ADAPT
NORTHERN HERITAGE
TOOLKIT

Adaptation stories

Examples of risk assessment, adaptation planning and conservation management of northern historic places

Northern Periphery and Arctic Programme
2014–2020

EUROPEAN UNION

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Cover image

A traditional shelter, in front of a modern summer hut, at Bartjan (Sweden), a summer herding site. This place is used by the local Sámi community used by Sami communities, the indigenous peoples of northern Finland and Scandinavia and north-western Russia, when its reindeer are grazing in this area in summertime. The place is particularly important to the community as they are marking their calves here. Due to climate change, the animals' migratory patterns are changing, and the place could lose its meaning, significance and use, and the camp's traditional tipis, made from turf and wood, fall into disuse and deteriorate quickly.

1 INTRODUCTION

Climate change is a global phenomenon, affecting historic places in various ways. How exactly places are effected depends on a variety of factors, such as local climate drivers and their environmental impacts. As versitile as the impacts are adaptation measures, which can be put into place to make the historic place more resilient.

The Adapt Northern Heritage Adaptation Stories, part of the Adapt Northern Heritage toolkit, draw from experiences across several historic places, how climate change has affected them and what adaptation measures have been considered. In these five stories, local stakeholders give account of their encounters with climate change on Svalbard, a Norwegian archipelago, Flåm Church in the Aurland Municipality, Norway, Threave Garden and Estate, home to Scotland's only School of Heritage Gardening and Bartjan, a summer herding site of the sámi village Tåssåsen, Sweden.

2 FLÅM CHURCH

Flåm church (image 1) in Aurland municipality was built in the late 17th century, however, the first time you hear about a church at the site is around 1340. The stave church was built on an old church site and when today's church was set up, the old stave church was demolished. The church is in use today for the Flåm parish and is a small panelled long building, which has room for 160 persons, and beautiful painted interiors. The graveyard around the church dates from the Middle Ages and is still in use.

The church is located in Flåmsdalen (Flåm valley), a few kilometres up from the fjord. Flåmsdalen has steep mountainsides and at the bottom of the valley the terrain flattens out, where you will find buildings and agricultural land. Flåm church is located next to Flåm river.

Image 1 Flåm church and graveyard. Photo: Leif Anker, Riksantikvaren

Flooding

At the end of October 2014, Western Norway experienced one of the most intense rainfall episodes so far this century. The Flåm watercourse was exposed to intense rainfall, which resulted in a major flood in the Flåm river and major destructions (images 2, 3, 4).

Image 2 Many residential buildings and several farm buildings were destroyed in the flood.
Photo: Marte Boro, Riksantikvaren

In total, 13 residential buildings were damaged. The river eroded away foundations, so that a total of five houses burst into the river and were washed away. In addition, an operating building and several smaller outbuildings were completely damaged and valuable farmland was damaged. The road in the Flåm valley was damaged on several sections and several other roads were washed away. Estimates of the total costs from insurance, repair of infrastructure and restoration of terrain, as well as the strengthening of riverbanks against new flood damage amounted to more than NOK 250 million (approx. £23 million). Climate change appears to increase the frequency and magnitude of rainfall events in the region (Hanssen-Bauer, 2017). This means that intense short-term floods of the same type as in 2014 will occur more often than before (Multiconsult, 2016).

Image 3 Securing the riverbank after the flood. In the background is one of the houses that were destroyed by the ravages of the water. Photo: Marte Boro, Riksantikvaren

Image 4 The flood caused large mass displacements. There was a need for extensive security work and mass return. In the background is Flåm Church. Photo: Marte Boro, Riksantikvaren

Image 5 Flood 2014. Several buildings, land and roads were washed away by the flood. Flåm church and the graveyard after the top flood tide. Photo: Oddleif Løset, NRK

The church and medieval cemetery are situated close to the river. During the flood, the river went up along the cemetery wall (image 5). Fortunately, the wall kept much of the water and streams away from the cemetery, but water and mud poured in through the gate and into the cemetery and the church. The water level stood above the floor of the church and mud was 20-30 cm up on the inside walls.

