

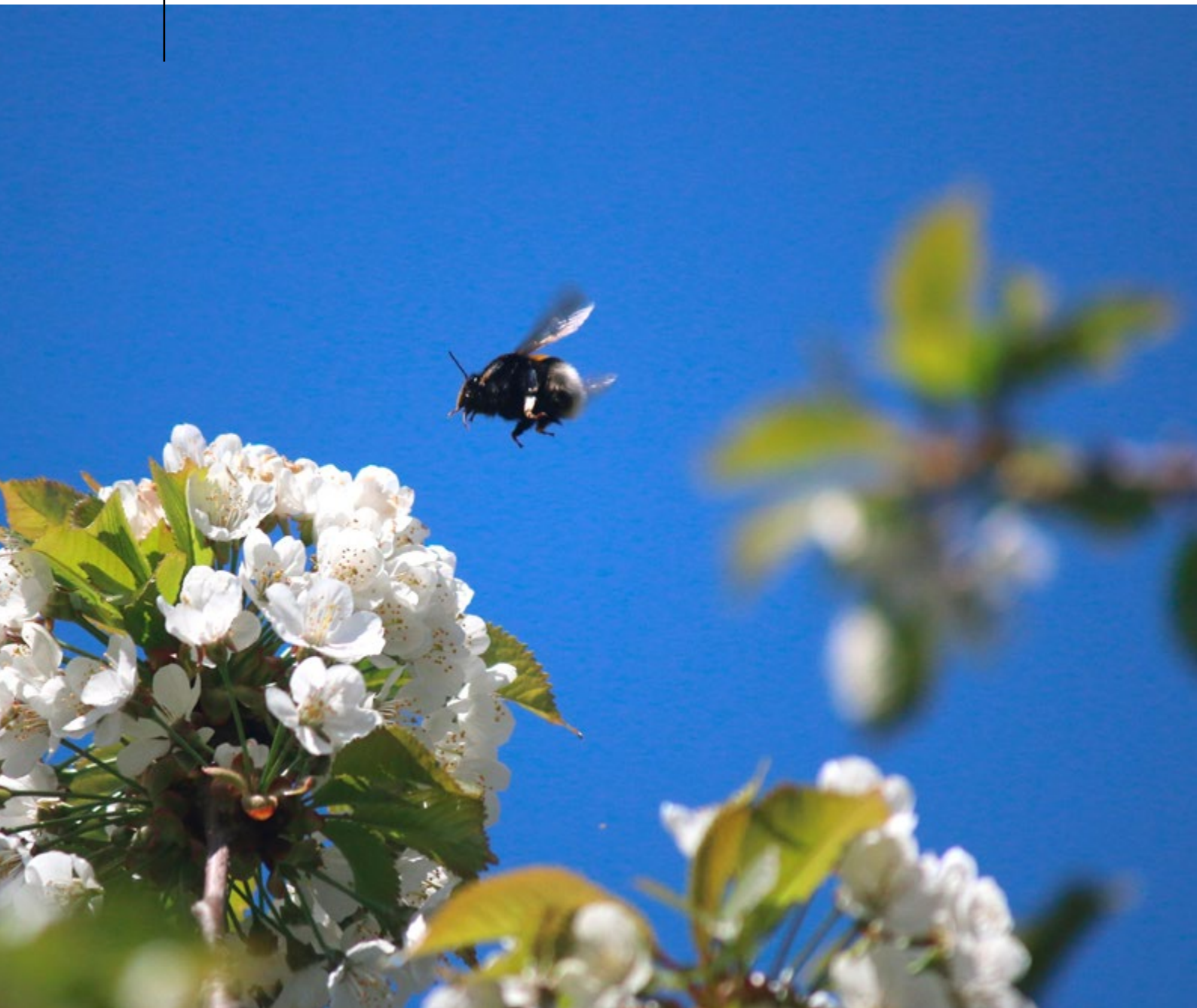


Norwegian Ministries

Strategy

National pollinator strategy

A strategy for viable populations of wild bees and other pollinating insects





Hay meadow in Buskerud. This meadow was registered in 1993 as being of national importance. The photo below was taken in 2004, after the meadow stopped being managed and became overgrown. Photo: Oskar Puschmann



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Foreword

The Government has published a national strategy, as requested by the Norwegian Parliament (Storting), with the aim of ensuring continued diversity of wild bees and other pollinating insects.

Pollinators play vital roles in ecosystems and in food production. At an international level, the decline in numbers of these beneficial insects is on the agenda of the IPBES (the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), with some countries having drawn up their own strategies.

One important objective of this strategy is to establish common goals and focus areas for a coordinated national commitment that builds on what has already been initiated in the public and private sectors. Anyone who manages an area of land can make a difference for pollinators, and the effect of individual efforts will be reinforced by means of effective cross-sector coordination. This strategy can help to strengthen the knowledge base and target established actions, as well as to identify and implement new actions that are essential in order to secure the living conditions necessary for pollinators in the long term.

While there is sufficient knowledge to implement targeted actions, it is also necessary to find out

more, about trends in pollinator populations and habitats, and about which actions are most effective.

The strategy has been developed by the Norwegian Ministry of Agriculture and Food, in collaboration with the Norwegian Ministry of Climate and Environment, the Norwegian Ministry of Local Government and Modernisation, the Norwegian Ministry of Transport and Communications, the Norwegian Ministry of Defence, the Norwegian Ministry of Education and Research and the Norwegian Ministry of Petroleum and Energy. The Norwegian Agriculture Agency and the Norwegian Environment Agency, with contributions from defence and transport agencies, have prepared the technical report for the strategy. Experts and organisations have contributed with their knowledge and experience.

In connection with work on strategy, there has been dialogue with interested parties in both the public and private sectors and in research environments, including through start-up meetings, dialogue meetings and written contributions. We wish to thank all those who have assisted with their great commitment and useful contributions, and we look forward to further dialogue on following up the strategy.



Jon Georg Dale
MINISTER OF AGRICULTURE
AND FOOD
Photo: Torbjørn Tandberg



Ola Elvestuen
MINISTER OF CLIMATE AND
ENVIRONMENT
Photo: Photo: Bjørn H. Stuedal/
Norwegian Ministry of Climate and
Environment



Monica Mæland
MINISTER OF LOCAL GOVERNMENT
AND MODERNISATION
Photo: Paul Paiewonsky



Ketil Solvik-Olsen
MINISTER OF TRANSPORT
AND COMMUNICATIONS
Photo: Olav Heggø/Fotovisjon



Frank Bakke-Jensen
MINISTER OF DEFENCE
Photo: Sturlason



Iselin Nybø
MINISTER OF RESEARCH AND
HIGHER EDUCATION
Photo: Marte Garmann



Jan Tore Sanner
MINISTER OF EDUCATION
AND INTEGRATION
Photo: Marte Garmann



Terje Søviknes
MINISTER OF PETROLEUM
AND ENERGY
Photo: OED/NTBscanpix



Summary

This strategy highlights three focus areas to achieve the goal of ensuring viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems: increasing scientific knowledge, providing good habitats and improving communication on the subject. The efforts of the public and private sectors, public-private partnerships and targeted, better-coordinated cross-sector initiatives will provide a solid framework for following up the strategy.

Enhanced national commitment requires follow-up of all focus areas in multiple sectors, as well as partnership between the various sectors and administrative levels. In order to stimulate greater collaboration, a meeting place, or “pollinator forum”, will be established for stakeholders in the private sector and those in the public sector at various administrative levels and in relevant knowledge environments. The Norwegian Environment Agency is responsible for leading the forum.

The pollinator forum is intended to help to ensure that the total effect of all current and future actions will reinforce each other and contribute to achieving the objectives. Through the pollinator forum, the Norwegian Environment Agency will prepare an overarching action plan during 2019, in line with the sectors’ areas of responsibility and priorities.

Actions to increase scientific knowledge about pollinating insects, what constitutes good habitats, threats and threat trends, and effective actions:

- Relevant sectors are to work to strengthen

monitoring of pollinating species and land areas that are important for pollinating insects through relevant programmes and systems, such as Artsprosjektet, surveys of habitat types, Natur i Norge, Naturbase, ecological base maps, Kilden and 3Q¹

- The voluntary sector is encouraged to use the artsobservasjonar.no portal to report observations of pollinating insects
- The environmental authorities will work to continue and develop the national monitoring programme for butterflies and bumblebees
- The environmental authorities and relevant sectors are to provide guiding signals about the need for additional scientific knowledge to their knowledge institutions and agencies. The Research Council of Norway will follow up the strategy within relevant programmes
- The agricultural sector is to increase scientific knowledge about practical solutions and actions that agriculture can use to ensure the provision of good habitats for pollinators
- The transport sector will continue to develop scientific knowledge about correct habitat management and increase scientific knowledge about pollinating insects and important habitats alongside transport arteries
- The municipal authorities should improve their own awareness about how they can improve conditions for pollinators in the green infrastructure
- Increasing collaboration between research environments, as well as the business and

¹ 3Q – Programme for status monitoring and verifying results in cultural landscapes in agriculture



Photo: Guri Tveito

administrative sectors, in order to fill gaps in knowledge.

- The relevant authorities are responsible for evaluating the effects of measures and subsidy schemes.

Actions to prevent loss of habitats and to increase the extent of continuous good habitats for pollinators throughout the life cycle:

- The private sector is encouraged to give consideration to pollinators when managing land
- The environmental and agricultural sectors will continue to facilitate the conservation and correct management of good habitats for pollinators
- The Norwegian Environment Agency and the Norwegian Agriculture Agency will clarify what actions the administration can take to facilitate the production of and access to pollinator-friendly flower seeds
- The environmental authorities will create action plans for endangered species where these are the most appropriate instrument, and will consider other actions, such as cross-sector management plans and pilot projects, to ensure the provision of good habitats and to protect pollinators.
- The agricultural sector will continue to encourage pollinator-friendly farming systems
- The transport sector will give consideration to pollinators in the management of verges alongside transport routes, within the bounds of the sector's other societal considerations
- The Armed Forces and the energy, health and educational sectors are to prioritise consideration for pollinators in their land management
- Builders of roads, railways, transmission lines, buildings and facilities, and other infrastructure should utilise natural revegetation from

local topsoil where appropriate, or sow pollinator-friendly seed mixes where these are commercially available

- The municipal authorities should give consideration to pollinator-friendly development and administration of municipal green infrastructure
- The municipal authorities should give consideration to pollinator-friendly land in municipal land-use planning, such as through thematic municipal master plans on biodiversity
- All sectors are to follow up the *National strategy against invasive alien species*. Measures aimed at combating such threats will be strengthened by means of a new action plan
- All sectors are to work to reduce the use of chemical pesticides and the risk of using such chemicals in line with regulations and the *Action plan for sustainable use of pesticides*

Actions for communicating information about pollinators and pollinator-friendly practice to all target groups (the private sector and public-private partnerships will play important roles in conveying relevant information to the target groups):

- Industrial stakeholders to be encouraged to communicate information within their own sectors
- The administration will continue to build on the established collaboration within and with the private sector
- The sectors are to communicate information about managing land within their own sectors
- The Norwegian Environment Agency will assess the need to reach various target groups by collating online information and using appropriate communication platforms



Photo: Frank Ivar Hansen

1 Background

The national strategy will secure a continued diversity of wild bees and other pollinating insects and is anchored in the Parliaments decision.¹ The strategy has been drawn up in a collaboration between relevant public-sector bodies, and the private sector² has contributed to the work. The private sector has shown significant commitment to the problem and a number of actions have already been implemented by means of voluntary efforts. This commitment has created a solid basis for the ongoing work. Established instruments within the public sector include subsidy schemes, legislation and action plans for the preservation of biological diversity.

There is growing international awareness of pollination as an ecosystem service and its

importance for biodiversity and food production. A decline in the number of pollinators in North America and north-west Europe has been recorded, and the Convention on Biological Diversity has defined international frameworks for addressing the problem. The IPBES³ has delivered a report on pollinators and food production with recommendations for the authorities.⁴ A decline has also been observed in Norway, albeit not to the same degree as the global trend. Approximately one-quarter of all pollinating insect species have been entered onto the Norwegian Red List.⁵ Land-use changes, climate changes, harmful alien species, the use of pesticides and environmental toxins are examples of threats against pollinators.

1 Recommendation to the Storting 172 S (2015–2016).

2 “Private sector” here includes various voluntary special-interest organisations and privately owned enterprises.

3 The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, or IPBES, is an independent intergovernmental scientific body, in the same vein as the UN Climate Panel, the IPCC.

4 The assessment report on pollinators, pollination and food production (2017), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

5 The 2015 Norwegian Red List of Species is a list of species that are at risk of becoming extinct in Norway. <http://www.artsdatabanken.no/Rodliste>

Improving conditions for pollinators is largely a question of how land is managed. The problem therefore concerns all members of the community that have a role in land management. A wide range of stakeholders can, in various ways, contribute to improving conditions for pollinating insects. It is therefore appropriate to have a strategy that establishes common goals and focus areas for a coordinated national commitment within various sectors, with both public and private bodies playing an important role. The Norwegian Agriculture Agency and the Norwegian Environment Agency, together with relevant sector agencies, have prepared a technical report for the strategy.⁶ This technical report is included as an appendix. References in the technical basis have not been repeated in the strategy.

1.1 Why are pollinators and pollination important?

It is vital for humans that the diversity of nature and ecological functions are preserved for the future. Pollination is an important example of an ecosystem service – that is to say, an example of the contribution made by ecosystems to human welfare. Pollination helps to maintain wild plant communities and is an important factor in the production of many agricultural crops.

Biodiversity

Worldwide, almost 90 per cent of flowering plants are wholly or partly dependent on animal pollination, which is predominantly performed by insects. In Norway no systematic survey has been carried out of all the relationships between plants and pollinators, but we know that more than 1,000 native plant species in Norway are pollinated by insects. It is likely that almost 80 per cent of wild Norwegian plant species benefit from insect visits to their flowers. A wide diversity of various insect species is essential, because they visit flowers of various plant species, and because different insects are differently affected by changes to the environment in which they live. Changes to the climate and to weather patterns, destruction of habitats, environmental toxins and invasive species affect not only insects and flowering plants, but



Bumblebee on a thistle flower. Photo: Wenche Dramstad

What is pollination?

