

NordGen Annual Review 2020



Introduction	3
About NordGen	4
Knowledge Center	6
NordGen Plants	7
NordGen Farm Animals	9
NordGen Forest	11
Genebank	13
Promotion of the Sustainable Use of Plant Genetic Resources	16
Digitalization of the Genebank	18
Projects	19
Svalbard Global Seed Vault	24
Public-Private Partnership	26
Financial Statement	28
Board	29
About this publication	30

INTRODUCTION



Lise Lykke Steffensen
Executive Director, NordGen

Click [here](#) to access the video in our digital version of the Annual Review.

Covid-19 Response

2020 was a very special year for NordGen as for so many others. When the COVID-19 pandemic reached the Nordic countries in February 2020, the management in NordGen took diligent measures. In March 2020 NordGen established a task force to ensure proactive mitigation of risks. The foremost priorities were to protect the health and well-being of the staff as well as the core functions at NordGen and protect the Nordic seed collection. Most staff worked from home and planned visits, business travels and external meetings were cancelled. While the COVID-19 pandemic is not over yet, it has shown that our crisis management is working and that NordGen staff has made an extraordinary effort that has allowed us to continue business operations almost as usual.

New Strategy on Track

In 2020 NordGen's new strategy came into force – a strategy that guides us through to 2023. The strategy increases cooperation with external stakeholders while still focusing on conservation and sustainable use of genetic resources of importance for Nordic agriculture and forestry. NordGen's strategic goals for 2020-2022 are closely linked to the Nordic Council of Ministers' vision for 2030 to make the Nordic region the most sustainable region in the world. NordGen plays an active and important role in realizing the Nordic Council of Ministers' strategic ambition of creating and promoting a green, social sustainable and competitive Nordic region.

Digitalization of the Genebank

A strong focus on increased digitalization has been a key component in NordGen's work throughout the year with the implementation of a new genebank data management system built on the internationally well-known genebank data management software GRIN-Global; an ambitious project carefully executed within timeline and budget.

New Main Office

In September, NordGen signed an important agreement on the construction of a new office building that will improve the work environment significantly and is optimally designed for the work conducted in a genebank. The new building will have a Nordic expression – a wooden building designed with sustainability in mind, including features such as sedum roof promoting local biodiversity and solar panels for more sustainable energy production. The relocation is supported by the Swedish Ministry of Trade and Industry.



ABOUT NORDGEN

Nordic Genetic Resource Center (NordGen) is the Nordic Knowledge Center for plant, animal and forest genetic resources as well as the Nordic genebank for seeds and plants. The institution was established in 2008 as a merger between the Nordic Genebank (established 1979), Nordic Genebank for Farm Animals (established 1983) and the Nordic Council for Forest Reproductive Material (NSFP) (established 1970)

As a knowledge center and genebank, NordGen's mission is to safeguard the Nordic genetic resources and facilitate the sustainable use for agriculture, horticulture and forestry, for current and future generations as well as provide knowledge and genetic material to facilitate sustainable food and feed production and other biobased solutions in the Nordic region's changing climate.

As a knowledge center, NordGen also promotes collaboration between farm animals, plants, forest and the environmental area as well as disseminate knowledge and create awareness about genetic resources. NordGen also promotes management and competences within the three disciplines.

NordGen provides technical advice and information to decision makers in the Nordic countries in national and Nordic collaborations and international negotiations on the conservation and sustainable use of genetic resources.

NordGen has a special responsibility for conserving and documenting genetic variation of Nordic material to ensure biodiversity and sustainable use of genetic resources. As early as 1979, the Nordic countries decided that a joint Nordic genebank for plants should conserve and facilitate the utilization of national plant genetic resources.

In the 2004 Kalmar Declaration, the Nordic countries have adopted the basis for how NordGen should manage access and rights to genetic resources. All accessions in the genebank, except for collections held by NordGen for other genebanks, are under joint Nordic management and are a common good.

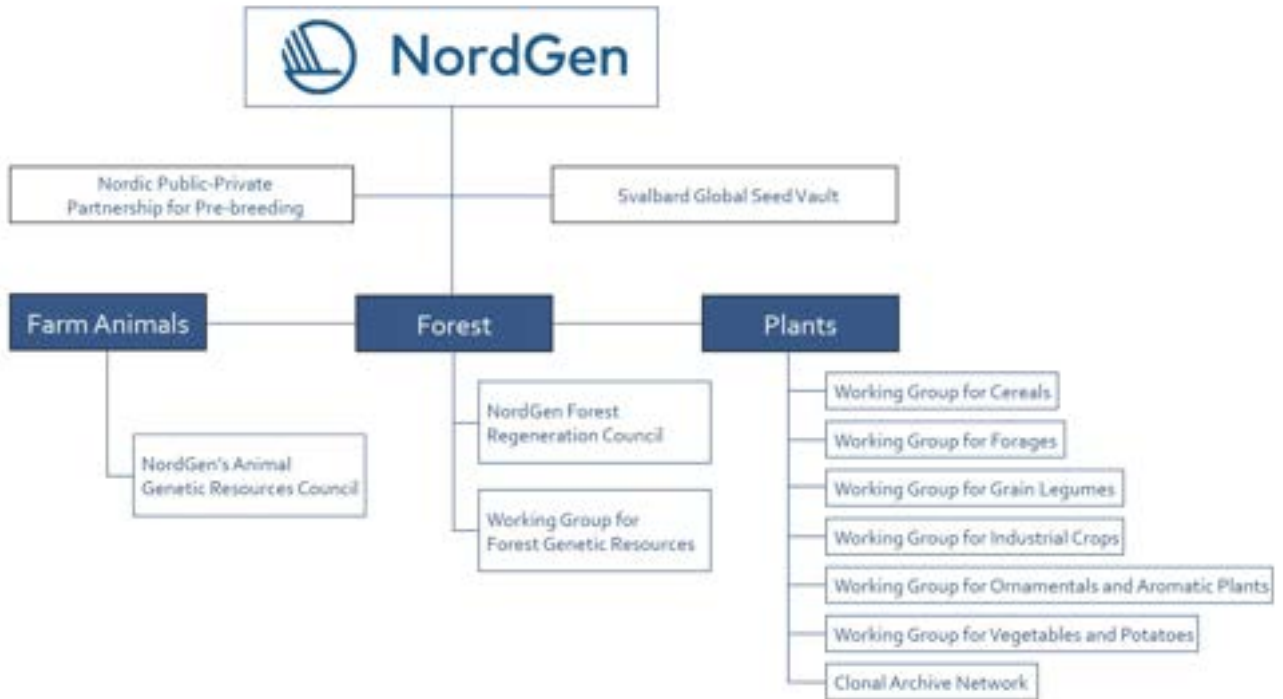
The genebank's seed collection should contribute to more resilience and new solutions to avoid biodiversity loss and contribute to increased use of genetic resources to achieve sustainable climate solutions, robust food and feed supply including new protein sources, sustainable plant choices in the forests, better health and sustainable ecosystem services. At the same time, efforts will be made to improve documentation by characterizing and evaluating the seed collection, so that more data becomes available to the Nordic community.

