



MILJØVERNDEPARTEMENTET

## Climate change and cultural heritage

Heidi Sørensen,  
Deputy Minister  
Ministry of the Environment

"Frozen pasts", Trondheim 5.10.10

Photo: Marianne Gjery

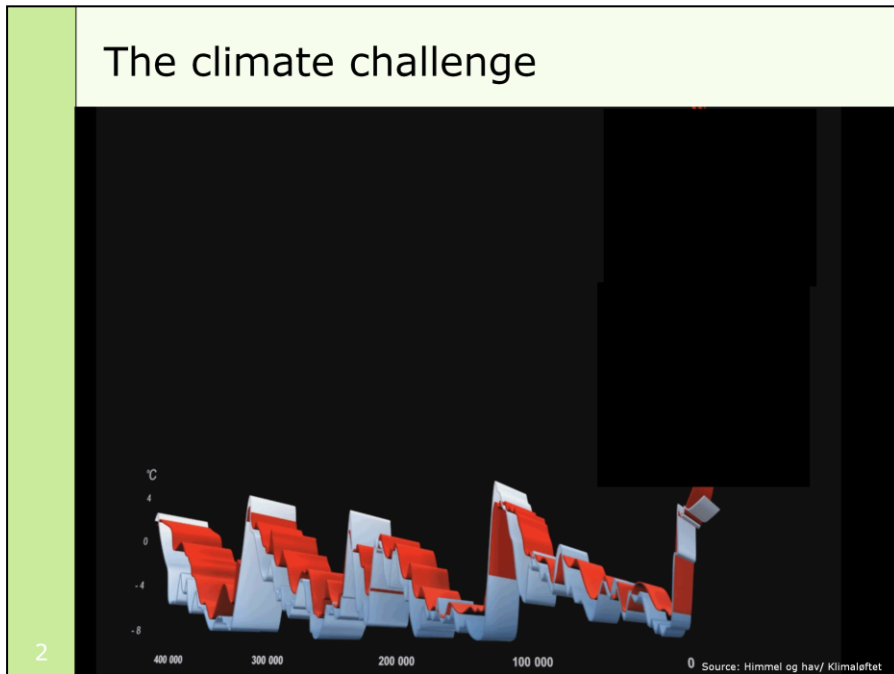
Picture: The glacier "Bøverbreen" in the mountain area Jotunheimen in the southern part of Norway.

I am honored to be given the opportunity to open this international conference "The Frozen Pasts".

As a politician I have never experienced to open a conference at 8 o'clock in the morning. I will remember that archeologists are hard-working people.

The conference brings together experts from different areas on the subject Glacial Archaeology. This is a subject that has become most present in the news during the last couple of years, with the focus on climate change and the massive melting of glaciers. However, many of us became aware of this phenomena already in 1991, with the find of the Ötzi-man in the Alps. This find is mostly an outstanding archeological find, but it is also a symbol of the increasing global challenges related to climate change.

## The climate challenge



This figure shows the relationship between temperature and greenhouse gases, based on analyses of ice cores from Antarctica. The blue belt shows the temperature, and the red belt shows the concentration of CO<sub>2</sub> up until the industrial revolution.

Klikk 1: This shows the increase of greenhouse gases up until today. Klikk 2: This shows what most likely will happen the next 40 years, if we do not reduce CO<sub>2</sub>-emissions.

The planet is now experiencing levels of CO<sub>2</sub> in the atmosphere that is nothing like what we have seen the last 400 000 years.

Climate change can now be observed out in the nature. The extent of the polar sea ice has dropped much faster than predicted by even the most pessimistic models. The scientists still don't fully understand the collapse of the polar sea ice we have seen since 2006.

## Norwegian glaciers on the mainland

The green signs show the front of the Briksdal glacier in 1870 and 1920



On these pictures we can see the Briksdal glacier, in the south-west part of Norway. It is an outlet of the glacier Jostedalbreen, which is the biggest glacier on the European mainland.

