EXCURSION in CENTRAL SKÅNE
II.
Water in the landscape
NGEA 01. 2018

by

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Cover photo: Bankfull discharge in the Klingälsån River at one of our stops. (Photo J. Åkerman February 2005). Inserted maps of the free water surfaces in the Kävlingeån River catchment in 1812 and 2000.
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EXCURSION in Central Skåne


A. EXCURSION in CENTRAL SKÅNE

This excursion guide is based upon material from various sources, published books, papers and especially public information material from local authorities (i.e. “City of Lund and Lunds Kommun” the regional environmental authorities etc. (Länsstyrelsen).

This guide has been compiled by Associate Professor H. Jonas Åkerman who will be your field guide October 4th, 2018 (Ulrik and Cecilia might be there as well to assist me and you – time permitting).
order to save space and time when using this guide in the field, the references are mainly given at the end of this guide and not in the text.

Details and information regarding logistics etc. are given during the lectures but as always, we are running the excursion in all weather. Good shoes (this time it might be wet!!) and wind/rain gear must be carried or at hand. No long walks (max 1km). **Lunch pack and drinks are necessary as there are no restaurants etc!!! No shopping stops!!!** Simple toilet facilities are available at some stops. (Might also be found on the bus – but no promise!)

Departure from Sölvegatan 12, **October 4th, 2018, 0800 sharp.** We do not wait!!!! Back around 1700 (no guarantee!).

Absence due to illness etc. to ulrik.martensson@nateko.lu.se or cecilia.axelsson@nateko.lu.se .

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**INTRODUCTION**

It is extremely important for us physical geographers and ecosystem scientists to be able to have a broad menu of methods and skills to collect and manage multidisciplinary field data. In fact, one of our main strength is our multidisciplinary skills and approaches. In many applied situations (research or in a job situation) there is a demand that you must be able to collect specific field data as an addition to already available data (literature, GIS databases, maps, air photos, satellite imagery etc. Your task is often to organize, and analyze material from all or some of these sources and make a collective analysis, judgment, presentation or illustration. Very often you do this, not only to yourself, but to an administrator, the media or to an audience that might have a much diversified background. In the case of some administrator’s and politicians you might indeed have “a mission impossible” as they do not understand or do not want to understand because your message does not fit into a party program etc. The connection between us and various media is also increasingly important! You may also end up as a teacher running field classes etc!

A wide range of observation techniques, instruments, sampling methods, dating methods etc. must be familiar to you. During the field week in the Verkeån River area you will met some of them. Beside that it is also important to learn how to plan and lead an excursion or field tour in a specific area and with a specific theme for an audience of diverse “background” and interest.

It is also important for us and geographers and ecologist to be able to “read the landscape” – meaning that we shall be able to observe and synthesize observations of geology, soils, morphology, hydrography, vegetation, crops and all forms of human interactions now and in the past – all in a systematic way. Our observations must not only include the present status but often needs to include a view back in history all the way back to the deglaciation process (some 13-14000 y BP here in Skåne). In many cases you may be asked to not only observe and describe but also to collect or transform your observations and data into digital formats suitable to fit into other datasets - manly within GIS applications. The demand for data that fit into use in various model applications is steadily increasing.

The recent trend put pressure on the quality and format of our observations but still rather simple observations, methods and instruments are quite useful. During this excursion, we should have all this in mind.

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WATER IN THE LANDSCAPE examples from CENTRAL SKÅNE

This is a small compendium, which contains maps and figures with the aim of assisting you during a “short” excursion in central Scania. The focus is BASIC HYDROLOGY using the KÄVLINGE Å RIVER and the RINGSJÖN LAKE and their catchment areas (se. dräneringsområde) as examples.

The theme of the excursion is SURFACE WATER (ytvatten) in the south Swedish landscape in general and with a focus upon the present and past hydrology and hydrography. The idea is to give you additional examples and pictures to your textbook and lectures and in addition a background view of the landscape from which data for some of the modelling exercises during future courses are collected and/or used.

Introducton map no.2. Our planned route during the excursion October 4th, 2018. (Google Earth Imagery)

1. INTRODUCTION.

1.2 Selection of the stops today.

The stops during the day will have the theme surface water (se. ytvatten) as the main topic, but a lot of other things will be discussed. The order of the stops is in line with the outline of the trip and you will have to sort them into a systematic “hydrological order” on your own during or later after the excursion.

To explain; a systematic “hydrological order” might be;
1. Formation of surface water
   a) Formation of surface water from Springs
   b) Formation of surface water from discharge areas (seepage from the ground surface)
   c) Hortonian surface water formation during precipitation
   d) Snow melt.
   e) Urban surface run off

2. Sheet flow

3. Rill formation

4. Small gullies

5. Small temporary streams/water courses

6. Small permanent streams

7. Intermediate streams

8. Larger streams

9. Inflow/outflow to/from lakes

10. River profiles

11. Type of flow at various sections of a stream

12. Old and young streams

13. Fossil streams

14. Lakes of different ages

15. Fossil lakes

16. Peat bogs

**Anthropogenic influences** (some examples)

1. Dams
2. Irrigation
3. Drainage
4. Soils and crops
5. Rehabilitation of wetlands
6. Eutrophication problems
7. Surface water and new infrastructure

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1.3 BEDROCK & HYDROGRAPHY.

The present hydrography in Scania is highly dependent upon the deglaciation history, but quite a lot is inherited from very old geological periods with different climates and hence different physical and chemical processes active in the landscape. For example, the larger streams are all preglacially formed (before the last glaciation), and are excavated in the bedrock (mainly in granites and gneisses) by fluvial action during millions of years. (In SW Skåne also in sedimentary rocks)

The valleys have today a form, highly modified by the last glaciation and a form, size and water discharge that do not correspond to the present climate and water balance. Without using too much time on the subject still we must go back to the glacial and postglacial history and landscape development. For you who come from parts of the world with no glacial history it might be difficult to understand our landscape if we do not give you a short background.

All of northwest Europe was covered by a more than 3 km thick inland ice between approximately 110 000 and 14 000 years BP. This **last glacial period** was the most recent glacial period occurring in the Pleistocene epoch. It began about 110,000 years ago and ended between 10,000 and 15,000 BP. During this period, there were several changes between glacier advance and retreat. The end of the last glacial period was about 13,500 years ago in south Sweden. (Fig. 1)

The **Last Glacial Maximum (LGM)** refers to the time of maximum extent of the ice sheets during the last glaciation (the Würm or Wisconsin glaciation), approximately 20,000 years ago. This extreme persisted for several thousand years. At this time, ice sheets covered the whole of Iceland and all but the southern extremity of the British Isles. Northern Europe was largely (completely?) covered, the southern boundary passing through Germany and Poland, but not quite joined to the British ice sheet. This ice extended...
northward to cover Svalbard and eastward to occupy the northern half of the West Siberian Plain, ending at the Taymyr Peninsula (Fig. 1). In North America, the ice covered essentially all of Canada and extended roughly to the Missouri and Ohio Rivers, and eastward to New York City.

The glacial and postglacial history vegetation history and colonisation by man follow a fairly simple pattern from a glacial, periglacial, boreal forest to temperate forest environment. (cf. Fig 2)

- **Glacial period** - inland ice cap, more than 3 km thick over Scania at its maximum. Ended in southernmost parts of Scania about 14 000 years ago. (The distribution of the inland ice is shown in Figure 1)
- **Periglacial climate** – open tundra ecosystem. 14 000 to 10 000 years ago.
- **A postglacial climate optimum (warm)** – stone age period 8 000 – 7 000 years ago
- **Boreal forests** – coniferous forest ecosystems, taiga
- **Temperate forest** - deciduous forest ecosystems

The surface water of the landscape up to its present status as well as the hydrography is of course a result of this environmental change from the glacial up to the present climate. Today the region of Scania is one of the most densely populated regions of Scandinavia and completely in the hands and under influence of man and her activities. This means that urban centres, agriculture and intense forestry dominate, leaving basically no virgin ecosystems that are remaining “intact”. Scania is hence also the most densely populated areas of Sweden and the area, has the highest % area under highly, mechanised agriculture.