Adaptation planning

After the flood, extensive hedging work was carried out along the river. The road was repaired, bridges rebuilt and destroyed buildings replaced. The church was situated low in the terrain and plans to raise the entire building have existed for a long time. The flood clearly showed that this was necessary.

The flood had brought water and mud into the crawl space beneath the floor and beyond the floor. After an attempt to dry out the crawl space without removing the mud, it quickly became clear that the mud had to be removed. The floorboards were taken up, the mud was cleaned away, new beams were installed where needed and the floor was insulated, and the old floorboards were remounted (image 6).

Image 6 Checking the conditions under the floor. A lot of sludge and moisture had accumulated here. Photo: Monica Finden, Aurland kommune

A total of 14 jackets and 14 pumps were installed under the church (image 7). The building was then raised 1 cm at each in turn. This was repeated for many rounds, as it was important that the church was raised synchronously to avoid damage. Under the bell tower, which is self-supporting, 20-ton jackets were used. In total, the church was raised by approx. 38 cm. Then the building was lowered onto the foundation which was built with natural stone from the area (image 8). Inside, tension bars and jack straps were used to keep the church stable during the raising.

Looking ahead, as the church has not been moved out of harm's way entirely, further adaptation measures will have to be explored to minimise flood impact on the building.

Image 7 Work in progress. Photo: Monica Finden, Aurland commune

Image 8 Finalising the raise of the building. Photo: Kjersti Ellewsen, Riksantikvaren

3 FREDHEIM – ARCTIC HUNTING STATION

On Svalbard, fur hunting has left its mark on the cultural landscape. Russian fur hunters hunted fox and polar bears from the early 1700s until the mid-1800s. Towards the end of the 19th century, Norwegian fur hunters began to settle on the archipelago, and one of the most famous is the legendary Hilmar Nøis. He settled in the Sassen fiord, at the west coast of Spitsbergen, and built his hunting station Fredheim. With the mountain Temple and the Von Post glacier as surroundings the hunting station is today a listed monument, in honour of Hilmar Nøis and his two wives, first Ellen Dorthe Johansen Nøis, and then Helfrid Nøis.

Today, Fredheim is owned by the Norwegian state. The main cabin is used in connection with rescue operations and as a general service cabin for the Governor. In addition, the cabin is loaned to residents of Svalbard for Christmas and Easter. A few weekends every spring, as it is still possible to go by snowmobile, the cabin is also open for the public to visit, accompanied with storytelling, coffee and biscuits.

The trapping station Fredheim is highly valued as a historic monument. The close connection to Hilmar Nøis and his family is highly valued, and the station is a popular destination both for residents and tourists, only a few hours' drive by snowmobile from Longyearbyen.

Image 9 Hunting station Fredheim close to the reosion edge. Photo: Anne-Cathrine Flyen, NIKU

Impacts of coastal erosion

Fredheim hunting station is threatened by coastal erosion. Over the past 20 yeas, reports repeatedly highlight that the station will be lost, if measures are not implemented. Currently, permafrost is limiting erosion, however, with increasing temperature of the active layer, this protection will reduce (M. Adakudlu et al., 2019).

Visible evidence of coastal erosion is the move of an old cabin, Danielbu, which in 2001 was moved back six metres from the coastal edge. Today, the old site of Danielbu is lost.

Adaptation planning

In 1999, different measures for the whole hunting station were discussed, inlcuding relocation and erecting a protection wall. However, the protective wall was not compatible with environmental targets for the archipelago and was rejected by the Governor. In 2013, the Governor started preparing for relocation and on April, 10th 2014, the characteristic hut was moved to a safer place for teh time being. This was an unusual measure not very often performed on Svalbard. The Governor, however, regarded the historic value of Fredheim as very high and found that relocation could protect it best.