Pollination is the transfer of pollen grains between flowers of one or more plants, enabling fertilisation and the development of fruit and seeds. Pollen can be transported by wind, by water or by animals. In Nordic ecosystems, insects are the only animals that perform pollination. Some crops, such as rye, maize, pine and spruce, are wind-pollinated and are therefore not dependent on insects for reproduction. The interaction between flowering plants and pollinating insects results in both parties benefiting from the process: the plants have their genes distributed, and the insects are rewarded with nectar and pollen. Nectar provides energy for the adult insects, while pollen provides protein for growing larvae. About 2,000 species of insect in Norway visit flowers and can therefore act as pollinators. Bumblebees and other bees are the most effective pollinators. Flies and beetles are also important pollinators, but they are less effective than bees because they are less targeted, though they are abundant. Butterflies also act as pollinators, but they are not considered particularly effective. There are also a number of species that are important because they pollinate only one species of flowering plant, or just a few species. Overall, bumblebees and flies are the most important pollinating insects in Norway.

⁶ Technical basis for national strategy for wild bees and other pollinating insects. Norwegian Agriculture Agency (2017)



Inspecting bees being used for pollination in a raspberry field. Photo: Marco Neven

also the relationships between them. Diversity increases the likelihood that some species will be able to cope with these effects and pollinate the plants in a given area.

In addition, plants that produce wild berries are dependent on pollination, and such berries constitute a readily accessible food resource.

Agriculture

Pollinators are vital to agricultural production. They are key to the production of honey and also contribute to pollination in plant production. Honey production involves beekeeping with honey bees, whereas pollination in plant production can take place by means of honey bees, domestic bumblebees or wild species.

Different crops are dependent on pollinators to various degrees. The IPBES estimates that 5–8 per cent of global agricultural production is dependent

on pollinators, and that the market value of such production is equivalent to USD 235–577 billion (IPBES 2016). The value of pollination services to agriculture in Norway has not been calculated. The Norwegian Agriculture Agency has estimated a total production value for oil crops, fruit and legumes of nearly NOK 900 million in 2017. This accounts for approximately 9 per cent of the total value of plant production in Norway.⁷ There may be other products, also dependent on pollinators, that have not been included here, such as the production of flowers, clover seed and caraway seed. The production of vegetables such as carrots and fennel is also dependent on pollinators, but the seeds are imported.

Both domestic and wild bees are important for the pollination of agricultural crops. Investigations have shown in many cases that the best crops are produced from fields with a wide diversity of pollinating insects.

⁷ Total value NOK 9.632 billion. Includes cereal and oilseed crops, peas, potatoes, horticultural products and other plant products (Budget Committee for Agriculture, 2017).

The buff-tailed bumblebee (*Bombus terrestris*) is of particular importance in greenhouses for the pollination of tomatoes, an area of production that has seen considerable growth in recent years. The buff-tailed bumblebee is discussed in more detail in section 1.4, under Invasiv alien species.

Beekeeping

Approximately 1,300 tonnes of honey are produced in Norway each year, equating to a value of about NOK 120 million in a market of about 2,600 tonnes.⁸ Interest in beekeeping is on the rise, and there is increased demand for Norwegian honey. If the share of Norwegian-produced honey can be increased, the contribution made by domestic bees to pollination will increase correspondingly.

In addition to their role in producing honey, domestic bees are important for the pollination and reproduction of both agricultural crops and wild plant communities. Each honey bee colony contains a queen and up to 20,000 workers, which hibernate and are therefore ready to pollinate flowers earlier in the spring than wild bees are. This is an advantage for crops that flower early in the spring, such as fruit trees. Fruit growers find that their crop yields increase when there are beehives in the vicinity. For farmers that need their crops to be pollinated, it is practical to use honey bees because they are flexible in various ways: the hives can be moved, the number of hives can be regulated, and the bees tend to restrict themselves to one flower species when collecting pollen and nectar. Many fruit growers hire beehives from honey producers to increase production, to the mutual benefit of both production processes. The PolliVest project (see fact box) has recorded a significant increase in crop yields for producers who hire beehives during the flowering period.

In Norway, beekeepers use three breeds of western honey bees: brown bees, Carniolan honey bees and Buckfast bees. In former times, southern Norway was probably within the distribution range of the brown bee, but all present-day honey

PolliVest

The pilot project PolliVest's objective is to increase the use of honey bees for pollination in fruit farming in the counties of Hordaland and Sogn og Fjordane. The project was set up by Honningcentralen and Gartnerhallen. As a result of the project, it is expected that 90 per cent of fruit farmers in these two counties in western Norway are using honey bees in their production process, resulting in a 15 per cent increase in yield in apples, pears and plums. The project is financed by Grofondet.

bees in Norway are regarded as introduced. The Norwegian Genetic Resource Centre has classified the brown bee as critically endangered in Norway, and few remain worldwide. The greatest threat to the brown bee is hybridisation with other breeds and displacement by the two other breeds. It is therefore important to give particular consideration to the brown bee in Norwegian breeding work.

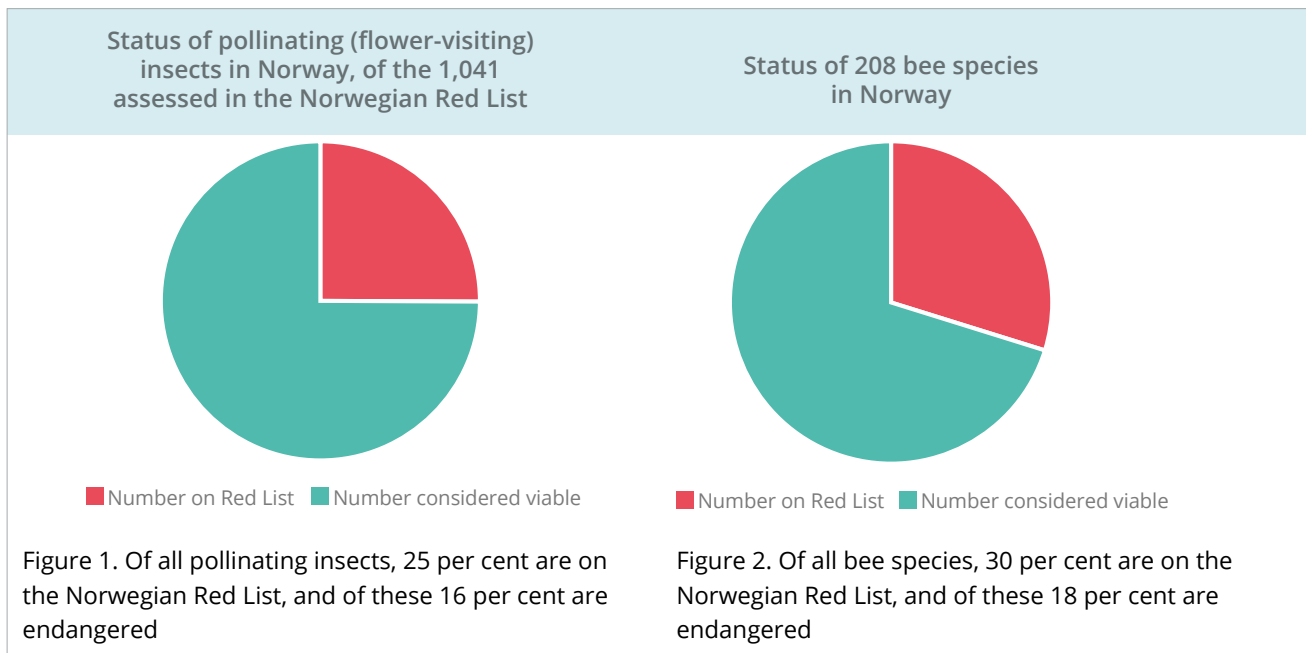
The *Regulation on Actions to Promote the Breeding of Bees* regulates the controlled breeding of honey bees. On application from the Norwegian Beekeepers Association, the Ministry can approve and set terms for breeding areas and beekeeping nearby, and can define limited geographical areas as pure-breeding areas for a single type of bee for a limited period.

1.2 The status of pollinators

In north-west Europe and North America, both the diversity and distribution of wild pollinators are declining. In other countries and on other continents there is insufficient knowledge about the pollinating species to determine any specifics about the situation. Long-term international and national monitoring of both pollinators and pollination is necessary in order to find out more about the status of and trends for these species (IPBES, 2016).⁹ According to a study of insect populations in nature reserves in Germany, there was a 75 per cent decline in total flying insect

⁸ Source: Norwegian Beekeepers Association

⁹ The assessment report on pollinators, pollination and food production (2017), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)



biomass between 1989 and 2016 (Caspar A. Hallmann et al.).¹⁰

The results from the IPBES report and the study in Germany are not directly transferable to the situation in Norway. The problems that these species are facing in large areas of Europe are not replicated in Norway to the same degree, in part because agriculture in Norway is not so intensive, and we still have a relatively diverse landscape mosaic.

The 2015 Norwegian Red List for Species, which contains a list of species at risk of becoming extinct in Norway, provides information about the status of pollinators in Norway. Hymenoptera (including bumblebees and other bees), butterflies, moths in the family Sphingidae, beetles and flies can all act as pollinators. There are a large number of endangered species among pollinating insects in general, and especially among bees. Eleven bee species were considered to have become extinct in Norway by 2010. In addition, in 2015 the plain dark bee (*Stelis phaeoptera*) was assessed as regionally extinct.¹¹ Eleven bee species that were red-listed in 2010 are now assessed as “least concern” and have been removed from the Red

List. The assessment for ten other species is now more serious. These changes are primarily due to new knowledge about the species, and only in exceptional cases are a result of actual population changes. This demonstrates the importance of obtaining more information in order to make precise assessments.

Even though we do have some information about pollinators in Norway, there is still a need for more information about them – for instance regarding which pollinating species we have in Norway, as well as information about their distribution and the development of their populations.

1.3 What do pollinators need?

All pollinators have one thing in common: they need flowering plants. Bees need nectar for energy, and their larvae need food – pollen – in order to grow. Other pollinator groups need flowers because of the protein-rich pollen and nectar they can get from them, whereas others use flowers as hiding places. In order to meet the requirements of pollinators they need both wide diversity and a large number of flowering plants throughout the flying season.

¹⁰ <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>

¹¹ <https://www.artsdatabanken.no/Rodliste/Pollinerendelnssektorer>

Areas that are important for pollinators:

- Semi-natural meadows and coastal heaths
- Special production areas and uncultivated biotopes relating to agriculture
- Forests and felling areas, including forest margins and woodland clearings
- Sandy areas and beach meadows
- Mountain and coastal areas
- Road verges, airports and other wasteland
- Land beneath power lines and cross-country skiing trails
- Parks, gardens and green infrastructure in cities and built-up areas



Rosa rugosa is a harmful alien species that spreads along the shoreline and displaces the indigenous flowering vegetation. Photo: AdobeStock

In order to maintain both the diversity and number of pollinators, they need somewhere to grow, somewhere to shelter in bad weather, somewhere to mate, and somewhere to hibernate. Corridors between suitable habitats are also needed. In order to meet these requirements, pollinators need varied landscapes.

Some habitat types and natural areas stand out as important for pollinating insects because they can fulfil one or more of their requirements, and because in many cases they can provide homes for specialists and rare species. It is particularly important that we safeguard these areas.

1.4 Threats and challenges

In order to understand the status and development of pollinators, and the threats that they face, as well as what we can do to improve the situation, we need to understand the underlying processes and driving forces. Loss of and damage to habitats, climate change, harmful alien species, and the use of pesticides and environmental toxins have been highlighted as the most important factors underlying the decline in numbers and distribution of pollinators and the fall in biological diversity globally. These explanations also apply in Norway. Furthermore, it is important to understand that these factors do not occur singly, but rather that there is a complex interplay between them all.

Land use and changes in land use

Access to suitable habitats featuring breeding locations and areas in which to feed and grow are absolutely vital in order for pollinators to succeed. The reduction and fragmentation of habitat areas as a result of changes in land use are therefore a central cause of the decline in biological diversity in general, and in particular of the numbers and diversity of pollinators. When land becomes overgrown or is subject to fertiliser use or redevelopment, these are examples of changes in land use that affect many of the habitats that insects need.

The relative importance for pollinators of changes in land use related to activities within agriculture, the expansion of infrastructure, energy measures, industrial activity and the construction of residential properties have not yet been examined in detail.

Climate change

Climate change is expected to be greatest in northern areas, and may have a particular effect on simple ecosystems. From a wider geographical perspective, climate change in particular is expected to pose a threat to many populations of bumblebees. Species are dependent on continuous or nearby habitats in order to move areas, exchange genetic material and survive in the long term. Species' existing habitats will be affected by climate change, and the survival of many species will be dependent on opportunities for moving to new areas. All

insects have requirements in terms of local climate conditions in order to be able to survive and reproduce. Both in Europe and in North America, the habitats of bumblebees will be restricted as the climate becomes warmer. There is a need for more knowledge about the effects of climate change.

Invasive alien species

The Norwegian Growers Association's project *Norwegian quality production of bumblebees for pollination* has played an important role in reinforcing Norwegian bumblebee production.

International trade and increasing cross-border transport contribute to increased introduction of alien organisms. Climate change increases the opportunities for such organisms to become established. Invasive alien species may have a negative effect on pollination by competing with native species, the introduction of new diseases and parasites, and hybridisation with native species. Introduced plant species can outcompete native plants, and they can attract pollinators that would otherwise have visited the native plants.

The importation and use of certain species of bumblebees in greenhouses may be one cause of the spread of the buff-tailed bumblebee (*Bombus terrestris*) to new areas. There is as yet no information about the extent of this spread. The introduction of this species brings with it a considerable potential for establishment and spread in Norway, with a risk of a substantial negative ecological impact.¹² The use of the buff-tailed bumblebee is therefore regulated by the Norwegian Regulation on alien organisms¹³ as administered by the Norwegian Environment Agency. The Norwegian Growers Association's project *Norwegian quality production of bumblebees for pollination* has played an important role in reinforcing Norwegian bumblebee production.

Pesticides, environmental toxins and chemicals

The IPBES report also emphasises pesticides as a factor behind the decline in the numbers and

distribution of pollinators. Certain pesticides, especially insecticides, have the potential to affect pollinators.

