

**ZERO SITE MANUAL
ZACKENBERG ECOLOGICAL RESEARCH OPERATIONS**

Zackenberg secretariat

**Department of Bioscience
Aarhus University**

www.zackenberg.dk

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ZERO Site Manual

Introduction

The Zackenberg Ecological Research Operations (at the Department of Bioscience, Aarhus University) appreciates that you have decided to allocate your high Arctic field research to the facilities at Zackenberg and/or its branch facility at Daneborg. The study area at Zackenberg is located around 74°30'N / 21°00'W within the National Park of North and Northeast Greenland and it comprises the Zackenberg valley and the entire drainage basin of the river Zackenberg.

The area was de-glaciated approximately 8 000 years ago and holds a great diversity of biotopes like ponds, fens, heaths, fell field plateaus and grasslands.

The study area at Zackenberg (see figure 1) is characterized by continuous permafrost with a maximum active layer thickness varying from 20 to 100 cm. A major geological flexure and thrust zone dissecting the Zackenberg valley, the core study area, and separates Caledonian gneiss bedrock (to the west) from Cretaceous sandstones and Tertiary basalts (to the east). The margin of the Greenland Ice Sheet is located approximately 60 km to the west of Zackenberg Research Station.

The objective of the station is to facilitate ecosystem research in the high Arctic. According to the framework programme of Zackenberg Ecological Research Operations (ZERO), this includes:

- Basic quantitative documentation of ecosystem structure and processes
- Baseline studies of intrinsic short-term and long-term variations in ecosystem functions
- Experimental studies enabling predictions of ecosystem responses to Global Change

This is done by:

- Providing facilities, logistic services and accommodation at Zackenberg and Daneborg
- Offering logistic support for transport to and from Zackenberg and Daneborg
- Providing access to a wide range of both biological and physical data from the long-term monitoring programme, Zackenberg Basic

The long-term monitoring programme, Zackenberg Basic, was initiated in 1995 and fully implemented in 1996. The objective of the programme is to provide long time series of data on the natural innate oscillations and plasticity of a high arctic terrestrial, limnic and marine ecosystem. This is accomplished through monitoring of selected biological and physical parameters in the terrestrial and marine environment. Zackenberg Basic comprises five sub-programmes, i.e.:

- Climate Basis – monitoring climate and river water discharge
- GlacioBasis – monitoring glacier mass balance
- GeoBasis – monitoring physical landscape processes, snow cover and solute fluxes and fluxes of greenhouse gases
- BioBasis – monitoring the biological compartment of the ecosystem
- MarineBasis – monitoring the physical and biological processes in the marine part of the ecosystem

In depth information on Zackenberg Basic is available in the ZERO Annual Reports.

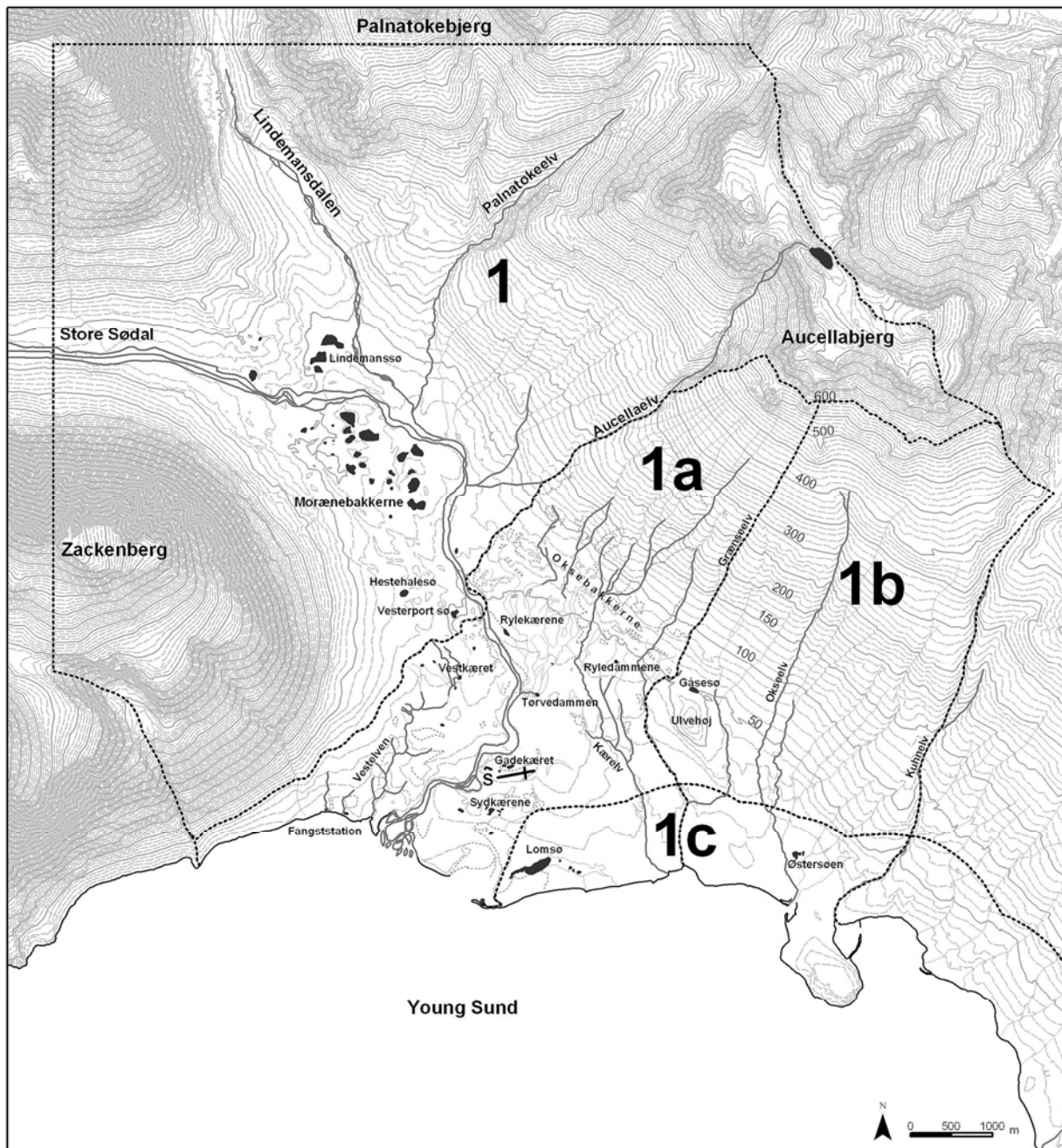


Figure 1 Map of the Zackenberg valley with research zones.