NordGen manages the program Nordic Public Private Partnership for Pre-breeding (PPP), which aims to support the development of Nordic plant pre-breeding.

NordGen has the operational responsibility for the Svalbard Global Seed Vault in a partnership with the Ministry of Agriculture and Food in Norway and the Global Crop Diversity Trust.



Figure 1:
Organogram - NordGen





KNOWLEDGE CENTRE

As the Nordic knowledge center for genetic resources, NordGen participates in and leads projects, arranges outreach activities and shares information with relevant stakeholders concerning conservation and sustainable use of genetic resources important for food and agriculture. NordGen is also participating in several Nordic, European and International networks and commissions.

Our most important tools for exchanging knowledge within the Nordic countries are our working groups and councils. The different working groups of NordGen Plants, the working group and council of NordGen Forest and the council of NordGen Farm Animals are vital advisory groups consisting of experts within each field from all the Nordic countries. The Board of NordGen also provides valuable input and knowledge exchange. Information is disseminated through our website nordgen.org, social media, project reports, press releases, arranged events, network meetings and targeted e-mails.

Followers Social Media	2019	2020
Instagram	1.118	1.592
Facebook	2.631	3.192
Twitter	639	1.050
LinkedIn	338	779

Table 1: Social media statistics

In 2020, NordGen has developed its competence within digitalization considerably. Video online meetings and seminars has increased the bridgebuilding over country borders, both internally and externally. Externally, our digital competence has enabled us to reach a wider audience that can take part in important knowledge sharing events concerning genetic resources without having to spend time and resources on travelling. NordGen Forest, for example, attracted far more listeners to its thematic days this year, compared to earlier years when they had to participate physically. It is expected that NordGen will continue to use these digital options at future events, after the pandemic.

A [new and updated website](#) was launched in June 2020. It is not only easier to navigate, more visually appealing and in accordance with the new European web accessibility rules. It also has, apart from a Scandinavian and English version, a Finnish version enabling us to reach members of a very important target group in their native tongue.

In the following pages, our different sections and their activities in 2020 will be introduced in more detail.

Knowledge Center

NordGen Plants

We live in a time when climate change is affecting our ability to grow our own food. Drought, floods and higher mean temperatures means that developing new plant varieties that can withstand the new challenges are more important than ever. But no plant breeding is possible without the green infrastructure stored in the DNA of seeds. And not even advanced gene technology can replace the natural genetic diversity that we find in our wild, semi-wild and cultivated crops. The most important task of NordGen Plants is to safeguard and facilitate the sustainable use of plant genetic resources that are important for agriculture in the Nordic countries. By doing so, we create conditions for a more environmentally friendly agriculture that can better withstand diseases, climate change and at the same time produce more nutritious food that corresponds to the consumers' demands.



Key Activities 2020

The research conducted at NordGen Plants is mostly carried out within different projects. Read more about this under the section "[Projects](#)".

Planning a State-of-the-Art Facility

To ensure the establishment of a new infrastructure for backup storage of the Nordic plant seed collection, NordGen was granted more than 8 million DKK from the Danish Novo Nordisk Foundation in 2020. The infrastructure will improve conservation, long-term viability and characterization of plant seeds and can contribute to scientific progress in future crop production as it will allow for an extensive overview and description of plant seeds for the benefit of researchers, educators, and breeders in the Nordic countries and world-wide. The project activities starting in 2021 will lead to an increased value and a considerable improvement of the Nordic seed collection and its safety.



Nordic Collaboration

Under normal circumstances, NordGen is part of and arranging several different meetings and seminars for the Nordic stakeholders concerning plant genetic resources. But 2020 was not a normal year and many of the activities planned had to be postponed due to the pandemic. However, during the year NordGen has still experienced an increased demand for knowledge on utilization of the plant genetic resources from public and private research programs, which are reaching out to NordGen for collaboration within utilization of the genebank collection.

International Collaboration

Preserving and distributing genetic resources requires international collaboration, and the foundation for this work is laid out in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Convention on Biological Diversity (CBD), ratified by all the Nordic governments. To NordGen, as part of the global genebank community, international collaboration is crucial. Forums for this work is the Governing Body to the ITPGRFA and the Commission on Genetic Resources for Food and Agriculture (CGRFA), The European Cooperative Programme for Plant Genetic Resources (ECPGR) and the Conference of the Parties (COP) to the CBD.

The year of 2020 was supposed to be the "Superyear of Biodiversity" with several important international meetings planned, not least the COP15 for the CBD which was to be arranged in Kunming, China in the end of 2020. However, this and many other international events were postponed due to the pandemic.

NordGen Plants is the largest department. It is divided in two, with the genebank maintaining the Nordic seed collection of 33 000 seed samples and the research department working in a close relationship with public institutions, plant breeding companies and other organizations in order to identify green solutions for a more sustainable society.

A central part of NordGen Plants is the seven different Working Groups on plant genetic resources that together with the national programs constitute the very core of NordGen's network of Nordic experts. They are an important link between the Nordic and the national technical work within a specific species group. The working groups contribute with insights to each Nordic country's operations with genetic resources and is also important for knowledge exchange and network contacts.

Knowledge Center

NordGen Farm Animals

The genetic diversity that our Nordic native farm animal breeds carry is invaluable. Over hundreds of years, they have developed desirable traits that make them robust and well adapted to the Nordic climate and way of life. Native breeds have a wider genetic base than commercial breeds and great potential for future food production in a sustainable way. For example, research shows that milk from Nordic native cattle breeds is among the best in world when it comes to cheesemaking and also contain valuable nutrients that could be used to develop bioactive food components. If further investigated, the genetic diversity of the native breeds can help adapt the Nordic agriculture to the needs of the market, climate change and new production systems. However, many of the about 140 farm animal breeds native to the Nordic countries are today at risk of becoming endangered. NordGen Farm Animals is working to reverse that trend.



Key Activities 2020

During 2020 NordGen has increased communications on its activities and established several networks that serve as a platform for discussing joint research applications and projects. The increased communication and knowledge sharing with stakeholders supports the current strategic goal to proactively strengthen NordGen as a Nordic knowledge center for genetic resources.



Relocation

In 2020 NordGen Farm Animal relocated to the Norwegian University of Life Science (NMBU) in Ås, Norway. The new location provides synergic effects of being close to cutting edge research of animal science and conservation of animal genetic resources. However, the long tradition of rewarding collaboration with the Norwegian Genetic Resource Center (placed in NordGen Farm Animal's previous office location) will of course continue also in the future.

Cryopreservation manual

An important receipt on the successful revitalization process is the fact that FAO has asked NordGen Farm Animals to co-coordinate and contribute to an updated version of their cryopreservation guidelines. In 2020, the EU-project "Innovative Management of Animal Genetic resources" (IMAGE), which was part of the Horizon 2020 program, was finalized. NordGen gathered the results from each work package and processed the material as recommendations. These recommendations will be included in the updated version of FAO's cryopreservation guidelines which will be finalized and published in 2021.