Norway has long experience from studies of glaciers on the Norwegian mainland. Mass balance, change in glacier length and glacier velocity, have been measured for nearly 60 years.

Data on changes in glacier length on glaciers in Norway, show that glacier outlets, in general, have had a retreat in length in recent years. On this pictures from the Briksdal glacier, the green signs indicate the position of the glacier front in 1870 and 1920.

Due to the enormous digging power of a glacier in motion, a sensational discovery was made in 1995, in front of the Briksdal glacier. A piece of a willow trunk [seljestokk] was found, which was determined to be 8400 years old. The log dated from a period when the glacier was smaller than today.

And in the period 7300 to 6100 years ago, all of Jostedalbreen melted away. It is likely that at that time, the area around Briksdalbreen was covered by a forest.

[Source: Jostedalbreen nasjonalpark visitor centre, The County Governor in Sogn og Fjordane, and ranger service, Statens naturoppsyn.]

# Svartisen – subglacial observatory



The glacier Svartisen, in the northern part of Norway, is a glacier being explored by scientists from all over the world.

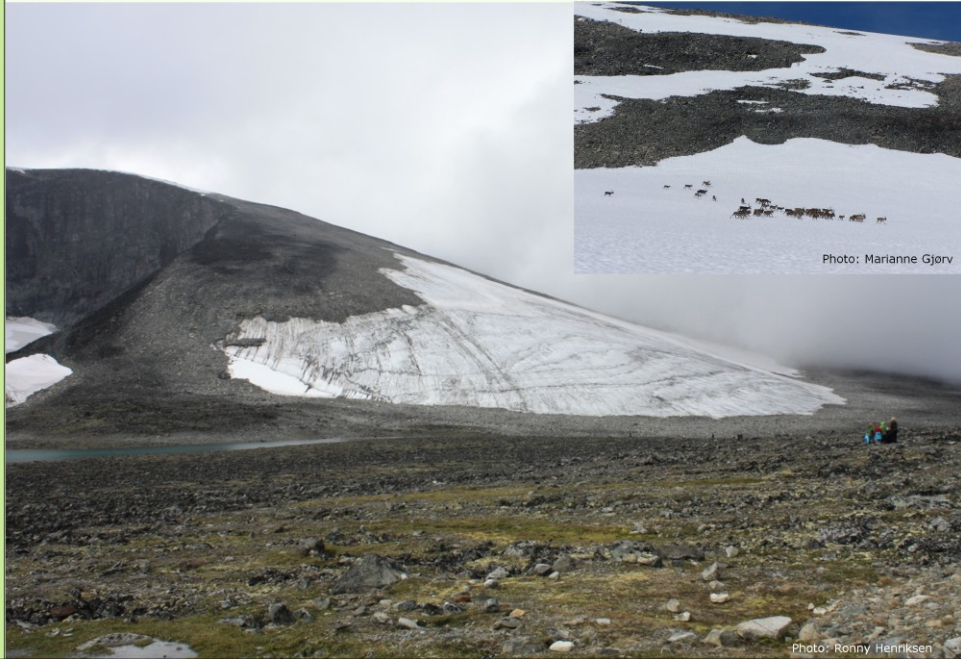
Svartisen Subglacial Laboratory is situated under 200 meters of ice. The laboratory provides a unique opportunity for direct access to the bed of a temperate glacier.

In tunnels into the glacier, scientists led by the Norwegian Water Resources and Energy Directorate (NVE), do measures.

These measures can give us important information relevant for agriculture, water supply, energy production and precautions concerning floods and landslides.

Maybe this subglacial observatory will discover some old cultural heritage items as well?

## Melting of snow patches on the mainland



This snow patch is called Juvfonna, and it is situated in Jotunheimen, close to Norway's highest mountain Galdhøpiggen (2469 meters above sea level).

The snow patch Juvfonna has withdrawn as much as 18 meters only this year! It can easily be seen by the light gray area around the snow patch without moss.