The main crops are cereals (wheat, barley, and oats), oilseed, sugar beet, and intensive dairy and meat production is also important.

The surface water and the hydrography have become highly influenced also by man’s agricultural activities in this process of transformation. Processes of change are still going on.

The history of transformation of the hydrography has many connections with present day environmental problems, i.e. the nutrient leaching from agricultural lands to rivers, lakes and coastal waters, loss of biodiversity, increased water and wind erosion etc.

We will encounter some examples of this during our tour.

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**Figure 1.** Distribution of the inland ice at 12 000 BC (14000BP) and 8000 BC (10000 BP).
Figure 2. The relative climate development in southern Sweden during the last 8,000 years.

Figure 3. The deglaciation situation about 10,000 BP. Note the land bridge between Denmark and Sweden. (source Svensk National Atlas)
Old endogenic processes create the background and set the scene for both large scale and small-scale landform features of the landscape in Scania. Scania is situated on the southern fringe of the Baltic shield and this fringe has been a zone of disturbances throughout geological history. Basically, the disturbances have occurred along a SE-NW stretching zone – the Törnquist zone (Fig 4). This zone gives character to all of the major components the landscape of Scania, geology, topography, and hydrography. The detailed shapes have then later been formed and shaped during the Quaternary glaciations and especially during its later deglaciation phases 14 000 –10 000 years BP.

In fact on 16th December 2008 we hand a quite significant earth quake here along this fault zone (Fig.5)
2. THE EXCURSION AREA -basics
2.1 The area to the North and East of Lund

We are initially leaving Lund going in an easterly direction. From a morphological point of view we are passing through a landscape that is rather flat – an almost 100% cultivated agricultural plain. In the distance towards the south we see a smoothly undulating landscape where the detailed shapes have been formed during the Quaternary glaciation through melting stagnant ice blocks.

The ice that left these ice blocks came from the south through the large lobes of ice that flow south in the Baltic Sea depression and then turned west and then north again! To the north we see a smooth rise or “long ridge”, this is the westernmost parts of the ROMERLEÅSEN mountain ridge. This ridge is the last remains of a very old bedrock feature – a horst - that today only raise less than 200 m above the surrounding plain. (Fig. 6).

Fig. 6. Schematic picture of the Scanian structural geology. To the north of the red line is the Baltic Shield, in the south west sedimentary rocks. Lund and the first stop is by the blue arrow.

Fig. 7. Geological overview of Scania. For better details - see the Map at the end of this paper. Pink and red are volcanic gneiss and granite of the Baltic Shield. Blue/bluish and lilac are shales and schists. Green is limestone. Black triangles are fossil volcanoes. Brown is quartzites.
Figure 8. Geological profile across Scania. We will cross the landscape and the “geology” along the red line. (Compare also with the previous figure)

Originally the ridge was very much higher and the actual tectonic uplift of the horst is estimated to 1500 m but erosion has kept even pace with the uplift and it is not a very high mountain ridge today. We will follow the southern slope for some few km and then cross the ridge over to its northern side.

To the south we have soils that are very calcareous. These are formed by the ice that came from the south grinding down the underlying limestone and from marine sediments that were deposited during the later stages of the glaciation when this area was below sea level (The sea level was up to 50m higher than at present).

North of this SW part the bedrock in the central part of Scania consists of elongated belts of sedimentary rocks (lime stones, shale, schist’s, quartzite’s and sandstones) from the Mesozoic time. These sedimentary rocks have the same general alignment in the landscape i.e. from the northwest to the southeast (see figs. 6-9).

The hydrography of the province follows the same general pattern. Still the hydrography is a mixture of very old pre-glacial streams and minor postglacial streams developed in newly deposited glacifluvial
**Figure 9.** Geological overview of south Scania.

Material. *(Fig. 10)* The influence of the variations of the coastline is also an important factor. Large parts of Scania have been under the level of the sea during the deglaciation phase and hence have sea bottom features and seas shore morphology well developed and still visible in the landscape.

**Figure 10.** The major pattern of the hydrography of Scania. The main catchment areas are shown. The max, mean and min annual discharge in the largest river, Helge Å River is also shown.
Figure 11. Mean annual precipitation, MAP (mm) in Scania.

Fig. 12. The major pattern of the hydrography of Scania. Parts of the Ringsjön Lake catchment area outlined in red. Our generalized route in blue.
The mean topic of today’s excursion is surface water and we will try to follow surface water from the formation towards bigger and bigger and more permanent channels.

1. Groundwater wells
2. Surface seepage
3. Wetlands and small dams
4. Very small streams (intermittent water flow)
5. Small streams
6. Medium streams
7. Larger streams
8. Lakes
9. Man’s influences

As said above we will not be able to follow this sequence from 1 to 9 and you will have to sort that out yourself – which stop that illustrate what.
PART 2. DESCRIPTION OF THE STOPS.

Figure 13. Lund and its surroundings in the year 1812 map.

STOP 0. St. Rāby dams.
Coordinates (55°41'21.16"N, 13°13'29.18"E)

Southern Rābylund area, which still is partly under construction will eventually contain between 1500 and 2000 residential units, several kindergartens and schools, parks, playgrounds, some small ponds and a larger daywater dam.
Southern Rābylund is developed with clear individual blocks of mixed housing and distinctive streetscapes where narrow residential streets are leading to wider streets with trees alleys which converge in the collective places and squares. The new streets together with the main street form a grid structure with pedestrian and cycle paths which orients itself along the streets to the residential blocks in the direction of the parks and the Rāby dam in the south. In central locations along the main street there are squares with bus stops.
In the spring of 2014 began the implementation of the plan for Southern Rābylund II. Most of the area is is today ready including parts of the water system and a large park in the west. Land allocation has so far been to four developers, Myresjöhus, Veidekke, LKF and JM. Additional property developers will be
involved in the process as well as private developers. The municipality will in autumn 2014 also release 7 private units for linked private houses (radhus).
In connection with the planned residential area Stora Råby, a larger stormwater pond is built. Towards the south the proposed dam will get a natural look with flats surrounding slopes and tree and bush plantings. The meeting between the new buildings and its urban design with the dam and the trees will have a promenade along the quay, designed with terraced seatings that cuts down toward the pond. The pond and its surroundings are an important prerequisite and quality for the expansion of the area. Through its design it also makes it an attractive place that attracts visitors from both the nearby houses and the rest of the city. As Lund city lacks major natural lakes, there is this possibility that at the dam construction creates an environment not previously present within the urban area. The municipality’s intentions were to begin the construction of the Råby dam in 2015 and it is today almost ready. The park area to the west and south is still not ready.

STOP 0. Planning map of the Råbylund area. Our route (with alternative) in red.

Stop 0b. St. Råby Village. (optional)
Coordinates; 55°41'6"N, 13°13"E

Stora Råby is located southeast of Lund, on the Lundasätten plain in an area with stone free and clayey soils (boulder clay). The soils are the result of ice streams passing the Baltic Sea from the SW and pressed up calcareous tills from the south over the landscape. A ridge of glacifluvium with a W-E direction became the localisation of St Råby village and the main road through it (Fig.3). The glacifluvium offered a dry and stable area for the village and the road in the rather swampy surroundings.
There are many archaeological remains within Stora Råby parish. Stone Age Settlements is the largest category, but there are also existing and destroyed bronze-age grave mounds within the parish. Just west of the village, there has also been a settlement from Vendel-time 1500BP.
The oldest written evidence for St. Råby is a mention from years 1120. In 1133 St. Råby is mentioned in a document issued by Archbishop Asser, among the extensive goods in Skåne that the archbishop donated to the brothers at the Cathedral in Lund at the Crypt's inauguration there. The church in Stora Råby is considered to be erected during the 1200 century and the church was the dominant land owner before the 1350.