Breed stories

In the fall of 2020, NordGen Farm Animals commenced the ambitious task of creating portraits of all the Nordic native animal breeds. The portraits contain information about each breed and its current status and are being written with support from the different breeding organisations in the Nordic countries. As we have some 140 different animal breeds this is a time-consuming and resource demanding project, but it fills a void and constitute information asked for as there is no other place where information about our Nordic native animal breeds can be found all in one place. The portraits are published bimonthly on nordgen.org and disseminated in social media, where they are very appreciated by our followers. The work with the breed stories will continue in the years to come.

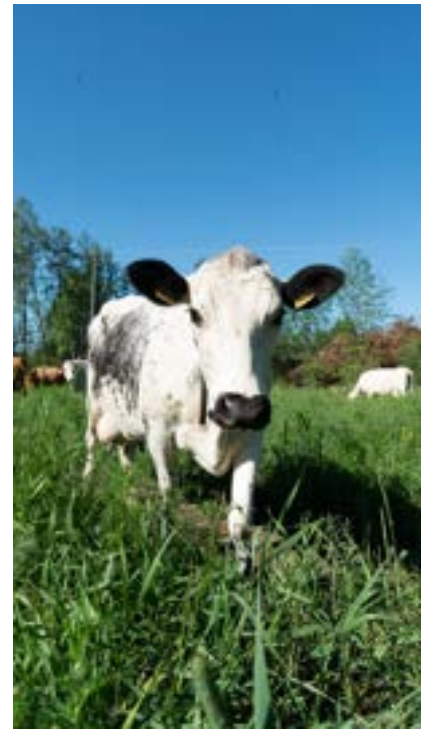
Mountain Cattle Project

Much of NordGen Farm Animal's resources in 2020 were devoted to work in the project "Nordic Mountain Cattle – Cultural heritage and Genetics" (3MC). The project utilizes an innovative approach for combining several academic disciplines to give us a more nuanced picture of the history, culture and heritage of the mountain cattle breeds in the northern parts of Finland, Norway and Sweden. Although the pandemic has led to constant re-scheduling of meetings and events planned in the project, it has so far gathered many new insights and pieces of information which may promote the sustainable use of the mountain cattle breeds. The project is co-funded by Interreg Nord, Lapin liitto and Region Norrbotten and running 2020-2022.

Special NordGen-issue and New Funding Granted

We were also happy to see the 2020 completion of the journal [Acta Agriculturae Scandinavia's special issue focusing on Nordic cooperation for conservation and a sustainable use of animal genetic resources](#). NordGen Farm Animals operated as the editor-in-chief of the issue and also wrote several peer-reviewed articles for the issue.

In the end of 2020, NordGen Farm Animals were also granted funding for implementing a network called NordFrost. The aim of the network is to strengthen the Nordic political ties in cryopreservation activities. The main objective of this network will be to develop a regional action plan for Nordic *ex situ* and *in vitro* conservation programmes that will serve as a new tool to increase resilience of agriculture in the Nordic region. The project period is from January 2021 to December 2022. [The Nordic Joint Committee for Agricultural and Food Research \(NJK\)](#).



NordGen Farm Animals is a service and knowledge centre working to conserve and promote sustainable management of the animal genetic resources in the Nordic region. Contributing to the Nordic countries' own work by promoting the genetic, economic, cultural, historical and social values that come with a wide variety of different animals in Nordic agriculture.

NordGen Farm Animals' activities are providing tools and advice to preserve the genetic variation in living populations (*in situ*) but also to establish cryo-storage of genetic material (*ex situ*). Through a variety of projects, NordGen Farm Animals are working to initiate research and development projects related to categorization, conservation, management and sustainable use of animal genetic resources.

NordGen Farm Animals also organizes workshops, seminars and courses for various Nordic stakeholders and promotes good collaboration between them. Actively distributing information about animal genetic resources and partake in international networks. Working to promote sustainable breeding practices and good principles for fair trade in animal genetic material.

KNOWLEDGE CENTER

NordGen Forest

Nordic forests provide wood and bioenergy, protection against wind and erosion, biodiversity and is a carbon dioxide sink. The trees planted today will grow for decades to come but climate change can hit our forests hard, and we must deal with the emergence of new pests and diseases that haven't existed in the Nordic region before. Within the forest industry there is a need for strong, resilient forests in the future and an important key to this resilience is genetic diversity. Since different trees carry different genes, chances are that some of them can resist the new threats. For example, the ash dieback disease is today threatening the Nordic ashes. But by identifying particular trees that carry resistance genes, the species could be saved. NordGen Forest is working to exchange knowledge about these kind of issues in the Nordic forest community.



Key Activities 2020

Being a "Nordic meeting place", 2020 obviously was a quite different year for NordGen Forest, due to Covid-19. All original plans for physical meetings were suddenly changed into digital meetings. This has provided us with quite some experience in the digital arena.



Thematic day, Anniversary and Seminar

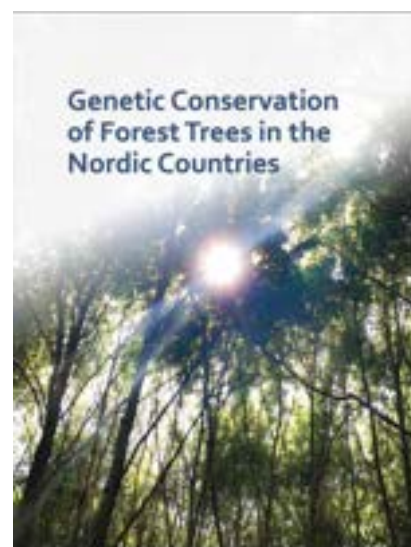
Starting out with the NordGen Forest Thematic day on 1 April, "*Framtidens träd: vad kan förädlingen ge och vad kommer att efterfrågas?*", the event was on short notice turned from a physical meeting in Uppsala to a digital meeting in Teams Live. Due to very good cooperation with Skogforsk, Skogsstyrelsen og Holmen Skog, the meeting was a success, with more participants in total and a more diverse Nordic audience. About 70 people joined the meeting.

The NordGen Forest 50 years anniversary conference was originally to be the highlight of the year. The physical meeting was however postponed till 2021, and it was decided to hold a 1-hour digital acknowledgement instead. The online event on 16 September had 136 participants and many positive responses. Several people have [watched the broadcast](#) after the actual live stream.

All meetings in the NordGen Forest Regeneration Council and in the NordGen Forest Working Group on Genetic Resources were held in a digital form. The Working Group meeting in November was held back-to-back with a seminar on forest genetic resources.

Publication

A NordGen Forest report on "[Genetic Conservation of Forest Trees in the Nordic Countries](#)" was published in January 2020. The report gives an overview of the genetic conservation of forest trees in the Nordic countries. The purpose of the report is to highlight what is being done in the different countries, investigate how the strategies of forest genetic resources can be implemented and to identify future possibilities and challenges.