During the summer field season (normally June, July and August) at least a logistics manager, a scientific leader, a logistician and a cook, staffs Zackenberg Research Station. During the rest of the season, there will be logisticians based at Zackenberg on demands. The branch facility at Daneborg is only staffed on demands.

Notice, that the station (figure 2) and its branch facility at Daneborg are available for use year-round but only after special agreement with the Zackenberg secretariat Zackenberg@dmu.dk

The Department of Bioscience, Aarhus University takes no responsibility for your safety while you are situated at Zackenberg Research Station. Furthermore, the Government of Greenland

requires a Search and Rescue (SAR) insurance from each project covering all persons involved (for more information, please see **Insurance** p. 12).

The daily fee for staying at Zackenberg Research Station and its branch facility at Daneborg (including full board and use of all facilities for scientists) are given in the price list. Non-scientists are generally not allowed access to Zackenberg Research Station and its branch facility at Daneborg. However, journalists and artists might be allowed access to the station but only if the planned activities does not conflict with the research activities at the station. Accommodation based on own tent and/or food is not allowed unless special arrangements have been made with Greenland Ecosystem Monitoring (GEM) Coordination Group. Please notice that prices for transport to/from Zackenberg /Daneborg and prices for staying at Zackenberg/Daneborg are differentiated depending on whether you are a scientist or a non-scientist.

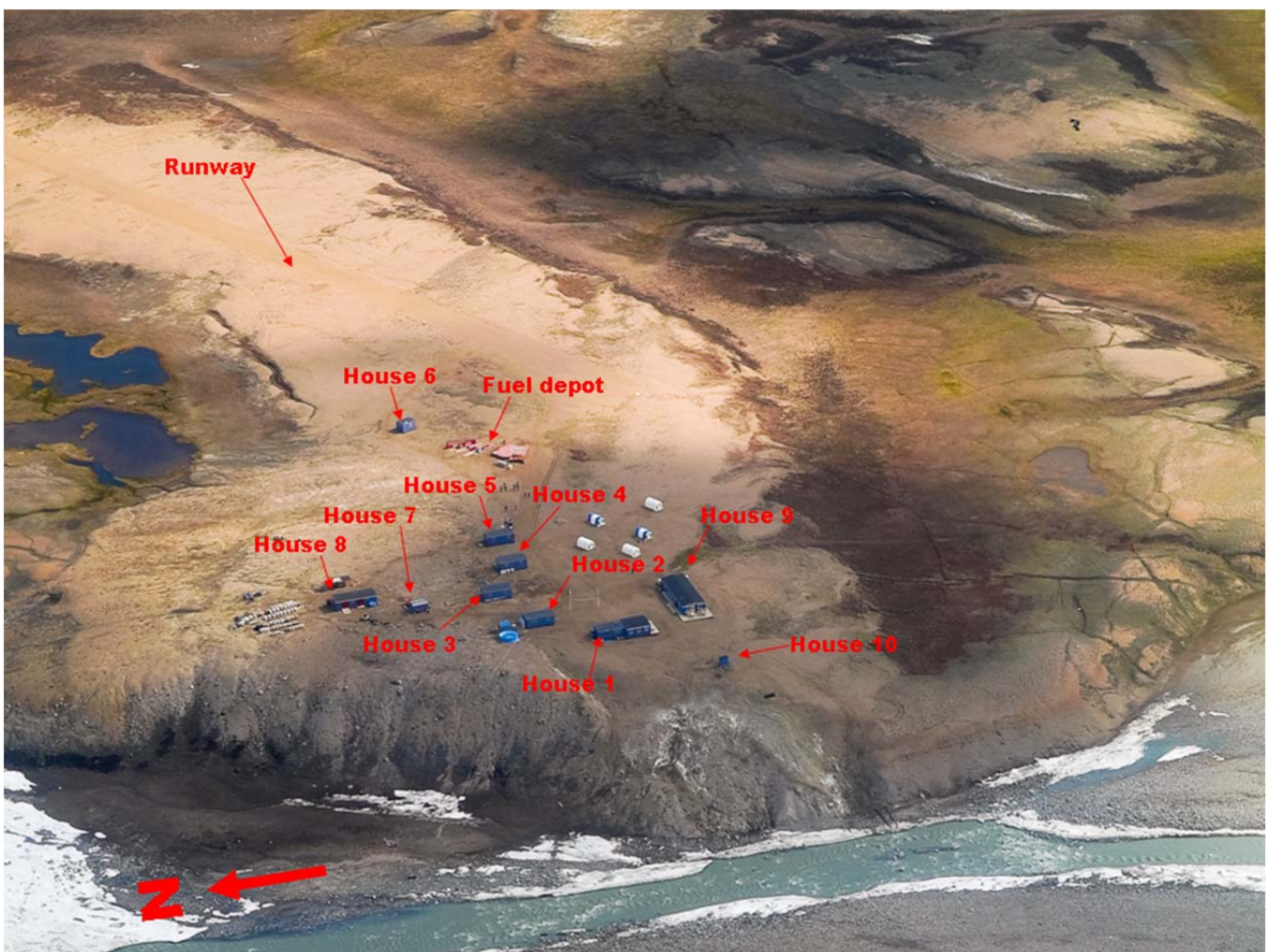


Figure 2 Aerial view of Zackenberg Research Station, Northeast Greenland, 2009. House no. 1: Kitchen, food store and dining room. House no. 2: Wet laboratory. House no. 3: Dry laboratory. House no. 4: Office and accommodations for Basis programmes. House no. 5: Office with means of communication (VHF, HF and satellite phones) and accommodations for logistics. House no. 6: Accommodations for logistics. House no. 7: Workshop for logistics. House no. 8: Generator and workshop. House no. 9: Living room, accommodations, sauna and toilets. House no. 10: Extra toilets. The runway is 450 metres long.

Please notice that the logistics services provided by the staff at the station include only those related to running the facilities and to your board at the station. As a rule, you **must** therefore be able to take care of all work relating to your research projects.

To minimise human impact and to prevent research and other activities from disturbing the study area, a set of regulations must be observed. Primarily, every single person visiting Zackenberg/Daneborg must give the utmost consideration to the natural environment and to the interests of others working in the area. This is also because Zackenberg Research Station and its branch facility at Daneborg are situated in a National Park, which have its own set of laws and regulations.