To prepare the cabin for the move, the floors and the barrel were removed. The building was reinforced from the inside and placed on a sledge made from steel. Preparations for relocation lasted a year but moving the main cabin Villa Fredheim only took a few minutes.

The entire hut was towed 50-60 meters away from the water's edge with a belt truck. The outhouses were also removed. The relocation went smoothly and the cabin was left on the steel foundation, which had been constructed to support it during the move. Remaining on the foundation means, it can be moved again in future, as erosion continues. Under medium to high emission scenarios, projections indicate an increase in erosion and sediment transport as well as near-surface permafrost thawing in coastal and low altitude areas (M. Adakudlu et al., 2019).

Image 10 Relocation of Fredheim. Photo: Tone Hertzberg, Govenor of Svalbard

Image 11 The main cabin at Fredheim 2019, Danielbu in the background, after relocation. Photo: Tone Hertzberg, Govenor of Svalbard

4 THREAVE GARDEN

Described as ‘a garden for all seasons’ by their National Trust for Scotland caretakers, Threave Garden has many unique selling points that attract visitors almost all year round. The harsher divides between garden types and large diversity of plants is what gives the garden its renown, as well is the rare Victorian-style walled garden, where seasonal produce is grown and sold. Beyond this, the land also has a rich history as the home of the School of Heritage Gardening. Following the post-World War Two period, when Scotland suffered from a shortage of gardeners, the land was bequeathed to the National Trust for Scotland by Major Alan Gordon in the hopes of training a new generation of gardeners and caretakers. To this day, the school continues to welcome new students every year.

Image 12 Young gardeners are introduced to the changing nature of Threave Garden every year. Photo: National Trust for Scotland

A changing climate and letting go

In 2019, while the garden reflects on the 60 years since its opening, the gardeners, caretakers and students also look to its future and the risks that climate change has brought to it. Climatic changes in the gardens, such as increased annual precipitation by around 4% since 1961, have exposed the need for adaptation, including the inadequacy of the Victorian path drainage systems that are currently in place. Increased precipitation, in combination with milder winters, has also been noted as an enabler of spreading tree diseases.

An example of this is the garden's Weeping Ash Tree. Towards the end of 2019, it was concluded that the nature of its disease meant it had to be uprooted to prevent further spreading through spores. The tree is located in a high-impact area and is due to be uprooted at the beginning of 2020, when the garden is closed to the public – a large undertaking due to the size of the tree and the fact that it is planted amidst a mix of daffodil and crocus buds. It is hoped, that the Ash will be replaced without too much impact on the surrounding environment, with longevity being the priority This is just one example of the adaptation measures that have become a necessity at Threave, due to climate change, in order to safeguard it for the long-term.

