The 7th Circumpolar Agricultural Conference

Circumpolar Agricultural and Land Use Resources- Prospects and Perspectives for Circumpolar Productions and Industries

Alta, Finnmark, Norway

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Foreword:

The Circumpolar conference is arranged every 3rd year by the CAA (Circumpolar Agricultural Association). The CAA is a non-governmental organization concerned with Northern agricultural science, practices and policies. It was founded in 1995 in Tromso, Norway on the ideas set out at the 1st Circumpolar Agricultural Conference (CAC) which was held in Whitehorse, Yukon, Canada in 1992.

The four topics of the 7th Circumpolar conference were as following:

1. Global Climate Change; Challenges and Opportunities in Northern Agriculture and Land use.

2. Traditional Knowledge as a Basis for Commercial Exploitation/ Business Development of our Natural Resources.

3. Unique Qualities in Circumpolar Food Products- a Basis for Business Development.

4. Rural Tourism Industries in Circumpolar Areas supporting multifunctional Agriculture.

This report contains the concentrated gist of a selection of individual presentations from different topics. The better part of these presentations deals with "Global climate change". A summary of the remaining presentations is listed as abstracts (see appendix: Abstracts_Norway). This report also contains personal notes and pictures of the conference tours.

The following presentations (subdivided in topics) were attended and summarized in that order.

Program (Topics and speakers):

1. Global Climate Change; Challenges and Opportunities in Northern Agriculture and Land use.

Inger Hanssen Bauer, Norwegian Meteorological Institute Norway: Climate scenarios

Jon-Olav Brunvatne, Special Adviser, Norwegian Ministry of Agriculture and Food, Norway: Climate challenges, Agriculture part of the solution. Report No.39 2008/2009

Inguun Ovsthus, PhD, Bioforsk, Norway: Nitrous emission from organic fertilizer and soils

Christian Uhlig, Scientist, Bioforsk, Norway:The Steigen concept: A regional approach towards an integrated resource management

Ole Martin Pettersen, Farmer, Norway: Energy potential in Arctic agriculture. Example from the Leivset farm.

Odd-Arild Finnes, Senior advisor, Bioforsk, Norway: Locally produced woodchips as bedding material for arctic animal production.

Bjorn Mathisen, Farmer, Hundstad Farm, Norway: Climate change and the need of adapted plant material- from a farmers view.

Irina Mikhaylova, Researcher, Polar Experimental Station Murmansk Region, Russia: Yield capacity of perennial rye and winter rye in multi-harvesting cultivation in Murmansk Region.

2. Traditional Knowledge as a Basis for Commercial Exploitation/ Business Development of our Natural Resources.

Ludmila Popova, Arkhangelsk Agronomy Institute, Russia: How to increase productivity of the cultivated land in Northwestern Russia.

Annika Trimble, Manager and Special Projects Coordinator, Aurora research institute, Canada: Northwest Territories native seed development project.

3. Unique Qualities in Circumpolar Food Products- a Basis for Business Development.

Tatiana Kuvayeva, Polar experimental Station Murmanks, Russia: Study of berries in Murmanks region, Russia.

Snorri Sigurdsson, Agriculture University of Iceland: Sheep production system in sub-arctic climate

Irina Mikhaylova, Researcher, Polar Experimental Station Murmansk Region, Russia: Study of perennial legumes *Galega orientalis L.* and yellow alfalfa (*Medicago falcate L.*) under conditions of Murmansk region.

4. Plenum sessions

Torfi Johannesson, Project Leader, West Iceland Regional Development, Iceland: Arctic-eco certification.

Hans Gelter, Lulea University of Technology, Sweden: Tourism and Environment

Rakel Nystabakk, Young Farmer, Norway: Perspectives to be a young farmer in the High North

Margaret Johnston, Professor, Lakehead University, Canada: A new program for education in small to medium scale Northern agriculture.

Diane Rickerl, Associate Dean, South Dakota State University, USA: The Prairie School.

Hanne Storteig, Senja Agriculture High school, Norway: Goat expertise centre in Northern Norway.