Therefore:

- Disturbance of soil, plants and animals should be kept at an absolute minimum.
- Objects and samples are only allowed taken home by special permission from the Government of Greenland.
- Scientific equipment, plot, transects or markers not belonging to your own project must not be approached (keep a distance of > 20 meters).
- No waste must be left in the terrain (see further details below).

It remains the responsibility of the individual leaders of research projects (*i.e.* the principal investigators) to remove scientific equipment from the field site(s) and from Zackenberg Research Station after termination of the study or experiment unless arrangements that are more permanent have specifically been accepted by the GEM Coordination Group. Tags and markers indicating the position of your field experiment shall generally not be removed, unless otherwise agreed with the scientific leader.

At Zackenberg Research Station, the GEM Coordination Group is represented by the scientific leader. The scientific leader is as such the local authority dealing - on ad hoc basis - with any issues concerning location of research activities and equipment in the study area. In the absence of the scientific leader, a deputy scientific leader is appointed.

Access to the station and the designated research zones for any research project is given by the GEM Coordination Group based on a proposal describing aims and practicalities of the field research (see the **application form** on www.zackenberg.dk). Your research activities at Zackenberg Research Station cannot be carried through unless you prior to your arrival at Zackenberg have received the GEM Coordination Group's acceptance of your research project from the Zackenberg secretariat. Such a permit is obtained by submitting (before 14 February) to the Zackenberg secretariat the required information of the planned project at Zackenberg. Experimental and manipulative studies will be allocated to specific sites and will only be allowed after approval by the GEM Coordination Group before the start of the field season. The final location of your sites/plots will be decided by the scientific leader at Zackenberg. Your application will also be used for applying to the Government of Greenland, concerning your admission to enter the National Park. This will be taken care of by the Zackenberg secretariat. If there is a need for dispensation (additional permit) from the National Park Executive Order (see www.zackenberg.dk) you will be informed by the secretariat but **you** will have to apply to the Government of Greenland for the dispensation (additional permit).

Any **manipulative study** and take of organisms must be registered. Please remember to fill in information about your projects manipulative sites including UTM coordinates and return the form (appendix F) to the scientific leader **before** leaving Zackenberg Research Station.

Research zones

To protect the research area we kindly ask visitors to respect a limited number of guidelines and regulations concerning your transport and research activities in the nearest surroundings of the station.

Research zone 1: The Zackenberg valley

Division 1a

This is the core area for monitoring and research projects. In this zone, a transportation corridor (from the east end of the runway towards the climate station and further to the north of the climate station) is staked out to concentrate general surface traffic to the least fragile habitats. Please use this corridor when you commute between the station and your field sites. Especially the area north of the runway markers, *i.e.* the gravel plateaux and Gadekæret should be avoided.

Division 1b

This part of the valley is reserved as a 'minimum impact' study area. This implies that only a minimum of activity will be permitted here and that research activities can take place only by prior approval from the GEM Coordination Group. Ad hoc access by individuals may be granted by the scientific leader, or in his absence, by the logistics manager.

Division 1c

Several hundreds of geese moult in the lowlands adjacent to the coastline. During the 50 days moulting season geese are extremely sensitive to disturbance. In order not to scare off the geese permanently and thereby altering significantly the grazing regime of the coastal meadows, access is prohibited between 20 June and 10 August in a 1000 m wide zone (landwards as well as seawards) adjacent to the coast east of the old delta of the river Zackenberg. Plans for research requiring access to this area during the critical period must be approved before the field season by the GEM Coordination Group.

Regulations for research zone 1

1.1 Firearms

Pistols and revolvers are not allowed. Rifles of cal. 0.308 (*i.e.* 7.62 mm) or larger are available at the station and can be borrowed from the logistics manager in accordance with current regulations and after proper instructions. Projects are obliged to carry a firearm as well as polar bear deterrents in the National Park (Executive Order no. 138 of 10 February 2010 on Access to and Conditions for Travelling in Certain Parts of Greenland).

Except for an emergency, it is strictly forbidden to carry rifles with ammunition in the chamber on the station area. Any weapons used in the field shall be delivered to the weapon storage as the first thing you do when you return to the station.

1.2 Geese

Family groups of barnacle geese and flocks of pink-footed and barnacle geese are highly sensitive to disturbances. Please avoid scaring them off their feeding and moulting sites.

1.3 Motorised traffic

Motorised traffic is generally not allowed except for within the station perimeter, on the runway area and in the designated traffic corridor (see figure 2). Use of any vehicle must be minimised. Generally, it is not possible to drive personnel and/or equipment to field sites after

the snow cover has disappeared (typically after mid-June). Motorised vehicles will be operated by the station personnel only.

1.4 Musk oxen

Keep a distance of at least 200 m from musk oxen, not only to avoid the danger from attacks, but also to avoid disturbing the spatial and diurnal foraging patterns of the animals. Please read **Encounters with Wildlife in Greenland** (can be downloaded from www.zackenberg.dk)

1.5 Skis and Snowshoes

Until late June, traffic in the study area is hampered by extensive snow cover. During spring, deep and water soaked snow may occur in many places. Skis and/or snowshoes will be an advantage during winter and spring.

1.6 Snowmobiles (Skidoos)

The station has two snowmobiles, mainly to be used in early spring to the end of May. Run outside the station's immediate area should always use two snowmobiles. Station personnel will provide instruction in vehicle use, and provide helmets and safety equipment. The rules for driving in terrain with motorized vehicles also apply to driving snowmobiles.

1.7 Smoking

Smoking is not allowed indoors at Zackenberg Research Station. When smoking outdoors, cigarette butts, cigar stumps, pipe tobacco remains etc. must be taken to deposition in the trash barrels.

1.8 Waste

All types of waste must be brought back to the research station for treatment. Use of the station toilets should always have a clear priority over open-air defecation in the field. However, if un-avoidable, cover your faeces with a stone big enough not to be removed by a fox. See also 'Waste' in 'A -> Z Information'.

1.9 Birds

Small populations of red-throated divers, king eiders and long-tailed ducks are found in the Zackenberg valley. As these birds are confined to the relatively limited number of small lakes and ponds, they are sensitive to disturbances. Please avoid scaring them off the ponds. In particular, this applies to incubating divers, which may leave the nest for good after just a single disturbance.