[Click; animated picture of reindeers]

Reindeers have for hundreds of years wandered in the mountain regions. In the summer they went to snow patches to cool off and to get away from insects, just as the smaller picture shows (the picture is taken close to Galdhøpiggen in Jotunheimen). Hunters followed the animals and put up a system with sticks that functioned as some sort of a reindeer fence. The sticks frightened the reindeer towards other hunters that hid behind shelters built of stone, bow positions.

## Archaeological finds is melting out of ice



Photo: Oppland fylkeskommune



Photo: Ministry of the Environment



Photo: Ronny Hærveien

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Because of today's warmer climate, archaeological organic finds are melting out of the ice. These old items provide both climate researchers and archaeological researchers with important data. Usually all organic material has been decayed, but the ice has preserved such material very well.

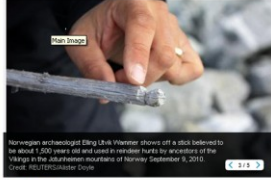
The picture to the left shows a famous shoe, which is 3400 years old! This was found near Kvitingsskjølen in Jotunheimen, and has been preserved in a glacier until recently. This is, as far as I know, the oldest shoe in Norway.

Both the Minister of the Environment and Development, Mr Erik Solheim, and I had the opportunity to visit Jotunheimen this summer. We learned about the important work that is being done to preserve old items coming out of the melting ice. We understand that time is short and that it is crucial to act quickly when new finds are revealed.

On the picture you can see me holding a wooden stick, which has appeared from the melting snow patch Juvfonna in Jotunheimen. This stick, also called a sewel or scaring stick, is part of the hunting system I talked about earlier. Together with me is my daughter and project leader Espen Finstad, who will speak more about Ice Patch Archeology later today.

The rapid melting of snow this year makes it difficult for archaeologists to preserve all the snow patches finds

Home of "Ice Giants" thaws, shows pre-Viking hunts



Norwegian archaeologist Erling Ulvik-Wikstrøm shows off a disc believed to be about 1,500 years old and used by reindeer hunters by ancestors of the Vikings in the alpine region of Norway. September 9, 2015. Credit: REUTERS/Christian Dowse

By Alister Doyle, Environment Correspondent  
JØVIØRMA, Norway | Tue Sep 14, 2016 1:17pm EDT

(Reuters) - Climate change is exposing reindeer hunting gear used by the Vikings' ancestors faster than archaeologists can collect it from ice thawing in northern Europe's highest mountains.

"It's like a time machine - the ice has not been this small for many, many centuries," said Lars Pilee, a Danish scientist heading a team of "snow patch archaeologists" on newly bare ground 1,850 meters (6,070 ft) above sea level in mid-Norway.

Source: Faksimile, Reuters 14.09.10

# Snøsmelting ødelegger for arkeologene

Redder bare en brøkdel av funnene

Årets nedsmelting av permanente snøfjerner i fjellet har skapt en krise: Flere forfattede funn avdekkes enn det arkeologene klarer å redde. Mye må etterlates.

CATO GURNEFELDT

Fra 200 til over 2000 år gamle gjenstander fra jakt, fangst og drift i fjellbjelken velter ut av de smeltende snøfjennene i et slikt omfang at man ikke makker å berge alle.

«Vi står i fare for å miste et betydelig antall funn på grunn av årets ekstremt store nedsmelting, sier arkeolog Vibeke Wangen ved Kulturhistorisk Museum, Universitetet i Oslo.

«Vi har ikke nok folk og ressurser til å samle inn alt samtidig som vi konstaterer at ting forsvinner eller ødelegges. Situasjonen er dramatisk - et er veldig bekymret.

