. Results

This section is divided into subheadings to provide a concise description of the experimental results, their interpretation, and the experimental conclusions that can be drawn.

4.1. Mapping Visitor Behaviour at the Sites

Conducting on-site observations enabled the mapping and analysis of visitor behaviour at the cultural heritage sites. These observations were then compared with pre- and post-visit documentation and some were further elaborated with follow-up interviews. The real-time assessment revealed a pattern wherein visitors closely followed the guide’s actions, even if this entailed stepping on delicate blubber ovens if the guide did so. This emphasised the unintentional contribution and lack of awareness of both the guide and the tourists to the degradation and impact on vulnerable cultural heritage sites. Notably, sites rich in captivating details attracted visitors’ attention, as exemplified by their eagerness to examine and explore a coffee pot left behind by the last trapper on a wood-burning stove, even when causing unnecessary and incorrect foot traffic across a deteriorated wooden floor (see Figure 3). This engagement prompted others, including the guide, to follow suit, oblivious to the fact that they were treading on protected, deteriorated surfaces. Several guides acknowledged their lack of training in appropriate behaviour and attention to cultural heritage sites. Tourists predominantly cited their attraction to Svalbard due to its wildlife and natural beauty, with cultural heritage exploration being of secondary interest. Nonetheless, most tourists expressed a deep fascination with these sites and described profound impressions. However, as these experiences were not their primary focus, they

were unprepared for them. Guides were perceived as knowledgeable but lacking expertise in cultural heritage vulnerability, resilience, and preservation.



Figure 3. Historic remains from the protected marble mine settlement London at Blomstrandhalvøya in Kongsfjorden. Visitors are closely looking at the historic remains, inadvertently destroying the remaining surrounding wooden floor. Photo: Anne-Cathrine Flyen.

4.2. Understanding Visitor Behaviour

To comprehend and analyse the motivations behind visitor behaviour, investigations were carried out through observations and interviews with guides and tourists. These inquiries unveiled a lack of understanding among visitors regarding designated protected cultural heritage sites and the inadvertent harm caused by their actions. They were unaware or unconcerned about the deteriorated state of the wooden structures they stepped on, resulting in damage (see Figure 4). They found it challenging to identify what constituted cultural heritage, often mistaking significant elements, such as protected graves, for mere piles of stones, or disregarding remains, like scrap metal and discarded timber, that were historically significant, such as remnants of a protected trapper's hut or a preserved locomotive used to transport minerals from the mine to the shipping port.

Tourists also shared that they assumed guides were knowledgeable and, consequently, safe to follow. In essence, guides echoed similar sentiments as the tourists; they acknowledged a lack of clarity regarding what qualified as cultural heritage, which, in turn, hindered them from unequivocally conveying the significance to the tourists. Many described instances where their focus on polar bear safety overshadowed their awareness of walking on protected and fragile structures to gain elevation for addressing the tourists.



Figure 4. Historic remains from the protected marble mine settlement London at Blomstrandhalvøya in Kongsfjorden. Visitors trampled on the remaining wooden floor, destroying the wood. Photo: Anne-Cathrine Flyen.

4.3. Assessing Visible Signs, Traces, and Damage Caused by Visitors

To evaluate the impacts of tourist behaviour on cultural environments, the tourists' conduct was documented through photography and sketches before and after their visits, as well as observations during the visits themselves. This documentation and observation were subsequently compared to discern the correlations between the behaviours and effects. Observable traces included trampled vegetation on slopes adjacent to protected buildings and structures, widened paths due to foot traffic, footprints, and minor erosions outside preserved blubber ovens from the whaling era, as well as damaged wood within protected ruins and foundations.

The study involved capturing and comparing the visual evidence, traces, and consequences of tourist behaviour on the cultural sites.

4.4. Site-Specific Factors' Impact on Visitors' Behaviour

To analyse the factors influencing such behaviour within the sites, all methods, including documentation, observations, and interviews, were reviewed and compared. In essence, the study examined how various factors within the cultural sites influenced visitor behaviour, resulting in either preservation or deterioration of these heritage environments. This was done during a coding process that involved systematic analyses of the collected data to identify patterns, categories, and relationships.