Pesticides are used in agriculture to protect against damage caused by fungi, weeds and insects. They are also used in other areas and in other sectors, for example in forestry, in parkland, beside roads and railways and in private gardens. Pesticides undergo extensive assessment before they can be approved for use. The Norwegian Food Safety Authority has technical responsibility for the approval of such chemicals for use in Norway.

Pesticides are used in some of the same areas and on some of the same crops that pollinators need, or against insects that are closely related to them. Such chemicals may therefore have both indirect and direct effects on pollinators.

In recent years, some chemicals in the neonicotinoid family have been associated with the death of bees, and the use of such chemicals has recently been restricted within the EU. This restriction will be followed up in Norway. Certain other chemicals that are in use in Norway are subject to restrictions, for instance that they cannot be sprayed on or over flowering vegetation. Regulatory compliance is important in order to reduce the risk of negative effects on pollinators.

Weedkillers account for the majority of pesticide use in Norway. These chemicals reduce the incidence of flowering plants in fields, resulting in poor access to food for pollinators in such areas.

Drift of pesticides between fields can cause the concentration of these agents to exceed the set limits, or can result in the introduction of pesticides to areas where spraying is actually forbidden. Whether this entails a risk for pollinating insects has not been sufficiently investigated, and there is a need for further knowledge on this area.

¹² Assessment of the risk to biological diversity of the introduction of the buff-tailed bumblebee (*Bombus terrestris*) to Norway. NINA report 895.

¹³ FOR-2015-06-19-716



An insect hotel made of timber and clay by residents and students in the neighbourhood garden of Parkens Grøde in the Sagene district of Oslo. Photo: Morten Brakestad

Pollinating insects are also exposed to environmental toxins and biocides. Environmental toxins are poisonous substances that are concentrated through the food chain and that have a long lifetime in the environment.¹⁴ Known environmental toxins such as perfluorinated compounds, organophosphates, PCBs, polycyclic aromatic hydrocarbons and a number of metals have been detected in bees and in products such as honey and pollen in a number of studies, primarily from Europe.¹⁵ Even though environmental toxins are known to have a harmful effect on living organisms, there is limited information about how they affect pollinators. Not much research has been done in this area. Biocides that are used as insecticides may also potentially harm pollinators.

Road salt, metals and other environmentally harmful chemicals from the transport sector may have negative effects on the soil, water and vegetation that pollinators rely on.

There is a need for increased knowledge about the transfer and uptake of environmental toxins in plants and pollinators. Furthermore, additional

knowledge is needed about the effects of chemicals that can, to varying degrees, interact at low concentrations.

Disease and parasites

Of all the pollinating insects, honey bees are the most researched species in respect of disease and the disease status. Pathogens that infect honey bee colonies include viruses, bacteria and fungi. Large parasites such as mites and other insects can also cause serious damage to honey bee colonies. In addition to pesticides, both diseases and parasites are considered to be important factors in the spread of so-called colony collapse disorder (CCD). No cases of CCD have been reported in Norway as yet.

The bee diseases and parasites covered by Norwegian legislation have been allocated to three hazard classes, named A, B and C, where A is the most serious. A list of the diseases and parasites and their classification is provided in the Regulation on Diseases of Animals. At present, these regulations do not cover any viral bee diseases.

¹⁴ <http://www.miljostatus.no/tema/kjemikalier>

¹⁵ García-Valcárcel et al. 2016; van der Steen 2016; Chiesa et al. 2016; Morgano et al. 2010; Perugini et al. 2009; Perugini et al. 2011; Surma et al. 2016

In Norway, the disease status is monitored by the Norwegian Food Safety Authority and the reference laboratories of the Norwegian University of Life Sciences (NMBU). The Norwegian Food Safety Authority is also responsible for handling disease outbreaks and epidemics. Preventive actions include restrictive import rules for honey bees, equipment, pollen and honey. At the same time, the risk posed by the import of honey bees and bumblebees as a source of disease outbreak cannot be ignored. At present, the requirements regarding documentation of disease status when moving bees within Norway are stricter than those applied to the import of bees. Animal health requirements for the import of live bees and bee-breeding products are regulated through the EEA agreement. However, there is nothing to prevent individual importers from placing additional requirements on imports.

There have been examples of diseases and parasites being transferred between different species of bees. Furthermore, competition between honey bees and wild bees, such as for food resources, can increase stress and reduce immune defence, and thereby contribute to the spread of diseases. This indicates that beekeeping can constitute a risk to wild bee populations, and vice versa. The transmission of disease between honey bees and wild bees has not been surveyed in Norway.

1.5 National commitment to pollinators

The private sector has demonstrated considerable commitment to bumblebees and other wild bees, and a number of actions have already been implemented by means of voluntary efforts. "Private sector" here includes various voluntary special-interest organisations and privately owned enterprises.

Communication by voluntary organisations, research environments and in scientific literature has increased awareness and the will among the general public to do something for pollinating insects. Many actions have been implemented, the objective often being both to improve conditions for pollinators and to increase awareness about the loss of pollinators so that the public better understand pollinating insects. Gardeners have been an important target group, as well as

farmers, municipal employees, children in schools and kindergartens, and others. This is an excellent basis upon which to build. Various organisations and technical environments are working on new projects, in particular in connection with the dissemination of knowledge.

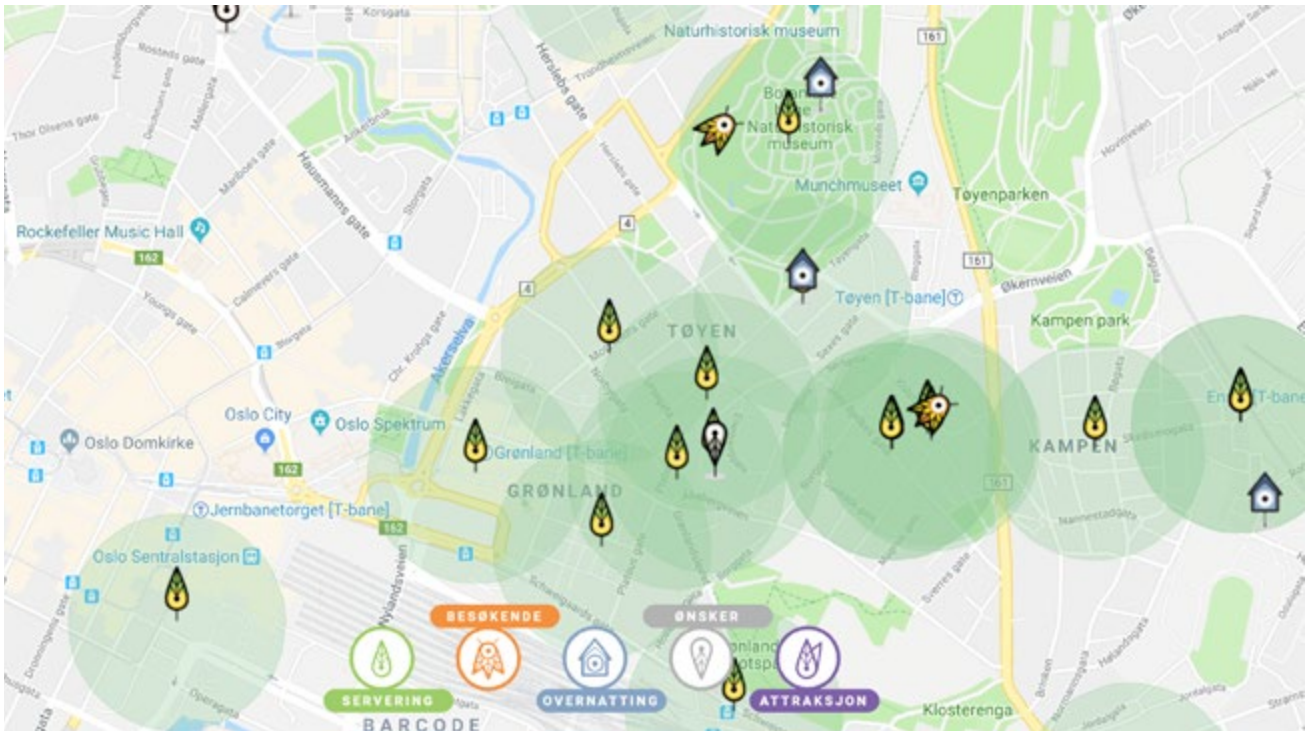
At this point we wish to highlight some examples of activities that have started in Norway, as well as examples of public-private partnerships.

Summende hager ("Buzzing gardens")

The *Summende hager* campaign has been running for several years and has gained considerable awareness among the public. Central to the campaign has been information about the function of pollinating insects and which flowers they are attracted to. The campaign focuses on providing information about what individuals can do to improve conditions for bumblebees. It was organised by the Norwegian Horticultural Society and the Norwegian Environment Agency, using a Facebook page as its main communications channel; 2016 was the last year in which the campaign received funding. The website <http://www.summendehager.no> (run by the Norwegian Horticultural Society) provides information about the story of the bumblebee, how to create a flower meadow, and which flowers are bee-friendly. Surveys undertaken before the campaign started and again in 2015 show that there has been a considerable increase in awareness of the challenges facing bumblebees and how to remedy them.

Pollinatorpassasjen ("The pollinator corridor")

This project has its origin in the *Summende hager* campaign, and is coordinated by the urban beekeeping association, ByBi. A map application has been developed, showing pollinator projects in and around Oslo. Initiatives can be registered by both private and public bodies. The project has been supported by the Norwegian Environment Agency. Oslo residents and voluntary organisations have been invited to create green corridors in the city along which insects can spread. <http://www.pollinatorpassasjen.no/#!/map>



The pollinator passage has its origin in the “Buzzing gardens” campaign, and is coordinated by the urban beekeeping association, ByBi. The map shows pro-pollinator actions taken in and around Oslo.

Blomstermeny (“The Flower Menu”)

The website blomstermeny.no, which has been created by a partnership involving several organisations, provides an excellent guide on what to plant in order to support pollinators throughout the year. It also shows what wild flowers are attractive to bumblebees. <http://blomstermeny.no>



La Humla Suse holds courses for farmers. Photo: Eivind Krey Nitter

La Humla Suse

The nonprofit organisation La Humla Suse (founded in 2013) works to secure habitat for bumblebees in Norway. It contributes to knowledge dissemination through a wide range of activities, including bumblebee walks; the creation of Humlegate (“Bumble Street”) in the Tøyen area of Oslo; courses for farmers, municipalities, school teachers and kindergarten teachers; and courses in creating bumblebee boxes. Work has begun on a guide to managing verges in collaboration with the Norwegian Agricultural Extension Service, the Norwegian Society for the Conservation of Nature and various farmers. The association also carries out surveys and monitors bumblebee numbers, and also provides advice to the administrative authorities. <http://www.lahumlasuse.no>

Bieffekten

Bieffekten is an enterprise that runs various projects to increase awareness of and improve conditions for pollinating insects in city areas and other locations. It works together with companies and industrial buildings that can sponsor urban beehives and large planters, as well as giving lectures and training presentations, and working with the authorities. <http://bieffekten.no>

Nordic Garden

The company Nordic Garden started the initiative BieBlomst in collaboration with the Norwegian Horticultural Society, the Norwegian Beekeepers Association and the gardening blog *Moseplassen*. It uses Facebook to spread information about bee-friendly flowers and related topics. The company has also created an app showing which bee-friendly plants to use. <http://www.nordicgarden.no>

Humlebuzz

Humlebuzz is a school project initiated by NTNU University Museum together with other parties. Its aim is to spread knowledge about pollination and the importance of insects for food production. The Bumblebee Bus visits schools all over Norway with the support of the Norwegian Environment Agency. <http://www.ntnu.no/museum/humlebuzz>

Humleskolen

Humleskolen, a website for experiences and learning about bumblebees and other Norwegian species, is operated by BRAINS Media in Trondheim. It contains a great deal of information about bumblebees and their habitats, positive initiatives, threats, and events about bumblebees. <http://humleskolen.no>

Norwegian Beekeepers Association

The Norwegian Beekeepers Association has run a campaign aimed at farmers. As part of this campaign, a printed brochure has been produced *Bee Seeks Flowers* featuring actions that promote both wild insects and honey bees. <http://www.norbi.no/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=56874>

The Norwegian Beekeepers Association has also published a brochure entitled *Bees and Flowers*, which is used by the association as part of various information initiatives around the country. <http://www.norbi.no/pop.cfm?FuseAction=Doc&pAction=View&pDocumentId=48075>

The project *Community project for town and country* was founded in spring 2017. This is a national voluntary project to increase awareness and understanding of “the story of flowers and bees” among the general public, and in particular among children and young people. Work is currently ongoing on a brochure for kindergartens, a collaboration with the youth organisation 4H about bees on 4H farms, and a film about pollination for social media (with support from the grocery wholesaling group Norgesgruppen). In addition, a number of demonstration apiaries have been set up, supported by the Honningcentralen cooperative and the charitable foundation Sparebankstiftelsen DNB, among others.

The Norwegian Beekeepers Association and Honningcentralen are collaborating on an elite initiative to increase the number of commercial beekeepers. Honningcentralen arranges the Norwegian National Honey Championships in partnership with Matstreif/Innovasjon Norge, Norgesgruppen, Bakehuset, Nordic Garden and MatMerk/Nyt Norge.

Norsk Landbruksrådgiving (the Norwegian Agricultural Extension Office)

The Norwegian Agricultural Extension Office communicates information to farmers about good pollinator practice and intends to compile this information into a guide for farmers. The office also contributes its expertise to courses on pollinating insects on behalf of La Humla Suse, NLR Østafjells and the ecological foundation Oikos. It also provides other relevant information on its website: <https://www.nlr.no/sok?s=bier>



The Norwegian Agrarian Association and the Norwegian Farmers and Smallholders Union have created this information board in partnership with Sabima.

The Norwegian Agrarian Association and the Norwegian Farmers and Smallholders Union Agriculture manages large areas of the open landscape that are important for pollinators. The professional associations, in partnership with the Sabima organisation, have created the information board *Use the Cultural Landscape*. In 2016, the Smallholders Union ran a seed campaign in which pollinator-friendly flower seeds and information were distributed to the public.

