

# Environment and Society in a Changing Arctic (AK1214)

Summer course at KTH, Kiruna, Tarfala and Gällivare

June 4 – July 4, 2018



# 1. Introduction

There is a growing international interest in the Arctic, triggered by the effects of global warming as well as global economic and political trends. Retreating ice sheets and glaciers, decreasing sea ice, changing seasonality of snow and ice, permafrost thaw and changing ecosystems characterize the present Arctic. These developments, with large potential feedbacks, have led to increased efforts by scientists to monitor the changes, explain their causes and predict their consequences. Simultaneously, climate change as well as changing global economic and



political trends, have led to an increased economic interest in the Arctic. The decreasing summertime sea ice cover in the Arctic Ocean has already offered new possibilities for shipping between the Atlantic and Pacific oceans along the northern coast lines of the Eurasian and North-American continents. In addition, global economic processes such as rising and falling world market prices for base and rare metals have resulted in boom and bust cycles in prospecting and mineral extraction across the Arctic region. Together these changes pose a challenge to all stakeholders in the region, from indigenous peoples and other local residents, municipal planners, to policy makers and economic actors on the regional, national and global scale. The changes also pose a challenge to students who wish to work for sustainable development in their careers.

However, the Arctic environment and the ways humans relate to and depend upon it have undergone changes before. In order to understand the present developments and their possible outcomes, we need to know why and how the region has developed in a long term perspective.

The geographical focus of the course is on the Fennoscandian Arctic, but changes in this region will be placed in a larger Arctic and global context. The Sami indigenous population has lived in the Fennoscandian Arctic since ancient times and the Nordic states have had a foot there since the medieval period. The natural environment in the region has undergone several changes since the last glaciation (10 000 years ago), often triggered by changes in the climate. The indigenous peoples of the north have shaped their lifestyles in interaction with these changing environmental contexts, but also in relation to new colonizers in the region. Over the centuries actors from the centers of power in the southern parts of the Nordic countries have successively increased their interest in the Fennoscandian Arctic as an arena for taxation, science, tourism industry, resource exploitation, energy production and settlement.

Thus the rise and fall of interest in natural resources and political influence in the Arctic is nothing new, but the scale of the operations and their potential impacts on environments and societies are more severe than ever before and therefore pose a challenge to residents (indigenous and non-indigenous), economic and political stakeholders and for policy makers on local, regional and national levels. We are aware we need to predict the effect of cumulative impacts, of which climate change and extractive industries are the two most important for this region.

## 1.1 Objectives and learning outcomes

The aim of the course is to provide a thorough orientation about long-term changes in the Arctic region, with a particular focus on the Fennoscandian Arctic. Which environmental changes has this region experienced historically? Why and how have humans used the region? How can we use past experiences when assessing the impact of the current changes? The course focuses on two interrelated themes: 1) climate- and environmental change and 2) societal- and cultural change. After the course, students will be able to:

1. Recount climatic and environmental changes in the Arctic
2. Describe and explain the main processes of societal change in the region
3. Conduct basic field research through documentation of natural phenomena, built environments and interviews
4. Perform simple research tasks by using and combining the

different sources.

5. Critically analyze current events in the Arctic, in relation to the course contents

## 1.2 Learning activities

The learning activities of the course take place in two different contexts - at KTH, Valhallavägen campus in Stockholm, Sweden; and in the field in Norrbotten county in the Swedish Arctic, which is a part of Sápmi – the traditional homeland of the indigenous people of the Fennoscandian north, the Sami. Here we will spend some days at the Tarfala Research Station which is located in a high alpine setting (see [www.ink.su.se/tarfala](http://www.ink.su.se/tarfala) or Tarfala Research Station on Facebook). The station is owned and operated by Stockholm University (SU), which is in charge of the field education in the course as well as some of the natural science oriented lectures in Stockholm.

The learning activities in the course are the following:

**Lectures:** An important part of the course consists of lectures which last from one to two hours. Most lectures are given by teachers from KTH and SU.

**Excursions:** On occasions, the lectures will be complemented by visits to museums in Stockholm, focused on museums which in various ways deal with the Arctic.

**Field work:** The students will be trained in field research (documentation of natural phenomena and built environments as well as interviews) during the field work period. As a part of the field work, the students will collect data for use in their written assignments.