1.10 Zackenberg trapping station

The old trapping station is a protected historic site at the shoreline, approximately 2 km from the research station. Visitors must show respect for the historical values. Use of the wood/coal stove is not allowed. The butane-based burner must be used for all heating and cooking purposes during your visit. Lock up the station carefully when you leave and bring any waste back to Zackenberg Research Station. Please notice that the Sirius Patrol uses this hut for overnight stays during the winter. Therefore, please respect that the provision storage is for their use only.

Regulations for research zone 2

2.1. Firearms

Projects are obliged to carry a firearm as well as polar bear deterrents in the National Park (Executive Order no. 138 of 10 February 2010 on Access to and Conditions for Travelling in Certain Parts of Greenland). See also regulation 1.1.

2.2. Itinerary

Before leaving the Zackenberg valley (i.e. research zone 1), it is mandatory to deposit a written itinerary with the logistics manager (take a copy of the itinerary with you). We further recommend that leaving research zone 1 should not be carried out alone. It is important that you stick to the itinerary unless a change has been mutually agreed upon with the logistics manager (by VHF radio or other means of telecommunication).

2.3. Waste

Combustible waste as well as other types of waste must be brought back to Zackenberg for deposition. Cover your faeces with a stone big enough not to be removed by a fox.

Regulations for research zone 3: Fjords and Daneborg

3.1. Firearms

Projects are obliged to carry a firearm as well as polar bear deterrents in the National Park (Executive Order no. 138 of 10 February 2010 on Access to and Conditions for Travelling in Certain Parts of Greenland). See also regulation 1.1.

3.2. Itinerary

It is mandatory for any group sailing outside the immediate coastal areas off Zackenberg or Daneborg to deposit a written itinerary with the logistics manager (take a copy of the itinerary with you). It is important that you stick to the itinerary unless a change has been mutually agreed upon with the logistics manager (by VHF radio or other means of telecommunication).

3.3. Sandøen

The island Sandøen, southeast of Daneborg, is a strictly protected nature reserve with no access allowed without a special permit from the National Park authorities (i.e. The Government of Greenland). Permission to visit the island for research purposes can normally be achieved by applying the Government of Greenland well in advance.

3.5. Sirius - Daneborg

In the Daneborg station area, instructions from the commander of the Sirius Patrol must be obeyed.

3.6. Trappers' cabins

When visiting the old trapping stations and huts, please show respect for the historical values, and lock up the house carefully when you leave. Do not leave any waste behind. Please respect that the Sirius Patrol uses these hut for accommodation during winter. Therefore, please do not use the provision or other things stored in the cabins.

3.7. Walruses

Walruses can be dangerous to small vessels. Hence, when working in boats and zodiacs in Young Sund - Tyroler Fjord, a distance of at least 200 m should be kept to walruses. Please read **Encounters with Wildlife in Greenland** (can be downloaded from www.zackenberg.dk)

A - Z Information

Access to Zackenberg

To facilitate planning and co-ordination of research under the ZERO auspices, all research projects must submit to the Zackenberg secretariat (zackenberg@dmu.dk) a request for access permit **no later than 14 February** of the year of the planned summer field season. Due to environmental concerns, all applications will be evaluated by the GEM Coordination

Group, which also maintains correspondence with the Government of Greenland concerning the overall access to the National Park of North and Northeast Greenland. The application form and the relevant appendixes for access to Zackenberg Research Station are available on the Zackenberg website (www.zackenberg.dk).

Accommodation

Zackenberg Research Station can accommodate a maximum of 24 scientists and staff. Scientists are accommodated in double rooms either in the accommodation building or in other buildings.

Accommodation is provided in double rooms with central heating, beds and essential furniture. Toilets, showers, sauna and living room are located in the same building. Dining is in a separate building.

Acknowledgement

It is mandatory when publications utilise primary data collected by a research project under the auspices of ZERO to acknowledge as follows: The Zackenberg Logistics at the Department of Bioscience, Aarhus University is acknowledged for providing logistics at the research station at Zackenberg, Northeast Greenland. If data from Zackenberg Basic is included in the work, the relevant Basic programmes must be acknowledged.

Aircraft arrival and departure

In order to minimise the disruptive impact on wildlife of low-flying aircrafts in and adjacent to the Zackenberg valley, the following approach and departure procedures must be complied:

- An approaching aircraft must remain above Young Sund and Tyrolerfjord at an altitude above 500 m above sea level as long as possible.
- A departing helicopter must climb to above 500 m altitude and then take a southward turn heading for the fjord.

Airstrip at Zackenberg

Please notice that the airstrip at Zackenberg is classified as an inadequate aerodrome.

An Inadequate aerodrome is an aerodrome where the following are insufficient (the following list is non-exhaustive):

- Air traffic service,
- meteorological information services,
- area control service or
- emergency preparedness

Any passenger to Zackenberg must sign a "**Disclaimer of Liability**" to the airline company, Norlandair, providing air transport to Zackenberg claiming that he/she has been informed that on the air route to Zackenberg inadequate aerodromes can be used as a landing fields. Inadequate aerodrome can increase the probability of damages and injuries.

The airline company Norlandair bears no additional liability (whether in contract, tort or otherwise) for any loss, damage or injury of any nature beyond the liability of Norlandair insurance policy (regulated by the Danish law, Luftfartsloven) on the base that inadequate aerodrome is used as a landing field.

Annual Report for ZERO

Following each calendar year, a comprehensive report (in English) is published by Department of Bioscience, Aarhus University covering all activities, events and accomplishments of the past year under the auspices of Zackenberg Ecological Research Operations (ZERO). All principal investigators working from Zackenberg Research Station are required to provide an abstract

(including relevant figures) to this report following specifications provided by the editor (see www.zackenberg.dk)

Boardwalks

In wet habitats, human activity may lead to a significant wear and tear of the vegetation and top soil layer. To counteract this undesirable influence on the local ecosystem, wooden boardwalks must be installed at selected project sites by the research projects.

Zackenberg Research Station can provide materials for boardwalks but it remains the obligation of the individual research projects to install the boardwalks prior to the research activities – and to remove the boardwalks at the end of the project period.

Camping

Camping and tent based equipment storage etc. at a research site must be specifically approved by the scientific leader or the logistics manager.

Cargo - airplane

It is essential for optimal planning and utilisation of the charter flights to and from Zackenberg that the amounts and types of cargo are known to the Zackenberg secretariat. You are therefore requested to inform in your application form the exact weight of all the cargo you and your project colleagues want to have transported to and from Zackenberg. Any changes in cargo amounts and types must be reported immediately to the logistics manager.