Sabima

Sabima is an umbrella organisation for the biological organisations in Norway, including the Norwegian Entomological Society and the Norwegian Botanical Association. It communicates information about threats to bees and what each

individual can do to take care of these important insects. Its work includes arranging courses, surveying tours for voluntary surveyors and grants for surveys of pollinating insects. It works together with NINA on surveys of bumblebees and butterflies through the Norwegian Nature Index.

In 2017, Sabima and NINA collaborated on a project to survey and assess ecosystems in natural environments close to cities. There has been a focus on carrying out surveys of plants that are important for pollinating insects in Oslo through specially arranged tours, along with a plant booklet that has been developed.

The Norwegian Botanical Association has arranged a community haymaking project, as well as courses in haymaking in various locations. <https://www.sabima.no>

Bumblebee poster

The Norwegian Institute for Nature Research (NINA) has worked in partnership with Artsdatabanken (the Norwegian Biodiversity Information Centre) and the Norwegian Horticultural Society to create a bumblebee poster showing all the bumblebee species that have been recorded in Norway. In recent years, two popular science books about bumblebees have been written: *Bumblebees in Norway* and *Norway's Bumblebees*. <http://www.artsdatabanken.no/Pages/201634>

Arter på nett ("Species Online")

Another important communication action is the digital encyclopaedia *Arter på nett* ("Species Online"), provided by Artsdatabanken (the Norwegian Biodiversity Information Centre). <http://www.artsdatabanken.no/Pages/231830>

1.6 International work on pollinators

In 2000, the Convention on Biological Diversity (CBD)¹⁶ voted to establish the International Pollinator Initiative for work with pollinators. In 2002, a pollinators action plan was drawn up, focusing on the ecosystem approach, which the

¹⁶ The Convention on Biological Diversity is a global treaty on the protection and sustainable use of biological diversity. Norway ratified the Convention in 1993.

member states are encouraged to follow up. The initiative is led by the Food and Agriculture Organization of the United Nations (FAO). The website <http://www.fao.org/pollination/en> provides an overview of various regional initiatives, programmes and projects with the common goal of promoting the protection, re-establishing and sustainable use of pollinator diversity in agriculture and related ecosystems. The 2017 party meeting of the CBD saw the creation of a group for work on pollinators: the Coalition of the Willing on Pollinators.

In 2016, IPBES produced a theme report on pollination, which provided a summary of all the worldwide knowledge on pollination and a checklist for work at national level. At the 2017 party meeting of the CBD, a resolution was adopted to encourage states to undertake specific work to follow up findings from the IPBES report, depending on national conditions.

In 2010, the Expert Group on Pesticide Effects on Insect Pollinators was set up as part of the OECD Environment Directorate's Working Group on Pesticides. In June 2016, pollinators and the testing of pesticides were highlighted as high-priority areas by the OECD.¹⁷

Under the EU Pollinators Initiative¹⁸ the commission presented three actions for tackling the decline in numbers of pollinators: actions to improve knowledge about the causes and consequences of pollinator decline by means of research and monitoring; actions to tackle the causes of pollinator decline, such as action plans to secure good habitats while looking at various policy areas in context; and actions intended to raise awareness, and to promote knowledge and collaboration.



Norway imports a number of products that to a greater or lesser degree are produced with the help of pollinators. Examples of such food products include almonds, cocoa, coffee, sunflower seeds, soya beans, melons, apricots and kiwi fruit. Other types of product, such as cotton and linen, also rely on pollination. These products are important for many countries' economies, and are also a necessary part of our own supply chain. Therefore, international work in this area is vital.

Various countries have drawn up their own national pollinator strategies:

- The Action Plan for Pollinators in Wales 2013¹⁹
- A Pollinator Strategy for Scotland 2017–2027²⁰
- The National Pollinator Strategy: for bees and other pollinators in England (Defra 2014)²¹
- Ireland: All-Ireland Pollinator Plan 2015–2020²²
- NL Pollinator Strategy – “Bed and Breakfast for Bees” (2018)²³
- USA: National Strategy to Promote the Health of Honey Bees and Other Pollinators (2015)²⁴

17 <http://www.oecd.org/chemicalsafety/testing/work-related-beespollinators.htm>

18 http://ec.europa.eu/environment/nature/conservation/species/pollinators/index_en.htm

19 <http://gov.wales/topics/environmentcountryside/consmanagement/conservationbiodiversity/action-plan-for-pollinators/?lang=en>

20 <https://www.nature.scot/pollinator-strategy-2017-2027>

21 <https://www.gov.uk/government/publications/national-pollinator-strategy-for-bees-and-other-pollinators-in-england>

22 <http://pollinators.ie/>

23 <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2018/01/22/nl-pollinator-strategy-bed-breakfast-for-bees/nl-pollinator-strategy-bed-breakfast-for-bees.pdf>

24 <https://www.epa.gov/pollinator-protection/federal-pollinator-health-task-force-epas-role>



Selected cultural landscape, Svartorseter, Sørkedalen. Photo: Guri Tveito

2 Goals and focus areas

2.1 National goals for agriculture

The agricultural policy has four primary goals: ensuring food security and emergency planning, promoting agriculture throughout Norway, increasing value creation, and facilitating sustainable agriculture with lower emissions of greenhouse gases.

Sustainable agriculture involves safeguarding our varied and diverse cultural landscapes in agriculture by preserving cultural assets and biodiversity, and reducing pollution. The cultural landscape is subject to continual change, and has developed through hundreds of years of human activity. Active use of the land through agriculture develops and maintains the cultural landscape so that the fundamental resources, habitat types and land areas with high biodiversity are also safeguarded. Examples include habitat types such as traditional hay meadows, natural pastures and coastal heaths, which are dependent on grazing and haymaking to prevent them becoming overgrown. Such active

use of uncultivated land by means of grazing and haymaking is also beneficial to pollinating insects.

In recent years, both the Government and the Storting have prioritised increasing food production. It is an ambition that the agricultural policy instruments should be organised in such a way that, within economic, environmental and trade-policy-related frameworks, they contribute to increasing production where this is possible and in line with market demand. There is a potential conflict between the goals of increasing food production and measures that are beneficial to pollinators. Considerations for differing goals must therefore be weighed against each other when following up the strategy.

2.2 National and international goals for biodiversity

Biodiversity is the foundation for human life on earth. Well-functioning ecosystems are vital for stability, welfare and growth. Natural systems

purify the water and the air, recirculate nutrients, stabilise the soil, moderate flooding, store carbon, protect against erosion and provide for the pollination of plants.

The UN's sustainable development goals (2015) set guidelines for sustainable development up until 2030, and goal 15 is particularly relevant in this context:

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

The subgoals in the UN's sustainable development goals harmonise with the Aichi biodiversity targets set by the UN Convention on Biological Diversity (CBD).¹

Norway's national biodiversity targets are based on and follow up the international obligations:²

- Achieving good ecological status in ecosystems (including that they supply ecosystem services)
- Safeguarding endangered species and habitat types
- Maintaining a representative selection of Norwegian nature (the conservation of areas covering the whole range of habitats and ecosystems) for the benefit of future generations.

2.3 Goals and focus areas for the national strategy

The national targets, together with international obligations, sector goals and objectives in legislation, establish an overarching vision. The objectives of the national strategy are anchored in these targets.

Primary goal and focus areas for the national strategy:

Ensuring viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems

Increasing knowledge

Increasing scientific knowledge about trends in pollinating species and habitats, what characterises good habitats, threats and effective actions.

Good habitats

Preventing habitat loss and increasing the extent of continuous good habitats for pollinators throughout the life cycle.

Communication

Communicating up-to-date information about pollinators and pollinator-friendly actions to all target groups.

The primary goal of the national strategy is to ensure viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems. This involves creating conditions for a varied landscape with a diversity of habitat types that provide pollinators with good habitats, including places to live and access to food. This is necessary in order

to sustain the natural service that pollinators provide in aspects of food production and in natural ecosystems.

In order to achieve this goal, focus will be directed to increasing scientific knowledge, ensuring good habitats and communicating information to all target groups.

¹ In 2010, the UN Convention on Biological Diversity (CBD) adopted the Aichi targets, whose objective is to halt biodiversity loss in order to ensure that ecosystems are robust and that they provide essential ecosystem services.

² Report to the Storting 14 (2015–2016)



Photo: NIBIO/E. Fløistad

3 Increasing knowledge

While there is sufficient scientific knowledge to implement targeted actions, it is also necessary to find out more about long-term trends in pollinating species, populations and habitats, more about the threats, and more about which actions are most effective. Therefore, efforts must also be directed towards relevant research and monitoring in order to increase knowledge in these areas.

3.1 International knowledge status – IPBES

The IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), which has 123 member states, was established in 2013 on the same model as the UN climate panel. Its objective is to strengthen cooperation between research and administration, and to help prevent the loss of biodiversity and reduction in the value of ecosystem services. In 2016, the IPBES presented a thematic report on pollination and its importance for food production,¹ summarising

existing worldwide knowledge on pollination. The main message of the report concerns primarily the value of pollination to food production, status and trends in pollinators and their habitats, and driving forces behind changes and threats. It concluded that pollinators are under increasing pressure due to human activity and climate change, and that wild pollinating insects have been reduced in terms of diversity and distribution in North America and north-west Europe.

➤ Increasing knowledge

Increasing scientific knowledge about trends in pollinating species and habitats, what characterises good habitats, threats and effective actions.

➤ Good habitats

Preventing habitat loss and increasing the extent of continuous good habitats for pollinators throughout the life cycle.

➤ Communication

Communicating up-to-date information about pollinators and pollinator-friendly actions to all target groups.

¹ https://www.ipbes.net/sites/default/files/downloads/pdf/individual_chapters_pollination_20170305.pdf

3.2 Existing national knowledge sources

When planning and implementing various actions in the natural environment, it is vital to know where important natural assets can be found. This is being addressed by surveying and presenting natural assets in such solutions as *Artskart*, *Naturbase* and *Kilden*. These are all important sources of information about pollinating insects and the natural locations in which they can be found. Even though there has been a considerable effort in recent years to build up the knowledge base on the distribution of habitat types and species, significant gaps in knowledge remain. It will therefore be important to continue with the development of monitoring programmes going forward, in order to observe trends and follow up by means of targeted actions.

In the work of surveying natural assets, special priority has been given to surveying habitat types that are endangered, that are important for many species, that provide key ecosystem functions or that are particularly poorly surveyed. Priority will also be given to areas where surveying is of particular societal benefit, including areas with high activity and substantial expansion pressure. Many of these prioritised areas are important for pollinating insects.

Safeguarding pollinating insects in the long term places particular requirements on the quality and condition of habitats for the species concerned. In order to observe the status and development of the condition of ecosystems, good monitoring systems are needed. Report to the Norwegian Parliament 14 (2015–2016) *Natur for livet – Norsk handlingsplan for naturmangfold* (“Nature for life – Norway’s national biodiversity action plan”) states that the Government will ensure representative monitoring of the ecological condition of all main ecosystems.

Existing surveys and monitoring

The Norwegian *Artsprosjektet* (“Species Project”) was established in 2009. It is believed that there are about 55,000 species currently living in

Norway. So far, nearly 44,000 of these have been scientifically described and named. Nevertheless, there is a considerable lack of fundamental scientific knowledge about very many of these species. The Species Project was set up to fill these gaps in knowledge and to build scientific expertise so that we will be better equipped in the future to survey our biodiversity. The Norwegian Biodiversity Information Centre is responsible for implementing this project.

Since the launch of artsobservasjoner.no,² the significance of voluntary efforts to survey pollinating insects has been increasing, and such work is now very important for knowledge about these species. Over the last five years, volunteers have been responsible for 65 per cent of all documented sightings of bee species.³

The Norwegian Nature Index shows the status and development of Norwegian ecosystems based on selected indicators. In order to depict the condition of the “open lowland” ecosystem (all semi-natural land below the forest limit), indicators such as bumblebees and butterflies and the condition of fields rich in grasses and flowers and coastal heaths are used.

Data from the monitoring programme *Area-representative monitoring of butterflies and bumblebees* is used as basic data for finding the indicator value for butterflies in the Nature Index. These surveys are carried out in open grassland and woodland in the lowlands by volunteer recorders, and monitoring has continued since 2009 in Østfold, Vestfold, Trøndelag, Rogaland and Vest-Agder.

As cultivated land is a rare land type in Norway, insufficient information about it has been gathered so far in the area-representative monitoring programme. Therefore, the *3Q programme* was established in 1998 to record such elements of the agricultural landscape as narrow border strips, habitat islands in fields and residual habitat patches. The programme focuses

² www.artsobservasjoner.no is an important tool for recording species, in both the professional and voluntary fields. The information generated is used by researchers and the administration in Norway, and it contributes to revealing trends and developments in biodiversity.

³ Source: the Norwegian Biodiversity Information Centre

on monitoring land areas, but also includes the collection of plant data from a number of permanently marked monitoring squares.⁴

In 2012, the Norwegian Biodiversity Information Centre issued *Alien species in Norway – with the Norwegian Black List*. The next revision of these assessments is due to be published in 2018, and the Storting has determined that future editions should appear every five years.

A total of 2,320 alien species have been recorded in Norway. The Biodiversity Information Centre has assessed 1,180 of these to determine whether they constitute an ecological risk to local species and habitat types. In addition, 203 so-called threshold species – species that have the potential to become established in Norway – were assessed. A total of 217 of the 1,180 species were considered to constitute a high or very high ecological risk, thereby qualifying to be placed on the Norwegian Black List.

Long time series do not exist for the monitoring of alien species. There is a need for more systematic surveying and monitoring of alien species and their effect on pollinators and their habitats.

In order to collate information about mapped natural assets and make such information more accessible to the general public, the Government is now following up on the Parliament's request to reinforce the work on nature surveying and the establishment of an *ecological base map* for Norway. The ecological base map is not one specific map, but a collection of mapped ecological and environmental information that includes verified information about habitat types, species and landscape types. Such map data is held by the environmental administration, scientific environments and various sector authorities. The intention is that this information, when brought together, will provide an ecological base map for Norway, providing the basis for an evidence-based administration of Norwegian nature.