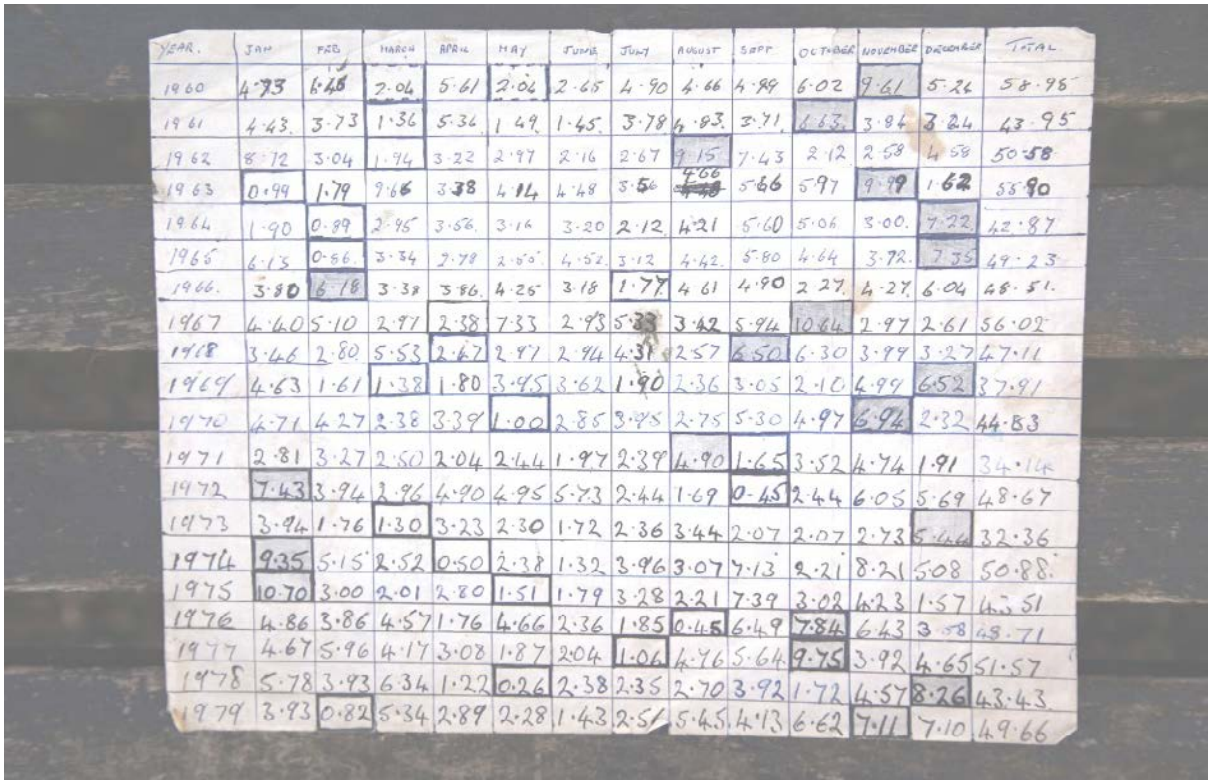
Storm damages

In 2018, Storm Ali caused 26 trees to fall. These trees varied in size, breed and age and resulted in a gap in the garden's shelter belt, a natural protection measure from more extreme weather occurrences based on the location of larger trees. This gap has resulted in a slow-acting domino effect that leaves the remaining trees more vulnerable. The lack of a continuation plan highlighted the importance of the natural shelter to the overall running of the garden. This shows, now more than ever, the need to adapt in the face of climate change should be brought to the forefront of conservation planning, education and training.

Image 13 In the aftermath of storm Ali in September 2018, 26 trees fell in Threave Garden. Photo: National Trust for Scotland

Contemporary witnesses

On the front line, when these events occur, and the man responsible for the future of the garden, is Head Gardener Michael Lawrie. Having worked at Threave for 15 years, he has seen great changes in the garden and how the team have had to work in it. “Futureproofing as custodians is new ground for head gardeners,” he reflects, summarising the situation that the garden and its caretakers are facing. According to Michael, in the past 5 to 8 years there have been high amounts of rainfall throughout the year and an increase in tree-borne disease. Observations such as Michael’s seems to be a long-standing tradition. His office holds a small collection of diaries, once belonging to past head gardeners at the estate. A large amount of the entries are dedicated to weather, temperature and environmental observations. Other volumes can be found in archives in Edinburgh, chronicling the changes to the garden’s climate and environment, as well as subsequent adaptation that had to be undertaken.