Ultimately, the evolving categories, interconnections, and ideas were synthesised into four distinct indicators that defined the sites most at risk from human visitors in Svalbard. These indicators emerged from the data and were closely grounded in the observations and patterns found within it (see Table 4 and Figure 5).

Table 4. Examples of the final stages of the coding, including the resulting main code providing the indicators for what makes cultural heritage sites vulnerable to visitors.

Stage of Coding	Resulting Indicators
Acting like the guide; not understanding what they see; not realising it is cultural heritage; standing on cultural heritage; capturing cultural heritage; damaging cultural heritage; standing on a grave; standing on a decaying wooden floor; being curious and approaching; not comprehending; only seeing the details, difficult readability, challenging legibility.	Legibility
Damaged; affected; trampled; crushed; traces; wood decay; weakening of wood; stepping on; kicking; stepping through; bad condition.	Physical condition/resistance to trampling
Curious and approaching; looking at and touching; lifting up; wanting to take close-up pictures; details; objects; machine parts; coffee pot; experience; left behind; shoes; belongings; parts of wood.	Quantity and quality of objects
Steep; bypasses; wet; muddy; slippery; inaccessible; far away; long walk; closed; difficult to walk; challenging to reach; collapsed; unsafe.	Accessibility



Figure 5. The figure portrays the vulnerability indicators, which consist of four primary parameters for characterising a cultural heritage site's vulnerability to visitors, as deduced from fieldwork. Top-left describes "Legibility", which pertains to the extent that it is apparent that the observed location is a cultural heritage site. Top-right illustrates "Physical condition", which is evaluated in the context of the cultural heritage site's capacity to endure the impact or pressure caused by visitor activities, such as foot traffic, tactile interaction, and overall engagement. Bottom-left illustrates "Quantity & quality of Objects", which quantifies the intricacy or number of objects situated on or in the vicinity of the cultural heritage site. Finally, bottom-right shows "Accessibility", which measures the ease, difficulty, or level of discomfort involved in reaching the cultural heritage site. All photographs: Anne-Cathrine Flyen.

4.5. The Vulnerability Indicators

Based on the material and condensed from the analysis, a four-part set of indicators to map cultural heritage sites' vulnerability to tourist activity in High Arctic Svalbard (the PLAQ-indicators) was proposed:

Physical condition/degree of deterioration: gauges the cultural heritage's resilience to foot traffic. A physically deteriorated site is less resilient to foot traffic compared with one that is intact. For instance, deteriorated wood is less tolerant of foot traffic than a fully standing structure.

Legibility: This characterises how easy or difficult it is for visitors to comprehend what they are seeing and recognise that it is a protected cultural heritage site. Without understanding what they are observing, accidental damage becomes more likely.

Accessibility: This describes how easy or difficult it is to approach the cultural heritage site or environment. If it is not feasible to access or if the path is muddy, challenging, or unsafe, the likelihood of causing damage diminishes.

Quantity and quality of objects: This accounts for the abundance of details and objects in a location, encompassing the number of objects, loose building components, or material fragments present. A multitude of intact objects attracts attention, prompting individuals to approach for a closer look, potentially leading to souvenir collection. Moreover, the likelihood of trampling loose objects and scattered materials increases with their abundance.

Table A1 (Appendix A) demonstrates how the vulnerability indicators can be utilised. The results from the 10 site locations have been compiled and analysed to assess the vulnerability towards tourist traffic and climate change impacts.

5. Discussion and Concluding Remarks

Cultural heritage sites and environments in Svalbard are highly susceptible to the impacts of climate and degradative forces. As most structures either contain or are entirely constructed of wood, they are particularly vulnerable to fungal decay. Given the proximity of most cultural monuments to the shoreline, often perched on the brink, they are highly exposed to erosion and other coastal processes. Additionally, cultural heritage sites are significantly impacted by permafrost-related processes. The natural deterioration and wear from tourism mutually influence and amplify each other.