3.3 The need for knowledge about pollinators and pollination

Very little research into pollination has been conducted in Norway, compared with other Nordic countries. Although international research has been carried out on the subject, it is unclear whether the conclusions reached also apply to Norway, as pollinator communities and the environment can be very different here compared with elsewhere. There are also major variations within Norway, e.g. between the lowlands and mountainous areas, and between south and north.

The Research Council of Norway is running a number of relevant programmes aimed at gathering the knowledge needed (cf. Appendix 2). Improved cooperation between the research environments is desirable. There is also a need to train more experts in taxonomy (the classification of species) and to train more specialists and volunteers who can take part in fieldwork. New technologies and new communication platforms can open up new opportunities for identifying species and reporting observations.

3.4 The need for monitoring

Our knowledge about how pollinator communities have changed over time, and the factors underlying any changes, is limited. In order to follow trends and measure the result of the national strategy, there is a need for programmes for monitoring pollinators, habitats and pollination as an ecosystem service. Such monitoring may reveal trends and increase knowledge about the interplay between pollinators, influencing factors and their surroundings, as well as changes to land areas that are good habitats.

For open lowlands, researchers indicate that there is a need for a better and more area-representative data basis for many of the indicators included in the Nature Index. Changes in farming practice are the biggest influencing factor for open lowlands, but at present there is no area-representative data that can distinguish between these changes.

⁴ Monitoring cultural landscapes in agriculture. <https://brage.bibsys.no/xmlui/handle/11250/2422365>

There is a need for more scientific knowledge in areas such as the following:

Increasing knowledge about species and habitats

- distribution, density and population trends for important pollinators
- pollinators' biology and requirements regarding habitats
- how pollinators are affected by the development of important habitat types, including endangered habitat types such as semi-natural meadows, coastal heaths and sandy areas. Methods for monitoring are needed, and are currently being developed for some of these habitat types

Increasing knowledge in order to reduce threats

- the effect of parasites, diseases, pesticides, environmental toxins and alien species
- The relative significance for pollinators of land-use changes caused by agriculture, infrastructure development, energy measures, industrial activity, residential construction, etc.
- the effect of climate change, e.g. on hibernation and changing flowering times for important species
- competition and disease transmission between domestic bees and wild pollinators

Increasing knowledge about actions

- determining optimal targeted, cost-effective management of various habitat types and areas, and the development of ecological relationships in the landscape
- documentation on the effect of instruments and actions that have been implemented

With regard to wetlands and mountainous areas, there is a great need to monitor indicators from a wider range of species that are important for being able to comment on the conditions in these ecosystems, and in particular for invertebrates. Better monitoring data for pollinators is also needed for forested and urban areas.

By adding insect monitoring to 3Q⁵ squares, it will be possible to link land-area information and species data in cultural landscapes in agriculture, and also obtain information about the history of

The Flowers and the Bees - Solutions and Tools for Integrated Sustainable Planning to Safeguard Biodiversity in Urban Landscapes (2018–2022): Project financed under MILJØFORSK, Research Council of Norway

The project will investigate:

- how much consideration is given to pollinators and biodiversity in urban development
- the distribution of and interaction between plants and pollinators in flower meadows and other species-rich areas with varying degrees of urbanisation
- how to establish new areas with high diversity of plants in the most effective way possible

The results will be used to create a tool for urban development processes with increased attention to biodiversity. The project partners are NIBIO (the Norwegian Institute of Bioeconomy Research), Rurális (the Institute for Rural and Regional Research), NTNU – the Norwegian University of Science and Technology (Centre for Biodiversity Dynamics), University of Reading, University of Helsinki, WWF, University of Oslo, the Norwegian Society for the Conservation of Nature, Bioveier i byen (Urban Bio-routes) and Trondheim municipality.

the land areas being surveyed. This will provide a basis for answering many of the research questions mentioned above. The fact that annual variations in weather and climate can have a substantial impact on pollinator numbers and make it difficult to measure the effect of actions is a challenge.

There is a general need for a more detailed assessment of how existing surveying and monitoring programmes can meet the needs for knowledge mentioned above, and of where there is a need for enhancement.

3.5 The need for knowledge about the effect and formulation of actions

We need to know more about what actions must be taken in order to ensure a continued diversity of pollinators. Many of the actions

5 Monitoring cultural landscapes in agriculture. <https://brage.bibsys.no/xmlui/handle/11250/2422365>

From grass field to flower meadow



Photo: Ellen Svalheim

The NIBIO Landvik project “From grass field to flower meadow”, run in partnership with the Norwegian Agricultural Extension Service, has two objectives: (1) gaining knowledge about strategies to increase the diversity of flowering meadow species and wild bees by depleting nutrients in grass-dominated agricultural areas and green spaces, and (2) improving access to seeds of indigenous populations of selected flowering meadow species. The project is directed at agriculture that is either dependent on insect pollination for its production or where those involved wish to start the production of flower seeds, gardeners in public or private parks, greenkeepers on golf courses, and the agricultural and environmental administration at various levels.

NIBIO Landvik has received support from the Norwegian Agriculture Agency’s Climate and Environment Programme and the Aust- and Vest-Agder Expertise Fund to develop into a national centre of expertise for flower meadows.

in this strategy are aimed at improving the management of various land areas and providing conditions for flower meadows and other habitat types that are important for pollinators. Reducing threats from pesticides and harmful alien species are also effective actions. There is a need for better documentation of the effect of many of the instruments and actions that have been implemented; we do not know whether these actions are sufficient or whether we need to take other additional steps. Increasing cooperation between research environments, the administration and the private sector can help to

improve scientific knowledge about the effect of the actions and how they can be improved.

Furthermore, we need more practical information in order to make the actions as cost-effective as possible. Such information could include scientific knowledge about the management of land that is important for pollinators, e.g. verges. For example, flower meadows are most easily developed on nutrient-poor land, and therefore there is a need for additional knowledge about methods for stripping nutrients from nutrient-rich land, and how to increase the production of pollinator-friendly native flower seeds. A large proportion of commercially available flower seeds come from abroad. We have limited information about how use of these seeds affects biodiversity.

All sectors that have an effect on the environment have a responsibility for obtaining knowledge about their own effect and effect level, and for researching and obtaining knowledge about actions, instruments and other solutions in order to help to achieve national climate and environment goals.

The environmental administration

The Norwegian Ministry of Climate and Environment is responsible for monitoring the overall state of the environment and reporting on the achievement of targets in the area of climate and the environment. In 2017, the Expert Committee for Ecological Condition presented proposals for a unified knowledge system for the assessment of good ecological condition to the Norwegian Ministry of Climate and Environment. The Ministry will review the recommendations in the report and consider how the work can be followed up. The intention is that the new knowledge system should contribute to a more unified and ecosystem-based administration, and improve the prioritisation of actions and instruments that overall help us to reach our national targets, i.e. for ecosystems to be in good condition. Consideration of how ecosystems and habitats for pollinating insects are to be included in this knowledge system will be one of the assessments to be made by the Ministry.



Phacelia is used as green manure for soil improvement, and its flowers are beneficial for pollinating insects. It is vital to increase knowledge about the correct management of field margins. Photo: Eivind Krey Nitter

The agricultural sector

Within the agricultural sector, there is a need to develop knowledge about which land-management types and actions are most cost-effective for improving conditions for pollinators. Existing research provides a relatively good knowledge base for proposing actions that may benefit pollinators in the agricultural landscape. One important consideration is that coordinated planning of multiple actions in a wider landscape context has proved to be more successful than actions applied piecemeal.

The cultural landscape must provide both places to live and access to food throughout the season, and a network of habitats is needed in order to avoid the isolation of populations and consequent inbreeding. Better knowledge is needed about which habitats are lacking, so that actions can be as targeted as possible, both in agriculture and in other sectors.

The options for monitoring pollinators in the cultural landscape are to be assessed under the 3Q programme.⁶

The Norwegian Food Safety Authority is responsible for the approval of pesticides for use in Norway. When assessing such chemicals, there is a need for more scientific knowledge about particularly Norwegian conditions that must be taken into consideration, and about how pressure on pollinators can be reduced.

To ensure an evidence-based administration of the beekeeping industry in the future, there is a need for more knowledge about monitoring and combating diseases in domestic bees.

The transport sector

The sector's main objective is to provide a safe transport system that encourages value creation and contributes to a changeover to a low-emissions society. Consideration for pollinators is one of many such considerations in the sector, and it is therefore important to have sufficiently reliable information in order to be able to take actions without impacting on other considerations, such as traffic safety and the reduction of alien species. There is a need for more scientific knowledge about which actions are best suited for pollinators in traffic areas, for example from surveying, pilot projects and evaluation. Furthermore, additional knowledge is required about the socio-economic consequences of such actions.

The Norwegian Public Roads Administration has surveyed road verges with high botanical biodiversity that should not be subject to the same management as other land areas. These areas will come under special, adapted management, such as only being mown once (in August). Avinor has surveyed biodiversity at its airports, and such surveys will be updated as needed.

The municipal sector

Within the municipal sector, there is a need for greater scientific knowledge about how

⁶ Programme for status monitoring and verifying results in cultural landscapes in agriculture.

the municipalities can contribute to improving conditions for pollinators. This will include both the public and private green infrastructure, along with urban environments such as parks, streets and squares containing elements of vegetation. By bringing together practical experience from many municipalities, it will be possible in time to develop sound methods for ensuring consideration for pollinators in the municipalities.

3.6 Actions to increase knowledge

The Government wishes to direct commitment to increasing scientific knowledge about pollinating insects, what constitutes good habitats, threats and threat trends, and regarding effective actions:

- Relevant sectors are to work to strengthen monitoring of pollinating species and land areas that are important for pollinating insects through relevant programmes and systems, such as Artsprosjektet, surveys of habitat types, Natur i Norge, Naturbase, ecological base maps, Kilden and 3Q⁷
- The voluntary sector is encouraged to use the artsobservasjonar.no portal to report observations of pollinating insects
- The environmental authorities will work to continue and develop the national monitoring programme for butterflies and bumblebees
- The environmental authorities and relevant sectors are to provide guiding signals about the need for additional scientific knowledge to their knowledge institutions and agencies. The Research Council of Norway is preparing will follow up the strategy within relevant programmes
- The agricultural sector is to increase scientific knowledge about practical solutions and actions that agriculture can use to ensure the provision of good habitats for pollinators
- The transport sector will continue to develop scientific knowledge about correct habitat management and increase scientific knowledge about pollinating insects and important habitats alongside transport arteries
- The municipal authorities should improve their own awareness about how they can improve conditions for pollinators in the green infrastructure
- Increasing collaboration between research environments, as well as the business and administrative sectors, in order to fill gaps in knowledge
- The administration is responsible for evaluating the effects of actions and subsidy schemes

7 Programme for status monitoring and verifying results in cultural landscapes in agriculture



Willow is an important food source for pollinators in early spring. Photo: Steffan Jönsson

4 Good habitats

Based on the current scientific knowledge about the status of pollinators, the threats they face and their needs, securing continuous habitats that are functional throughout the life cycle has been highlighted as a key focus area. Suitable habitats are characterised by good access to a variety of flowering plants and places to live, along with an absence of harmful foreign materials and alien species. Examples of such good habitats are provided in the box on page 13.

4.1 The private sector

All private landowners can help to create good habitats, such as on areas connected with agriculture, industry, hotels, housing cooperatives, kindergartens, parks and gardens, etc. Such areas are often planted and managed, and with some adjustments in planting and management, they can become good habitats for pollinators.

4.2 The environmental administration

The environmental authorities currently contributes to maintaining and improving habitats

for wild bees and other pollinating insects across all sectors and ecosystems. Cooperation with the agricultural administration is vital, as many of the habitats for pollinators in agricultural areas are dependent on management and restoration. Various legal and financial instruments within the environmental administration are currently used to safeguard nature that is prioritised by the authorities, such as the scheme UKL, *Selected Cultural Landscapes in Agriculture* (described below).

The most important legislation within the field of environmental administration is the Norwegian Nature Diversity Act. This law regulates the management of species, land area protection, invasive alien organisms and selected habitat types, and it safeguards habitats for prioritised species.

Action plans or technical reports have been drawn up for certain pollinator species and habitat types that are important for pollinating insects. This

applies to *Osmia maritima* (endangered), *Andrena hattorfiana* (critically endangered), and a common technical report for three endangered species of bumblebee: the great yellow bumblebee (*Bombus distinguendus*), the short-haired bumblebee (*Bombus subterraneus*) and *Bombus quadricolor*. The proposed action plan in the technical report for bumblebees highlights actions at a national, landscape and locality level that can help to maintain populations of these species. It also points out that the actions concerned are beneficial for many other pollinating insect species. Monitoring is usually also included in the action plans. Natural pastures have been mapped in Naturbase, with almost 7,000 localities mapped, including one area of 300 km². A technical report and action plan have been prepared for this species-rich habitat type.

Land areas that are protected and that may be of particular importance for pollinators in Norway make up only a small part of the total protected land area. In some habitat types within the protected areas, land management is ongoing, for instance as an initiative to combat harmful alien species, to prevent the land becoming overgrown, and in general to safeguard the protected area.

The Norwegian Environment Agency leads a directorate group that, in the course of 2018, will prepare a joint proposal for instruments to be used to safeguard endangered habitat types and species. This will form the basis on which the Government can select instruments that are as effective as possible.

The environmental authorities have a dedicated subsidy scheme for *endangered habitat types* and *endangered species*, including *selected habitat types and prioritised species*. The county governor's environmental protection department administers the subsidy scheme for selected habitat types and endangered species. There is some coordination with the agricultural subsidy schemes that have partly overlapping objectives (Regional Environmental Programmes, RMP, and Special Environmental Measures in Agriculture, SMIL). Such coordination has proved to be highly effective.

In 2018, the Norwegian Environment Agency launched a new scheme providing subsidies for actions to benefit wild pollinating insects. Land management and other measures that contribute to creating areas where multiple endangered or Red-Listed species are present will be prioritised.

UKL, *Selected Cultural Landscapes in Agriculture* is a joint initiative between the agricultural and environmental authorities to ensure a long-term

➤ Increasing knowledge

Increasing scientific knowledge about trends in pollinating species and habitats, what characterises good habitats, threats and effective actions.

➤ Good habitats

Preventing habitat loss and increasing the extent of continuous good habitats for pollinators throughout the life cycle.