YEAR.	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER	NOVEMBER	DECEMBER	TOTAL
1960	4·73	6·48	2·04	5·61	2·04	2·65	4·90	4·66	4·89	6·02	9·61	5·24	58·96
1961	4·43	3·73	1·36	5·34	1·49	1·45	3·78	4·83	3·71	4·63	3·84	3·24	43·95
1962	8·72	3·04	1·94	3·22	2·97	2·16	2·67	7·15	7·43	2·12	2·58	4·58	50·58
1963	0·99	1·79	9·66	3·38	4·14	4·48	5·56	F·66	5·66	5·97	9·79	1·62	55·90
1964	1·90	0·89	2·95	3·56	3·14	3·20	2·12	4·21	5·60	5·06	3·00	7·22	42·87
1965	6·13	0·66	3·34	2·78	2·60	4·52	3·12	4·42	5·80	4·64	3·72	7·35	49·23
1966	3·80	6·18	3·38	3·86	4·25	3·18	1·77	4·61	4·90	2·27	4·27	6·04	48·51
1967	4·60	5·10	2·97	2·38	7·33	2·93	5·33	3·42	5·94	10·64	2·97	2·61	56·02
1968	3·46	2·80	5·53	2·67	2·97	2·94	4·31	2·57	6·50	6·30	3·99	3·27	47·11
1969	4·63	1·61	1·38	1·80	3·95	3·62	1·90	2·36	3·05	2·10	4·99	6·52	37·91
1970	4·71	4·27	2·38	3·39	1·00	2·85	3·95	2·75	5·30	4·97	6·94	2·32	44·83
1971	2·81	3·27	2·50	2·04	2·44	1·97	2·39	4·90	1·65	3·52	4·74	1·91	34·14
1972	7·43	3·94	2·96	4·90	4·95	5·73	2·44	1·69	0·45	2·44	6·05	5·69	48·67
1973	3·94	1·76	1·30	3·23	2·30	1·72	2·36	3·44	2·07	2·07	2·73	5·44	32·36
1974	9·35	5·15	2·52	0·50	2·38	1·32	3·96	3·07	7·13	2·21	8·21	5·08	50·88
1975	10·70	3·00	2·01	2·80	1·51	1·79	3·28	2·21	7·39	3·02	4·23	1·57	43·51
1976	4·86	3·86	4·57	1·76	4·66	2·36	1·85	0·45	6·49	7·84	6·43	3·58	48·71
1977	4·67	5·96	4·17	3·08	1·87	2·04	1·06	4·76	5·64	9·75	3·92	4·65	51·57
1978	5·78	3·93	6·34	1·22	0·26	2·38	2·35	2·70	3·92	1·72	4·57	8·26	43·43
1979	3·93	0·82	5·34	2·89	2·28	1·43	2·51	5·45	4·13	6·62	7·11	7·10	49·66

Image 14 Entries from a former head gardener at Threave, monitoring temperature changes from 1960 to 1979. Photo: Michael Lawrie, National Trust for Scotland

As stated by Michael, the changes in climate have caused a need for staff to adapt to how the garden is run and cared for. The annual growing period in the area increased by 25 days from 1961 to 2004, as a result of shorter frost seasons, increased mean winter temperatures by 0.9° and a slight increase in daylight hours. The increase has been even more stark in the past decade, yielding a 14% higher growing degree. This has resulted in the need for much more flexible working hours, with later hours worked on nicer days and generally maximising the time and resources available.

Adaptation planning

In terms of exploring adaptation measures, considerations must be made to the seemingly more flexible nature of a garden, especially when compared to a historic building. Replanting of existing plants and the introduction of new varieties have already been explored. With this in mind, Michael emphasises the importance of investigation, in order to inform actions that are already being undertaken, as well as any future adaptation planning. Reports on tree damage are starting to be produced twice a year, monitoring and research is ongoing for new plants being introduced in the garden. Such research has already helped to inform the nature and location of trees as part of the shelter belt and the replacement for the Weeping Ash. Based on the collected information, Michael plans to put a programme together for immediate adaptation action with a focus on longevity, as well as using the results to support his education efforts. Of course, due to the charity status of the National Trust for Scotland and the reliance upon tourist and event income, the impact that any adaptation planning has on the footfall and considerations of the local community have to be taken into account as well.