1. Field education at the Storglaciären glacier



2. Exploring Arctic mining landscapes - Kiruna iron ore mine

*Seminars:* An important part of the course consists of seminars. The seminars will be in three different forms – literature seminars, field work seminars and essay seminars. The **literature seminars** will be devoted to the course literature. They are normally 1 hour long and follow some of the lectures. If there is no seminar following the lecture, we will examine you on the readings by a quiz. During the second part of the course, the **field work seminars** will be devoted to discussing different issues related to the field work. The **essay seminars** will be held on two occasions during the course – one at the beginning and one towards the end. During those seminars the students will have the opportunity to present their work in progress and receive feedback from the teachers before completing and handing in their final essays.

*Quizzes:* in connection with some of the lectures, we will have a quiz on the readings.

*Writing an essay:* The students will write essays in pairs. The essays have to deal with research problems pertaining to environmental and societal changes in the Fennoscandian Arctic. They need to be based on course literature, lectures and data the students collect during the field work. We encourage you to combine both natural science and humanities-social science data. The essay has to contain clear and informed reference to course literature from all disciplinary fields in the course. In addition, other literature sources may be used. At the beginning of the course, a full synopsis of the essay should be presented at a seminar. Towards the end of the course a work in progress on the essay shall be presented and discussed. The final version of the essay should be handed in at a date in the third week of august.

### 1.3 General outline of the course

The first part of the course will be held at KTH, Valhallavägen campus in Stockholm, from June 4 to June 22, and consists of a series of lectures, seminars and museum visits on the topic Arctic environmental and societal change. The lecture schedule is summarized below.

The second part of the course takes place in Kiruna, the Tarfala research station and the Gällivare area in the Swedish Arctic from June 24 to July 4 and consists of different field work exercises, focusing on different aspects of the changes taking place in the Arctic.



3. Tarfala research station – base for the Arctic course 2018

One set of field work excursions will focus on the societal and environmental legacies of large scale mining operations, with visits to spectacular mining sites such as the Boliden Aitik open pit copper mine, and the LKAB mines in Kiruna, Svappavaara and Malmberget – the latter a mining town that is currently being swallowed up by a huge open pit. We will also visit different sites related to the so-called



4. Students having break by mountain stream



5. High alpine Tarfala valley

technological mega-system of Norrbotten, such as the Porjus hydropower station, as well as landscapes affected by the megasystem such as the Laponia world heritage area and the system of hydro-power dams in the Luleå river valley. The field work tasks will focus on the legacies of large scale resource utilization in the Arctic and how local communities can deal with those legacies in order to build sustainable futures. Students will conduct interviews with actors and document mining landscapes and various representations of history (museums, cultural trails, exhibitions).

Another set of activities throughout the field work will explore past and contemporary aspects of Sami culture in the region. We will visit the town of Jokkmokk - internationally renowned for its vibrant Sami culture –, where the Ájtte Sami museum and cultural center is based. Subject to availability, we will also meet with local Sami representatives to learn about contemporary Sami communities. The field work tasks will address issues of self-determination, resilience and resistance of Sami communities in the past and present.

Another set of field work excursions will focus on the environmental impacts of climate change. These excursions will take place in the spectacular Tarfala valley – a heavily glaciated high alpine valley in the Swedish-Norwegian mountain range. In Tarfala valley we will be based at the Tarfala research station, located below the highest peaks in Sweden – Kebnekaise. We will hike to Tarfala station from the Sami village Nikkaluokta and use the station as a base for excursions in its surroundings. The field work tasks will focus on the retreat of glaciers, changing ecologies and geology and geomorphology.

The general objective of the field work is to train students in addressing main research problems of the course, by documenting and analyzing evidence on environmental impacts of climate change, as well as data pertaining to changing Arctic communities and the consequences of natural resource extraction in the Arctic. A third objective is for the students to collect data for their final essays.

The main teachers of the course are faculty members from KTH and Stockholm University (SU).