During the 1700 century, the village suffered two major fires, in 1710 and 1767. The last fire mainly affected the farms in the southwest of the village.

**Figure 3.** St. Råby village in the 1812-year map. The cartographer has clearly noticed the ridge upon which the road and village is situated.

**STOP 1. ARENDALA**
Coordinates; 55°41'34.25"N, 13°16'17.52"E

Our second stop will be at Arendala just outside LUND. Here we are at the south slope of the Romeleåsen ridge (**this is a HORST!**). We will pass parallel with a former open water way that you may see in your maps from 1812 (**Figure 15.**). Today the small stream is not visible apart from some concrete “access wells” seen in a line above the culvert in which the stream today is captured. Further up on the hill some of the old wetlands – small swamps, today are reclaimed. Several small dams have been dug in cooperation between the Lund City authorities and the landowner. Money for the work has come from central, EU and local government funding as a measure against the problems with high nutrient contents in the drainage water from the agriculture in the area. We are here in the drainage area of the Höje Å catchment area in which numerous similar dams have been built. (**Figure 13, 14 & 15**)
Figure 14. The area just east of LUND with Arendala and the second stop (no.1).

Figure 15. The area just east of LUND with Arendala and the second stop (no.1) in the 1812 map.
Figure 16. The area just east of LUND with Arendala and the second stop (no.1). Note the fish bone pattern in the fields which is the subsurface drainage. Compare the two maps and the Google Earth Imagery.

NOTICE!
1. Surface water (streams)?
2. Irrigation (se. bevattning)
3. Drainage in fields (se. dikning)
4. Soils and crops
5. Rehabilitation of wetlands
6. Eutrophication problems (se. övergödning)
7. Surface water and new infrastructure
8. Field size

Notes:........................................................................................................................................
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B. Agriculture in Skåne

Skåne has a unique role in the Swedish agriculture. It lies also very close to the international markets. Still the agricultural economy in Skane is mainly directed towards domestic markets, with special interest attached to the development of the agriculture and industry in Skane in relation to the rest of Sweden. Land use in Skåne is highly dependent of the present agriculture today and has so been throughout history since man colonized this area. Private production and resource use in Skane, and in the rest of Sweden, may be crudely summarized in six different sectors: agriculture, food industry, equipment industry, other industry, commercial activities, and forestry. In these economic sectors, public production is negligible. Table 1 contains a rank order of the sectors in question according to the level of international dependence.

Table 1. Composition of the Skane economy and that of the rest of Sweden, 1979 (percentage distribution of production).

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>SKÅNE %</th>
<th>REST OF SWEDEN %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Food industry</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Trade</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Other industry</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Equipment industry</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>Forestry</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Figure 16b. Land Use in Sweden and Skåne. Source: Statistics Sweden, 2008

Figure 16c. Land Use in Skåne. Source: Statistics Sweden, 2008
Figure 16d. Land Use in Skåne the last 1000 years. Source: Statistics Sweden, 2008

Figure 16e. Precent crops in Skåne. Source Statistics Sweden
Today
Most villages have disappeared
Large fields
No open water
No permanent field borders

**Figure 16f. Typical Land Use in Skåne today.** Source: Google Earth.
Figure 16g. Land Use in Skåne 700-1983.
### Crop rotation

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong> Spring cereal and rape seed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>H</strong></td>
<td></td>
<td><strong>S</strong> Winter cereal and rape seed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>H</strong> Sugarbeet</td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
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<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
</tr>
<tr>
<td><strong>Grassfodder</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
<td><strong>H</strong></td>
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<td><strong>H</strong></td>
</tr>
</tbody>
</table>

S = Sowing  
H = Harvest

**Conventional farming**
Crop rotation 3-4 years (one year of grass/clover)

**Organic farming**
Crop rotation 6 years (3 years of grass/clover)

*Figure 16h. The agricultural year in Skåne, Source Statistics Sweden*

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**STOP 2. BILLEBJÄR (Optional)**
Coordinates: 55°41'12.20"N, 13°19'17.43"E

We will travel just a few km to the east. Stop 2 is at BILLEBJÄR which is a small rock outcrop of the ROMELEÅSEN ridge (Horst) (See Fig. 18). In fact, it is the westernmost rock out crop of the Romeleåsen horst where you can see the gneiss and in some cases also the quartzitic sandstones of the area. The bedrock here is gneiss and there are some quarries in the area using this rock for road construction and for concrete manufacturing.

At this stop we shall discuss the general landscape and the view south. The rock outcrop area is a small nature reserve acting as a small island of biodiversity in the “uniform” agricultural desert. The area is semi-open grasslands with juniper, heather, and hawthorn, mixed with trees.
Heather and juniper are indicators for poor soils, low nutrient content. Fig. 18.

Figure 17. The typical vegetation on Billebjär – Juniper (Juniper Sp.) and Heather (Calluna vulgaris)

NOTICE!
9. Surface water (streams)?
10. Land use
11. Bedrock and use of it
12. Soils and crops
13. The village we just passed - Sjöstorp
14. Tree species
15. Horizont line
16. Bird life?
STOP 3. DALBY HAGE
Coordinates; 55°40'19.76"N, 13°19'50.12"E

The third stop will be at the small National Park “Dalby Söderskog”. (Fig. 19 & 20). Here you will be given a short description of the landscape development from the glacial and tundra period via a temperate forest period to the establishment of man’s societies and today’s modern agricultural landscape.

The national park Dalby Söderskog is situated ten kilometres east of Lund and has been a national park since 1918. As such it is the oldest NP in Sweden. The history of the small forest is very complex and a summary is given in a table on the following page.

The Dalby Söderskogs national park is 36 hectares large. The vegetation is a temperate deciduous forest with Elm (Ulmus glabra), Ash tree (Fraxinus excelsior), Oak (Quercus Robur), Lime tree (Tilia cordata), Maple (Acer platanoides) samt Beech (Fagus silvatica). Common in the forest is also two species of Alder
(Alnus glutinosa, Alnus incana) och Hazelwood (Corylus Avellana). The soils are fertile and rich in lime and the forest is famous for its spring flora (Picture 1). Common is for example the Wood anemone (Anemone nemorosa) the Yellow wood anemone (Anemone ranunculoides), different violets (Viola sp.), The Bird-in-a-bush (Corydalis bulbosa), The Star-of-Bethlehem or Radnor lily, (Gagea lutea) and many others. (Fig. 21).

In the forest, we can still find a part of a small brook meandering down towards the main river which is the Höje å (Fig. 22). This river we can see in the valley bottom towards the south (Fig. 24).

Figure 19. Dalby Söderskog National Park and the city of Dalby. The stop 4 is also indicated with a red arrow.
**Figure 20.** The “Dalby Söderskog National Park” 100 years before it became a National Park. (From the old 1812 map). Note the small river flowing through the forest and out on the plain. This river and most of the others on the map are not seen in the landscape today. The previous stop (2) Billebjär (Billeberg) is also seen in this map.

**Figure 21.** Dalby Söderskog in the spring - May. (Photo J. Åkerman).
Figure 22. *The small brook in DALBY SÖDERSKOG.* (Photo J. Åkerman).

Figure 23. Hydrographic map over Dalby Söderskog in 1928-36. Lindquist (1938).

- Surface water – ”swampy”
- Soil water at 0-50cm depth
- Soil water at >50cm depth
Figure 24. Google Earth Imagery of Dalby Söderskog and surroundings. The blue hatched line is the approximate subterranean drainage of the brook you saw flowing freely inside the forest.

The history of the Dalby Söderskog

The National park Dalby Söderskog was established in 1918 and became Skåne’s first national park. The aim was to protect the remains of an old forest on the hillside of Romelåsen, "the only purely natural mixed forest we have in the area". But it was not true. Human beings and their livestock had used the forest for hundreds of years and influenced strongly. In fact, the forest was an overgrown grazing land. Already in the 1500s the monastery in Dalby used the area as pastureland and this land use continued for centuries and the land was characterised grazed land with sparse standing old trees. The stone walls that surround the forest were then the fences to keep the animals inside. Hard grazing and logging occurred with varying intensity when the land was exchanged between Danish and Swedish royal estates. (More in the summary below)
Table 1. Summary of the history of Dalby Söderskog.