5. Conference tours with pictures

Farm 1: Jorra samdrift- a dairy farm company, near Alta

Farm 2: Dairy farm in Kvaenangen, approx. 1.5 hours west from Alta

Farm 3: Goat farm, approx. 2.5 hours south-west from Alta

Introduction:

Cold winters and a short growing season pose a challenge for the agriculture in Northern regions. Scientist assume that global warming will change the climate conditions which seems to affect the Northern areas strongest. These new conditions will lead to new opportunities e.g. in animal and plant production and also to new challenges e.g. pests and diseases. It is important that agriculture products adapt to these changed conditions to ensure the greatest possible food production.

Norway is the Northernmost country in the world with agriculture activity due to the mild climate along the coastline and in the valleys. Approximately **three per cent** of the land is cultivated soil. Apart from the 37 % forested areas potatoes and grain are mainly cultivated. Agriculture is basically restricted to the coastal strips and the region south east of Oslo. Dairy farming is conducted in the southern coast line near Stavanger and on the west coast near Trondheim. The farms are small usually family owned and run on the sideline. This poses quite a challenge for the younger generations to step into the shoes of their parents.

Summary of presentations, structured in Topics:

1. Global Climate Change; Challenges and Opportunities in Northern Agriculture and Land use.

Agriculture is one of the sectors that will be most affected by *climate change*. It is expected that changes will influence agriculture positive and negative.

Inger Hanssen Bauer from the Norwegian Meteorological Institute Norway, analyses possible climate changes and effects with the help of various climate models. They show that especially the Northern regions are affected by the climate change. In her presentation the climate models point to the north of Norway. They show an increase of probably 3,4 up to 4,2 degrees in Nordland/Troms and Finnmark until 2100. The growing season in the coastal areas will extend for 1-2 months and further inland for 2-3 months.

The annual amount of precipitation will increase in Halogaland at an average of about 17%, in Finnmarksvidda at about 19% until 2100. Higher precipitation is expected particularly in the fall (+ 26 % Halogaland and + 23 % Finnmarksvidda). The length of the snow season will be 2-3 months shorter in the coastal regions and 1- 2 months inland according to the climate models. The max snow depth will be reduced by proximately 50% and inland by about 5-30%.

The frequency of rain events (with an average factor of about 2) as well as the volume (average at about 15%) will increase until 2100. The effect on nature would be a higher risk of mud slides and avalanches plus an increase of the sea level along the Norwegian coast.

One of the main points when talking about climate warming is the *Reduction of emissions*. ***Joan Olav Brunvatne*** from the Norwegian Ministry of Agriculture and Food in Norway presented the new "White Paper" which demonstrates the role of agriculture in reducing emissions. In Norway agriculture contributes to 13% of the greenhouse gases (GHG) emissions. The Government considers emission and uptake of GHG's in the agriculture sector in Norway, and the adaption and instruments necessary for robust, climate-adapted agriculture in the future.

Inguun Ovsthus from the Bioforsk Institute also covered the subject emissions in her dissertation. Her Presentation was about nitrous emission from organic fertilizers and soils. N_2O is with a percentage of 9 % one of the most important Greenhouse gases (Ch4=17%, Co2=74%). N_2O is mainly generated through nitrification and denitrification in soils. About 56 % of all N_20 is produced this way. The increase of N_20 in agriculture is primarily related to the addition of fertilizer. Relevant organic fertilizer is foremost "green manure, animal waste, industrial waste, food waste, fish waste and calb from the sea." In her dissertation *Inguun Ovsthus* analyses the N_2O release of various fertilizers. She combines soil and fertilizer in a glass construction and extracts regularly gas samples which are then analyzed in a gas phase chromatograph. Additionally she analyses gas development in a field experiment with the help of a plastic foil. The results indicate that N_2O emissions are higher from pelleted shrimp shell org. fertilizer than from the other fertilizer samples. The physical properties of organic materials markedly influence the N_20 emission from the soil. A decrease of the N_2O release can be achieved by mixing the soil with organic material and therefore, due to the heterogeneous structure, lower the chance of anaerobic zones "hot spots".

The subject "*renewable energy"* was presented by ***Christian Uhlig*** from the Bioforsk Institute and the farmer ***Ole Martin Petterson*** from Norway.