Onboard the aircraft between Iceland and Zackenberg the luggage weight limit is 20 kg per passenger. Any luggage in excess of this is treated as cargo and is given lower priority than scheduled visitors and staff, and is charged to the pertinent person or project at the current rate (see the price list on www.zackenberg.dk). This charge applies both for the northbound cargo transported by aircraft from Iceland to Zackenberg and to the southbound cargo transported by aircraft from Zackenberg to Iceland.

Please notice that you further might be charged for any access luggage on the commercial flight between Iceland and the airport from where you start and end your journey to/from Zackenberg.

Cargo - ship

Since the prices on excess luggage and cargo on flights between Copenhagen and Keflavik are very high, you should consider using the possibility of having your cargo transported by ship from Denmark to Iceland at a substantially lower price (see the price list on www.zackenberg.dk). However, this requires that you deliver your cargo at the Department of Bioscience, Aarhus University in Roskilde in early May. You **must** pack your goods in plywood or aluminium boxes with padlocks together with a table of content, and with a precise indication of recipient on the box.

From Iceland to Zackenberg, the cargo will preferably be airlifted well in advance of your stay at Zackenberg to allow it to be there when you arrive.

If it fits your time schedule, you can also have cargo transported by ship from Denmark to Daneborg (and then airlifted the last 25 km to Zackenberg). This requires that you deliver your cargo at the Department of Bioscience, Aarhus University in Roskilde in mid-June. You **must** pack your goods in plywood or aluminium boxes with padlocks together with a table of content, and with a precise indication of recipient on the box. The annual cargo ship leaves Denmark in early July and arrives in Daneborg in early August.

Likewise, you can send cargo back to Denmark on board the southbound cargo ship, with departure from Zackenberg around 15 August.

Please notice that southbound cargo airlifted out of Zackenberg will continue from Iceland to its final destination by surface transportation (i.e. ship, truck, train) unless you specifically has indicated something else to the logistics manager. Accordingly, it might take at least a month before you receive your southbound cargo.

Cargo – dangerous goods

If you need to send 'dangerous goods' to or from Zackenberg, you must inform the Zackenberg secretariat. It is your responsibility to ensure that cargo can be identified, labelled and packaged according to International rules applicable to both land, sea and air transport. You can find more information about products to be classified at Danish Emergency Management Agency website www.kemikalieberedskab.dk (only in Danish).

Climate

At Zackenberg, the mean annual air temperature for the period 1996-2008 is -9.0 °C. The warmest month is July (6.1 °C), while the coldest months are January, February and March (-19.8, -19.4 and -19.5 °C). The mean precipitation is 218 mm w.e.

In Daneborg, situated on the outer coast, approximately 25 km SE of Zackenberg, the mean annual air temperature for the period 1960-1990 is -10.3 °C. The warmest month is July (3.8 °C), while the coldest month is February (-17.6 °C). The mean annual precipitation at Daneborg is about 200 mm w.e., according to measurements carried out by the Danish Meteorological Institute. Climate data from Zackenberg are available in the Zackenberg Ecological Research Operations Annual Reports that can be downloaded from www.zackenberg.dk

Computer hardware - software

You must bring your own portable hardware/laptop to meet your computer needs in the field and in the laboratory.

Daily fee

The fee for using the station at Zackenberg for scientists and non-scientists are found in the price list (www.zackenberg.dk). The fee includes food, accommodation and free use of all facilities except e-mail and satellite phone calls. In case you have special logistics needs, you will be charged for the extra service. Please contact the secretariat (Zackenberg@dmu.dk) for advices concerning extra services.

Before the field season, the Zackenberg secretariat will mail you a prepayment invoice concerning the expected station fee and transportation costs relating to your stay at Zackenberg - in anticipation of a reimbursement at a suitable time and before your departure to Zackenberg. Please notice that the final invoice, in which your prepayment is regulated, cannot be expected before late November/early December.

Database contribution

The ecosystem monitoring sub-programmes, ClimateBasis, GeoBasis, BioBasis, MarineBasis and GlacioBasis constitute the extensive cross-disciplinary monitoring programme, Zackenberg Basic, which generates the ecosystem information stored in the ZERO database (approximately 3 500 different parameters are measured each year at different time intervals). These data are provided free of charge to anyone interested. All research projects under the auspices of ZERO are also encouraged to provide, for public availability, its primary data. Specific agreements concerning this can be made with the secretariat (Zackenberg@dmu.dk).

Electricity

The station supplies 230 V, 50 Hz AC power. Electricity outlets are of DIN standard.

First aid and medicine

A well-equipped first aid kit is situated at the station. Any personal medication must be brought in by you.

Any disease that might affect your ability to stay and work in the field must be reported to the staff on the application form, but please notice that the Department of Bioscience, Aarhus University will take no responsibility for any problems relating to the health information reported on page 5 of the mandatory application form.

The staffs at Zackenberg Research Station are experienced in handling situations requiring evacuation out of Zackenberg. However, please notice that evacuations are carried out at your own cost. Therefore, make sure that you are properly insured or self-insured before you start your journey to Zackenberg.

Force majeure

Please notice that flights to and from Zackenberg may be changed due to weather conditions. Furthermore, southbound flights from Zackenberg to Iceland may be rescheduled if the station manager, the logistics manager or the captain of the aircraft considers it necessary due to weather forecasts.

GIS and GPS

Any principal investigator must see to that all manipulative sites, dug holes, take of organisms etc. relating to his/her project are registered with exact UTM coordinates. These GIS data must be delivered to the scientific leader who will enter them into the 'Experiments Database' providing an overview of the location of all research and monitoring sites during the years.

The Zackenberg secretariat can assist you in preparing thematic field maps for the study area. A digital elevation model covering the Zackenberg valley and Store Sødal allows for preparation of specialised maps based on the individual researchers wish. You might also produce your own maps with the Web-GIS tool on the Zackenberg website (www.zackenberg.dk).

Zackenberg Research Station provides a number of different maps covering the study area. These maps can either be downloaded from www.zackenberg.dk or ordered from the secretariat [Zackenberg secretariat](#).

Different equipment for surveying is present on the station. This includes a digital theodolite and equipment for differential GPS.

Twenty meters to the north of the mess house (House 1) a boulder carries a copper plate for exact GPS and altimeter calibration. The position can be found on the bulletin board in the mess room.