<table>
<thead>
<tr>
<th>Time period</th>
<th>Use of the forest, major events, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1050-1523</td>
<td>The forest owned by the Augustiner Monastery in Dalby. The forest was grazed by the Danish King’s horses. The forest was also used for hunting for deer and other small game. Still it was called the “Hästhagen” (the horse paddock)</td>
</tr>
<tr>
<td>1536</td>
<td>Danish reformation. No grazing and the forest had a bush encroachment (mainly Hazel)</td>
</tr>
<tr>
<td>early 1600</td>
<td>The Hazel bushes were cleared by the order of the Danish King Christian IV. A horse breeding enterprise was established. A large area also around the forest was used for grazing</td>
</tr>
<tr>
<td>1658</td>
<td>Scania became Swedish. King Karl X Gustav reestablished the horse breeding enterprise to provide the Swedish army with horses. The grazing extended to nearby areas. The forest was open with oak and beech as the main trees.</td>
</tr>
<tr>
<td>1664-67</td>
<td>The farmers of the area had free access to the forest and cut down the majority of the trees</td>
</tr>
<tr>
<td>1682-88</td>
<td>No horses and only limited grazing.</td>
</tr>
<tr>
<td>1688-1700</td>
<td>Private horse breeding and some grazing.</td>
</tr>
<tr>
<td>1700-1721</td>
<td>The large Nordic wars. Only limited use by local farmers</td>
</tr>
<tr>
<td>1718-24</td>
<td>The horse breeding again under the Swedish King and army. Only light grazing.</td>
</tr>
<tr>
<td>1731-34</td>
<td>The horse breeding under the Swedish cavallery. Light grazing and the forest regained its structure (original species with oak, lime, ash, elm and beech as dominating species) <strong>The oldest trees of today from this period.</strong></td>
</tr>
<tr>
<td>1750-1800</td>
<td>The horse breeding under the Swedish crown prince. Only light grazing.</td>
</tr>
<tr>
<td>early 1800</td>
<td>Only sporadic grazing. Many trees cut, mainly oaks. Beech and ash trees increased</td>
</tr>
<tr>
<td>1830-80</td>
<td>No organized management. Used by local farmers only. Bush encroachment mainly Hazel.</td>
</tr>
<tr>
<td>1880-1904</td>
<td>Use by local farmers only. Bush encroachment</td>
</tr>
<tr>
<td>1904</td>
<td>Application from the Botanical Society, Lund University, to protect the forest from any exploitation</td>
</tr>
<tr>
<td>1914</td>
<td>King Gustav V gave the governmental forestry authority the mandate to mange the forest.</td>
</tr>
<tr>
<td>1915</td>
<td>A major logging campaign was performed. (1500m³ wood)</td>
</tr>
<tr>
<td>1916</td>
<td>The Academy of Science demanded that the forest should be a National Park. A logging ban was proclaimed by the King</td>
</tr>
<tr>
<td>1918</td>
<td>July 14th the government approved the National Park status.</td>
</tr>
<tr>
<td>1942</td>
<td>A division into two areas, one to be managed and one to be left with out any interference.</td>
</tr>
<tr>
<td>1985</td>
<td>The main responsibility for the forest is given to the provincial environmental authorities.</td>
</tr>
<tr>
<td>2018</td>
<td><strong>NOW - You are there!</strong></td>
</tr>
</tbody>
</table>
Figure 26. Trees in Dalby Söderskog NP from an unpublished inventory 1921.
Figure 27. Wind and snow/ice polished boulder at the parking lot just outside the Dalbyhage NP. (Photo J. Åkerman)

NOTICE!
1. The “Virgin” temperate forest (se. ädellövskog)
2. Tree species you do not know
3. Vertical stratification of the vegetation
4. Soils
5. Temporal organisation of the vegetation
6. NP history
7. Use and management of the NP
8. Surface water
9. Signs of the periglacial climate
After the visit to Dalby Hage National Park we will pass through the old village of DALBY with its old cathedral which is from the 900\textsuperscript{th} century. At this time Scania was Danish and there was one archbishop in DALBY and one in LUND competing for the religious and secular power over the people of the area. Ultimately LUND and its archbishop won since it was the richer and better place and a settlement of greater potential.

Leaving Dalby, we will pass several quarries developed in the hard gneiss or in the quartzitic sandstones of the area. Some of the quarries are still active and some abandoned because they have come to close to the village and cause environmental problems. Some of the abandoned quarries have been developed to recreation areas for swimming, fishing etc.

STOP 4. The KNIVSÅSEN ESKER.
Coordinates; 55°39'34.02"N, 13°23'59.46"E

We will stop by one of the abandoned quarries that have been developed to a recreation area for swimming, fishing etc. We will just have a brief glimpse of that and continue through the beech-forest to a glacifluvial esker that is situated a few hundred meters to the east of the parking. The formation of an esker is shown in the figs. below. Eskers are extremely important in our landscape and important aquifers for our domestic water supply both in a large and in a small scale.

We have reached the chapter about glaciology and glacial geomorphology in our lecture series so you may remember some of it and here you have a small but good example of an esker. Observe and remember.
We have here a short walk for about 500m and back.

**Figure 29.** Schematic illustration of the formation of eskers (se. rullstensåsar).

**Figure 30.** Schematic illustration of the internal structure of the glacifluvium in eskers.

**NOTICE!**

1. The Esker
2. The Beech forest
3. Other types of forest or tree species
4. The Old quarry and its reclamation
5. Nature reserve
6. Surface drainage from the quarry
7. Natural surface drainage (se. utströmningsområdet)
8. Soils and soil profiles. (Time permitting)
9. Modern use of the area
The section from stop no. 4 to stop no. 5 and 6

From the old village of DALBY, we will continue east and pass over the ROMELEÅSEN ridge and travel down into a former glacial lake called the Vomb Lake depression. (Fig. 33).

On the way towards the east the road is new and we will follow the red arrows in Fig. 32 below. We will pass into a completely new environment with new types of soils a new type of land use and agriculture. **Try to look out after surface water!!!! What do you find?????**

We will turn left/north at Lovelund and head towards the north for 3.5 km. The area is an old lake bottom of a former glacial lake some 150 m deep. The lake was drained towards the NW when the inland ice left the area and melted away northwards (and southwards!). Here we pass through a flat sandy area with hardly any “modern” agriculture. The smallholders that occupied the area in the old days have left after being bought up by the government in the late 1800th. The land is now owned by the government and the military that use the area as training ground for tanks and other mechanised units etc. The military actions have helped in keeping the area open, which has been good to wildlife and the environment as a whole (of course under debate!!!). The area is today also grazed by thousands (5000-6000) of cattle that go free around the area all year around.

The area is very sandy and the only morphology that we see is small sand dunes. The sand dunes are generally covered by pine trees (*Pinus* Sp.) that have been planted here during the 1700th, 1800th and also as late as in the 1940th as protection against wind erosion. This is a common practice all over Scania where we have light sandy soils in many places (Fig. 31). We will see further examples of this during the day.

![Figure 31. Sandy soils of Scania.](image)
Figure 32. The route east of stop no. 4.

Figure 33. The hydrography and some of the associated landforms during the last stages of the deglaciation.
Figure 34. Two possible models of the final stages of the glacial cover over Scania.

Figure 35. Hydrography of the final stages of the glacial coverage over Scania.
STOP 5. “Revinge hed”. Unique heath land (sand stepp)

Coordinates; 55°39'10.15"N, 13°29'46.99"O

Revinge hed is an area of open, sandy grazing land with heath vegetation, heather moorland, dry grassland, sandy, grassy heath and sandy steppe. It contains an important component of rare plants and fungi and it has a very rich insect fauna. This part of the Vombsänkan is partly a military practice area and partly a grazing area for cattle. Revingefältet contain the centrally located Krankesjön and Vombsjön which are surrounded by sand ridges. The open heath also has alternating wet and dry grasslands, scattered trees and wetlands. The sandy soil consists mostly of silt, sand and gravel from the former Vomb-issjön. Figures 33-35. The soils are of a fraction that allow windtransport and all small hills of the area is former sand dunes of wind blown sand.