Christian Uhlig demonstrated the "Steigen concept" in his presentation. It contains optimizing of energy and nutrient cycles, due to a cooperatively and integrated resource management system on a regional scale in Steigen, Northern Norway. Utilizing a bio gas recycler enables to gain energy and nutrients from organic waste. In other words we can achieve a 100 % recircumulation of nutrients, climate neutral energy production and a reduction of methane gas. Animal waste as well as fish waste and sewage sludge contains a substantial part of organic material. Results show that bio gas production can generate 7 GWh pre-tax, 3 GWh net (1.7 GWh animal manure, 1.0 fish waste, 0.3 remaining part). Since it is responsible for 2/3 of it especially fish waste is considered to be very energy resourceful.

The farmer ***Ole Martin Peterson*** owns a biogas system and demonstrated mainly the production of biogas and the potential use of that energy. Out of 150 cattle living on his farm 65 are dairy cows. Milk quota is about 400 tons per year. Because the production of energy through animal waste alone is too low fish waste needs to be added. To produce 3000000 kWh per year 3000 m^3 manure and 600 m^3 organic waste is needed. 35% of the total yield is used as electricity, 65% for hot water. The energy can be used as heating for the farm houses, in greenhouses for flowers and tomatoes and as tractor fuel (enough for 45 farms in the neighborhood). An additional advantage is that the release of excess methane is harmful to the planet and the process will reduce the release of methane to nearly none at all. Highly concentrated fertilizer is basically produced as a side effect. The biogas reactor will be in production in 2011. Total investment will be around 1 million US Dollar.

The presentation of ***Odd Arild Finnes*** from the Bioforsk institute showed the connection between energy production and animal welfare. His lecture was about the local production of wood chips which is used as bedding material. The bedding material is traditionally transported from the south of Norway to the north but due to high transport costs some farmers have decided that they would try to produce bedding and litter material from local resources. Out of this initiative another scientific project named "PROLOCAL" evolved. The PROLOCAL project is divided into four successive WP's. They are closer described on the Bioforsk website.

Wood chips can also be used as deep litter, compost bedding pack (e.g. goats) or as top layer in corrals. To ensure a high grade of animal welfare the bedding material has to fulfill special requirements. The size of the shavings as well as the humidity plays an important role. Results have shown that foremost larger shavings are more suitable than smaller ones. Temperature is essential in all experiments because it needs to increase. The optimal wood used for the production of bedding material is birch.

The farmer ***Bjorn Mathisen*** from Norway talked about changes in agriculture that are caused by the climate change, the farmer has to face in the future. The climate change in Norway will very likely leads to an extension (about 1 month) of the growing season and an increase in precipitation of about 20% especially in the fall. The plants must be as winter hardy as before maybe even more. Mild periods during the winter are causing additional stress for the plants. Even an extension of the growing season could be stressful for the plants due to more harvest periods (more traffic) and more rain.

An adaptation to the altered climate conditions needs to happen. The basis for this adaptation is the comprehension of the genetic and physiological nature. Plants need a better resistance and a better productivity. Additionally possible changes to the cultivating mode should be given some thought.

Irina Mikhaylova from the Polar Experimental Station Murmansk in Russia investigated the yield capacity of winter and perennial rye with different frequencies of harvesting and the biochemical composition of both crops. Both rye varieties are used as fodder and are available in this area. Winter rye has the ability to grow fast in the early spring and is one of the earliest crops to produce green forage. Irina tested 17 varieties in a field experiment. Perennial rye was planted once a year, winter rye once every 3 year. The results showed that the time of harvesting is important. The highest amount of protein in plants was found when they harvested them very early. Perennial rye showed the highest productivity by the second Harvest, winter rye by the first Harvest.

2. Traditional Knowledge as a Basis for Commercial Exploitation/ Business Development of our Natural Resources.

Ludmila Popova describes in her presentation the agricultural challenges in NW Russia and which experiments are conducted to improve this. There are two types of vegetation in NW Russia: Tundra and forest. Each has its own resources. In the tundra we find more sheltered agriculture although they start growing potatoes in this region now. The transition to the forested regions allows a more variable agriculture (vegetables, potatoes, cereals and greens) due to a longer photo period. Conditions in the Northern boreal forests are also agreeable especially for vegetables and grains. Limiting factors in these regions are foremost high silicate oxide deposits, a rocky landscape and too much moisture. The percentage of cultivated land is 23% (0.4 hectare per person) most of it is forested areas. A normal family owned farm would be around 5 hectare.