Mapping and analysing the behaviour of visitors, including tourists, at cultural heritage sites in Svalbard can be challenging, as most sites contain structures that may appear insignificant or difficult to comprehend. Additionally, vulnerability varies significantly between different sites and can even differ within a single location. Thus, it is crucial to identify the appropriate vulnerability criteria that are sufficiently broad to describe the vulnerability of any cultural environment and heritage site in Svalbard. This process has been extensive and groundbreaking within cultural heritage management at Svalbard. When defining vulnerability criteria, the factors that render a heritage site susceptible to human visitation are based on case studies. The selection of cases can influence outcomes, which is why it was done collaboratively with authorities using statistical data. However, the transferability of the research may be affected. Therefore, it is emphasised that the vulnerability criteria developed and described in this article are tailored to Svalbard's cultural environments. Nonetheless, the methodology employed in this development work should be fully transferable, and the outcomes could also apply to areas with similar types of cultural heritage or comparable susceptibility to the escalation of tourism, as exemplified by the sites discussed by Dragovich and Amiraslani [40].

Cases that experienced heavy tourist traffic were chosen, yet the selection of interviewees depended on those willing to participate at the time. Similarly, observations were contingent upon cruise ships and the number of tourists coincidentally present during the specific period of the fieldwork. The data collection was based on what was feasible during the fieldwork duration. However, interviews were extended until saturation, ensuring the dataset was sufficient for analysis. A significant challenge with qualitative analysis was generalising from qualitative data to ascertain true patterns. Since we work with reality to

find answers to real questions, seeking answers within reality is natural. Nonetheless, reality is not always general, and individuals may not represent anyone other than themselves. Hence, conducting interviews and observations until saturation was crucial. To ensure unbiased data, observations were carried out as non-participatory observations. In the analysis, coding was designed to be as empirically close as possible, preventing code reuse.

The sub-objectives were addressed through a mixed-method approach that involved pre- and post-documentation of cultural sites, observations, and interviews. This approach ensured data triangulation, enabling sub-objectives to be answered. By achieving the sub-objectives, the main goal was accomplished: identifying the fundamental factors rendering cultural heritage sites susceptible to visitor influences. These factors were discovered to encompass physical state/degree of decay, legibility, accessibility, and quantity and quality of objects.

These parameters might serve as a guiding framework for the management of the sites, distinctly suggesting the need for strengthening knowledge and consciousness among guides and tourists alike. This could encompass training initiatives, informative resources, and effective signage. Correspondingly, the discoveries, as embodied within the parameters, imply that on-site facilitation could be imperative to protect the exceedingly delicate cultural treasures. Moreover, upcoming research and advancements could leverage these parameters to construct a mechanism for appraising the susceptibility of each unique site, as advocated by Hagen et al. [4]. The findings also clearly demonstrate, though not surprisingly, that the guide holds significant importance in influencing tourists' behaviour at the sites, as highlighted by Alazaizeh [47]. Consequently, the guide can serve as a vital instrument for promoting sustainable conduct.

By understanding and considering these parameters, site managers and authorities can make informed decisions to mitigate the potential harm caused by visitors. Utilising these vulnerability parameters can contribute to the overall preservation and sustainability of cultural heritage sites. Through foreseeing and managing visitor impacts and minimising potential harm, these sites can be better conserved for future generations.

Potentially, the results have a twofold impact. First, the typology can be incorporated into the day-to-day practice of cultural heritage management. Additionally, it contributes to the current methodological and theoretical discourse about comprehending and evaluating site vulnerability, strengthening the resilience and long-term viability of fragile regions, expanding the examination of socio-cultural impacts arising from tourism development, and boosting knowledge to more effectively address management challenges. Additional research endeavours can enhance the typology by refining and quantifying indicators or by devising a comprehensive systematic approach for assessing the vulnerability of cultural environments based on these indicators. Ideally, the PLAQ indicators should be integrated with indicators pertaining to natural vulnerability and climatic change.

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Appendix A

Table A1. The ten case sites evaluated according to PLAQ indicators.