Indoor footwear

It is recommended to bring footwear dedicated to personal indoor use since outdoor footwear is not allowed in any of the buildings except the workshop, garage and generator building. Furthermore, a pair of clogs is handy for use between buildings.

Insurance and liability

The Government of Greenland requires a Search and Rescue (SAR) insurance from each project covering all persons involved.

The SAR insurance must cover the amount of DKK 1,000,000 with the Danish State as the sole beneficiary if the project or expedition takes place inside the area covered by the Executive Order on remote travel. An expedition/project required to have SAR insurance must also for each participant obtain an additional evacuation (ambulance) insurance covering the amount of DKK 280,000 for projects travelling south of latitude 78° N within the National Park borders and/or outside the National Park in the remaining areas covered by the Executive Order.

A research project carried out under the auspices of a public research institution (e.g. a university) normally does not need to obtain a SAR and evacuation insurance as project

members will be covered by the institution through the institution's self-insurance. However, the self-insurance generally covers employed staff only and other people whose wages or funds are administered by the above-mentioned institution. The project leader (PI) must therefore forward to the Zackenberg secretariat, an official statement with enclosed documentation from the involved institution(s) clarifying that the SAR and evacuation insurance conditions are valid for all participants in the project (**Appendix D or E**).

The Zackenberg logistics staff from the Department of Bioscience at Aarhus University can, based on their local experiences of the conditions in Northeast Greenland, generally guide you concerning many security issues.

The Department of Bioscience, Aarhus University takes no responsibility for your security while you are situated at Zackenberg Research Station. Therefore, please make sure that you are properly insured before leaving for Zackenberg.

If you need to be evacuated, the logistics staff will help you in any possible way but any expenses relating to this will be the responsibility of you, your institution or your insurance company.

If you are operating outside the ZERO study area (i.e. outside research zones 1, 2 and 3) it still remains your own responsibility that you possess a valid insurance covering all expenses deferred from any case of illness, injury etc. requiring a non-scheduled transportation out of Northeast Greenland. Please contact an insurance provider (e.g. Europæiske, International Health Insurance, IF or the HR-department of your institution)) for more details.

It remains your own responsibility to secure that your insurance/self-insurance covers expenses deriving from your evacuation, hospitalisation and/or medical treatment in case you have to be evacuated from Northeast Greenland.

Laboratories

A wet and a dry laboratory accommodate all types of work relating to sample preparation, sorting and examination. There is a supply of basic laboratory equipment available in both laboratories. Though the facilities are well equipped with basic laboratory equipment, there is still space available for more specialised equipment brought in by researchers.

The basic laboratory equipment at Zackenberg includes pH-meters, conductivity meters, a high precision scales, normal range scales, a stereo microscope, a centrifuge, drying ovens, thermometers, sieves and meshes, pipettes, various glass ware, plastic containers, refrigerators and deep freezers etc. In the wet laboratory demineralised ($< 0,01 \mu\text{S}/\text{cm}$) and filtered ($< 1 \mu\text{m}$) water is available. Zackenberg Research Station does not provide laboratories with low temperature.

For specific information about the laboratory equipment at Zackenberg, please contact the secretariat (Zackenberg@dmu.dk).

For specific information about the laboratory equipment at Daneborg, please contact the secretariat (Zackenberg@dmu.dk).

It is your own responsibility to bring the necessary chemicals and to bring out of Zackenberg and Daneborg all waste chemicals belonging to your project.

Local transportation

First, anyone visiting Zackenberg must bear in mind that minimising human impact on the pristine ecosystem has highest priority. Local transportation must therefore take place with due consideration to landscape, flora and fauna. The staked-out corridor through the most heavily used areas must be followed as far as possible before fanning out to the various

destinations in the landscape. The scientific leader will give you an introduction to traffic regulations in the Zackenberg region immediately after your arrival at the station

For use of motorised vehicles, please confer regulation 1.3 and 1.6. Please stay at least 20 meters away from study sites, experimental plots, scientific equipment etc., unless you have arranged otherwise with the scientific leader. Especially sensitive plots are marked with red-topped nylon poles.

Mail

The postal connection between Zackenberg Research Station and the rest of the world goes through Akureyri, Iceland, thanks to the charter flight company Norlandair. Therefore, Icelandic stamps are needed on outgoing mail. The station office at Zackenberg Research Station will have envelopes, stationary and stamps available for purchase. In case you need special envelopes (e.g. for samples), you must bring them yourself. Postage ready envelopes must be left in the out tray in the logistician's office in order to leave with the next aircraft.

To receive mail at Zackenberg the following mailing address applies:

'Person's name'
ZERO - Zackenberg
C/o Norlandair
Akureyri Airport
IS-602 Akureyri, Iceland

Mosquitoes

These nasty creatures are frequent during June and July and they can be quite disturbing for any field activities. Bring mosquito nets mounted on hats as well as repellents.

Meals

During the main season (June through August), the mess at Zackenberg Research Station is staffed with a professional cook. All meals are served buffet style. Snacks and candy are available throughout the day (and night) on a self-service basis. If you know that you will be significantly late for a meal, please contact the kitchen staff well in advance, and then servings can be saved for you. In case you are on a special diet for health reasons or have other special diets (e.g. vegetarian), please inform the Zackenberg secretariat before the field season. Alcoholic beverages must be brought in by you.

If you need freeze-dried food for several days, please contact secretariat prior to the field season.

National Park regulations

Zackenberg and its study area are located within the National Park of North and Northeast Greenland under the jurisdiction of the Government of Greenland. Please confer to the unofficial English translation of the 'National Park Executive Order' (see www.zackenberg.dk) with all current rules and regulations to be observed while you are in Northeast Greenland. Please notice that objects and samples are only allowed taken home by special permission from the Government of Greenland. If your research will include activities not complying with the National Park regulations, you are required to apply the Government of Greenland for additional permit(s)/dispensation well in advance. If there is a need for additional permit(s)/dispensation from the National Park Executive Order you will be informed by the secretariat but **you** will have to apply to the Government of Greenland.

Personal equipment

The high Arctic summer season has a climate comparable to a southern Scandinavian autumn/early winter. There is a risk of sub-freezing temperatures and snow throughout the summer. However, be prepared for windy conditions and occasionally rain.