The vegetation on the pastures consists of a mosaic of heather moorland, dry grassland and sandy, grassy heath. The heather moorland has rather a species poor flora. Where the heather is sparser, the vegetation changes to herb rich, dry grassland with species such as field avens, Helianthemum nummularium, Euphrasia stricta L. and maiden pink. In the parts with open wind-blown sand, is found sandy, grassy heath with a not entirely complete plant cover. Characteristic species for these areas are Corynephorus canescens and the lichen component is large. Corynephorus canescens, common name grey hair-grass or gray clubawn grass, is species of plants in the grass family, native to Europe, the Middle East, and North Africa. Another characteristic stepp species is “Tofsäxing” or the Koeleria glauca is a rare grass species of the genus Koeleria. It grows in dunes and other sandy places. It is mainly distributed in eastern Central Europe and in Sweden only found on Öland and here in Skåne.

Figure 36. The rare stepp species “Tofsäxing” (Koeleria glauca). Ölands Sandby. Foto J. Åkerman

Much of the Revingefältet was used for agriculture until the beginning of the 20th century. Because the very meager soils a crop rotation of up to 6 years was practised. The crops grown were manly potatoes and cereals grown on small fields by a number of smallholder farmers.

In the 1960s the military activities were lowered to almost a minimum but the current level has again increased. The Swedish fortifications agency today owns all of the excercise field and is today used for militära exercises of the Scanian Regiment (P7). The military operations with off-road vehicles has created wear and tear on the open areas and there are still areas with bare sand for the specialized plant and animal life. Large portions of the field today are shared between the military and cattle that goes outside all year round.

Plant and animal life Revingefältet is a real ”hot spot” for biodiversity and the area has a large number of red-listed species that are associated with the dry, sandy soils. There are many solitary bees which have their sole presence in the country (i.e. rödtoppebiet (Melitta tricincta). There is also a fantastic fauna of dung beetles and other insects that rely on grazing animal dung. In the area, there is a range of threatened arable weeds, including a) klubbfibbla (Arnoseris minima) (b) åkerfibbla (Hypochoeris glabra) (c) åkermadd (Sherardia arvensis), largely thanks to the history with an extensive agriculture which is not affected by the great rationalisation efforts in the 20th century. A common feature of most of the endangered species is that they benefit from bare sand and disadvantaged by overgrowing.
Many of the red-listed species that are found on the Revingefältet will benefit from the present activities like the military actions leaving scars in the cover. Beetles like the yellow seed Runner (*Harpalus flavescens*) and the flat seed Runner (*Harpalus hirtipes*) want a sparse vegetation with lots of seeds and hot sand. Dung beetles like (*Aphodius luridus*) and rakhorndyvel (*Onthophagus nuchicornis*) need both open bare sand and grazing animal dung. The wild bees “stäppbandbi” (*Halicuts leucatheneus*), väplingsandbi (*Andrena gelriae*), väddsandbi (*Andrena hattorfiana*) need a combination of food (nectar and pollen) and bare sands for nesting. The rare Butterfly black spotted blue (*Maculinea arion*), need wild thyme for egg laying and ants that nurse their larvae.

![Google Earth imagery of the stop no 5. Arrows indicate restoration areas.](image)

The most interesting parts of the area are those that consist of the true sandy steppe. The sandy steppe is one of the country’s rarest natural types and is characterised by a broken plant cover. Large surfaces of the partly calcareous sand are exposed, which is also a prerequisite for the continued existence of this type of nature. The characteristic plant of the sandy steppe is, above all, *Koelaria glauca*. Other typical steppe plants here are *Androsace septentrionalis*, *Ceriastium semidecandrium* and *Carex arenaria*. Surfaces with true sandy steppe are quite small and are found mainly upon old sand dunes and where the surface is disturbed by vehicles or cattle.

A restoration of the area has begun to extend the surface area of sandy steppe. The heather and ogher vegetation is being removed and certain soil preparation is done to increase the acreage of bare sand (See figure 37.).

Other rare plants are *Holosteum umbellatum*, *Petrorrhagia prolifera*, *Euphrasia micrantha Rchb.*, *Silene conica*, *Phleum arenarium* and *Carex ligerica J. Gay*. In some years, large numbers of *Holosteum umbellatum* can be seen.

The sandy heath has a very rich fungus flora. Particularly characteristic are different species of puffballs (*Basidiomycota*) and jordstærnor (*Geastrales*), of which several are very rare. Amongst these can be mentioned *Geastrum elegans*, *Disciseda candida*, *Tulostuma brumale*, *Geastrum schmidelii* and *Tulostuma kotlabae*.
STOP 6. The KLINGAVÄLSÅN River “grassland is the mother to cropland”

Coordinates; 13°32'42.94"E, 13°30'30.40"E.

A Wetland reclamation area in the small stream of the Klingavaelsån River, a tributary to one of the major streams of the area - KAEVLINGEÅN.

Schematic history of the area;

Natural fertilizing from flooding → large hay production → more cattle → more manure → more cropland → overgrazing → land degradation, wind erosion, → tree plantation

We stop at a parking lot with a bird observatory tower. We are in one of the best waterfowl wetland areas of our part of Sweden. It was an unused virgin area until the late 1700th and early 1800th century when demand for more agricultural products rose. At this time, more manure was needed for the cereal production. More manure meant a demand for more cattle and hence more fodder for the cattle. All wetlands were good potential fodder production areas but to become reliable, water had to be regulated. No flooding and an even water supply during the full year were in demand. At this location, this meant a controlled water flow in the small river of Klingaväelsån river through small dams and sluices. The river was deepened and straightened out which meant that the wetlands got drier and drier (cf. FIG 44.). Many of the rare birds left the area i.e. the European stork. In late 1990 and early 2000 a wetland reclamation program was launched all over Sweden and the city of LUND went in the forefront of this.

Figure 38. The opening of the reconstructed old channel in 2001. (photo J. Åkerman)

Figure 39. The new channel and the flooded wetland in spring 2003. (photo J. Åkerman)
Figure 40. The Kävlingeån catchment.

In 2001 the city of Lund and the environmental authorities performed a complete reconstruction of this part the Klingavaels ån river. Compare the water distribution in the flooded areas in spring and winter from 2002 (Fig. 37 & 45)

The development of the new channel and the flooding and other results of the reconstruction have been followed by several monitoring projects. Some of these have been MSc projects by students from our department. Figures 45 below are examples from a MSc thesis using RS and GIS to illustrate the flooding and its development during the annual hydrological cycle.
Figure 41. Part of the undisturbed Klingavälsån River in winter 1968. (Photo J. Åkerman)

Figure 42. Part of the disturbed Klingavälsån River in winter 1968. (Photo J. Åkerman)
FIGURE 43. Surface water distribution at 1812 and 1960 (and today!) in the Kävlingeåns catchment area. *The picture speaks for itself – I hope!*
FIGURE 44. The old map from 1812 over the Womb Lake surroundings.

Figure 45. The wetland reclamation area at high (winter/spring) and low water levels (summer).
(From a MSc thesis in Physical Geography by Astrid Göthe)
Figure 46. Map of the Klingavälsån and the Womb Lake and their surroundings. (Lunds Kommun)

1. Old straightened River – now filled in.
2. Remeandering
3. New wetlands

Figure 47. Map of the Klingavälsån and the Womb Lake and their surroundings. In the map, you see 1. the position the former old straightened river (now filled in) and 2. the new river course and 3. New dams/wetlands.
STOP 7. The water treatment area of Vomb. See Figure 48. Coordinates; 55°39'41.91"N, 13°32'27.88"E (or 55°39'0.64"N, 13°32'42.94"E)
We are still on the former lake bottom of the old glacial lake. Everything is but sand and sand dunes. Here we will discuss how modern society is using these old glacial deposits for water purification purposes. In this case it is the cities of LUND and MALMÖ that up to 15 years ago got practically all its drinking water from this area. Today the increasing demand has called for some import of water from Lake BOLMEN some 200km north. (Through the Bolmen tunnel).