Site Name and Geographical Location	Physical Condition/Degree, i.e., Good, Medium, or Poor Condition/Resistance to Wear	Legibility, i.e., Good, Moderate, or Difficult Legibility	Accessibility, i.e., Easy, Moderate, or Challenging Accessibility	Quantity of Objects/Identifiable Objects, i.e., Few, Some, or Many Objects
Gnålodden in Hornsund, south-western Spitsbergen	Good condition and resistance to wear	Good legibility	Easy accessibility: The site is primarily visited by cruise ships and is located in the far south of Spitsbergen. However, once you arrive at the site, the cabin is easy to spot and easily accessible.	Few objects
Bamsebu in Van Keuenfjorden, south-western Spitsbergen	Cabin: good condition and resistance to wear Ruins of outhouse: poor condition and resistance to wear Remnants of whale hunting: poor condition and resistance to wear	Cabin: good legibility Ruins: moderate legibility Remnants of whale hunting: moderate legibility	Easy accessibility: The cabin is privately owned and rarely visited by others. Nevertheless, upon arrival, it is easy to locate and reach, with whale hunting era remnants scattered nearby along the beach.	Cabin: moderate number of objects Remnants of whale hunting: many objects
Russekeila, at the mouth of Isfjorden, western Spitsbergen	Poor condition and resistance to wear	Difficult legibility	Moderate/challenging accessibility	Few objects
Hiorthhamn in Isfjorden, on central Spitsbergen	Cabins: good condition and resistance to wear Other remnants: poor condition and resistance to wear	Cabins: good legibility Other remnants: difficult legibility	Easy accessibility	Cabins: moderate number of objects Other remnants: moderate number of objects
Longyearbyen in Isfjorden, on central Spitsbergen	Mining structures: good condition and resistance to wear Old Longyearbyen: poor condition and resistance to wear	Mining structures: good legibility Old Longyearbyen: difficult legibility	Easy accessibility: When visiting Svalbard, most visitors also visit Longyearbyen. Most historic structures in Lyb. Are easily accessible.	Mining structures: few objects Old Longyearbyen: few objects
Ny-Ålesund in Kongsfjorden, north-western Spitsbergen	The village: good condition and resistance to wear The mining area: medium condition and resistance to wear	The village: good legibility Ny-Ålesund is the largest collection of protected buildings in Svalbard. The village, once a mining town, is now an international research station with many new structures, but most of the protected buildings are still in daily use. These protected buildings may not immediately appear as such, but their historical significance is evident. The mining area: difficult legibility The former mining area underwent significant cleanup shortly after its closure, and today, it appears as a vast and seemingly chaotic area filled with old mining debris. Nevertheless, this area is protected as part of the Ny-Ålesund mining town, which is a culturally significant heritage site.	Easy accessibility: The site is visited by cruise ships and locals from the research community in Ny-Ålesund. It is located on the west coast of Spitsbergen. However, once you arrive at the site, the cultural relics are close to the landing point.	The village: few/moderate number of objects The mining area: many objects
London in Kongsfjorden, north-western Spitsbergen	Buildings: poor condition and resistance to wear Ruins: poor condition and resistance to wear The standing buildings are in relatively good condition and can withstand foot traffic. However, the ruins are extensively deteriorated, and the wood crumbles upon stepping. Several of the machines within the cultural setting are placed on a wooden floor, which is the only remaining part of the garage where the machines were housed. The wood in the floor is severely degraded and collapses under pressure/when stepped on.	Standing buildings: good legibility Ruins and machinery: difficult legibility The site comprises several standing buildings. These are simple and not grand monuments, and it may not be immediately intuitive that they are protected. However, it is relatively easy to document them as historical structures. But the site also includes several ruins and low remnants of buildings, and these are not easily perceived as protected structures. Similarly, there is preserved machinery that appears to be abandoned scrap.	Easy accessibility: The site is visited by cruise ships and locals from the research community in Ny-Ålesund. It is located on the west coast of Spitsbergen. However, once you arrive at the site, the cultural relics are close to the landing point.	Buildings: moderate number of objects Ruins: many objects Parts of the cultural environment feature numerous small components and objects, especially within the ruins. Here, various items capture attention and curiosity, leading tourists/visitors to venture closer, including onto the wooden floor, to examine these details more closely.

Table A1. Cont.