## 2. General course schedule

### Week 23: Lectures and seminars at KTH

|                 | Monday<br>June 4 | Tuesday<br>June 5   | Wednesday<br>June 6     | Thursday<br>June 7  | Friday<br>June 8    | Saturday<br>June 9 | Sunday<br>June 10 |
|-----------------|------------------|---------------------|-------------------------|---------------------|---------------------|--------------------|-------------------|
| 9-12 /<br>10-12 | Introductions    | Lectures            | Free                    | Lectures            | Lectures            | Free               | Free              |
| 13-15           |                  | Lecture/<br>Seminar | Swedish<br>National Day | Lecture/<br>Seminar | Lecture/<br>Seminar |                    |                   |

### Week 24: Lectures and seminars at KTH

|                 | Monday<br>June 11   | Tuesday<br>June 12  | Wednesday<br>June 13 | Thursday<br>June 14  | Friday<br>June 15   | Saturday<br>June 16 | Sunday<br>June 17 |
|-----------------|---------------------|---------------------|----------------------|----------------------|---------------------|---------------------|-------------------|
| 9-12 /<br>10-12 | Lectures            | Lectures            | Lectures             | Lectures             | Lectures            | Free                | Free              |
| 13-15           | Lecture/<br>Seminar | Lecture/<br>Seminar | Lecture/<br>Seminar  | Lecture /<br>Seminar | Lecture/<br>Seminar |                     |                   |

### Week 25: Lectures and seminars at KTH

|                 | Monday<br>June 18              | Tuesday<br>June 19             | Wednesday<br>June 20           | Thursday<br>June 21 | Friday<br>June 22                   | Saturday<br>June 23 | Sunday<br>June 24       |
|-----------------|--------------------------------|--------------------------------|--------------------------------|---------------------|-------------------------------------|---------------------|-------------------------|
| 9-12 /<br>10-12 | Lectures                       | Lectures                       | Lectures                       | Lectures            | Free<br>(Midsummer<br>Celebrations) | Free                | Departure<br>for Kiruna |
| 13-15           | Lecture/<br>Seminar/<br>Museum | Lecture/<br>Seminar/<br>Museum | Seminar /<br>Film<br>Screening | Free                |                                     |                     |                         |

### Week 26: Field work in Norrbotten-Sápmi, Arctic Sweden

|      | Monday<br>June 25                              | Tuesday<br>June 26                                 | Wednesday<br>June 27 | Thursday<br>June 28                   | Friday<br>June 29                  | Saturday<br>June 30 | Sunday<br>July 1        |
|------|------------------------------------------------|----------------------------------------------------|----------------------|---------------------------------------|------------------------------------|---------------------|-------------------------|
| 9-18 | Kiruna<br>City walk/<br>Museum/<br>Luossavaara | Kiruna<br>Mine tour/<br>Samegården<br>/ Sametinget | To Tarfala           | Tarfala<br>Field<br>work/<br>Lectures | Tarfala<br>Field work/<br>Lectures | To<br>Gällivare     | Laponia /<br>Malmberget |

### Week 27: Field work in Norrbotten-Sápmi, Arctic Sweden

|      | Monday<br>July 2 | Tuesday<br>July 3 | Wednesday<br>July 4            |
|------|------------------|-------------------|--------------------------------|
| 9-18 | Aitik/<br>Porjus | Jokkmokk<br>Ájtte | To<br>Stockholm<br>Course ends |



4. Kiruna mining town in Arctic Sweden

### 3. Lectures and literature

All lectures will take place at KTH campus. The aim of the lectures and related readings is to explain how and why global processes of change (climate, economic, political, cultural) influence environments and societies in the Arctic, how Arctic communities deal with those changes, and how different stakeholders perceive the future of this region. With this objective, the lectures are divided into the following themes.

A detailed schedule for the lectures and seminars, including the course readings, will be made accessible to the students in due time to prepare for the sessions.

## 4. Field work plan, Kiruna & Tarfala



5. Mining landscape at Kiruna, Swedish Arctic

### 4.1 Introduction

From June 24 to July 4 2018, the field component of the course Environment and society in a changing Arctic (AK1214) will take place at Kiruna, Tarfala, Gällivare and Jokkmokk, all located in the Norrbotten county of Arctic Sweden. The objective of the field work is to train students in addressing the main research problems of the course, by documenting and analyzing a) natural phenomena giving evidence on climate change and its environmental impacts and 2) built environments and material pertaining to past and present Sami culture as well as the legacies of natural resource exploitation in the Arctic. As a part of this field work, the students will collect material for use in their essays.

Participants will arrive at Kiruna on June 24. On July 4 all course participants will depart Kiruna (or stay on private expense).