➤ Communication

Communicating up-to-date information about pollinators and pollinator-friendly actions to all target groups.

Selected habitat types and prioritised species

The selected habitat types and prioritised species are managed in accordance with targeted action plans that build on existing knowledge about the habitat types and species concerned. As of 2016, there are 13 prioritised species, one of which can be considered to be a pollinator: the chequered blue butterfly (*Scolitantides orion*). The flower-rich selected habitat types that are particularly important for pollinating insects are traditional hay meadows and coastal heaths, and to some degree mires/fens traditionally used for haymaking.¹ Some 930 areas of coastal heath have been registered. A dedicated action plan has been drawn up for coastal heaths, and since 2010 subsidies have been granted from the environmental administration to safeguard them.

- 2,500 traditional hay meadows have been registered in Naturbase
- By means of the subsidy scheme for endangered habitat types (environment) and the regional environment programme (agriculture), the environmental and agricultural authorities are helping to maintain approximately 40 per cent of all traditional hay meadows registered.

¹ Mires/fens traditionally used for haymaking are often home to large numbers of orchids of various species. This is a group of plants that has a specialised interaction with pollinators.



Cattle grazing on a flower meadow in Østfold.
Photo: Eivind Krey Nitter

management of selected cultural landscapes of particular biological and cultural-historical value. The scheme was expanded from 22 to 32 areas in 2017, with a plan for a further 13 areas up until 2020.

The environmental authorities also administer subsidies for actions to promote biodiversity in valuable cultural landscapes (in addition to UKL). The subsidy scheme applies to approximately 280 prioritised cultural landscape areas. The areas are mapped in Naturbase in the dataset *Helhetlige kulturlandskap* ("General cultural landscapes"). The scheme can also be used for actions to protect, safeguard or establish habitats for pollinating insects.

In order to look after species-rich agricultural land areas that are no longer in active use, *land management agreements between the environmental authorities and landowners* is an instrument used to protect important habitats. Various subsidy schemes, e.g. for endangered nature or particularly valuable cultural landscapes, can be used to safeguard habitats.

The schemes for selected habitat types and prioritised species also contribute to protecting biodiversity across sectors, for instance through land management agreements and incentives, as well as requirements that local planning authorities take extra consideration during planning processes.

4.3 The agricultural sector

The primary goals of agricultural policy in Norway are ensuring food security, promoting agriculture throughout the country, increasing value creation and facilitating sustainable agriculture with lower emissions of greenhouse gases. The agriculture and forestry sector is important for safeguarding good habitats for pollinators. Management methods such as the use of uncultivated pasture, crop rotation and organic farming, and the production of fruit, oil crops and legumes can be beneficial for pollinators. Furthermore, the management of verges, vegetation zones, grass-covered waterways and other uncultivated areas, along with semi-natural meadows and hay meadows, is vital in order to avoid the loss of habitats and safeguard pollinator diversity. The current management of isolated hay meadows and other species rich semi-natural sites as a preservation measure is important, but actions in surrounding areas are also required. The meadows usually constitute pollinating insects' nectar and pollen resources, while the surrounding land areas cover other needs (reproduction, growth, shelter).

Commercial enterprises have an important role to play in achieving this. Often, minor adjustments in land management, and doing things differently, can help to create good habitats. Such actions need not involve additional costs. Cooperation between parties, in both the public and private sectors, is important in order to prevent loss of habitats and to safeguard pollinator diversity.

Producers of fruit and oil crops, who need both domestic and wild pollinators to produce those crops, are in an excellent position to provide pollinator-friendly vegetation on their farms.

Instruments that contribute to preserving the agricultural landscape will have a beneficial effect for pollinators. A decline in the areas of valuable semi-natural land should be avoided, and traditional management of ancient meadows, coastal heaths and other old semi-natural land types must be encouraged. Farming systems such as the use of unfertilised land for pasture provide a varied, open and flower-rich landscape

that is valuable to pollinators. Organic methods of production can also help to provide good habitats and have a beneficial effect for biodiversity. The use of crop rotation with pollinator-friendly cultivation, such as oil crops and legumes on land otherwise used for cereals, will both provide increased access to food for pollinators and be beneficial for the soil structure, for plant conservation and for the content of organic material in the soil.

UKL ("Selected Cultural Landscapes in Agriculture") is a joint initiative between the agricultural and environmental administrations (described in more detail in section 4.2). The scheme is voluntary, and it ensures that these landscapes are well maintained through active agricultural use.

General, national schemes such as *Areal- og kulturlandskapstilskot* ("Land area and cultural landscape subsidy") primarily help to maintain agricultural land in its current condition, whereas regional and local instruments such as *Regionale miljøprogram* (RMP, "Regional Environmental Programmes") and *Spesielle miljøtiltak i jordbruket* (SMIL, "Special Environmental Measures in Agriculture") are applied where a particular effort to safeguard rare natural assets is necessary.

Coordination of the subsidy schemes within the environmental administration that have partly overlapping objectives with subsidy schemes within the agricultural administration is discussed in section 4.2 above.

Beekeeping also plays an important role in pollination, and it is covered by various subsidy schemes. The Norwegian Parliament has requested that, in connection with the work on this strategy, an assessment be made as to whether the lower threshold for production subsidies for bee colonies should be reduced from the current level of 25 hives.¹ The committee believes this will help to increase food production and contribute to a higher level of self-sufficiency in honey. The arrangement of this subsidy is dealt with in the agricultural

agreement. The agricultural agreement is an industry agreement that prioritises commercial producers rather than hobbyists. For beekeeping, enterprises operating at least 25 hives are covered by the subsidy. If the enterprise receives a production subsidy on another basis, there is no lower threshold. The Government believes that the goal of increasing production will be best achieved by supporting those who produce large volumes of honey. The current regulations for the subsidy prioritise those with commercial beekeeping operations. The Government believes that that should remain the case.

The Regulation on Pesticides, which regulates the approval, sale and use of pesticides in Norway, has been laid down by the Norwegian Ministry of Agriculture and Food. The Regulation implements EEA regulations on the approval and sustainable use of pesticides.

With certain pesticides, spraying at the right time is important in order to reduce the risk of negative effects on pollinators. The Norwegian Food Safety Authority performs risk-based inspection of the use of pesticides.

The Norwegian authorities participate actively in the international development of regulations and guidelines with the objective of reducing the risk of negative effects on pollinators. The Norwegian Ministry of Agriculture and Food has laid down the *Action plan for sustainable use of pesticides (2016–2020)*. The plan sets out goals and actions to reduce the health and environmental risks involved in the use of pesticides, and to reduce the use of such chemicals. It will be important to continue to build on the work that has already been started through this action plan.

The Regulation for Sustainable Forestry states that forest owners must ensure that the inherent values of important natural habitats and key biotopes are safeguarded in accordance with the guidelines in the PEFC Norwegian Forestry Standards.² This means, for example, that dead

¹ Recommendation to the Storting 251 S (2016–2017) Recommendation from the Standing Committee on Business and Industry on Change and development – A forward-looking agricultural production system

² <http://www.pefcnorge.org/>

The National Cultural Landscape Prize

Norwegian Cultural Heritage has instituted the *National Cultural Landscape Prize*, and collaborates with the Norwegian Ministry of Agriculture and Food and the Norwegian Agriculture Agency to highlight the best project each year. The county governors' agriculture departments, county authorities, farming organisations and others are proposers of candidates for the prize.

wood should as a rule be left in place, and that verges to watercourses etc. should be maintained. The municipalities are responsible for verifying compliance with the regulation. The *Subsidy for industrial and environmental actions in forestry* has a double objective: to stimulate increased value creation in forestry, while safeguarding and developing environmental assets relating to biodiversity, landscapes, outdoor life and cultural monuments in woodland areas.

4.4 The transport sector

The transport sector helps to create good habitats for pollinators alongside roads and railway lines and at airports, but these areas are also potentially hazardous for pollinating insects. The transport agencies already have various measures in place.

New and existing actions must be evidence-based and verified, and must be implemented within the frameworks for safe, efficient operation and the movement of road vehicles, trains and aircraft. Pollinators are just one of many factors that require consideration. A more differentiated and diverse land management may require changes to the current management practice and operations. This may entail increased costs, and it is important that such actions are assessed on the basis of both the socio-economic benefits and the sector's other considerations and targets.

The Norwegian Public Roads Administration and the rail network agency, Bane NOR, are responsible for many of the long transport arteries running through the Norwegian landscape. They therefore share many of the same challenges. The

habitat types highlighted in the technical basis as being important for pollinators can be found alongside both roads and railways. The agencies are already taking consideration of these areas.

Verges alongside E roads, main roads and secondary roads are mown once or twice each summer. Mowing verges should serve multiple purposes: ensuring good visibility for road users, safeguarding biodiversity (including pollinators), preventing the spread of harmful alien species, preventing the spread of field weeds to cultivated land and caring for aesthetic aspects. Road verges are broadly divided into two types: those dominated by tall-growing plants, and those dominated by low-growing plants. Verges dominated by tall-growing plants are mown early in June and again in August. Verges dominated by low-growing plants are only mown in August. This mowing schedule ensures the long-term preservation of a variety of flowering plants in road verges for the benefit of pollinators, while also preventing the spread of some invasive alien species. With such a broad division, there will always be areas requiring separate attention. For example, mowing in June reduces pollinators' access to food. However, if this mowing is not done, the floral make-up of these areas will gradually change, reducing their value to pollinators. Some mapped areas are specially managed, for instance in Romerike, where the mowing time has been changed to benefit the great yellow bumblebee, in a collaboration between the Norwegian Public Roads Administration and other parties including the municipalities and contractors.

By using the method *natural revegetation from local topsoil*, the Norwegian Public Roads Administration is helping to create new flower-rich areas on new road verges, if there are seeds from pollinator-friendly flowers in the topsoil used. This method is used where circumstances permit – for instance, the topsoil must not contain undesirable species. This often results in flower meadows that are beneficial to pollinators. On a couple of occasions, the Norwegian Public Roads Administration has also used hay containing seeds from hay meadows to create verge meadows. This action can be used

where circumstances permit, for instance where there are good flower meadows in the vicinity and where the soil is nutrient-poor and does not contain undesirable species.



Natural revegetation from local topsoil, by the E10 in Vesterålen. Photo: Astrid Brekke Skrindo, Norwegian Public Roads Administration

Pesticides are now being used less than was previously the case on road verges, but the difficulty of mowing under crash barriers and other obstacles is a problem. Attempts have been made in some parts of the country to use non-chemical methods, such as with boiling water and sugar, but it is too early to form any conclusions on their effectiveness and whether they are cost-effective.

The Norwegian Public Roads Administration has carried out a number of R&D projects focusing on road salt and its effect on lakes near roads. The National Transport Plan 2018–2029 states that the Norwegian Public Roads Administration will assess whether the consumption of salt should be reduced where this does not conflict with road safety, and that the Norwegian Public Roads Administration will continue to monitor lakes near roads.

In general, many airports provide important “open habitats” that are used by many species, including endangered species and pollinators. The vegetation includes a wide variety of habitat types, such as clover-rich man-made meadows, wasteland, coastal heaths, former natural pasture

and sandy heathland. On many airports, especially long-established ones, unfertilised or little-fertilised meadows and hay meadows can be found. Local soils with seed banks in the earth have created the conditions for species-rich flower meadows, which are maintained by means of current land management practices.

When it comes to Avinor’s airports, reports have been prepared giving specific management advice to safeguard or improve biodiversity. The reports are used in operations and project planning, where permitted by aviation considerations. Examples of actions include special mowing arrangements, preventing the spread of harmful alien species, natural revegetation after ground work, and cooperation with neighbours for the management of coastal heaths. Avinor has also carried out a survey of PFAS³ at all the airports for which it is responsible, and it has analysed a number of organisms in connection with that survey.

New, relevant actions within the transport sector could include using seeds from pollinator-friendly plants when these are commercially available and if this would be socio-economically beneficial. Avinor is also considering investigating whether PFAS accumulate in bees from hives in areas where these environmental toxins are found. New actions in the sector must be assessed in the light of the sector’s own overall societal considerations, and must be taken within the frameworks of the overarching objective of a safe transport system that promotes value creation and contributes to a changeover to a low-emissions society (cf. Report to the Storting 33 (2016–2017) *National Transport Plan 2018–2029*). In addition, new actions will be assessed on the basis of socio-economic benefit.

3 Per- and polyfluoroalkyl substances – environmental toxins that primarily come from the use of foam to extinguish fires.

The Planning and Building Act

The objective of the Norwegian Planning and Building Act is to promote sustainable development for the benefit of individuals, society and future generations, and planning in accordance with the Act is to contribute to coordinating tasks at national, regional and municipal level.

Each municipality can highlight important landscapes and habitat types in the land-use section of the municipal plan in various ways. For example, landscapes and/or habitat types can be included as green infrastructure or LNFR (agricultural, nature and outdoor recreation, and reindeer husbandry) land-use objectives. The type of land-use objective used depends on whether the land area concerned is located in an urban or built-up area (green infrastructure) or not (LNFR). Regulations on the preservation of particularly important landscapes or habitat types can be linked to the land-use objective. The municipality can also highlight important landscapes or habitat types as zones requiring special consideration with guidelines for management, preservation, etc. Land-use objectives, regulations, zones requiring special consideration and guidelines may be further specified in a zoning plan. This is a land-use plan map with ap-purtenant provisions specifying use, conservation and design of land and physical surroundings.

Provisions can be set in a zoning plan regarding the preservation of green characteristics in construction areas, such as tree-preservation areas. Similarly, it is possible for regulations to be laid down regarding plans for planting and to require that species use is consistent with consideration for biodiversity and pollinating insects, providing that the municipality has responsibility for operation and management.

The website miljokommune.no provides directions on how municipalities can give consideration to nature and the environment in their land-use planning. It also covers topics such as landscapes, green infrastructure, cultural landscapes and biodiversity.

The Norwegian Environment Agency has issued a guide: *Planlegging av grønnstruktur i byer og tettsteder, M100-2014* ("Planning Green Infrastructure in Urban and Built-up Areas").