Site Name and Geographical Location	Physical Condition/Degree, i.e., Good, Medium, or Poor Condition/Resistance to Wear	Legibility, i.e., Good, Moderate, or Difficult Legibility	Accessibility, i.e., Easy, Moderate, or Challenging Accessibility	Quantity of Objects/Identifiable Objects, i.e., Few, Some, or Many Objects
Gravneset in Magdalenefjorden in the north-western corner of Spitsbergen	<p>Poor condition and resistance to wear: The blubber ovens are highly sensitive to foot traffic and can easily collapse under pressure. Many of the graves have partially collapsed, and the wood inside the chests has decayed to some extent. Consequently, they cannot withstand much trampling before collapsing.</p>	<p>Moderate legibility: The blubber ovens resemble low sand mounds, making it challenging to document them as protected cultural relics. Similarly, some graves are difficult to spot as they have sunk into the ground. However, several of them are partially exposed, and you can see the wooden chest between the stones. Without the fence keeping tourists at a distance, many of these cultural relics would be hard to discern. Occasionally, small groups without guides have been seen inside the fences, and these groups struggle to appreciate all the cultural relics.</p>	<p>Moderate accessibility: The site is primarily visited by cruise ships and is located in the far north of Spitsbergen. However, once you arrive at the site, the site is close to and partly on the sandy beach and easily accessible. Both blubber ovens are situated on the beach and are easily accessible from the most common landing point. The burial site is located on a small rocky hill above the beach and is also easily reachable. However, during the visiting season, both the blubber ovens and the burial site are enclosed by a low chain fence to prevent visitors from approaching the fragile cultural relics. Additionally, the governor has stationed two field inspectors during the visiting season who reside in a cottage nearby. This arrangement document visitors' intrusion within the fenced area.</p>	<p>Few/moderate objects: there are not numerous items in this cultural site, but the wood within the chests, and skeletal remains within some of the chests, capture the attention of tourists.</p>
Virgohamna on Danskøya in the northwestern corner of Spitsbergen	<p>Poor condition and resistance to wear: Most historical remnants have been heavily degraded by rot, rust, or the foot traffic of visitors. The deteriorated wood is vulnerable to footsteps and at risk of collapsing upon further pressure.</p>	<p>Difficult legibility: The historic structures are challenging to comprehend. Most of them appear as debris or blend into the landscape. There are numerous metal parts, wooden remnants, and ruins, and many rusty barrels once containing metal shavings have scattered their contents across the ground.</p>	<p>Easy accessibility: The site is primarily visited by cruise ships and is in the far north of Spitsbergen. Once at the site, the cultural relics are scattered along the rocky beach and easily accessible.</p>	<p>Many objects: Virgohamna contains a large quantity of details and objects. Most of them are deteriorated wooden components, but there are also numerous metal parts and pieces of machinery from the expeditions of Andree and Wellman. Additionally, there are some remnants of whaling, such as parts of chalk pipes.</p>
Smeerenburg on Amsterdamøya in the north-western corner of Spitsbergen	<p>Poor condition and resistance to wear: The low remains of the blubber ovens collapse under any form of pressure, and the blubber concrete—a mixture of sand and whale fat—that is still found in some of the historical ovens is extremely fragile. These delicate remnants cannot endure any trampling. The barely visible building foundations are so weak that they are nearly indistinguishable now. Some of them contain deteriorated wooden remnants that crumble underfoot. The graves are in better condition, especially those situated on the plateau behind the beach. These appear as small, low stone cairns and house wooden chests with historical remnants from the whalers. The wood in the chests has partially decayed and cannot withstand much pressure.</p>	<p>Difficult legibility: Beyond the sandy shoreline, there are several low sand mounds with what appear to be stone and concrete remnants along the edges. These are the remains of the blubber ovens where whale hunters in the 1600s melted whale blubber into oil and stored it in barrels. Today, it is hard to grasp that these low sand mounds are protected cultural heritage that should not be disturbed in any way. Behind these sand mounds are barely visible traces of small buildings, some with remnants of wooden structures. Some of the graves are hardly visible, while others are clearly discernible as low mounds of stones. Most of these graves contain wooden chests with historical remnants from whalers.</p>	<p>Easy/moderate accessibility: The site is primarily visited by cruise ships and is located in the far north of Spitsbergen. However, once you arrive at the site, the cultural relics are scattered along the sandy beach and easily accessible. Most graves are located away from the whaling station and the landing point. These are not frequently visited by tourists. The area is periodically very wet, making it challenging to navigate in some places.</p>	<p>Few/moderate number of objects: The historical remnants in Smeerenburg do not comprise many objects, and thus, there is not much that can be taken as souvenirs. However, the "blubber concrete" generates curiosity, and many people get up close to have a better look at what it is.</p>

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