Oftentimes organic fertilizer is deployed to improve soil conditions. In this case the forested areas are quite helpful since they provide a larger reservoir of exactly that fertilizer namely bark, especially timber bark. Additionally animal manure and various minerals are needed. Green manure is another way to improve soil conditions through land rotation, especially through the cultivation of clover and other bean cultures. In particular the new cultivars in NW Russia, among them new projects for grains, clover and potatoes are posing a new challenge for the local agriculture.

Annika Trimble is pointing in her presentation to the importance of local seed sources from native plant species. The project was initiated 2005 by the aurora research institute and is pursuing the aim to create a native seed bank to be used in revegetation and reclamation. The reason for this is the continuous advancement of industrial development (oil, gas and mining) and the need to improve land reclamation practices. The use of none native species have demonstrated a poor long term survival and a frequent interference with natural native growing plants and animals. Another disadvantage is invasive species displace native species and therefore have a dramatic impact on the habitat

The seed collection in NWT contains about 400 seeds of 65 species. Most of them are grasses, legumes and shrubs. Various germination trials are conducted as well as seed tests under natural conditions in different habitats.

The aim or the future is to continue seed amplifications, research the market and assess commercialization options.

3. Unique Qualities in Circumpolar Food Products- a Basis for Business Development.

The presentation of ***Tatiana Kuvayeva*** deals with a study of berries from the Murmansk region in Russia which was initialized in 1923 in the Polar Experimental Station. Various berry species were collected: black current (6 cultivars), raspberry, red current (5 cultivars), strawberry (1 cultivar) and blue honeysuckle. The aim of this work is to study new species and cultivars of berries under different climate conditions of the Murmansk region and select plant material for breeding new cultivars.

Snorri Sigurdsson from the Agriculture University of Iceland concerned himself with the topic "sheep housing" in his presentation. In regions with subarctic climate, sheep are kept inside for a longer period. This poses certain challenges for the production system like e.g. animal welfare, management and engineering. In Iceland the housing period is about 6-7 months (Middle of November until middle of May), with about 500.000 sheep living in 2.500 barns, up to 1.200 sheep per farm (average: 200).

Sheep farmers are always trying to find better solutions in the production system to reduce the amount of work and to increase the herd size. A major step in the production system was reached when they finally invented the round feeding system. With this automatic feeding machine the farmers needed less space and saved a lot of time because they didn’t have to feed their sheep. Their research

showed that the automatisation cuts down the working time per day for the farmer from 25-30 minutes per 100 sheep to 5-8 minutes per 100 sheep. Constant access to the hay also helps the sheep to deal with severe sub zero temperatures in uninsulated buildings.

Studies have shown that it is not necessary to insulate the sheep barns in arctic climate. An advantage of the building insulation would be a better working comfort (because it is warmer) and no trouble with free water supply. A disadvantage could be more ammonia and a higher relative humidity. Ongoing research in Iceland, meant to end in 2011, to collect sheep housing experience from all the Iceland sheep farmers, will give information regarding the knowledge within production systems.

Irina Mikhaylova from the Polar Experimental Station in Murmansk, Russia talked about her study of perennials legumes under conditions of Murmansk region. In the Murmansk region there is a limited assortment of forage crops. Irina Mikhaylova tested different cultivars of the perennial legumes *Galega orientalis L.* and Yellow alfalfa (*Medicago falcata L*.) in the Murmansk region (Apatity). *Galega orientalis* L. is a promising, perennial and fast — growing forage legume, which is useful for the production of diverse grass forage. It can be used up to 8 years and it can produce a high quantity of leaf mass.

The results showed that *Galega orientalis* L. is a better forage crop than *Medicago falcate L*. It demonstrated a higher winter survival (98-100%) and a higher forage yield 20 tons/ha compared to *Medicago falcata* L.(76%, 16 tons/ha). Breeding trials showed a good appearance of the cultivar “Zapolyarny” (*Galega orientalis L.*) and “Valentina” (*Medicago falcate L.*).

4. Plenum sessions

Torfi Johannesson from the West Iceland Rural Development held a presentation about arctic eco certification, pointing to the problem, that many of the eco certification restrictions are not adapted to high circumstances in the North. The aim is to find a unique system. What they need is a certification of origin, quality

central system, science based and decentralized to minimize cost. The overall goal should be that 30-50% of the farmers should manage the label with minor adjustments.