**The Vomb water works** ([Data from the homepage of “SYDVATTEN”](http://www.sydvatten.se))

The Vomb water treatment plant became operational in 1948. It produces clean, fresh drinking water by simulating the natural process by which rainwater infiltrates slowly down through the sandy and gravelly glaci fluval and glaci lacustrian layers and eventually forming groundwater in a vast aquifer. Via two intake pipelines Vomb plant takes in about 1000 liters of water per second from the Vombsjön Lanke.

The first steps in the purification process begins with a passage through micro sieves before it enters the “natural process” where the water is distributed out to one or several of the 54 infiltration ponds that are found in the landscape of Vombfältet. In the ponds, the water sinks slowly down through the glacifluval and glaci lacustrian layers of sand and gravel and adds to the natural aquifers where it is pumped up from 120 pumping wells. These wells are lining the area in the west of the infiltration dams - mainly. (WHY???)

When Vombverket was built in the 1940s this process was sufficient as a purification process. Nowadays, however, there is a higher demand on the water quality, and the input water quality is “lower”!! Accordingly, today the water is treated further before it is pumped out for drinking. The first step is to “air the water” (expose to oxygen) when the water it is pumped out of the ground. This process will remove or lower the content of iron and manganese in nthe input water. The next step is a process that is “softening” the water to a lower hardness of the water. (lowering the Ph is a part of this process)

![Figure 49. Schematic layout of the “Vombverkets” different steps in water treatment.](image)

The “softening” of the water is made in eight reactors using sodium hydroxide (NaOH) which is mixed into the “hard”, calcareous water whereupon the dissolved lime (CaCO₃) in the water precipitates. The precipitated lime is deposited on the small grains of sand which remain as a suspended solid matter in the water. As the suspended particles and their load of lime becomes heavier the grains fall by gravity to the bottom of the reactor where they can be taken out of the process. The “softening” of the water reduces the water hardness by 50 %, which means that households will have softer water which reduces detergent
consumption and lime precipitation and coatings in pipes, washing machines and dishwashers. (Fig. 49) It also may lower the the release of copper from domestic pipes and thus lower the copper content in what the water and sludge treatment plants receive as residue. With a low ore negligible content of copper, the sludge may be of such quality that it can be spread on arable land and thus come back to be a part of the natural cycle of material and water.

Fig. 50. The principle of “softening” the water.

Adding Ferric chloride. After softening of the water it is pumped into a mixing treatment bassin where chemical ferric chloride is added to separate the small particles still remaining in the water. In a subsequent rapid filter with sand beds these remaining pollutants are separated before the water is added with small and variable amounts of chlorid as a precautionary disinfecting measure against bacteria and then it is pumped into the distribution network. The wayer quality is constantly monitorered through continuous samples and analysis. The monitoring operations take continuously laboratory samples for analysis of raw water, water during the process and finished drinking water.

900 liters of drinking water per second. The Vombverket water works produces an average of 900 liters of drinking water per second. Are you interested in what the drinking water from Vombverket and the water is distributed to the Lund -Malmö region where it is or might be mixed with water from the other main sources (the Vomb Lake and the Bolmen Lake via a 200km long pipeline and tunnel)

More information can be obtained from!!!! [http://www.sydvatten.se](http://www.sydvatten.se).

The nature of the Vomb area.

Vombs fure is a vast, to visitors and naturalists friendly, coniferous forest area south of the Vombsjön Lake, one of Skånes major lakes. The sandy, fairly flat ground slopes steeply down towards the Lake Vombsjön in the north and in many places along the south shores there is a beautiful view of the lake and the landscape around the old castle Övedskloster in the east. The area has been inhabited and used by man during the Iron Age and the Middle Ages as an extensive farmland (sandy easily worked soils) using long intervals of fallow to meet the demand of additional nutrients. During this period the forests were still extensive and there was still a lot of hardwood (i.i. oak) in the area. But in 1600s and 1700s the land use became increasingly intense and the forest vegetation being overused. The forest soon disappeared and the now open, intensively grazed landscape became affected by sand drift. Still visible tracks of this is seen in the topography of the flat plains lands as mighty sand dunes, formed then. A lot of dunes are also still to be seen inside the extensive pine forest.
To order to bind the sand and keep it in place not inundating the fields of agriculture a process of planting pine (Pinus sp.) begun in the late 1700s and the 1800s. The pine trees grew well on the sandy ground and pretty soon it had stopped the sand drift. Areas of the marginal areas of the pine forest are still open, and grazing and military exercises on the sandy soils have created scars where the sand drift and aeolean processes are slowly starting to grow again.

**Fauna and flora.**

Generally speaking the area has a very interesting fauna and flora – both species of the open heath ecosystem and the sandy dune system as well as the artificial pin forest are common. Some examples are: The Vombs fure (Pine forest) is one of the central areas of the population of the elk (Kronhjort) in Skåne. Although many peoples roam the trails of the area the elk deer may lie quiet and rest just a close. The waiting season is Oct-Nov. and during mornings and evenings the bulls can be heard from several hunderes of metres distance. Wild boars are cince 2 decades vey common. Among the insects the rare green heath cricket (hedvårtbitaren), is found here in one of the few localities in the country. The area, including the infiltration ponds, is a very interesting bird area both as a nesting and a wintering environmet. The wetlands around the rivers are among the best wetland environments for birds in Sweden. Especially winter visiting birds of prey, like the White tailed eagle, the Golden eagel, the Red Kite and the mountain Buzzard are numerous. The wetlands and the lake shores as well as the infiltration ponds can often be good observation areas for wading birds when they dry up.

The area has also one of very few inland localities of the Natterjack toad (*Bufo calamita*). Resembling the shape of a common toad, but it is much smaller. The Swedish name is Strandpadda but it is also known also as the natterjack as it when scared or irritated secretes a foamy liquid that smells like burnt rubber. Because of their short legs it can not jump, but still it is a relatively fast runner.

![The Natterjack toad (*Bufo calamita*).](http://www.lysekil.se/arkiv/)
Figure 52. Sedimentation and purification dams at the Vomb water works. (Photo J. Åkerman)

Figure 53. The “Vombs fure” pine forest area and the southern shores of the Vomb Lake.
STOP 8. The shore of the Vomb Lake.

Coordinates; 55°41’32.46”N, 13°33’14.61”E

See Figure 56 for localisation. A quick stop to go down to the lake side of the regulated water level of the Vomb Lake. We will discuss the water quality etc.

The drinking water that is delivered from the Lake Vombsjön to the users in the Malmö/Lund region is soft-medium-hard, 6dH. The water from the Lake Vombsjön is hard, but is treated in the softening process at the water works to become softer. The Lake Vombsjön is regulated due to the water extraction and holds no “remarkable” breeding bird fauna. However, a lot of birds rest here during autumn, winter and spring, and it may be worthwhile to look out over the lake. In winter, there is also a good chance to see eagles and when the lake is ice covered you may see eagles on the lake. In summer, the lake is popular for swimming and fishing and there are several popular beaches around the lake.

Figure 54. The western shores of the lake Vombsjön. (Photo J. Åkerman)
Figure 55. The main stream entering the Vomb Lake (Björkaån/Åsumån) is a key to the water quality. Intensive agricultural land all around in the upstream catchment area plus vastes from a minor city - Sjöbo!

NOTICE!