### 4.2 General info about food and accommodation

The field work component of the course is divided into three sections: 1) from the 24<sup>th</sup> to the 27<sup>th</sup> of June in Kiruna, 2) from the 27<sup>th</sup> until the 30<sup>th</sup> of June at Tarfala Research Station, Kebnekaise, and 3) from June 30 to July 4 in Gällivare, Jokkmokk and its vicinity.

#### 4.2.1 In Kiruna

During the days we spend in Kiruna we will stay at the Malmfältens logi & konferens. This guest house has common spaces which can be used for meetings, post-processing of data and work on reports. The

guest house is close to the centre of Kiruna where shops, restaurants and most field work localities are located.

<http://www.kiruna.fhsk.se/logi-konferens/about-the-company/>

While staying in Kiruna, breakfast will be included. Other meals can be prepared in the common kitchen area with food acquired from local food stores. There are also restaurants in Kiruna.



6. Ralph Erskine architecture, Kiruna

#### 4.2.2 At Tarfala



9. Research labs and accommodations for scientists at Tarfala research station

During the period of time when are based at Tarfala, we will have rooms and all meals at the Tarfala research station.

#### 4.2.3 In Gällivare/ Jokkmokk

More information about accommodation in Gällivare/Jokkmokk will follow shortly.

### 4.3 Safety

The field work will take place in environments which calls for careful behavior. Therefore we want you follow the lead and instructions of the course leadership. If you do not know what you should do, always go and ask a course leader. Never take drastic initiatives without first communicating with the course leaders.

Kiruna, Tarfala and Gällivare are all situated in the Arctic. The weather is unpredictable and can be everything from sunshine and 20 degrees Celsius (+) to zero with strong winds and even snowfall. Extended rainfall is common. This means that as a minimum requirement, you must bring 1) shell clothes (jacket and trousers) that must be water proof, 2) a warm second layer (preferably fleece), 3) a thinner inner layer (shirt+long johns) and 4) sturdy and water proof hiking boots. 5) Hat, gloves, sunglasses. You are obliged to bring these items. If you do not, you may be unable to take part in the field work at Tarfala.



There are mosquitos in the region below the tree-line. Lots of them. Bring repellent.

Also make sure to bring extra clothes to change if you get wet. Bring a daypack rucksack for carrying lunch sandwiches and dry clothes during field work excursions. To use common sense is the best advice. At the end of this course description there is a packing list. Bring the clothing and equipment specified on that list.

A re-occurring advice from previous students in the Arctic course is: do not bring too much luggage. You need a lot less than you think!

If you have any further questions concerning equipment and clothes, do not hesitate to contact Dag Avango (avango@kth.se).

## 5. Packing list (essentials)

The list below describes the essentials of the personal luggage you need for the field exercises in northern Sweden.

### Bags

1) **Bag for main luggage.** Preferably water resistant. Back pack or sports trunks are good. Avoid airport bag on wheels.

2) **Day pack.** Smaller back pack for field excursions. Should have enough space for bringing extra clothing, sandwiches, camera, band aid etc. on day excursions from the field camp. Backpack cover is convenient.

3) **Water proof bag.** Smaller water proof bag for keeping devices that must not get wet, for example cameras, lap-tops, pads, and phones.

## Shoes

4) **Boots.** It should be water proof boots which are made for walking - high enough to support the ankles, with a good “foot bed” (a good insole will usually do as well) and a good grip sole. Bring indoor shoes.

## Clothing



The weather can change fast between warm and cold at Tarfala valley

It is of outmost importance that you choose your clothing wisely. The principle you should follow is to have three layers of clothing + extras.

5) **Layer 1:** water and wind proof jacket and trousers, preferably Gore-Tex

6) **Layer 2:** fleece jacket and fleece trousers

7) **Layer 3:** thinner long johns and sweaters

8) **2 extra sets of layer 3** (it will get wet. You must not wear wet clothes. You must not get cold!)