Image 15 Behind the walled garden. Photo: National Trust for Scotland

Looking to the future, Michael believes that “education is a very important starting point. Publicising facts and figures, creating publications exactly like this adaptation story” are just some ways to raise awareness of the climate issues affecting the garden’s future. Michael sees himself as a custodian, who can show good practices that can be taken forward to future gardeners. He believes the rest of the Threave team feels the same - they want the garden to last far into the future. Overall, it seems that learning from changes in climate observed by previous head gardeners, showing good practices now and allowing for the younger generations to be more adaptable, will give hope to Threave Garden and those similarly affected by climate change.

5 THREAVE HOUSE

Built in 1872 for William Gordon, this Baronial-style house was home to the Gordon family for many years. The land, including the estate was bequeathed to the National Trust for Scotland by Major Alan Gordon in the hopes of training a new generation of gardeners and caretakers. To this day, a gardening school is run by the National Trust for Scotland on the Estate, with new students recruited annually. The estaste, house and gardens have been open to the public since 1960, with tours of the house conducted four times a week by local volunteers. Visitors are impressed by the Scottish Baronial style, which may have taken inspiration from Castle Fraser in Aberdeenshire.

Image 16 The Baronial House towering over the garden. Photo: The Daily Record

Staying informed

Climate changes observed on the estate, such as an increase in annual precipitation by around 4% since 1961 have exposed the need for adaptation. The estate is home to a weather station, sending data directly to the UK MET office. This produces a very accurate and precise set of climate data for the estate and its surrounding area, supporting any risk assessment and adaptation planning. Richard Polley, General Manager of Threave Garden and Estate is exploring the opportunity of recruiting students to assist the estate in collecting and analysing the climate data.

Impacts of precipitation

Existing hoppers and guttering on the house have been identified as struggling to cope with current precipitation levels. Particularly, the house's recessed roof above a west-facing bay window has experiences increased pressure onto its rainwater goods. A concealed pipe is too small to cope with the current precipitation levels. Combined with increased wind speeds, the west-facing window is impacted on by wind-driven rain. "Because of the frequency of increasing heavy torrential downpours, the rainwater goods are suffering from being overloaded by the sheer volume of water", Richard Polley observes. The more extreme weather events are causing this problem, he believes, and the increase in regularity makes the need for adaptation more pressing. Climate projections indicate fluctuations in precipitation, with decreasing levels in the summer months, but a 20% increase during the winter.

Image 17 The west-facing bay window. Photo: The National Trust for Scotland

Adaptation planning

Over the past years, work has been undertaken on the estate, inlcuding roof checks and remedial work. Extreme weather events have been increasingly considered and noted as part of routine maintenance at the house. In cooperation with Historic Environment Scotland, adaptation measures were applied over two years, following the maintenance work, to help with occasional overflow of the gutters at the west-facing bay window. Initially, the existing lead roof had been repaired, but as water was discovered to still be getting around the roof, it was decided to extend the lead. Its height was increased.

Looking ahead, it should be emphasised that rainwater goods will have to be reviewed regularly and ways to increase their capacity must be explored, in line with projections of increasing precipitation.

Image 18 West facing side of the Baronial House. Photo: The National Trust for Scotland

6 BARTJAN – SÁMI SUMMER HERDING SITE

Bartjan is situated just below the mountains in the southwestern part of Jämtland on the border to Härjedalen. Bartjan is defined as a cultural environment of national interest in Sweden and serve as the summer site of the Sámi village Tåssåsen. The history of the site is being told by findings of old banks for reindeerherding and milkpits. In the middle of present buildings and traditional tipis, old tipiplots tells stories about former inhabitants. Nearby, there are several reindeerherding fields, some of them still in use, some deserted long ago. The name Bartjan comes from the southsámi word ”barsje” meaning ”edge of the mountain” or a place where you can see both mountains and the forest.