Hans Gelter from the Lulea University of Technology in Sweden presented a lecture about the relationship of tourism and environment. Problems of the "sustainable tourism" are foremost the need to cover large distances and the related CO_2 emissions. It is intended to create a concept with a "green pedagogic" background to change the human consciousness in relation towards environmental care. The "transmodern tourism" should establish an enduring form of tourism through learning "about nature" to learning "in and with nature."

One of the main questions that kept our minds busy at the conference was *how to encourage people to become farmers and what are the values of being a farmer*.

Rakel Nystabakk**,** a Norwegian sheep farmer talked about this particular subject in her presentation. She lives on a farm that has been family owned since 1912 mainly producing meat and wool. For her being a farmer means to continue a long tradition and heritage, to take responsibility for others and for herself and to contribute to the food production.

The work as a farmer in Norway has its challenges though: a rocky and steep landscape, unstable weather conditions and economic challenges. Opportunities are: Global need for food, national food security, environmental considerations and tourism.

The following discussion came to the conclusion:

The industrialization did not only create new professions but also lead to a change in the mental attitude towards various job descriptions. This has become very obvious for the farmer profession. One of the major concerns is the fact that young people cannot relate to agriculture itself and therefore have no knowledge of the farmer's life. This leads to an urban ignorance which makes the job "farmer" appear quite uninteresting. Additionally young people wish for a good education and a job that offers financial security.

The farming occupation tends to be not only a job but a way of life.

The topic “Agriculture Education and knowledge” was also discussed by ***Professor Magaret Johnston***, ***Diane Rickerl*** and ***Hanne Storteig***.

Professor Margaret Johnson from the Lakehead University in Canada talked in her presentation about “a new program for education in small to medium scale Northern agriculture”.

This course was designed as a response to a lack of courses dealing prevalently with small and medium farming in Northern areas. Even though there is a trend towards large scale farming especially in the south, the Northern agriculture still tends to be smaller in scale. The number of small farm decreases because the younger generation more often does not continue with the farm occupation. This change also shows in the demographic data, like the average age of farmers in Ontario is in the mid 50’s, which is common across Canada. These facts call for an increasing concern for the local food security and underline the importance of this course.

The course contains 4 field trips, an independent study and an applied service learning project. In this pilot program students could examine models of successful small-scale agriculture in Northern Canada, Iceland, Estonia, Finland and Norway. According to first impressions of students and supervisors this course was quite successful.

Another program named “Prairie PhD” was presented by ***Diane Rickerl*** from the University of South Dakota State, USA. This program deals with a cohort based, distance delivered graduate program designed for tribal college faculty and tribal professionals. A full description of the first program results and experiences is listed on the website:

http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1030&context=pocpwi10

Hanne Storteig from the the Senja Agriculture High school in Norway presented her project “Goat expertise centers." The objectives of this project were as follow: cooperation and coordination, educating farmers as managers of their own businesses, research, health conditions of the herd, buildings and processing. The following courses are offered: milking and quality of the milk, growing fodder, health situation. The main objectives are established breeding and feeding strategies (example: GPS tracking to find out what they eat). Feeding strategies are important because the forage influences the fat content of the milk. This is an important factor for the cheese manufacturing (a low fat content is desired).

Some facts: In Norway there are 372 goat herds, they produce approx. 20000 metric tons of milk per year, whereas 8000 tons come from Northern Norway. One goat gives approx. 700 liters per lactation.

5. Conference tours

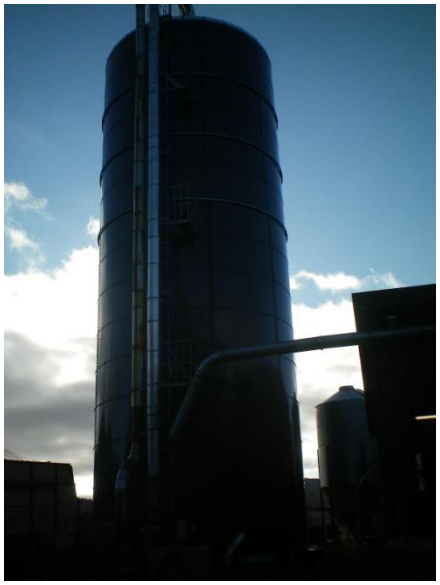
Farm 1: Jorra samdrift- a dairy farm company, near Alta