9) Headwear

- 10) Warm gloves + 1 extra
- 11) Scarf or buff
- 12) Thin socks – one pair on and a minimum of 5 extras
- 13) Thick socks – minimum of two pairs
- 14) Underclothing – as many as you figure you will need



Sturdy shoes are needed - the terrain is often rocky and often wet

## Other items

- 15) Camera – this is essential, you will need it for your field work tasks
- 16) Water proof light weight packing bags for keeping the extra clothes dry (plastic bags sufficient)
- 17) Plasters to protect blisters on your feet (Compeed or similar brands) and plaster tape
- 18) Head ache pills
- 19) Imodium (for stopping a running stomach)
- 20) Sun block
- 21) Sun glasses

22) Straps and extra shoe laces (handy not only for shoes but also for tying up stuff)

23) Extra batteries for your cameras



24) Extra memory cards for your cameras

25) Wake up alarm (cell phone)

26) Water bottle

27) Walking sticks

29) Mosquito repellent!

### **Other items you might want to bring (not compulsory, but convenient)**

30) Binoculars

31) Earplugs (your room companions might snore)

32) Something to cover your eyes with during night time (sun is up 24/7)

### **Wearing while hiking**

OBS: the items mentioned here are already listed in the above. The list below is just to give you an idea of what you will wear during our daily hikes:

- Day pack with extra clothing, lunch pack, water bottle, plasters, sunblock, sunglasses and worn out extra shoes
- Sturdy hiking boots (water proof)
- Layer 1 water proof jacket
- Layer 1 water proof trousers
- Layer 2 fleece jacket
- Layer 3 thin set of long underpants + undershirt
- Thin socks
- Thick socks
- Water bottle
- Head wear
- Gloves
- Scarf

## 6. Requirements

In order to pass the course and receive a grading, you need to meet the following requirements:

- a) Mandatory attendance during all course activities: in order to pass the course you need to be present at all lectures, seminars, museum visits and in all activities during the entire field work period.
- b) Read the course literature and prove that by correctly answering reading quiz questions at the seminars.
- c) Actively participate in discussions during seminars and during field work.
- d) Write an essay in cooperation with other students.

*Examination:* The course is examined in three ways – 1) by active participation in discussions on the course literature and correct answers on the literature quizzes, 2) by collecting field data from all field visits (museums, mining sites and natural environments) in a note book and 3) by writing the above mentioned essay.

### 6.1 Grading

The course uses the grading system of KTH and SU – the ECTS grading scale. This grading scale ranges from F (fail) to A (excellent), according to the following:

A = excellent

B = very good

C = good

D = satisfactory

E = sufficient

F = fail

A distinction is made between the grades FX and F that are used for unsuccessful examinations. FX means: “fail- some more work required to pass” and F means: “fail – considerable further work required”.

Passing the examination in ak1214 requires active participation in discussions during lectures and seminars, as well as writing and presenting an essay. In other words, the overall grading is based on the major learning activities, which are a) lectures and excursions, b) field work c) seminars and d) writing the final examination essay. The grading is made according to the following principle:

- 1) 10% active participation in lectures, seminars and excursions
- 2) 30% active participation in field work and compiling field documentation in a field notebook
- 3) 50% the examination essay
- 4) 10% presentation of the examination essay

The grading is related to the learning objectives of the course, according to which the students should be able to:

1. Recount climatic and environmental changes in the Arctic
2. Describe and explain the main processes of societal change in the region
3. Conduct basic field research through documentation of natural phenomena, cultural remains and interviews
4. Perform simple research tasks by using and combining the different sources.
5. Critically analyze current events in the Arctic, in relation to the course contents

These learning outcomes can be achieved in all of the above mentioned learning activities. However, since 60% of the grading is related to the examination essay, the grading of this essay is of special importance.

### **Criteria for grading**

*In order to get an E (1-20), the student should accomplish the following:*

- 1) Display sufficient general knowledge regarding major climatic and environmental changes in the Fennoscandian Arctic, in discussions and quizzes.
- 2) Display sufficient general knowledge about cultural and societal change in the history of the Fennoscandian Arctic, in discussions and quizzes.
- 3) Display results of field work (documentation of natural phenomena, built environments and interviews) in the note book and the essay.