You should bring clothes that are versatile, durable and comfortable. One general rule should be obeyed: Keep dry from sweat and water. This can be accomplished by frequently adjusting the amount and combination of clothes to the weather at any given time. For an optimal adjustment, it is advisable to dress in many thin layers, not one big bulky sweater. Be sure to bring some wind- and waterproof garment and make sure that your footwear is comfortable, durable and waterproof. Do not forget gloves and hats – even during summer. A pair of sunglasses is essential for most seasons.

During the snowmelt period in June - early July rubber boots as well as snowshoes and skis are recommended.

Remember soap and towels for your personal use - as well as all necessary personal toiletries. Detergent for washing clothes is available at the station. Remember, the nearest shop is approximately 500 km away!

Polar bear precautions

The Zackenberg Station has contingency plans for situations where polar bears appear in the valley or within the station perimeter. Please read "Encounters with Wildlife in Greenland" and "The Handbook: Prevention and control of wildlife damage – Polar bears", both can be downloaded from www.zackenberg.dk before going to Zackenberg so you can react prudently if you have to face a polar bear.

Polar bears are rare at Zackenberg. Since 1995, only five-six bears have been seen in the area around Zackenberg Research Station. However, at Daneborg polar bears are frequent visitors.

The logistics staff and the scientific leader will introduce you to polar bear and musk oxen precautions immediately after your arrival at Zackenberg Research Station.

Prices

Check the price list (www.zackenberg.dk)

Recreation

The old Zackenberg trapping station at the coastline as well as the summits of Zackenberg and Aucellabjerg mountains are all favourite destinations for recreational hikes. Remember to inform the logisticians about your excursion schedule and to leave an itinerary with the logistics manager.

Zackenberg Research Station holds a special permit that allows persons staying at the station to do sports fishing from the shore in front of and to the west of the old Trapping Station, but only by means of rod and tackle. The fishing season opens at 1 July.

Hunting is prohibited in the National Park.

A number of novels and games - indoor as well as outdoor - are available at the station. When you leave Zackenberg, it is acknowledged if you donate any literature to the local station library.

Safety instruction

Immediately after your arrival at Zackenberg, the logistics staff will introduce you to different safety issues, including use of different weapons, use of VHF-radios and general rules concerning rational behaviour in a mountainous area. Further, the scientific leader will give you a short introduction traffic rules and sensible behaviour in the different research zones and a short introduction concerning safety precautions in relation to the local wildlife.

Telecommunication

You may use three kinds of voice communication to communication between the station and the outside world:

- 1) For local communication purposes, i.e. within the core study area, a number of VHF radios will be at your disposal. A VHF repeater station on the mountain Dombjerg extends the range of normal VHF-radios to cover the entire Store Søndal, Daneborg and Sandøen.
- 2) Regional communication, i.e. to/from destinations in Northeast Greenland, is dealt with by means of a HF radio.
- 3) Long distance and international communication, e.g. to/from Denmark, will be handled with different types of satellite telephones.

Zackenberg can be reached at the following (irridium) telephone numbers:

00 881 631 420 626
00 881 651 442 985

Important: As you cannot count on somebody being within hearing distance of the phone when you put your telephone call through to Zackenberg - except around 8 a.m. (local time) - it is strongly recommended to use the e-mail option as the cheapest and most reliable mean of communication.

Please notice that during the winter period the telephones and the HF radios are disconnected as the station is unmanned. During winter, you can contact the station staff at zackenberg@dmu.dk

E-mail communication is available but at a high price ([see price list](#)). The Zackenberg e-mail system is only operated by the logisticians who will transfer your e-mail text from a memory stick to the mailing system and who will provide you with paper copies of the e-mails you receive. E-mail communication takes place via a dedicated PC located in the radio room. The e-mail inbox will be emptied daily just before breakfast and dinner, and recipients will be notified.

Due to technical constraints in the satellite, e-mail and data transmission can take place only at a very low baud rate. E-mails should therefore only be used for sending text messages (not attachments of any kind).

Please remember to write the name of the recipient in the subject line.

The e-mail address for Zackenberg is logistics@zackenberg.com

Toilets, showers and sauna

The station has several toilets. In order to secure, a continuous optimal function of the toilets it is important that all users comply with the instructions that the logistician may give you regarding use of the toilets. Two showers and washrooms (both with hot and cold water) are located in the accommodation building and a sauna is available for recovery after cold days in the field. Furthermore, two standard household washing machines are available in the same building.

Travelling to and from Zackenberg - general

It is the objective of the Zackenberg secretariat to plan and implement the charter flights to and from Zackenberg in order to meet the interests of the involved researchers as much as possible while considering the overall goal of optimal use of available aircraft payload. This

balance may result in researchers having to adjust their proposed travelling schedule to fit into the logistics framework.

During the field season, charter flights with Twin Otters between Iceland and Zackenberg will be available approximately every week during July and August, approximately every fortnight in June and for the rest of the season please check the preliminary flight schedule (www.zackenberg.dk). The final flight schedule cannot be established until all travel needs are known. Therefore, you **must meet the deadline** for applications to the Zackenberg secretariat and in your application form indicate the dates you would prefer to travel north and south.

The Zackenberg secretariat can offer all visitors to Zackenberg a special airfare between European/US airports serviced by Icelandair and Zackenberg.

The Zackenberg secretariat is in charge of organising the charter flights between Iceland and Zackenberg (as well as any associated overnight stays in Iceland) and provides travels as package solutions including tickets to/from Zackenberg and accommodation including full board at Zackenberg. Current prices for scientists and non-scientists are available in the price list on www.zackenberg.dk.

Between Iceland and Zackenberg, owners of any excess luggage weight will be charged for excess luggage according to the price list! Please notice that luggage as well as cargo will be weighed and related to owner prior to every flight to/from Zackenberg.

Any excess luggage weight on the Iceland - Zackenberg - Iceland legs must be notified to the Zackenberg secretariat and will be dealt with as cargo to be transported accordingly and at your expense. It further remains your economic responsibility to cover the expenses defrayed from bringing excess luggage on the commercial flights between your hometown and Iceland.

Following the field season invoices covering the travel related expenses defrayed on behalf of the individual person or project will be issued and mailed by the Zackenberg secretariat. Invoices will be sent out in late November/early December and must be paid to the Zackenberg secretariat before the end of December.

Travelling - northbound

Prior to the departure date the traveller will receive - from the Zackenberg secretariat - a mail with information and an attached electronic ticket covering the flight from your point of departure to Akureyri via Keflavik, Iceland.