NordGen Forest-SNS Scholarships

A total of 28 applications (10 male and 18 female) were received by the deadline on 15 February 2020. 9 of them were granted. The grants were given to travels and field work, supporting activities in all the Nordic countries.

NordGen Forest addresses conservation and sustainable use of forest genetic resources, by being a forum for researchers, practitioners and managers working on forest genetic resources, seeds, planting stock and regeneration. We facilitate flow of scientific information and knowhow between these groups.

NordGen Forest is focusing on knowledge exchange about conservation and sustainable use of forest genetic resources, forest seed and plant production and regeneration of forests. By disseminating knowledge and experience between the various actors and to the public, we aim to support better plant production and better regeneration methods of forest, as well as conservation of forest genetic resources. We conduct various types of projects and information activities.

NordGen Forest consists of two bodies: The NordGen Forest Regeneration Council, which meets twice a year and the NordGen Forest Working Group on Genetic Resources, which meets once a year. The main activities arranged by NordGen Forest are our conferences and thematic days. In cooperation with Nordic Forest Research (SNS), NordGen Forest also grants scholarships to enhance knowledge and competences in the area of seed, plants and forest regeneration.



GENEBANK

NordGen's genebank is a joint plant genebank for all the Nordic countries. It conserves and documents seeds and living plant samples of Nordic heritage and of importance for the Nordic countries. The genebank ensures that the genetic resources that underpin our food supply are both secure in the long-term for future generations and available in the short term for use by farmers, gardeners, plant breeders, and for research and development.

The seed and plant collections of NordGen are important to ensure that agricultural and horticultural plants do not become endangered or extinct over time. Because these plants may contain genes which enables them to resist diseases, have enhanced nutrition composition or survive in changing or harsh climate environments. The services of the genebank are a common public good. The plant genetic resources stored in our genebank are available for research, education, and breeding purposes.

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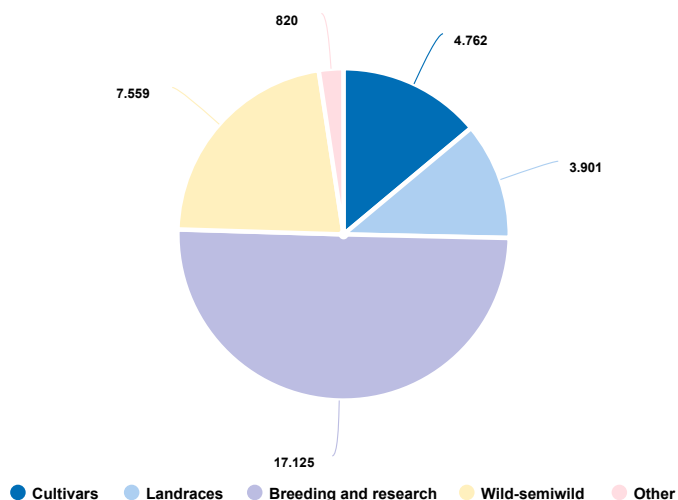
The services of the genebank is a global public good.

Table 2: Plant Groups in Seed Collection

Plant groups represented in the Nordic seed collection	Number of seed samples
Cereals	21.826
Grain legumes	2.859
Vegetables	2.121
Forages	4.815
Oil, fibre and root crops	1.607
Medicinal species	489
Ornamentals	275
Potatoes	128

The genebank contains about 34.000 seed samples from 536 different plant species. These species carry a wide palette of different genetic traits that constitutes the green infrastructure for research and development of a sustainable agriculture and green growth.

Figure 2: Plant groups represented in the Nordic seed collection



Laboratories

NordGen has a well-equipped seed laboratory for quality assessment of seed samples and follows the FAO's international genebank standards. This includes, among others, species identification, seed drying, seed cleaning, estimation of thousand grain weight and seed viability. The molecular laboratory provides facilities to prepare and conduct DNA extractions, do PCR-based marker analyses as well as prepare samples for more complex downstream analyses. The *in vitro* laboratory provides sterile working conditions and incubators for tissue culture or germination in controlled light and temperature. A room for cryo-preservation is planned for in the new building and will enable safe long-term storage of different kind of samples.

Growth Facilities

NordGen greenhouse and field team has experience with regeneration of a very broad variation of agricultural and wild plants. This includes valuable knowledge about specific requirements of sowing, transplanting, isolation, fertilization, watering, weeding, winter storage and seed harvest. The team can also assist in recording plant descriptors during the regeneration.

Reducing the regeneration backlog

Due to historic accumulation of new material to the collection of plant genetic resources at NordGen, a backlog of accessions which needs handling to secure long-term conservation has been built up 2008 -2016. To further expand NordGen's regeneration activities to reduce the backlog, the Board of NordGen adopted in 2019 a project plan to eliminate the backlog problem by end of 2024. The project named 'No regeneration backlog by 2024' is funded by an extraordinary grant from the Nordic Council of Ministers. In 2020 the project showed good progress and all expected goals were met due to an extraordinary focus in the seed lab.

● Total number of regenerated accessions 2020 ● In-house regeneration accessions 2020

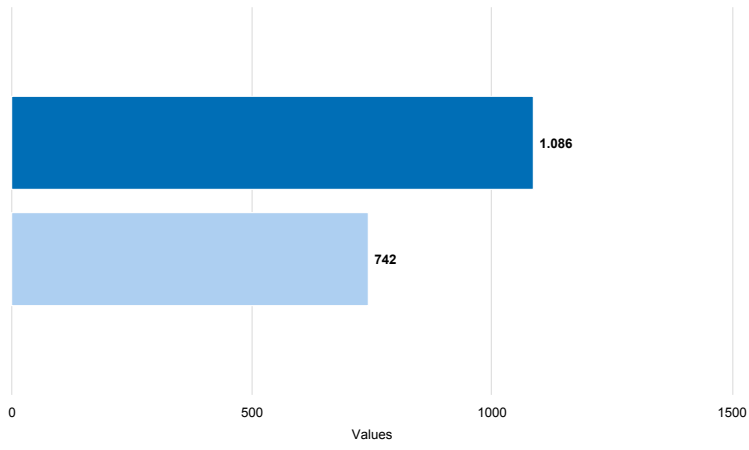


Figure 3: Total number of regenerated accessions in 2020

GENEBANK

Promotion of the Sustainable Use of Plant Genetic Resources

NordGen provides genetic material to facilitate sustainable food and feed production and other biobased solutions in the Nordic region's changing climate. The best way to preserve genetic diversity is to use it and the Nordic seed collection is no exception. Therefore, NordGen sends out thousands of seed samples annually to scientists, plant breeders, companies, museums, botanical gardens and home gardeners with an interest in old cultural plants.

From 2018 to 2020, NordGen has noticed a considerable increase (+89%) in the number of requested seed samples and that the number of requested accessions was at an all-time-high in 2020. Seeds are primarily requested by Nordic and European countries, although requesters in a total of 21 countries have ordered seeds from NordGen in 2020.