Sámis consider cultural heritage as a holistic system, where the different parts interact and are dependant on each other. ”Culture and history of the Sámi people in a geographical context” is the official definition of cultural heritage of the Sámi parliament. In the definition, they stress the following aspects of cultural heritage;

- Material cultural heritage; all physical remains and traces in nature such as buildings etc.
- Immaterial cultural heritage; traditional knowledge, stories, myths etc.
- Biological cultural heritage; proof of usage of nature, such as banks for reindeerherding etc.

Image 19 Bartjan summer camp used by the Sámi community for reindeerherding. Photo: Therese Sonehag, Riksantikvarieämbetet

Bartjan in a changing climate

Bartjan is a site under constant change. While change is difficult to appreciate while occuring, we face a challenge in relating these changes happening now to climate change and not only to natural degeneration. Current knowledge will alert us to these effects. aswell as help us understand changes that already have occured. These changes mainly involve growth of trees and bushes in new and formerly not suitable environments such as on higher altitudes. Nowadays not only the mountain birch can be found on the slopes of the mountains but also pine and spruce. These effects of climate change have gradually changed how the site has been used.

The Sámi perspective

In Sámi culture people show great respect and live for, by and with nature and it´s resources. Sámis have their own view upon, and their own relationship to all changes in nature. For Sámis it is natural and a tradition that a tipi, after decades of usage, or areas deemed surplus or unusable, are abandoned and left to go back to nature to regain it´s original status. According to Sámi tradition, descendants must not be limited or disturbed by remnants from previous generations but have the same conditions and possibilities.

Reindeerherding Sámis are subject to conditions affecting the reindeer and how it can handle changes in nature and among other animals. The reindeer, as most animals, are dependant on habitual patterns and prefer stable and reliable conditions. It gives birth in the very same area as it was born, it grazes in the same areas, it moves between areas in the same paths. If these habitual patterns have to be abandoned, it changes the conditions not only for themselves but to a great extent, also for the reindeerherders and the Sámi village as a unit. This could lead to the Sámi village abandoning a site, leaving cultural heritage values and the constructions to go back to nature.

From these perspectives, Sámis need to address climate change and it´s effects in their own way, free from systematisation and schemes. Changes that in western interpretations are vulnerable threats can, according to Sámi traditions, be seen as natural changes and conditions to handle over time. According to this, the risk- and vulnerability analyses must be handled and interpreted differently.

Image 20 View of wooden construction of inside a traditional tipi. Photo: Jerker Bexelious, Stiftelsen Gaaltije

What is left to tell?

The Sámi parliament defines cultural heritage as holistic. This can be interpreted as the physical cultural heritage being important in itself, but that its value increases through the philosophy, the knowledge and the stories that it carries and canalises. It is in the light of this meaning that Sámi cultural heritage values and the risks that they are subject to must be seen in a bigger perspective. With deteriorating physical cultural heritage values, the stories risk losing its connection to a place and not being remembered and told any more. Knowledge about the lands, the people and important events can disappear. Local Sámi traditions are at risk of disappearing. Transfer of knowledge, so often stressed in Sámi culture, must be appreciated being under stress from climate change and therefore be strongly considered when discussing effects on Sámi society by climate change.

Adaptation planning

Preservation of Sámi cultural sites means preservation of Sámi culture and traditions. On the bases of the effects of climate change on Bartjan, it was discussed what measures were needed to preserve and protect it´s cultural heritage values. Based on culture and traditions, differences in perspectives on nature and the changes occuring mean different assessments of the climate change effects and the measures are needed to adapt. According to the Sámis, preserving culturally important constructions or land is important, but cannot be separated from the preservation of all the stories, myths and knowledge that are carried by them. None

the less, Sámis and Sámi organisations need to acknowledge the need for monitoring and strategically plan for the long term maintenance of their cultural heritage sites.

Image 21 The camp's traditional tipi, made from turf and wood, falling into disuse and deteriorating quicker. Photo: Jerker Bexelius, Stiftelsen Gaaltije

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