Årsaken til at funnene ødelegges skyldes at det aller meste er organisk materiale som raskt brytes ned når det eksponeeres for temperaturfluktninger, vekselvinding, tørke og fuktighet. Typiske funn er komplette piler fra både bue og armbrøst, med jernspike, skutt og streffet, videre trespader, skremmespinner som



Ekstrem nedsmelting har bl.a. rammet Åndfonna på Lomsøeggen i Sjøvik. Ved Lendvatnet i 1650 meters høyde har arkeologene slått opp en snøskot for å samle opp funnene.



Arkeolog Erling Ulvik-Wikstrøm holder opp en trespade av tre fra jernalderen som har vært fester til toppen av en skremmespinner. Om et år vil museet ha funnet tusenvis av slike sperrer.

I 2006 møttest Kulturhistorisk Museum rundt 250 gjenstander fra snøfjennene. Et begrenset feltarbeid ved flere fjener fra 2007 kulminerte i 600 med funn av rundt 500 gjenstander fra jernalderen bare fra Jarvonna.

Krever innsats. Både miljøvernmister Erik Solheim, statssekretær Heidi Sørensen og rikantikvar Jørn Holme har besøkt funnstedet ved Jarvonna.

«Snøfjennene representerer i øyeblikket det mest sårbare arkeologiske materiellet i hele Norge, sier fylkesarkivleder Espen Fjæstad i Oppland fylkeskommune. «Det er således nødvendig

Source: Faksimile, Aftenposten, 05.09.10

Here you can see two recent articles, one from the Norwegian newspaper Aftenposten, and the other from Reuter. Both of them tell us about the rapid melting of snow this year, and how this makes it difficult for archaeologists to preserve all the snow patches finds.

Finds like this will increase in the future. They will give us valuable knowledge about human activity in the past. They also give us an opportunity to bring together scientists of different areas and visualize the effects of climate change for people in general.

This is an obligation this government has taken, stated in the "governing platform" (Soria Moria II), that states clearly that we will "Increase the knowledge on archaeological finds melting out of ice and snow patches in the high mountains due to climate changes".



The project in Jotunheimen is called “Climate Park 2469” (Klimapark 2469), where the number refers to the altitude of the mountain Galdhøpiggen, which is the highest mountain in Norway. Climate Park 2469 is located in the alpine region around Galdhøpiggen (2469 metres) and the Juvasshytta lodge.

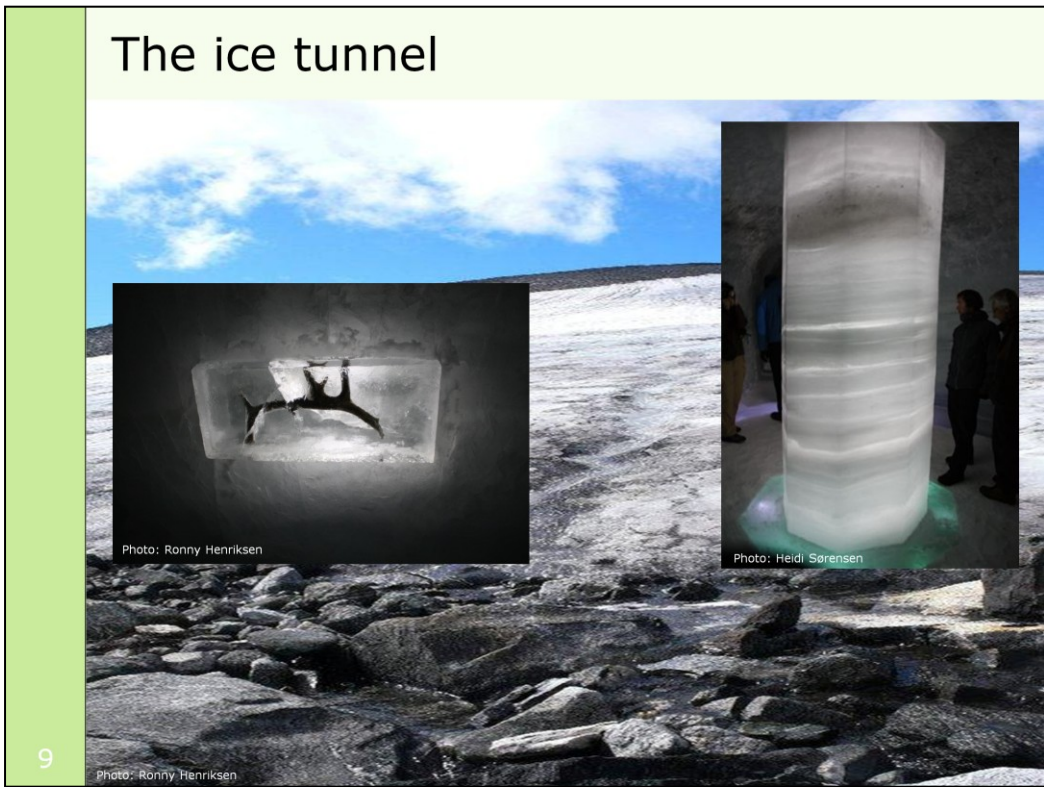
The goal of the Climate Park 2469 is to communicate new climate-historical knowledge to young and old. The climate park will be a site where visitors can physically sense and experience climate change and the relationship between nature and culture from a long-term perspective.