***In addition the student should accomplish the following in order to get a D (21-40):***

- 4) In the essay display satisfactory knowledge regarding major climatic and environmental changes in the Fennoscandian Arctic, exemplified by clear references to lectures, literature and field work, using proper citations.
- 5) In the essay display satisfactory knowledge regarding societal and cultural change in the European Arctic, exemplified by clear references to lectures, literature and field work, using proper citations.
- 6) In the essay, having used and combined the field data (natural phenomena, built environment and interviews) in order to perform a simple research tasks.
- 7) The research task presented in the examination essay should have a logic disposition and a clear narrative, with headlines and sections.
- 8) The essay should have a proper introduction with questions, delimitations, sources and methods. It should have an analysis section and end with conclusions where the questions are answered.

***In addition the student should accomplish the following in order to get a C (41-60) (in the essay):***

- 9) Discuss the relation between environmental changes and societal changes in the Arctic.
- 10) Voice separation: the student displays an ability to separate his / her voice from the voice of the sources (literature, lectures, interviews etc.).

***In addition the student should accomplish the following in order to get a B (61-80)(in the essay)***

- 11) In the analysis, the student shows an ability to use his / her field work data together with other course materials (literature and lectures), in order to discuss the relation between environmental changes and societal changes in the Arctic.
- 12) Critically analyze current events in the Arctic, in relation to the course contents.

***In addition the student should accomplish the following in order to get an A (81-100) )(in the essay):***

- 13) Present conclusions that not only summarize the results and answers the questions, but also interpret the results, discuss and make reflections on a higher level of abstraction, and/or suggest alternative interpretations.
- 14) Display a critical approach when using and analyzing the sources (such as natural phenomena, statements by actors, written material, and the built environment).

## **6.2 The essay**

The examination essay is written by work groups and should consist of an introduction, an analysis dealing with the research problem, and a conclusion. The essays should first and foremost be based on data the students collect during field work, but with clear references made to the overall literature and the lectures of the course.

The essay shall be between 5000-7000 words, distributed according to the following: Introduction 1000 words, Analysis section 4000 words and conclusions 1000 words.

The essay should be structured in the following way:

## **Introduction**

### ***General introduction***

The introduction should present how the group's chosen topic(s) fits in the context of the overarching objectives and research questions presented in the lectures of the course regarding historical and current changes in the Arctic (environmental as well as societal changes).

### ***Questions***

Here the authors should present the research questions which will guide their analyses and choice of sources. (Remember that the data collected in the field should be central in these research questions.)

### ***Sources and methods***

In this section the authors describe the methods used to obtain and analyze the sources that will be collected – for instance observations of natural phenomena, your recorded interviews of people, observations during guided tours and material you may have collected during these, and documentation of the built environment. It should introduce a summary explanation of the critical approach(es) that will be used in the following analysis.

## **Analysis**

Here, you describe, discuss and analyze your research problem in depth, involving both environmental and societal changes in the Arctic.

To discuss environmental changes in the Arctic, you should describe a change in an Arctic natural system which could be forced by economic development (e.g. resource extraction, construction, tourism etc.), climate change or both. The section should include a description of the change, a discussion of how and why the change is occurring and an analysis of how the change impacts natural systems. The timeframe over which the change is occurring should be mentioned and consideration of change over a range of timescales is encouraged.

Analyses of societal changes should be done in a similar way. To what extent are the changes related to or a result from global economic or political trends? Here, you can for instance focus on economic activities (like mining, tourism, reindeer herding) and the consequences of these activities for people and the environments in which they live and work, preferably dealing both with problems and opportunities. Can you identify narratives (cultural or political, dominant or silenced) that impact people's view of the environment, or how in turn the environment informs such narratives? What implications follow from this? Also this section should ideally include historical perspectives on the described changes, discussing how the past relates to the present and the future.

What the analysis looks like depends on your research question. We encourage you to try and combine the discussion of environmental and societal changes in order to show how they are interrelated.

The documentation from your field note book should be included as an appendix to the essay.

## Discussion and conclusion

In this final chapter you should bring together and relate your results from the analysis. This chapter should answer the overall questions of the essay, which you presented in the introduction.

Note that you should try to lift your essay to a higher level of abstraction in the conclusions than was presented in the introduction. You can do that by addressing the overall research problem of the course – the relation between environmental and societal change and human action in the Arctic. How should we understand that relation? Why do changes take place in the Arctic? What can we learn from the past and present in order to better deal with the future?

## 6.3 Communication and educational tools

All information will be given through the web-based system at KTH called Canvas. As soon as students are registered, they can access the course webpage in Canvas (see [www.kth.se](http://www.kth.se)).