Children from schools and kindergartens have planted edible and pollinator-friendly plants in Abels Hage, John Colletts plass, Oslo. Photo: Monica Løvdahl

4.5 The municipalities

The municipalities have primary responsibility for the management of land in Norway. In addition to their role as planning authorities, the municipalities are also responsible for the management of important areas for pollinators, such as parks, churchyards and other public spaces. Targeted administration of the municipalities' public and private green infrastructure is vital to the creation of good habitats for pollinators in cities and densely populated areas. Volunteers also represent an important resource in this work. No overview exists of what is actually being done in private gardens in this area. The Norwegian Horticultural Society, in partnership with other organisations, has communicated information to this target group through such projects as "Buzzing gardens" and "The flower menu". Cooperation between planners and various operational agencies in each municipality, as well as private landowners and gardeners, is therefore key to following up the strategy.

The municipalities as planning authorities

As planning authorities, the municipalities can prepare plans for biodiversity and green infrastructure to be included in municipal planning work. By means of such plans, it is possible to improve the continuity of pollinator-friendly vegetation in the land areas and provide guidelines that promote pollinator-friendly vegetation. Parks, natural areas, large trees, urban

spaces, green spaces and private gardens are an important part of such green infrastructure.

Plans for biodiversity and green infrastructure can include such actions as surveying various land areas, developing and establishing parks and gardens, and the management and restoration of natural areas. The municipality can create a strategy for pollinating species that is incorporated into the various sector plans and plans in accordance with the Norwegian Planning and Building Act.

The municipalities as operational management

Consideration for pollinators should be built in to day-to-day operations, and the municipalities' operational agencies should utilise the correct methods for land management, plant pollinator-friendly vegetation in existing and new parks, open spaces and green spaces, and restore vegetation in uncultivated areas.

Examples from the municipalities

Various towns and cities have focused on bees and urban agriculture, with various voluntary organisations having set up beehives in town parks and the urban environment. This has contributed to increased awareness of the value of bees and other pollinators.

Some municipalities, such as Moss, Oslo and Trondheim, have drawn up plans detailing how they will work to improve land areas for pollinators, and the Norwegian Directorate of Public Construction and Property is also taking actions on its own land.

The energy sector

Norway has an extensive network of power lines, and the land beneath them requires regular management to prevent it becoming overgrown. Such land can be a good habitat for pollinating insects if managed correctly, i.e. in this context in a manner that promotes flowering plants that are important for pollinators. In parts of eastern Norway, investigations have been carried out to find what methods of land management produce

Moss, Trondheim and Oslo municipalities

The bumblebee plan in Moss is politically anchored and is the result of a partnership between the environmental administration and the municipality's agricultural and operational departments. It is an excellent example of how a holistic perspective can be applied to land use in a municipality.

Trondheim municipality is working systematically to improve conditions for pollinators. The municipality has implemented a plan for the use and management of valuable cultural landscapes in the municipality, including a particularly flower-rich hay meadow in a built-up area just outside the city centre. The municipality has also made agreements with landowners to have grazing animals on biologically valuable areas in Bymarka.

Oslo City Council has taken measures to safeguard, manage and develop a network of important natural assets within Oslo's construction zone. The objective is to restore and/or develop cultural landscapes, hay meadows, flower meadows and pollinator corridors.

Gamlehaugen in Bergen – Statsbygg

Statsbygg – the Norwegian Directorate of Public Construction and Property – develops projects for the state and acts as the client and property manager. One of the three primary objectives of the Directorate's environmental strategy is to contribute to local environmental solutions in its deliverables; this includes maintaining or increasing biodiversity. It cannot impose environmental ambitions on governmental enterprises above and beyond statutory requirements, but it does provide advice on environmentally friendly solutions. Actions implemented in recent years to increase biodiversity include the Fornebu area project, Pilestredet Park and Gamlehaugen in Bergen.

the greatest numbers and diversity of solitary bees. The greatest effect was observed in lower-lying areas with high levels of flower diversity. The best form of land management proved to be where branches and trees were cut and removed (Sydenham et al. 2015).

In the Life Elia project⁴ in Belgium and France, a range of actions have been taken in selected locations in order to improve biodiversity beneath power lines. For instance, flower meadows have been established under power lines to increase the number of pollinators in the area.



4.6 The Armed Forces

The Norwegian Defence Estates Agency manages large and varied areas of land throughout Norway, with the objective of ensuring good conditions for military exercises. At present a number of actions are being taken that have a positive effect on pollinating insects. Existing actions include maintaining a varied natural environment on training areas, adapting the mowing schedule on ramparts and other areas on certain fortifications so that flower-rich areas are preserved, and mowing and scrub removal on certain areas that previously were hay meadows or pastures.

In addition to this, the Armed Forces will work to

- prevent skewed distribution of wild and domestic bee populations, and reduce the number of new beehives on defence-sector land
- use plant species that are beneficial to pollinators in flowerbeds and in other planting
- increase expertise among operational staff
- adapt green land management
- prevent areas becoming overgrown by mowing and scrub removal on valuable meadow areas

4.7 Cross-sector actions

Sustainable use of pesticides

Pesticides must be used in line with the Regulation on Pesticides as enforced by the Norwegian Food Safety Authority. With certain pesticides, spraying at the right time is important in order to reduce the risks for pollinators.

Since June 2015, users of professional-grade pesticides have been required to utilise principles for integrated plant conservation. For instance, the use of methods other than chemical agents should be considered. The protection of beneficial organisms is a further principle of integrated plant conservation. All use of pesticides must be documented. A certificate of authorisation is required to purchase and use professional-grade pesticides. Integrated plant conservation is emphasised in the training.

The *Action plan for sustainable use of pesticides (2016–2020)* stipulates goals and actions to reduce health and environmental risks when using pesticides and to reduce the use of such chemicals. It will be important to continue to build on the work that has already been started through this action plan and to consider enhancing it.

Alien organisms

The objective of the Regulation on Alien Organisms is to contribute to preventing the introduction, release and spreading of alien organisms that may have detrimental consequences for biodiversity in Norway. The regulation includes an annex listing harmful alien plant species that may not be imported, sold or planted, and another annex listing harmful alien plant species that can only be planted out with permission.

The import and release of non-native bumblebees for pollination in greenhouses requires a permit pursuant to the regulation. Import permits are at present only granted in the period between 15 November and 15 February, as the risk of survival outside greenhouses during these months is considered to be low. European honey bees can be imported for beekeeping purposes without a

⁴ Information about the project can be found at <http://www.life-elia.eu/en>



Field margins in Hedmark containing pollinator-friendly vegetation. Photo: Vegard Urset

permit, provided that there is compliance with other rules and applicable regulations, such as CITES.⁵

The regulation includes a requirement to act with due care, and requires that those responsible for the introduction and release of alien species must, insofar as is possible, attempt to prevent such actions having detrimental consequences for biodiversity. This applies to actions that do not require a permit, such as the import of land plants and the sowing of flower meadow seeds on cultivated ground.

In 2007, a *national strategy to combat harmful alien species* was drawn up that is applicable to all sectors. Private individuals, organisations, municipalities and county governors all contribute to the work of combating the spread of harmful alien species. A national action plan to combat the invasive species *Rosa rugosa* followed in 2013. There are a number of regional action plans to combat alien species such as lupins.

The environmental administration also contributes budgetary funds via various county governor positions to combat harmful alien species. The Norwegian Environment Agency administers a subsidy scheme under which organisations and

private individuals can apply for funds for actions such as surveying, combating and information work: *Subsidy for actions to combat alien organisms*.

Through the UKL scheme ("Selected Cultural Landscapes in Agriculture"), funds are also granted for combating harmful alien species in selected areas. The SMIL scheme can also be used to combat harmful alien species in the cultural landscape.

By way of follow-up to the biodiversity report, in 2019 a *joint action plan to combat harmful alien organisms* will be drawn up. This cross-sector strategy will be pursued and will form the basis for the action plan. The action plan will propose priorities and actions in order to achieve greater commitment and improved targeting and coordination of efforts to combat harmful alien organisms up until 2024. In order to protect vulnerable natural assets, a number of alien plant species will be removed from priority protected areas and other important areas, such as sand dunes and endangered habitat types in the cultural landscape.

Access to flower seeds

When sowing seeds on roadside embankments and other areas, it is desirable to use plants that are beneficial for pollinators. When establishing meadows on a small scale, the use of local hay from nearby flower meadows is preferred. In recent years, a need has been expressed in various quarters for seed mixes for use on a larger scale. The problem is that very few Norwegian-produced meadow-flower seed mixes are available. The private sector has indicated a need for clarification of the regulations, such as a definition of "indigenous" in the Regulation on Alien Organisms.⁶ The regulation regulates how seeds from various areas can be used. The use of Norwegian seeds in areas regarded as parks, transport and industry development areas and other cultivated areas generally does not require a permit.

⁵ The Convention on International Trade in Endangered Species of Wild Fauna and Flora, as regulated in Norway by FOR-2002-11-15-1276

⁶ FOR-2015-06-19-716, Norwegian Ministry of Climate and Environment

It is necessary to increase access to regionally produced pollinator-friendly seed mixes that come from the region in which they will be sown and that feature species that flower throughout the pollinators' flying season. Therefore, information about how these can be propagated is also required.

4.8 Actions for good habitats

The Government wishes to direct efforts to prevent loss of habitats and to increase the extent of continuous good habitats for pollinators throughout the life cycle.

- The private sector is encouraged to consider pollinators when managing land
- The environmental and agricultural sector will continue to facilitate the conservation and correct management of good habitats for pollinators
- The Norwegian Environment Agency and the Norwegian Agriculture Agency will clarify what actions the administration can take to facilitate the production of and access to pollinator-friendly flower seeds
- The environmental administration will create action plans for endangered species where these are the most appropriate instrument, and will consider other actions, such as cross-sector management plans and pilot projects, to ensure the provision of good habitats and to protect pollinators
- The agricultural sector will continue to encourage pollinator-friendly farming systems
- The transport sector will give consideration to pollinators in the management of verges alongside transport routes, within the bounds of the sector's other societal considerations
- The Armed Forces and the energy, health and educational sectors are to prioritise consideration for pollinators in their land management
- Builders of roads, railways, transmission lines, buildings and facilities, and other infrastructure should utilise natural revegetation from local topsoil where appropriate, or sow pollinator-friendly seed mixes where these are commercially available
- The municipal authorities should give consideration to pollinator-friendly development and administration of municipal green infrastructure
- The municipal authorities should give consideration to pollinator-friendly land in municipal land-use planning, such as through thematic municipal master plans on biodiversity
- All sectors are to follow up *the National strategy against invasive alien species*. Measures aimed at combating such threats will be strengthened by means of a new action plan
- All sectors are to work to reduce the use of chemical pesticides and the risk of using such chemicals in line with regulations and the *Action plan for sustainable use of pesticides*



Bumblebee on a hollyhock. Photo: Lajla T. White

5 Communication

Various corporate groups, private and public enterprises and private individuals currently manage land with the potential to become good habitats for pollinators. Therefore, effort must be focused on communicating information to these target groups about pollinator-friendly actions and pollination as an ecosystem service.

Anyone who manages an area of land can make a difference for pollinators. This includes farmers, forestry enterprises, municipalities, transport agencies, the Armed Forces, schools and kindergartens, private gardeners, etc. In order for the actions described above to be successful, it is necessary for anyone who manages areas of land to be well informed about such matters as proper establishment and land management, good plants for pollinators, invasive alien species and integrated plant conservation.




It is therefore necessary to reach out with up-to-date and quality-assured information about how the various target groups can best create good

Target groups

- Farmers, forestry enterprises and beekeepers
- Garden owners, residents of housing cooperatives
- Other private landowners
- Managers of transport land areas
- Managers of municipal and government green spaces
- Schools and kindergartens
- Managers of land areas in the defence and energy sectors
- Architects and landscape architects

conditions for pollinating insects and how to practically go about this on their land. For example, the authorities in Ireland accomplished this by setting up an online pollinator portal, bringing together guiding information for all the various target groups.



- 
Increasing knowledge
 Increasing scientific knowledge about trends in pollinating species and habitats, what characterises good habitats, threats and effective actions.
- 
Good habitats
 Preventing habitat loss and increasing the extent of continuous good habitats for pollinators throughout the life cycle.
- 
Communication
 Communicating up-to-date information about pollinators and pollinator-friendly actions to all target groups.



Kindergarten children plant out pollinator-friendly flowers in Kirketorget in Moss town centre. The children are learning about the life of bumblebees. Photo: Cecilie Kildahl

5.1 Communication measures
 The Government will direct efforts to communicate information about pollinators and pollinator-friendly practices to all target groups. The private sector and public-private partnerships will be important in conveying relevant information to the target groups.

- Industrial stakeholders will be encouraged to communicate knowledge within their own sectors
- The administration will continue to build on the established collaboration within and with the private sector
- The sectors are to communicate knowledge about land management within their own sectors
- The Norwegian Environment Agency will assess the need for reaching various target groups by collating online information and using appropriate communication platforms

Vulnerable zones in the City of Oslo

Vulnerable zones in the City of Oslo. The map shows areas where the City of Oslo does not advise placing beehives and where permits have not been granted to set up hives on the City Environment Agency's land. ByBi uses this map in courses and when providing guidance to members. Applications are invited for placing beehives on municipal land that is not in these vulnerable zones.



Illustration of actions to balance consideration for biodiversity and beekeeping.



Pollinator garden in Bjølsenparken in the Sagene district of Oslo. Photo: Nzinga Macedo

6 Implementation and follow-up

Coordinated national initiative

An important objective of this strategy is to establish common goals and focus areas for a coordinated national initiative. There has been considerable commitment from voluntary organisations to tackling the problem. A number of actions have already been initiated in both the public and private sectors, and it will be important to continue to build on these. Anyone who manages an area of land can make a difference for pollinators, and the effect of what each individual does will be reinforced by means of effective cross-sector coordination. This strategy can help to strengthen the knowledge base and target established actions, and also to identify and implement new actions that are essential in order to secure the living conditions necessary for pollinators in the long term.

Stakeholders, sectors and administrative levels

A range of stakeholders, sectors and administrative levels will play a role in implementing actions to follow up this national strategy. Some actions relate to an individual sector, whereas others relate to two or more sectors in cooperation, and some to all sectors.