I am very impressed by the work of Oppland county, which is responsible for the “Climate Park 2469”. People from the Norwegian Nature Inspectorate (Statens Naturoppsyn) are guides in the project, and give people an opportunity to see the impacts of climate change.

One of the Climate Park 2469 main attractions this year was the opening of an ice tunnel. A 30 meters long tunnel was carved into the Juvfonna snow patch. This tunnel brought visitors to a travel into the ice and journey in time.



## The ice tunnel



Here you can see some pictures from the spectacular ice tunnel at Juvfonna, a tunnel which have been heard of in many countries.

Someone told me that a lady from the Unites States came all the way from New York to Juvfonna to experience how it is to walk inside an ice glacier.

In the ice tunnel, you can get information about climate changes and the archeological finds, like the horn of reindeer, seen in the ice block.

## Norwegian glaciers on Svalbard



Norway possesses extensive knowledge about climate and glaciers from studies of glaciers in Svalbard, where this picture is from, and in Antarctica, where we have a research station called Troll.

The Arctic is a highly priority area for Norway in our work with climate change. We have a special focus on monitoring and the consequences related to ice and glaciers.

When the minister of finance presents the next year state budget today, he will reveal increased funding for research on ice and climate.

# Cultural heritage in Svalbard



Photo: Ronny Henriksen



Srevet av Berge Amundsen for, 24/08/2008 - 23:11

Følg oss på:

Arbeidet med å bygge ny bukk, som erstatter for bukken som gikk i bakken og ble knust under en storm i april 2004, har pågått i tre uker. Arbeidsleder Karl Fredheim, restaureringshåndverker hos Syssemmannen, forteller at bukken skal være ferdig og klar for reising i løpet av fjorten dager.

Source: Faksimile. Svalbardposten



Photo: Ronny Henriksen

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Cultural heritage in Svalbard has a special position, both in the legislation and management, where cultural heritage and nature management is combined. But also because of the harsh climatic conditions in Svalbard. Protecting and managing the cultural heritage has different approaches.

**First [click]: certain items are supposed to remain in peace.** All cultural heritage, monuments and sites from before 1946 are automatically protected. And example of this is this German airplane from the Second World War (you can see the wreck of this plane on the picture to the right, on top).

**Secondly [click]: some items have to be repaired.** Because of the thawing permafrost and erosion settling, damages occur on for examples buildings. Action has to be taken to stabilize the construction. Because of the melting permafrost, wooden constructions will also sink down in the melting ground and more easily be exposed to rot/decay. One example of this is the Swedish house (Svenskhuset) Kapp Thordsen (picture down right).

**And last [click]: other items have to be replaced.** One example of replacement is part of a larger system of boughs (picture to the left), that illustrate the former distribution of coal to the harbour of Longyearbyen, the main town in Svalbard.