The farmer of this farm owns 55 cows. Milk production averages at about 500 tons per year. One cow produces 8000 tons of milk per year. 700 kg forage per day is needed which is locally produced. Four people work on the farm at a rate of 40% each. The milk is further processed to cheese by TINE which is located about 320 km from the farm and is picked up every 3 days. Although the fields are enriched with manure additional fertilizer has to be applied because the soil is very acidic. The cows can be out on the pasture for 3 month of the year but only few farmers have their cows outside. Most farmers keep them in boxes. A new European legislation is about to change that though.

The cows on this particular farm are milked by a machine which is located in a special box. A laser sensor detects the udder after the cow steps into the box. The cost for this machine is about 600.000 US dollar.

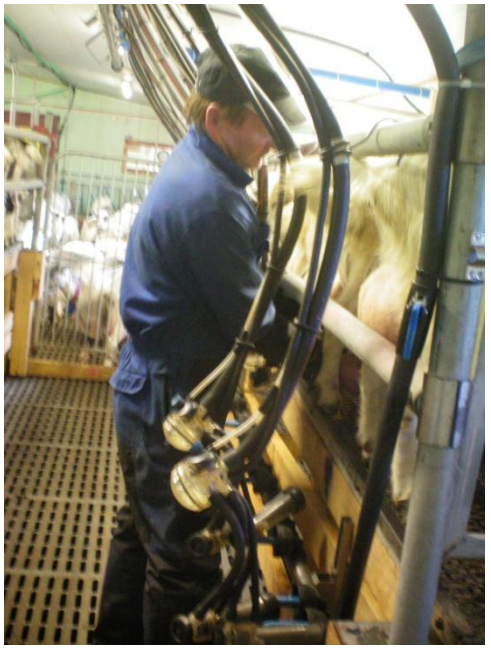
Farm 2: Dairy farm in Kvaenangen, approx. 1,5 hours south from Alta

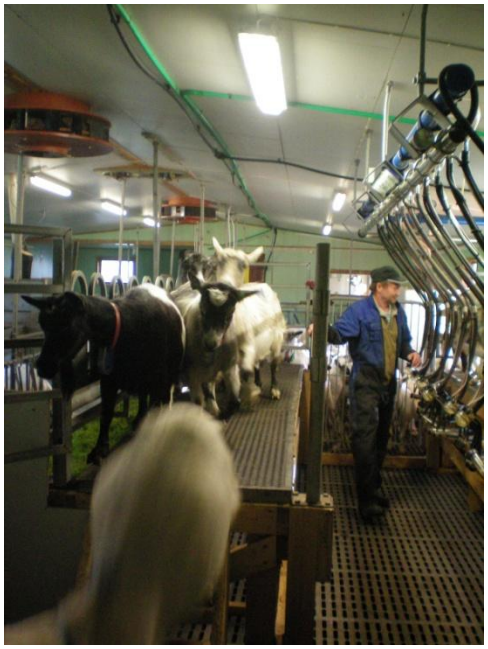
This farm owns 120 head of cattle of which 40 are dairy cows, mainly Norwegian Red Cattle. They did not have a sophisticated milking machine like the first farm, but this farmer owned a shredder for woodchips using any kind of wood and all parts of the tree to produce bedding material which is changed twice a day. The cost for a shredder machine is about 100.000 Norwegian krone. About 500 bales of silage are needed as forage for the winter which is also produced locally in a silage tank with a capacity of 970 m^3.



Farm 3: Goat farm

The farmers of this farm produce two sorts of white cheese and “Gomme” (regional specialty). Gomme is produced from whole milk and resembles soft cheese. For the cheese production they have to pasteurize the milk in the winter, but not in the summer. The cheese needs two months to ripe whereas cheese made from pasteurized milk takes even longer. The goats produce 93000 liter milk per year. On this farm live 100 milk producing goats and 35 calves. A Norwegian person consumes about 1.4 kg goat cheese per year. Most of the goats are Norwegian some are French goats which are better for the cheese production.





Appendix (in separate pdf file)

- Abstracts
- Conference program
- Poster presentation
- List of participants