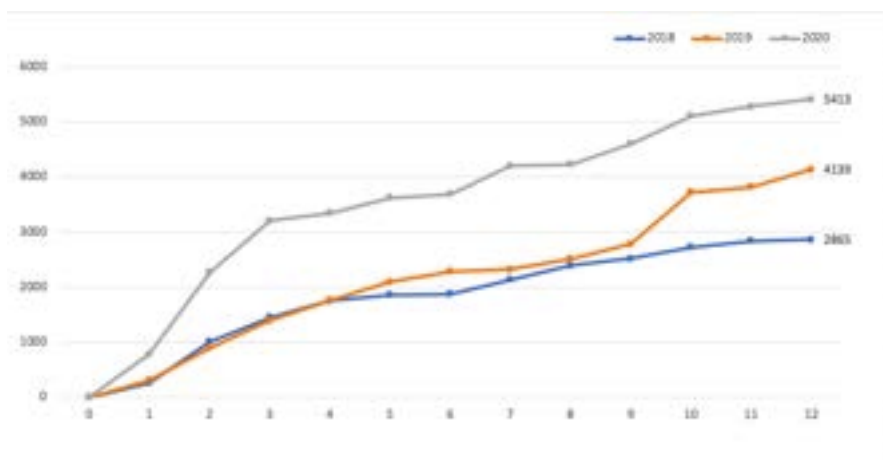


Figure 4: Samples sent 2018 - 2020

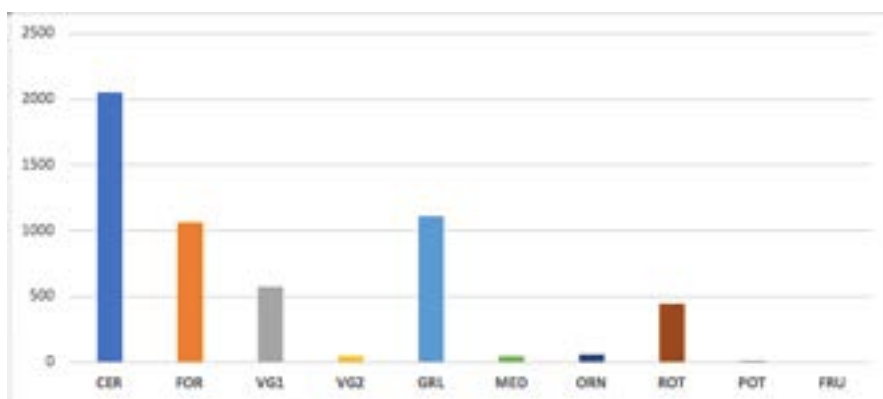
The seed samples are mainly ordered by universities and research/breeding institutes while others interested in the material are seed saver organizations, museums, schools and municipalities for education or demonstration use.

The most ordered crop is cereals with more than 2 000 accessions ordered in 2020. Just above 1 000 accessions have been ordered respectively from the groups forage crops and grain legumes.



Figure 5: Crop of requested accessions in 2020

- CER: Cereals
- FOR: Forages
- VG1: Vegetables1
- VG2: Vegetables2
- GRL: Grain legumes
- MED: Medicinal plants
- ORN: Ornamentals
- ROT: Root tubers
- POT: Potatoes
- FRU: Fruits



In addition to the distribution of seed samples for scientific purposes, the seed lab also handles the seed orders in NordGen's online shop where the number of orders increased with 35% from 2019 to 2020.

As one of the ways to promote the sustainable use of plant genetic resources to the general public, NordGen has established an online shop where we distribute our surplus of seeds for a small admin fee. During springtime, hobby growers and home gardeners with an interest in older varieties of vegetables, flowers and cereals can order seed samples and mini tubers of potatoes from NordGen.

1 November 2020 the online shop launched in a new version with new functionalities, better user-friendliness and integration with NordGen's website. The product range was expanded with more products.

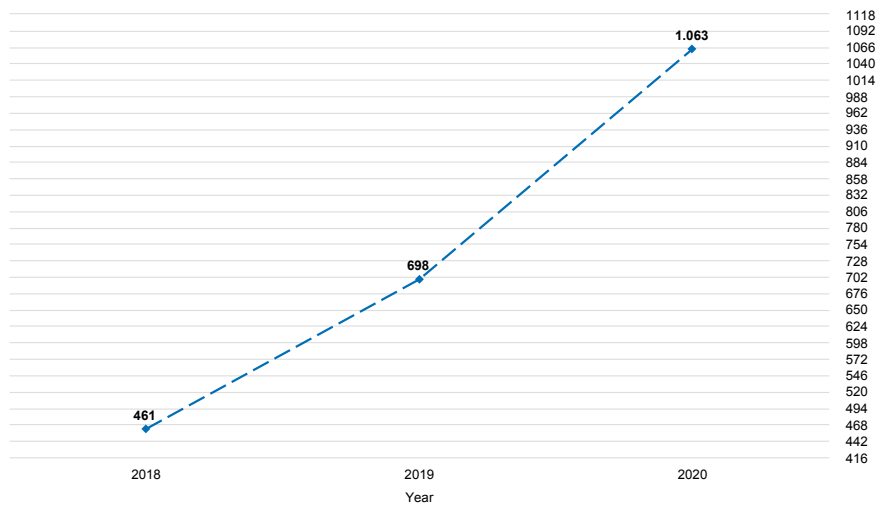


Figure 6: Number of orders in the online shop 2018-2020

GENEBANK

Digitalization of the Genebank

The very core of NordGen's genebank is the information system that contains all the data gathered over the years about the seeds and the plants in the Nordic seed and plant collection. This data is unique and invaluable for the research and development of new crop varieties needed to support future food production in the Nordic countries.

During the last few years, NordGen has been on an ambitious digitalization journey to secure that the genebank information system is future proof. In 2019, NordGen decided to implement the internationally well-known genebank data management software GRIN-Global.

After months of intense work with data migration and technical developments to ensure full functionality, the project reached a very important milestone in July 2020 with the launch of the '[Nordic Baltic Genebanks Information System, GENBIS](#)' which is built within the GRIN-Global data management system. This is a critical step bringing improved possibilities for strengthening documentation processes in the genebank, and will secure efficiency, security and accuracy in the seed handling and documentation as well as providing a more user-friendly interface for seed requesters.

GENBIS will serve not only NordGen but also the Nordic and Baltic national genebanks. This has in a positive way impacted collaboration between NordGen and the Nordic and Baltic national programs for plant genetic resources. GENBIS will also enable users to explore data from eleven different genebanks at the same site, instead of visiting several different ones.



GRIN-Global is a system designed for genebanks to store and manage data information associated with plant genetic resources and to deliver that information globally. Researchers, educators and breeders around the world can request seeds through the GRIN-Global website. By implementing GRIN-Global, NordGen has joined an international network for data management in genebanks with almost 20 genebank institutions using GRIN-Global worldwide.