1. The material of the beach and the lake bottom
2. The Water quality (colour, algae and sediments)
3. Bottom and shore features
4. The shore vegetation
5. Wild life –if any
Figure 56. Map of the area north of the lakes of KRANKESJÖN and the VOMB lakes.
STOP 9. The river Kävligeån outlet from the Vomb lake.
Coordinates; 55°41’55.89”N, 13°33’15.12”E

See Figure 56. Just a very quick stop where the river Kävligeån starts as the outlet from the Vomb lake. We stop close to a small dam and a sluice construction that regulate the river flow and lake level. The construction is needed to prevent the winter and snowmelt floodings and to maintain a necessary water level for using the lake as a raw water source for drinking water.

STOP 10. THE HJULARÖD CASTLE (optional)
Coordinates; 55°44’1.35”N, 13°33’28.01”E

One of the numerous nobility castles that we have in Skåne. This castle has an old history but the buildings we see today are not very old. 200-300 years only. The castle is first found in documents from 1391 but the present castle was only built 1894-87. The count Hans Gustaf Toll built it with French architecture as a model.

During the forthcoming courses, we will discuss the large estates and the important components of our history and the landscape development related to them more in more detail.
STOP 11. The Rövarekulan ravine. (The Rovers den) (Figure 56)

Coordinates; 55°47'30.78"N, 13°30'3.44"E

A famous geological locality and a small nature reserve. It’s a deep ravine cut into the landscape by a river (BRÅÅN) much bigger than the one we see today. It is not clear whether the ravine is postglacial or was initiated before the glaciation but clearly the ravine was used by meltwater from the retreating inland ice. The water flow followed the same direction as today. The bedrock is a grey claystone or slate, which contains 400 milj. (Silur era) year old fossils. The area is rich in valley side springs and has rich flora and fauna. The forest is a typical beech forest. The flora in the spring is dominated by Bear's Garlic (Allium ursinum) and Pestilence wort (Petasites hybridus) and the air is often filled with the smell of onion. Both these species have an old history and traditional use as medical herbs.

The Rövarekulan canyon was formed 14,000 years ago when the ice melted and a dammed ice lake burst. The gushing flood eroded the valley in the soft shale. The water has continued to shape the valley by creating the winding, meandering river that runs down the gorge.

Figure 58. The Subcatchment Bråån River is a part of the Kävlingeån River catchment.
Figure 59. The bedrock in Rövarekulan is a grey claystone or slate, which contains 400 milj. (Silurian era) year old fossils. (photo J. Åkerman)

Figure 60. Spring vegetation in the “Rovers Den”- RÖVAREKULAN. Pestilence wort (Petasites hybridus) (photo J. Åkerman)

NOTICE! (Rövarekulan)

1. The bedrock – slate (se. lerskiffer)
2. Fossils from the Silurian era
3. Weathering features
4. The size of the Ravine in comparison with the river and its discharge.
5. The water quality
6. Why is the water so “clean”
7. Water fauna?
8. Vegetation in the ravine.
After the Rövarekulan we continue north and northeast into the Ringsjön drainage basin (catchment area) (Figure 61.). We have already passed the water divide, which is difficult to locate in the map or terrain (Figure 61 and 63). We descend from the slightly higher ground with Silurian slates and enter the RINGSJÖN depression. In the North and Northeast, we again see higher areas at a distance. What we see is the southern fringe of the South Swedish highland and the BALTIC SHIELD. The BALTIC SHIELD, which consists of gneiss and granites, start here at its southern fringe and continues all the way up to northernmost Scandinavia (Norway and Finland). Regarding soils, we are now well within the NE moraines which are sandy, stony, and blocky and containing a fairly low amount of clay and lime.
Figure 62. Land use within the Lake Ringsjön catchment.

Figure 63. The "Ringsjön" catchment area. It is 347 km² and can be divided into 14 sub catchments. The largest are the Hörby river, the Kvesarums river, the Höör river, the Nunnes brook and the Snogeröds brook.
and are hence rather unfertile. The Baltic moraine, that we have been passing earlier is the youngest and is a deposition of an ice that has advanced over the bottom of the southern Baltic basin with its Cretaceous bed-rock that is very Calcareous and has a rich content of flint. The North-East moraine has a very low content of flint (in Central Scania there is some from the Cretaceous bed-rock in North-Eastern Scania. Further to the north there is none) but consists mainly of material from the gneiss and granites of the Baltic shield in the north. Compare the geological map and the soil map at the end of this compendium.

STOP 12. The Osbyholm water mill (inlet of the Hörby ån river).
Coordinates; 55°50’59.78”N, 13°36’30.44”E
Here we stop at an old water mill in the Hörbyån river (Figure 61 & 65). Almost all rivers in the old days had the waterways regulated with dams in order to use the energy. Here at the mills the crops were grinded into flower. Land owners with water or wind mills became very important institutions in the agricultural society. Today many mills are gone; especially the windmills, but still we can find them in place names on the maps. Here at Osbyholm we have one mill that has survived through the centuries.
Figure 65. The South-East part of the Ringsjöen Lake and the Ousbyholm Castle and Water Mill. From the old 1812 map.

Figure 66. The Osbyholm Water Mill. (Photo J. Åkerman)
STOP 13. An old bridge over the Hörbyån river. (optional)

Coordinates; 55°50'59.73"N, 13°36'49.40"E
Traditional architecture using the block from the moraines coming from the bedrock in the North and Northeast.

Figure 67. An old bridge over the Hörbyån river. (Photo J. Åkerman)

STOP 14&15. The FULLTOFTA Nature reserve & European Stork nursery.

Nature reserve Lake side stop coordinates; 55°52'32.02"N 13°35'49.60"E
European Stork nursery coordinates; 55°52'51.67"N, 13°36'47.68"E

Fulltofta nature reserve is a place where you can experience almost all land use categories that you have within the Ringsjön catchment area (Figure 62.). The reserve east of the lake Ringsjön is an old cultural landscape, with low stone walls, pastures and numerous big oak trees some of them up to 500 years old. The forest is full of ancient remains and cultural objects which demonstrate the efforts that have been made throughout time by people cultivating the land.

The area surrounding Fulltofta hamlet and the manor is an estate with a historical significance. There are a lot of historical remains that show that the area was inhabited from early on. The area today mainly consists of planted forests, as well as dry heath lands, meadows, open pastures and old oak forests. Like the rest of Scania the landscape started to take its shape around 13 000 years ago when the inland ice began to recede.
As the ice retired animals and plants gradually returned basically from the south and southwest. Some immigrants came from the more continental ecosystems in the east and southeast. The since long, extinct giant deer lived here in the semi open landscape.

Man settled here already during the Stone Age 8000 BP, with seasonal dwellings on the beaches of Ringsjön, where food was in rich supply through hunting and fishing. As well as fishing in the lake of Ringsjön there is good fishing in smaller adjacent lakes and in the small brooks Gradually the dwellings became permanent, people started cultivating the land and still today you can see traces of their primitive farming practises.

It is likely that the area was fully colonised by the later part of the middle Ages. The landscape would then have been dominated by meadows strewn with trees and pastures, with the small irregular fields situated closest to the villages. During the 17th century Fulltofta developed into a “small” town. Flour and saw mills were established and farmsteads sprung up here and there, by 1900 there were 25 of them, which were rented from the big estates by the farmers.

Today only a few larger commercial farms remain and a large part of farms and houses have turned into summer houses or commuter’s homes.

**Lake Ringsön Problems.**

Severe problems with eutrophication, algal blooms and poisonous algae.