## Thawing permafrost



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The small picture show an old hunting station in Svalbard (in Recherchefjorden). The building is falling apart because of thawing permafrost.

In arctic areas, thawing permafrost will make the condition a lot more difficult for the preserving of archaeological material. The foundations for buildings will become unstable. Reduced sea ice by the coasts of areas like Svalbard and Greenland, will lead to increasing erosion made by waves. Cultural heritage by the coasts will suffer.

Warmer summer temperatures will lead to poorer conditions for organic material. Increased temperature will lead to more rot. A shorter season of sea ice, will damage the cultural heritage exposed to waves and erosion.

# Reptil excavation in Svalbard

forskning.no lechthysaur excavations 2010

The Svalbard excavation project is a collaboration between:

- NATURALHISTORISKT MUSEUM
- SVALBARD MUSEUM
- UNIS



Latest News Arrival Establishing Removal Uncovering Documentation Plastering Flipping Completion Backfilling Departure

### Removal of overburden

Before the slow process of brushing clear the skeleton can start, several tons of overlying shale has to be removed.

This is done using pick axes, shovels, and trays. The loose shale is put in piles on both sides and above the hole, so it can easily be moved back once the skeleton has been taken out.

By following the inclination of the shale layers one can ascertain when to start using more gentle tools to avoid damaging the fossil.

Photos:



This photo is from an earlier expedition. (Photo: Naturhistorisk Museum)

### News

Reptile excavation live



From August 2 to 18 there are fourteen Norwegian reptile hunters doing field work at the foot of the Janus Mountain in Svalbard, digging for remains of prehistoric sea monsters from the

### Scientists +1

- Jeru M. Hjørnum (42), paleontologist**  
The weather can quite often be both the best and the worst aspect of field life.
- Espen M. Knutsen (29), PhD student**  
The best part of working in the field is snapping out of your normal everyday routine, doing something that is totally different.
- Patrick Brucknermiller (43), geologist**  
Friendship and wildness, and the excitement of new discovery.

### Multimedia

- Video**  
Earlier excavations  
Watch videos from earlier excavations at Svalbard.
- Picture**  
Plesiosaur gallery  
Picture gallery with illustrations of plesiosaurs.
- Earlier excavations  
Photo gallery from the earlier

Source: Faksimile, forskning.no

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In August this year, there were fourteen Norwegian reptile hunters doing field work at the foot of the Janus Mountain in Svalbard, digging for remains of prehistoric sea monsters from the Jurassic period.

The first plesiosaur fossils were found in Svalbard more than a hundred years ago. But a lot of work remains, before the reptiles are uncovered and brought to museums for preparation and further research.

In 2004 - 2009 several expeditions uncovered fossils, and skeletons were brought to Natural History Museum at the University of Oslo. This year more will be brought out of the ground, hopefully in good shape. Maybe they also will find new species.

(Source: [http://www.forskning.no/svalbard/index\\_english.html](http://www.forskning.no/svalbard/index_english.html))

## A lot to loose...



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Photo: Stiftelsen Bryggen

As you can see, the impacts of climate change might do severe damage to both nature and cultural heritage. There is a lot to loose if we do not act in time.

Here you can see the world heritage site Bryggen, which is the old wharf of the city of Bergen, on the west coast of Norway.

Bryggen is very vulnerable to rising of the sea level.

Cultural heritage is not the cause of climate changes, but it is a sector that will have to cope with the problems. The predicted weather changes will influence biological, chemical and physical decomposition, and it will probably lead to increasing decay of cultural property and cultural heritage. This will have to be reflected in the cultural heritage management.

## A melting future?



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The picture shows Engabreen at the glacier Svartisen, in the county of Nordland.

For the future, I hope that humans still will have the opportunity of experiencing glaciers, snow and ice patches. I also hope that we can look back and conclude that we took the challenge we were given of saving the remains of the frozen pasts. Thank you.