Upon arrival at Keflavik, you must collect your luggage and proceed to the domestic air terminal, located 52 km to the east in the capital city, Reykjavik. Citizens of Schengen do not need to show their passport, but it is always a good idea to bring your passport. All other nationals must be prepared to show their passport at the control booth at Keflavik. In front of the control booth, a bank branch offers you a convenient opportunity to buy Icelandic currency (i.e. 'kronur').

Please note that Iceland enforces strict regulations against letting fishing gear (potentially infected with fish disease vectors) into the country. Therefore, be prepared to explain that your luggage is in transit and bound for Greenland with first available flight, and be prepared also that you might be charged for a disinfection of your fishing gear (approximately 55 - 60 US \$/ for each rod) should the officials decide so.

Likewise, bringing firearms into Iceland will trigger questions at the customs checkpoint. Be ready to present your valid firearm licence to the customs officer - and explain that you and your firearm are in transit only.

Transport between Keflavik and Reykjavik is possible by the Icelandair shuttle bus that leaves just outside the Keflavik arrival hall. Tickets are sold at the newsstand in the airport. The bus stops at the bus terminal in Reykjavik and at several hotels. Alternatively, there are taxis also leaving from Keflavik to Reykjavik.

Once at the Reykjavik airport you must check in your luggage again - although it should be labelled with Akureyri as your final destination. The flight Reykjavik - Akureyri is 'ticketless'. The reservation number is your valid travel licence to this route. Remember to bring ID with a picture (preferably passport). The flight to Akureyri takes approximately 50 minutes and - weather permitting - offers you low-level views of magnificent lava landscapes and local ice caps. Some turbulence is frequently encountered when descending into the Akureyri valley.

The Norlandair personnel will announce the expected time of departure for the Zackenberg flight (if not otherwise informed this is Tuesday at 9.00 with check-in at 8:00) and - in case you will be departing the following day - show you the location of your overnight accommodation in Akureyri.

Notify the receptionist about your departure time in the morning so breakfast can be ready in due time. Any expenses derived from room service or private telephone calls charged to your room will have to be paid by you before departure. Except for breakfast, all meals in Akureyri will be at your own expense. Credit cards like EuroCard, MasterCard, Visa and Diner's Club are widely accepted.

Notice that all local taxi transportation between airports and between airports and overnight accommodation is at your own responsibility and cost.

It is essential for the charter flight Akureyri - Zackenberg that you comply with the following weight limit, i.e. one person is allowed 20 kg luggage! Any excess to that limit will have to be announced well in advance to the Zackenberg secretariat in order to secure an optimal planning and transportation service, e.g. using alternative cargo options. Therefore, please indicate, when you submit the access application, how much excess luggage you plan to bring.

The flight from Akureyri to Zackenberg goes via Constable Pynt and takes 2 - 2.5 hours. At Constable Pynt only a brief ground stop allows for refuelling of the aircraft, 'defueling' of passengers and loading of any northbound additional Zackenberg cargo. The journey then continues north, sometimes via Daneborg, to Zackenberg - a distance covered in approximately 2 hour. For your own comfort, take your precautions to counteract the absence of any toilet facility on board the aircraft.

Travelling - southbound

You will depart Zackenberg in the afternoon and arrive in Akureyri during the evening. If you are booked on an international flight leaving Keflavik early the following morning or during the night, your flight from Zackenberg must arrive in Akureyri early enough for you to catch a domestic flight from Akureyri to Reykjavik.

Upon arrival at Reykjavik Airport, you and your fellow travellers must organise the transfer to the bus terminal from where the shuttle bus to Keflavik International Airport will depart. Shuttle bus tickets are bought in the bus terminal building or from the bus driver.

If the planned date of departure from Zackenberg is altered due to weather conditions, technical problems etc., the Zackenberg staff will make the necessary arrangements with Norlandair in Akureyri to change your tickets and hotel reservations accordingly. A worst case scenario will result in you staying a couple of additional days in Iceland on your way home - but Norlandair is indeed very efficient when it comes to re-booking and re-scheduling.

Travelling - problems

If, immediately before or during your travel, you should encounter any problems relating to airline tickets or hotel reservations you are recommended to contact Norlandair directly:

Norlandair
P.O. Box 400
IS-600 Akureyri
Iceland

Contact persons: Mr Fridrik Adolfsson (also known as Frissi, e-mail: frissi@norlandair.is, cell: +354 8945990). Mrs Kristbjörg Björnsdóttir (also known as Kibba, e-mail: kibba@norlandair.is, cell: +354 8601208).

Waste

Waste is separated into organic waste, combustible items and non-combustible items. Paper and cardboard are burned in the local incinerator. Toilet waste is fragmented and dumped into the river. All other types of waste are flown out from Zackenberg for treatment or deposition.

Workshop

All tools are at your disposal in the workshop. In order to keep the workshop well stocked and functional it is required that everyone treat the facility appropriate. Therefore, please inform the station staff if you need anything from the workshop. They will then inform you about the proper use of the equipment and they will make sure that the equipment is still in good order when you deliver it back.

Zackenberg secretariat

If you need information on a certain subject concerning Zackenberg Ecological Research Operations (ZERO), please contact the Zackenberg secretariat (zackenberg@dmu.dk). Most of the members of the secretariat are out of office for extended periods due to their stay at Zackenberg Research Station. **We therefore recommend that you use the e-mail address zackenberg@dmu.dk.**

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Kenny Plauborg Madsen

Logistics Coordinator

Cell: +45 30783169

E-mail: kpm@dmu.dk***ZERO logo***

As an acronym for Zackenberg Ecological Research Operations, the overall framework of the scientific and logistic efforts in Zackenberg, ZERO symbolises the objective to establish a basic insight into the dynamics of an undisturbed high arctic ecosystem, i.e. the state of 'year zero' before climate change. The logo includes the 'zero-line', which continues as a graph symbolising variation in any of the ecosystem phenomena monitored or studied. The graph is actually also a simplified profile of a distinct part of the jagged northern edge of the Zackenberg mountain. This mountain was named by the second German North Pole Expedition 1869-1870, because of its jagged profile, as 'Zacken' in German means jags, *i.e.* the jagged mountain.

ZERO merchandise

In 'The Tundra Shop' at Zackenberg, you can buy caps, T-shirts and sweatshirts in various sizes and all carrying the ZERO logo and the text: Zackenberg Northeast Greenland 74°30' N. The Tundra Shop also has postcards, toothbrushes, sanitary towels and tampons, batteries etc. for sale.