The private sector has demonstrated considerable commitment to the problem at hand, and a number of actions have already been implemented by means of voluntary efforts. These stakeholders also wish to have an active role in the ongoing work in this area, and it is therefore important and continued public-private cooperation is therefore necessary.

Within the public sector, the different sectors have

varying degrees of responsibility and roles in land management. The agriculture, transport, defence and energy sectors manage land areas through legislation and subsidy schemes within their own sectors, as well as cross-sector legislation such as the Norwegian Nature Diversity Act and the Norwegian Planning and Building Act.

The environmental administration has a cross-sector role as the competent authority for the Nature Diversity Act. For the individual sectors, sector responsibility involves an independent responsibility for taking consideration of the environment in all activities, and assessing the consequences of interventions and activities.

The environmental and agricultural authorities have in common that following up the actions in the strategy will necessitate good cooperation between the agricultural and environmental ministries, as well as between the agricultural and environmental departments at county and municipality level.

The municipalities have a cross-sector role as responsible authority for the Planning and Building Act. At the same time, the municipalities are responsible for the management of land areas, such as municipal green infrastructure.

The pollinator forum

This strategy highlights three focus areas for achieving the goal of ensuring viable populations of wild bees and other pollinating insects in order to sustain pollination in food production and natural ecosystems: increasing scientific knowledge, providing good habitats and improving communication on the subject. The efforts of the public and private sectors, public-private partnerships and targeted, better-coordinated cross-sector initiatives will provide a solid framework for following up the strategy.

An enhanced national commitment requires follow-up of all focus areas in multiple sectors, as well as partnership between the various sectors and administrative levels. There is generally potential to improve cooperation within and between sectors and administrative levels in order

to secure the continuous habitats that pollinators need to survive.

In order to stimulate greater collaboration, a meeting place, or "pollinator forum", will be established for stakeholders in the private sector and those in the public sector at various administrative levels and in relevant knowledge environments. The Norwegian Environment Agency has responsibility for leading the forum.

The pollinator forum is intended to ensure that the total effect of all current and future actions will be to reinforce each other and contribute to achieving the objectives. This meeting place will contribute to:

- each sector seeking to coordinate its actions with other sectors that manage adjoining land areas, such as through cross-sector pilot projects
- research environments, the authorities, industry and the private and volunteer sectors cooperating to increase knowledge about the effect of the actions and how they can be improved
- establishing a learning arena for sharing information across sectors, administrative levels and knowledge environments
- developing and coordinating communication actions between organisations, the administration and competent technical environments so that up-to-date, quality-assured scientific knowledge is communicated to relevant target groups
- various research environments collaborating to fill gaps in knowledge
- regular compilation of information about how each sector is following up the strategy

Through the pollinator forum, the Norwegian Environment Agency will prepare a cross-sectoral action plan during 2019, in line with the sectors' areas of responsibility and priorities. The strategy has a timeframe of ten years. The need to update it will be assessed in the light of relevant new scientific knowledge.

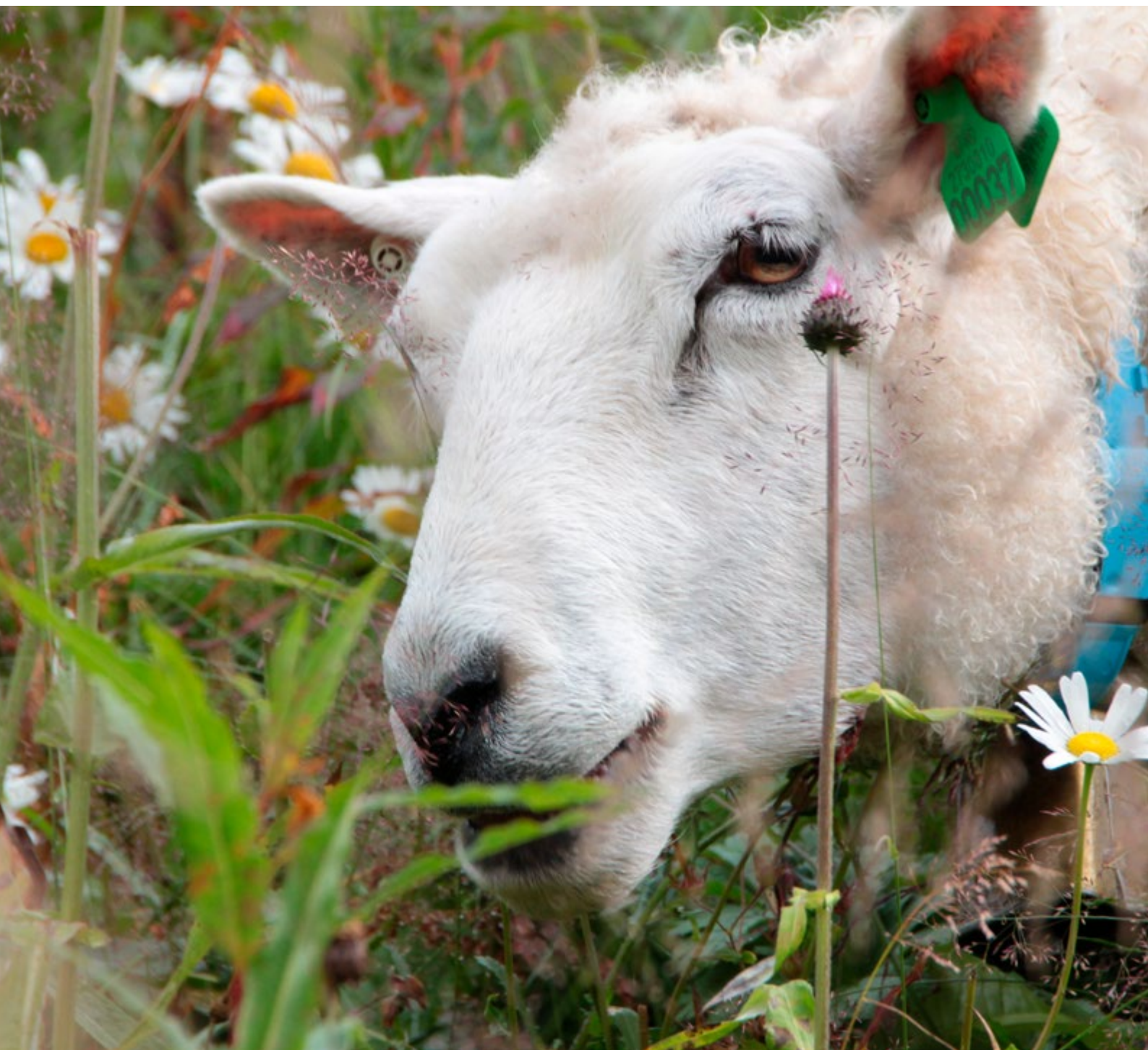


Photo: Bente Lise Dagenborg

The actions discussed in the strategy can be implemented within applicable budget frameworks. Increased administrative costs are not anticipated.

Appendices

Technical basis for a national strategy for wild bees and other pollinating insects,
Norwegian Agriculture Agency, 2017

https://www.landbruksdirektoratet.no/no/miljo-og-okologisk/jordbruk-og-miljo/naturmangfold/_attachment/65476?_ts=15c5934bb18&download=true

Tables detailing instruments and knowledge environments

TABLE 1: FINANCIAL INSTRUMENTS – THE ENVIRONMENTAL ADMINISTRATION

Subsidies for endangered habitat types	The Norwegian Nature Diversity Act makes it possible to give individual habitat types special protection by awarding them status as selected habitat types. The six habitat types that currently have “selected habitat type” status are coastal heaths, hollow oak trees, calcareous lime forest, calcareous lakes, traditional hay meadows (including wooded hay meadows) and mires/fens traditionally used for haymaking. In addition, subsidies are given for other endangered habitat types that are on the Norwegian Red List of Ecosystems and Habitat Types (2011)
Subsidies for endangered habitat types	Subsidies for actions to safeguard endangered species and prioritised species. The 2015 Norwegian Red List for Species classifies endangered species into the following three categories: Critically endangered (CR), endangered (EN) or vulnerable (VU). This covers 2,355 species
Subsidies for administrative actions in cultural landscape areas	Subsidies for administrative actions in valuable cultural landscapes that are prioritised in the National Register
Subsidies for actions for pollinating insects	Subsidies for actions for wild pollinating insects in order to safeguard or improve their habitats
Subsidies to voluntary environmental organisations and beneficial environmental foundations	The objective of this subsidy scheme is to facilitate broad popular involvement in environmental matters. The scheme is to stimulate environmental activity at local, regional and national levels
Subsidies for actions to combat alien organisms	The objective of this subsidy scheme is to support actions to combat harmful alien organisms, including surveying and the communication of information. The target group is regional, national and international voluntary organisations, institutions and private enterprises

TABLE 2: FINANCIAL INSTRUMENTS – THE AGRICULTURAL ADMINISTRATION

Cultural landscape subsidies (production subsidies)	Contributing to the management, maintenance and development of cultural landscapes in agriculture. Keeping agricultural areas in operation in accordance with applicable agricultural policy objectives
Land subsidies (production subsidies)	Achieving the goal of promoting agriculture throughout the country. Also stimulating pollinator-friendly cultivation such as oil crops and fruit
Subsidies for grazing animals (production subsidies)	Stimulating the use of grazing resources
Subsidies through Regional Environmental Programmes (RMP)	Maintaining traditional management of important semi-natural habitat types. Reducing the use of pesticides
Special Environmental Measures in Agriculture (SMIL)	Restoring important culturally impacted habitat types (investment subsidies)
Selected Cultural Landscapes in Agriculture (UKL)	Securing the long-term administration of certain selected landscape areas of particular biological and cultural-historical value. An expansion to include additional areas is currently in progress. Jointly funded by the Ministry of Climate and Environment and the Ministry of Agriculture and Food
Subsidies for organic agriculture (production subsidies and other schemes)	Increasing areas with organic production
Climate and environment programme	Increasing knowledge about environmental challenges and actions in agriculture, particularly in connection with biodiversity. Developing practical instruments for commercial enterprises
Project support through the action plan for the sustainable use of pesticides	Contributing to practically targeted knowledge development, reports and communication actions that can contribute to sustainable use of pesticides
Subsidies for beehives in production Sugar tax refunds Agricultural allowance	Stimulating beekeeping through financial support
Compensation in the event of failed honey production	Compensating for production shortfalls due to the climate, which beekeepers cannot insure themselves against
Foundation for Research Levy on Agricultural Products (FFL)/ Agricultural Agreement Research Fund	Funded from a tax on Norwegian-produced and imported food. The entire value chain is covered, including agriculture, industry and consumers. Funds are set aside annually for research from the agricultural settlement. These funds go to research projects in the agriculture and food sector

TABLE 3: FINANCIAL INSTRUMENTS – RESEARCH COUNCIL OF NORWAY AND EU	
Research Council of Norway	<p>BIONÆR – Sustainable Innovation in Food and Bio-based Industries</p> <p>MILJØFORSK – Environmental Research for a Green Transition</p> <p>KLIMAFORSK – Large-scale programme on Climate Research</p> <p>BYFORSK – Research and Innovation for the Cities of the Future</p> <p>Regional research funds/regional initiative</p> <p>FRIPRO – Funding for independent projects</p> <p>The Research Council also administers instruments that can stimulate international research collaboration</p>
EU	<p>The EU finances the world’s biggest research programme, Horizon 2020, and there are numerous EU announcements that may also be relevant. In addition, JPI (e.g. JPI FACCE) and ERA-Net (e.g. BiodivERsA) include relevant announcements</p>

TABLE 4: FINANCIAL INSTRUMENTS – PRIVATE SECTOR	
<p>Grofondet</p> <p>Founded by Gartnerhallen SA, BAMA Eiendom AS and NorgesGruppen ASA</p>	<p>Grofondet’s objective is to contribute to the “green shift” by increasing the sales value and consumption of Norwegian fruit and vegetables. The fund provides support for specific projects on application. Grants can be given for R&D projects including to PhD students, development projects initiated in the value chain, and skills development</p>

TABLE 5: A SELECTION OF NATIONAL KNOWLEDGE ENVIRONMENTS

Norwegian Biodiversity Information Centre	The Norwegian Biodiversity Information Centre is a national knowledge bank for biodiversity. Its main task is to convey up-to-date and easily accessible information about species and habitat types
NIBIO – the Norwegian Institute of Bioeconomy Research	NIBIO’s objective is to contribute to food security, sustainable resource administration, innovation and value creation within the value chains for food, forestry and other bio-based industries. The Institute provides research, administrative support and knowledge
NINA – the Norwegian Institute for Nature Research	NINA is an independent foundation that conducts research into nature and the relationship between nature and society
NMBU – Norwegian University of Life Sciences	NMBU conducts study and research into the major global questions of environment and ecology, land and resource management, sustainable development, improved human and animal health, climate challenges, renewable energy sources and food production. MINA, the Faculty for Environmental Sciences and Natural Resource Management, operates research and communication on bees and bee health. In addition, the Institute for Landscape Architecture (under the Faculty for Landscape and Society) is also relevant
Norwegian Veterinary Institute	The Norwegian Veterinary Institute specialises in biomedical emergency response planning and research. Its core activities are diagnostics, research, innovation, monitoring, risk assessment, consultancy and communication. It offers diagnostics for certain diseases of bees
NTNU University Museum	NTNU University Museum is one of Norway’s leading institutions in the field of protecting, preserving, publishing and researching natural and cultural-historical material from Norway and the rest of the world. The museum’s collections include 960,000 specimens of plants, animals and insects
University of Oslo	Research at the Institute of Biosciences at the University of Oslo revolves around understanding fundamental biological processes, from the molecular and cellular level up to population and ecosystem level. At the Centre for Ecological and Evolutionary Synthesis (CEES), research is conducted into bees and other pollinators, with a particular focus on how man-made changes affect the relationship between pollinators and the plants they pollinate, both in agriculture and in the wild
Natural History Museum	The Natural History Museum aims to be a centre of expertise and documentation of a high international standard within the fields of biological and geological biodiversity, while integrating collections, communication, research and teaching. In line with the University of Oslo’s community responsibility, the museum aims to be a supplier to the community of high-quality biodiversity information that has a strong technical basis in collection-based research





Photo: John Ingar Øverland

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