PROJECTS

To participate in and lead different projects is an important part of NordGen's operations. In close collaboration with public institutions, private companies and other organizations, the overall purpose of all projects is to conserve and promote the sustainable use of genetic resources for Nordic food and agriculture. The funding for the projects is granted by the European Union, the Nordic Council of Ministers, directly from the Nordic countries through its government bodies or from public and private foundations and other organizations. The funding is leading to solutions for a more sustainable society.

Below is a summary of some of our more high-profiled projects:

Arctic Pea

Finding suitable grain legume crops with traits that make them possible to cultivate in the Arctic region will give possibilities for a future local plant protein production. This will in the long-term strengthen Northern culture communities and help reducing import of plant protein. In our region, the low temperatures and long summer days however require specifically adapted accessions.

In 2020, the results from field trials conducted in 2018 and 2019 at four environmentally contrasting sites were compiled. The aim of the trials, including 50 accessions from the NordGen pea collection, was to identify pea accessions suitable for future cultivation in the Arctic regions. The evaluated accessions represented a diverse material including different types of peas with origin in Sweden, Finland and Norway.

Differences were revealed in expression of phenological, morphological, crop productivity and quality traits in the accessions. Overall, the results indicate that pea genetic resources are available, for breeding or immediate cultivation, which would aid expansion of pea cultivation further north. Predicted climate changes would further aid this expansion. Many of the accessions that performed best at the sites in Tromsø, Norway, and Umeå, Sweden, were sugar pea landraces gathered from northern locations. It was concluded that agricultural practices and timing of sowing dates for pea cultivation in the Arctic will be extremely important to use available light and temperature as efficient as possible.

A project report was submitted to Nordregio in August 2020. Further analyses of the results were initiated and in collaboration with the other project participants, the writing of a scientific article was started. The manuscript will be submitted in the spring of 2021.

The Nordic cooperation project Arctic Pea is funded by Nordregio's Arctic cooperation program.



A Richer Agricultural Landscape

Cultivation of historical wheat species that are part of our cultural heritage favors biodiversity and provides a richer agricultural landscape. Einkorn and bucket wheat are historical wheat species that were previously grown on a large scale in Sweden. In recent years, mainly bucket wheat but also einkorn has generated interest by organic growers and in special bakeries.

The project carries out a detailed study of the einkorn and bucket wheat that are stored at NordGen in order to provide knowledge about their characteristics, disease resistance, and several quality parameters. In 2020, the collaborative partner Lantmännen conducted quality analysis on the four einkorn and four emmer wheat accessions that were grown in 2019 (these were selected from data on the 69 accessions grown in 2018). The quality data was used to select two einkorn and two emmer wheat further quality and baking analysis in 2021. Ultimately, the aim is to be able to recommend the best varieties in regard to cultivation and baking properties. The study will be communicated to organic growers and bakeries in order to increase the interest and use of traditional plant genetic resources.

The pandemic delayed the baking tests and the communication activities planned in the project, which is financed by the European Agricultural Fund for Rural Development.



Crop Wild Relative

Crop Wild Relatives (CWR) are wild species that are closely related to crops. They are of importance to agriculture since traits in these wild species can be transferred to crops by traditional plant breeding approaches. In many cases, wild species have traits that are not present in modern crops, for example pest and disease resistance, tolerance to drought, waterlogging or heat stress. Such traits are of central importance when adapting crops to future climate conditions and diseases and are therefore central for climate change adaptation and future food security.

The Nordic network on Crop Wild Relatives (CWR) was initiated in 2015 with the long-term aim to promote a well-functioning, climate- and environmentally friendly Nordic agriculture by strengthening CWR conservation and facilitating use of CWR. During 2019, the second phase of this network was finalized, and a report was published summarizing the results (<https://www.lantmannen.se/meddelanden/meddelanden/2019-06-20>). The third phase of the project was initiated in 2020 with funding from NKJ (The Nordic Joint Committee for Agricultural and Food Research) and the focus during the year has been on communication activities. Additional funding was granted from the *Nordic Committee of Senior Officials for the Environment and Climate* in December, which will make it possible to expand the Nordic work on CWR during 2021 -2024.

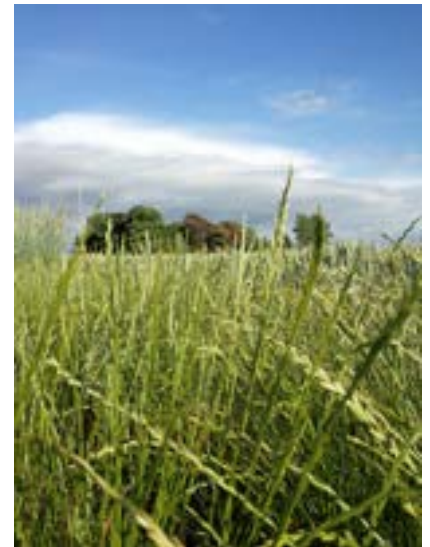


EUCLEG

The project EUCLEG, *Breeding forage and grain legumes to increase EU's and China's protein self-sufficiency*, was initiated in 2017 with the aim to "improve diversification of crops, crop productivity, yield stability and protein quality of both forage (alfalfa and red clover) and grain (pea, faba bean and soybean) legumes" (www.eucleg.eu). In 2020 NordGen started working on establishing a pipeline for uploading of characterisation and evaluation data from NordGen's new information system GENBIS to EURISCO in order to improve visibility of the data.

The project include development of molecular- and phenotypic tools, phenotyping and genotyping of genetic resources, development genomic selection strategies, improvement of access to data and facilitating of data exchange. NordGen's material is evaluated both genetically and phenotypically within the project.

NordGen's main contribution to the project has been work with improving public access to data on the focus species. We have for example made an inventory of European plant genetic resources for alfalfa, red clover, pea, fava bean and soybean, a gap analysis of the information in EURISCO (the European Search Catalogue for Plant Genetic Resources) and encouraged European collection holders to upload information to EURISCO.



Farmer's Pride

Plant genetic resources – our crop plants and their related wild species, and the genetic diversity they contain – are essential for our food, nutrition and economic security. In current times of global transformation, including the rapidly increasing human population and climate change, greater diversity is needed to sustain food supplies than ever before as the environmental conditions in which crops are cultivated become more extreme, changeable and uncertain.

The Farmer's Pride project is building a collaborative network for on-site conservation and sustainable use of Europe's plant diversity for food, nutrition and economic security throughout the region. The overarching objective of Farmer's Pride is to establish a network of stakeholders and conservation sites that effectively coordinates conservation actions to safeguard the wealth of Europe's *in situ* plant genetic resources (PGR) and integrates the user community to maximize their sustainable use. The aim is to significantly strengthen the European capacities for the conservation, management and sustainable use of *in situ* PGR as a foundation for increased competitiveness in the farming and breeding sectors, and ultimately for long-term food and nutritional security in Europe.