**Causes**

Naturally an eutrophic lake

Increased eutrophication due to:

- Lowering of water level (draining of the lake)
- Sewage discharge
- Intense agriculture production in the surroundings
Measures introduced
Increased capacity of sewage treatment plants
Regulation for farming activities, regarding fertilizers/manure/crops
Biomanipulations of fish populations, removal of white fish

Food cycle
predatory fish (pike, perch)
white fish (roach, carp bream)
zoo plankton
phyto plankton

Figure 69. Beach view of the eastern shore of Ringsjön inside the Fulltofta NR. (photo J. Åkerman)

NOTICE! (Near the lakeshore)

1. Hydrography in association with the Ringsjön Lake
2. The beaches of the Ringsjön lake.
3. Signs of lake drainage (lowering of lake levels)
4. Water quality
5. The distribution of reeds
6. The beach material
7. The Natur reserv and information to visitors
Figure 70. Nesting, free-living European storks at the Flyinge castle 2005. This nesting pair emanates from the Fulltofta aviary! (photo J. Åkerman)

Figure 71. Group of the 60 young let out in august 2017 from the nesting pairs in the Fulltofta aviary! (photo J. Åkerman)
NOTICE! (At the stork nursery)

1. The idea how to help the stork.
2. The information board
3. The wetland behind the aviary
4. Land use in the surroundings

Figure 72. The southern part of the Ringsjöen Lake with the Fulltofta Nature Reserve.
STOP 16. The “Road of darkness”
Coordinates; 55°52’51.55”N, 13°38’55.24”E

We leave the lower levels near the lake and ascend into the forested areas (Figure 72). The idea here is to show you some of the different types of forest that we have within your catchment area. Note that you have some description of the different trees at the back of the paper. This stop is just outside the map to the east in Figure 72. Here we will examine the different types of managed forest that is typical of the area.

Mixed forest;

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………………………………………………………………………………………………………………

Spruce forest

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………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

Beech forest

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………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

STOP 17. Forest spring.
Coordinates; 55°52’50.58”N, 13°38’51.72”E

Just an example of how the open channel flow and the rivers may start in this type of forest environment. The small brook will join others and become a small river joining the lake some 5 km to the west just where we visited a short while ago. Depending on the season the spring might be dry!!!
After the stops here east of the lake we will drive around the Lake – first we are heading north towards the small city of Höör which is situated just outside to the north of Figure 72 & 74. Here we are turning west and will follow the northern shores of the western part of the Ringsjön. We will pass the River Rönne å that is draining the lake system towards the NW. The lake has been artificially drained several times and lowered with almost 2 m in order to create more agricultural land. This can clearly be seen in the maps if you compare the two maps Figure 77 & 78. The lowering of the lake and hence a change in the water volume and turnover time for the water in the lake has contributed to the problems with the water quality in the lake.

NOTICE!

1. Surface water from a small naturel spring
2. Soils and bed rock?
3. The size of the infiltration area.
4. The flow of water - if any
5. Can the flow be traced downhill from the spring?
6. Can the flow be seen in a map?
7. The Vegetation
Figure 74. The northernmost part of the western Lake Ringsjön.

STOP 18. RÖNNEHOLMS PEAT BOG (or an alternative)

Coordinates 55°55'10.11"N, 13°25'41.15"E

Figure 74, 75 & 76.
Rönneholms bog is a peat bog north west of the western Ringsjön Lake. In the early post-glacial stage, before the peat bog area was formed it was a shallow lake that was linked to the Western Ringsjön Lake. Today there are few pristine bogs left in Skåne as the peat has been mined since long. On Rönneholms bog peat mining continues today and here like in the adjacent Ageröds peat bog there is a large amount of remains from Palaeolithic period, for example some of Europe’s best preserved settlements. The findings are between 8,000 and 9,000 years old.

Peat.
In the wider sense peat is a humus rich soil composed mainly of plant residue as a result of inhibited or prevented access of oxygen to the decay processes of vegetation (mainly Sphagnum mosses) anaerobic conditions. In most cases peat are only certain types of peatland soils namely those built and consisting of plant remains deposited specifically on the site and preserved there. The actual peat bulk has not been transported and deposited by water. It is thus a sedentary formation and not a sediment (as many other organic soils. During peat formation, the plant remnants are undergoing various chemical processes, generally called humification, which means that the plant substance emits part of its oxygen and hydrogen, so that the carbon content increases. If these processes continue fora longer geological periods the peat is transformed into more carbon rich formations: lignite and coal.
It has in some coal layers been identified several of the soil types that make up the modern peat bogs. But these, formed during a geologically very short time period after the Ice Age, these slow-acting processes are playing a very subordinate role. One manifestation of the recent ongoing transformation that takes place in Swedish peatbogs is the appearance and release of methane (marsh gas) in some of peat layers.

Raw peat contains about 90% water, while in the dried state it contains about 60% carbon and can be used as fuel. The peat is rich in information as it commonly contains preserved, recognizable vegetation debris (seeds, pollen, leaves, tree branches or even whole trees and the like) from both the site of deposition and to some extent the vegetation in the surroundings. Therefore, peat and its contents is the main source and the backbone to the knowledge of the vegetation and environmental development history. There are various turf species depending on the plant species that dominated the site when the peat material was formed. The incomplete decomposition means that a large part of the energy content of the biological material is still there; this is why peat can be used as a fuel. In 2006 peat was reclassified as a slow renewable energy source, having previously been considered as a fossil fuel. Around the turn of 1900/2000 the formation of peat was greater than harvesting in Sweden.

Peat is also used as a soil improvement material on humus poor soils, as a soil conditioner (lowers pH, good for plants that do not like lime) and as bedding for animals (mostly cows and horses) where the absorption capacity of peat comes in handy. Peat is in this respect superior to straw. As bedding material the type used is a quality called shredded peat.

In older homes from the Neolithic to the early 1900 man has traditionally used peat (so called lump peat from the upper part of the low degree of humification), for filling and isolation in walls, and ceilings. Regarding some properties peat is better than many modern once. A disadvantage of peat is that it unlike mineral wool etc is combustible, flammable and that it in time it is getting packed. The walls must therefore, if possible, after a few years from top to fill up with more peat.

Figur 75. The southern edge of the Rönneholms peat bog. (Foto J. Åkerman)
Figure 76. The outlet of the Ringsjön Lake via the Rönne River and Rönneholms and Ageröds mosse (peatbogs) in scale 1:10 000.

NOTICE! (Rönneholms mosse)

1. The peat
2. Other material in the peat?
3. Ground water and surface water
4. Present vegetation
5. Reclamation measures

Coordinates; 55°52'27.86”N 13°30'10.19”E

Two families are active with commercial fishing in the lake. One of the enterprises is having a small processing plant (smoking of the fish) and also a store and restaurant at the isthmus between the two parts of the lake. The main fishes are - pike, perch, eel, pikeperch (grey perch) and crawfish.

STOP 20. The Snogeröds brook.

Coordinates; 55°50'27.43”N 13°30'36.01”E

We will look at a trial site for modern water treatment of “excess water” from the agricultural fields in the surroundings. Here the small brook has been put into culverts in most of its upper reaches. The catchment area is not very big - less than 10 km². Basically all water in the catchment come from agricultural fields. Near the small village Snogeröd there is a small wastewater treatment plant that will take care of the sewage water from the village. But the water from the fields still needs to be treated from excess in phosphorus and nitrogen. In order to do this a number of sedimentation dams are built that will keep the water before it is let out into the lake. Part of this water is also circulated through a meandering labyrinth of channels in which Salix trees are planted. These trees use the nutrients and the water leaving the system is hence much cleaner. The Salix is harvested every 3rd year and used for burning in heat water plants in the surrounding cities.
Figure 77. The last 2 stops.

Figure 78. The Bosjö Kloster caste and its surroundings in the old 1812 map.
Figure 79. Stop 16. Salix sp. Trapping nutrients from the Snogeröd brook and at the same time acting as an energy plantation. (Foto J. Åkerman)

Figure 80. Areas with extremely high nitrogen load in the surface and ground water. (in red)
Figure 80. The new topographic map of the area around the last 3 stops. The south-western parts of Eastern Lake Ringsjön

Figure 81. Just harvested three year old Salix sp. (Photo J. Åkerman)
NOTICE! (Snogerödsbäcken)

1. The hydrography around the Ringsjön Lake
2. The Snogerödsbäcken brook—open and or culverted?
3. The sedimentation basins
4. Biological purification of the water
5. Salix sp.
6. Nature reserve
7. The old glacial drainage in the Pinedalen valley

Sen kör vi him och är himma i Lunn om en halv timma ca.
Geological map of Scania
Soil map of Scania