Funding for the project "Farmer's Pride – Networking, partnerships and tools to enhance *in situ* conservation of European plant genetic resources" has been granted from the Horizon 2020 Framework Programme of the European Union. During 2020 a report and analysis of crop wild relative networks was prepared "[Crop wild relative network showcases – analysis and best practices](#)" as well as a report on case studies of *in situ* conservation "[Crop wild relative in situ conservation case studies](#)"

(). A folder describing the network for *in situ* conservation proposed by the project has been prepared and is now available in several languages, including [English](#) and [Swedish](#). All the publications are publicly available on Farmer's Pride's homepage (www.farmerspride.eu), together with other publications from the project. The project will be finalized during 2021.



Image

FAO's Global Plan of Action for Animal Genetic Resources identifies conservation of animal genetic resources as a "Strategic Priority Area". Farm animal genebanks are important sources of genetic variation to ensure breeds' long-term survival and preservation of rare genotypes. Yet, their collections need to be better documented and progress in reproductive biotechnologies is needed to improve feasibility of genebanking. The challenge for animal genebanks will be to raise global awareness of the value of their collections for research and breeding and to further strengthen, implement and optimize the *ex situ* conservation strategies.

The aim of the project Innovative Management of Animal Genetic Resources (IMAGE) is to enhance the use of genetic collections and to upgrade animal genebank management. IMAGE partners are developing a renewed strategy for animal genebanks, taking advantage of genomic methodologies, biotechnologies, and bioinformatics for a better knowledge and exploitation of animal genetic resources.

The project was finalized in February 2020, after delivery of a Nordic case study and the document D7.13, gathering all relevant cryopreservation results from the project. The project led to further work outside the project, where NordGen in cooperation with FAO will compile and publish global cryopreservation guidelines.

IMAGE was funded by the Horizon 2020 Research and Innovation Programme of the European Union.



Virus cleaning, evaluation, and characterization to enable increased use of older Nordic cultural heritage potatoes.

The overall goal of this project was to increase the utilization rate and interest in older Nordic heirloom potato varieties. These are at risk of disappearing and there is a great need today to preserve and actively use these heirloom potatoes, as they are an invaluable part of our cultural heritage. In recent years, NordGen has noticed an increased demand for older, preferably locally grown potatoes. In addition to that, Pom (The Programme for Diversity of Cultivated Plants) is currently requesting more kitchen plants within its brand Grönt kulturarv® and has been very positive about the launch of one or more potato varieties.

The project started in 2018 and the first part of the project which took place in 2018 and 2019 focused on virus cleaning of 15 potato accessions. 2020 was a busy year for the project with several different activities carried out within the second and third part of the project. Morphologic characterization was conducted in cooperation with Bodaholms gård, late blight resistance was conducted in cooperation with Agrolab in Skåne, chemical analyses were conducted in cooperation with Eurofins and NordGen conducted culinary evaluations in Alnarp. The project was finalized in 2020 and as a result of it, 15 potato accessions that were not previously known more than locally have now become a part of NordGen's *in vitro* collection of potatoes and are currently available for researchers, plant breeders, open-air museums, and hobby growers.

The project was financed by The Swedish Board of Agriculture with funds from the European Agricultural Fund for Rural Development.

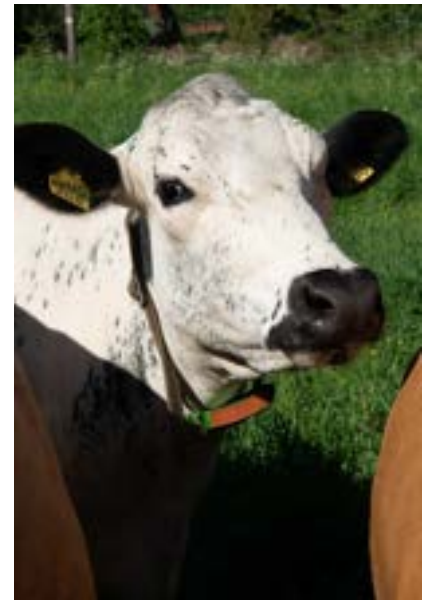


3MC - Traditional transboundary mountain cattle breed in Nordic. Their cultural inheritance and genetic resources

The Finnish Northern Finncattle, The Norwegian Sidet Trønderfe and Nordlandsfe and the Swedish Fjällko are three closely related cattle breeds that have played an essential role in the history of the northern parts of Scandinavia. To promote conservation and a sustainable use of these northern mountain cattle breeds, this project utilizes an innovative approach for combining several academic disciplines to give us a more nuanced picture of the history, culture and heritage of the breeds.

The studied fields are historical references, cultural heritage survey and peer support platform, genetic relationships based on archaeological finds and pedigrees and finally game development sector. The project will collect and distribute knowledge of Northern mountain cattle breeds in Finland, Norway and Sweden. Once gathered and consolidated, the information will be made available for everyone interested, for example, through an art vernissage, up-to-date education packages for schools, including a game application. The ultimate goal is to promote the native breeds and increase the opportunities for the local livelihoods and the conservation of genetic resources.

As one of NordGen's flagship projects, coordination of the project and our tasks in it took up many working hours in 2020. Due to the pandemic, many planned events and meetings had to be postponed or reverted to online arrangements instead. But despite these difficulties, the project has reached many relevant conclusions and managed to disseminate information about the cattle breeds to the different target groups. The project, which is financed by Interreg Nord, Lapin liitto and Region Norrbotten, is carried out in Nordic co-operation between universities, companies and breeding organisations in Finland, Sweden, Denmark and Norway.





SVALBARD GLOBAL SEED VAULT

Svalbard Global Seed Vault is a backup facility for the world's crop diversity. By putting seed duplicates for long-term and safe storage in Svalbard, genebanks reduce the risk of losing invaluable genetic material if anything should happen to their original collections. NordGen is responsible for operating the Svalbard Global Seed Vault in cooperation with the Norwegian Ministry of Agriculture and Food and the international organization Global Crop Diversity Trust. NordGen's role in the Seed Vault partnership is to communicate with genebanks, handle seed deposits and update the Seed Portal – a publicly accessible database gathering information about the seeds stored in the Seed Vault.

Svalbard Global Seed Vault	2020
Seed Vault openings:	3 February, August and October
Depositing institutions:	42 8 of these for the first time.
New seed sample duplicates:	82 501
New institutions signing the deposit agreement in 2019:	5 Located in Lebanon, Israel, USA, Morocco and the UK.
Number of seed samples in the Seed Vault (31/12 2020):	1 074 533
Number of depositing institutions - 31/12 2020:	87
Lectures about the Seed Vault given by NordGen staff:	6

Table 3: Svalbard Global Seed Vault

Key Activities 2020

Seed Summit

The comprehensive upgrade of the Seed Vault facility, which was completed during 2019, was marked with a Seed Summit and a major seed deposit event in February 2020. In total 35 genebanks deposited seeds in the Seed Vault at this occasion, and 28 of them were represented by one or more officials. The second meeting in the International Advisory Panel was organized in Longyearbyen back-to-back to the Seed Summit and the seed deposit events.

Seed Longevity Experiment

A new 100-year seed longevity experiment was started in 2020. The first seeds belonging to the experiment produced by the genebank IPK in Germany and prepared and packed at NordGen in Alnarp were put in place in the Seed Vault in August 2020. A project meeting, gathering representatives from all project partner institutes was organized in Longyearbyen in the end of February.



The Seed Vault was established in 2008 and is owned by Norway. NordGen is responsible for managing the Seed Vault in partnership with the Norwegian Ministry of Agriculture and Food and the international organization Crop Trust. The iconic building, on the top of the world, safeguards security copies of seeds stored in genebanks and thereby contributes to securing the world's food supply.

The location of the Seed Vault was chosen due to Svalbard being a remote, cold and safe place, yet easily accessible for shipping and handling. In addition, the Nordic Genebank (now NordGen) stored a backup of the Nordic seed collection here already from 1984, something that inspired to the establishment of the Svalbard Global Seed Vault. The seed chambers of the Seed Vault are carved out from the solid rock of the Plateau mountain. They offer a frozen environment where artificial cooling keeps the temperature at a constant -18°C and according to FAO's genebank standards. The ownership of the seeds stored in the Seed Vault remains with the depositing genebank, and only the institution that deposited the seeds are allowed to withdraw them.



PUBLIC-PRIVATE PARTNERSHIP

Together we are stronger. That's the very essence of the Nordic Public-Private Partnership (PPP) for pre-breeding. Through the partnership, plant breeding companies in the Nordic region can cooperate in a non-competitive way on pre-breeding projects and cooperate on research with the Nordic public institutions. The Nordic PPP is a collaboration aiming to strengthen plant pre-breeding in the Nordic countries and through its work promoting sustainable use of genetic resources in the Nordic region with its unique climate, temperature, and daylight.

The Nordic Public-Private Partnership (PPP) for pre-breeding is funded by the Nordic countries and plant breeding entities, and the secretariat is placed at NordGen.

Key Activities 2020

2020 was a busy year within the Nordic Public-Private Partnership for pre-breeding, as it marks the final year for the current program period 2018-2020.

On 1 June 2020, a call for new pre-breeding projects for the next project period was announced and in December 2020 the Steering Committee of the Nordic PPP-collaboration decided to grant funding to four new projects in the coming project period 2021-2023.

The Nordic Public-Private Partnership (PPP) for pre-breeding is a cooperation intended to strengthen plant breeding in the Nordic countries and through its work promote sustainable exploitation of genetic resources in the Nordic region with its unique climate, temperature, and daylight. The PPP is funded by the Nordic countries and plant breeding entities.

The PPP Secretariat at NordGen is responsible for the administration of the Nordic PPP. The PPP Secretariat facilitates project management in cooperation with the PPP Steering Committee. In 2020, the performance of the PPP secretarial role has been strengthened by upgrading the quality of management and meeting documents.

Presentation of the projects under the current program period

Pre-breeding for future challenges in Nordic fruit and berries

The focus in this project is to strengthen pre-breeding cooperation by validating available germplasm resources by genetic and phenotypic characterization in order to widen the parental pool aimed at genetic resources enhancement by increasing diversity for targeted traits in strawberries and apples.

Combining Knowledge from Field and from Laboratory for Pre-breeding in Barley

The focus within the PPP barley project is to utilize a developed MAGIC populations and use the setup of genomics assisted pre-breeding using genome-wide association study and genomic selection in pre-breeding. A spring barley core set from genebank material will also be selected to be used for genomic assisted pre-breeding.

PPP for pre-breeding in perennial rye-grass (*Lolium perenne* L.)

The project aims at improving the winter hardiness, persistence and other important traits for perennial ryegrass in northern Europe. It will also make plant breeding in northern Europe more prepared to meet new demands due to climate change, political decisions or consumer demand. Growth conditions in northern Europe differ from other parts of the world due to a unique combination of day length and other environmental variables like temperature. Only breeders in the Nordic and Baltic countries can be expected to breed for these special conditions. With this project, these breeders will get better tools and genetic variation to make adapted varieties. Agriculture in these countries will, despite its northern location be more competitive compared to other countries.

6P Phenotyping Project

The main activities within 6P-phase 2 consist of two categories - Research & Innovation (R&I) and Networking. R&I activities will involve a continued focus on the use of unmanned aerial systems derived images and the integration of high-throughput phenotyping technology. The specifically targeted crops are barley, oats, wheat, ryegrass and potatoes. The networking activities will effectively be a social platform to integrate ongoing research, strengthen cooperation and facilitate knowledge sharing between research institutions, technology providers, and plant breeders. The benefit to the plant breeding industry arises from either making the current visual phenotype observations faster, more reliable and cost-efficient, or the introduction of new phenotyping traits not possible to score visually with the human eye.



FINANCIAL STATEMENT

The Financial Statement for the year ending 31 December 2020 was prepared in accordance with Swedish National Financial Reporting Standards and audited by the Swedish National Audit Office.

(TSEK)	Budget 2020	Result 2020
Income		
Nordic Council of Ministers ordinary budget	31 532	31 532
National contributions	3 205	3 336
Other income	180	456
Financial income	0	161
Project funds, Nordic Council of Ministers	1.000	3 826
Other external project funding	6.786	6 557
Total income	42 703	45 868
Costs		
Staff costs	26 263	24 329
Goods and services	12 449	9 875
Contribution to external projects	104	104
Financial costs	55	403
Other costs	3 784	7 812
Total costs	42 655	42 523
Result year	48	3345

BOARD

The Board of NordGen meets three times a year to address issues of substantial importance to NordGen.

The members and their alternates are appointed by the Nordic Council of Ministers and the executive committee for Fisheries and Aquaculture, Agriculture, Food and Forestry.

BOARD MEMBERS	ALTERNATES
Finland Tove Jern, Chair Ministry of Agriculture and Forestry	Eero Pehkonen Ministry of Agriculture and Forestry
Sweden Carina Knorpp, Vice-Chair Ministry for Rural Affairs	Åsa Widebäck Ministry for Rural Affairs
Denmark Gitte Wolff, Member The Danish Agricultural Agency	Birgitte Lund The Danish Agricultural Agency
Iceland Emma Eypórsdóttir, Member Agricultural University of Iceland	Guðni Þorvaldsson Agricultural University of Iceland
Norway Geir Dalholt, Member Ministry of Agriculture and Food	Ivar Ekanger Ministry of Agriculture and Food
OBSERVERS	
Greenland Birgitte Jacobsen Ministry of Fisheries, Hunting and Agriculture	The Environmental Sector Birthe Ivars Ministry of Climate and Environment, NO
The Faroe Islands Tróndur Gilli Leivsson The Agricultural Agency	Staff Representative Sara Landqvist NordGen

NordGen Annual Review 2020

NordGen Publication Series: 2021:01

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NordGen

The Nordic Genetic Resource Centre (NordGen) is the Nordic countries' gene bank and knowledge center for genetic resources. NordGen is an organisation under the Nordic Council of Minister and works with the mission of conserving and facilitating the sustainable use of genetic resources linked to food, agriculture and forestry.

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