Sustainable Edge Sector Brief: Agriculture

Year 2020

Sector definition

This brief describes the Norwegian agricultural sector. The sector mainly consists of farms with crop and/or animal production, but also some directly related support services, totaling around 40,000 individual businesses.

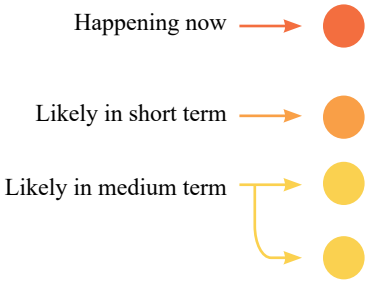
In this definition, the sector comprises the following NACE codes:

- A1.1, Growing of non-perennial crops
- A1.2, Growing of perennial crops
- A1.3, Plant propagation
- A1.4, Animal production
- A1.5, Mixed farming
- A1.6, Support activities to agriculture and post-harvest crop activities

Summary

The agricultural sector can contribute significantly to emission reductions and to reaching the goal of achieving a net zero carbon economy, primarily by reducing emissions of greenhouse gases other than CO2 (such as methane), maintaining carbon sinks, and increasing sequestration. Establishing detailed emission benchmarks is difficult due to lack of data and large variations in emission intensity and mitigation potential at the farm level. The EU taxonomy therefore identifies a series of "essential management practices" that, when implemented, are taken to indicate the delivery of substantial mitigation benefits.

Main climate and environmental risks[1]



Production is highly vulnerable to changes in rainfall and temperature

More stringent emission regulation very likely over the next decade

Risk of substantial demand changes driven by policies and norms

Further physical risks include pests and invasive species

[1] The selection of key risks and categorization of those is based on expert judgement. Short-term refers to impacts that are likely in the next decade.

!

Physical risk exposure

- Strong temperature rise will present the most dramatic challenges for the sector, which is already impacted by increased variability in rainfall and temperature
- More extreme precipitation may damage crops and farm infrastructure, and will require substantial hydrotechnical investments
- Longer and more intense drought periods reduces output and increases costs related to irrigation and animal feed, possibly forcing early slaughtering
- Increased long-term risks of pests and invasive species
- Temperature increases may also provide productivity gains due to longer growth season in some areas. Utilizing this will likely require enhanced R&D, competence building and new farm-level investments

Transition risk exposure

- More ambitious mitigation policies increase transition risks in the sector, as emissions so far have not been heavily regulated
- As a consequence of Norway's new climate policy targets, further regulation of agricultural emissions are likely over the next decade
- Farm-level measures and sector-wide R&D can contribute to emission reductions, but requires substantial investment and competence building
- There are large potential emission reductions in dietary changes away from the most emission-intensive production. In the medium term, meat and dairy demand may fall as a consequence of norm-driven behavioral changes, potentially amplified by policy change
- The sector is highly regulated and thus very sensitive to changes in domestic support structures

Key statistics & background figures

- 8.6 % of Norway's total GHG emissions are agricultural, with slightly falling trend since the 1990s (1)
- The sector is different from most others in that greenhouse gas emissions are largely due to gases other than CO2: Primarily methane from livestock production, as well as nitrous oxide (N2O) from fertilizers and crop production
- Close to 80% of Norwegian farms produce meadows for grass; around 30 and 35% producing cattle and sheep respectively, and just over 25% produce grains.

Contents

About this brief

This sector brief was developed by CICERO as a part of the Sustainable Edge research project. The purpose of the brief is to outline the key material climate-related issues for the sector. The audience for the brief is the financial sector, either as potential investors or lenders to the sector. The reader is expected to have background knowledge of the sector and of climate risk assessment. The analysis methodology is rooted in CICERO's climate science and build on CICERO Shades of Green's methodology for green bond frameworks. This brief is to be considered a science-based opinion.

CICERO Shades of Green AS is a subsidiary of CICERO established in November 2018. CICERO Shades of Green AS has commercialized a corporate climate risk assessment based partially on the Sustainable Edge research, in addition to their own methodological development.

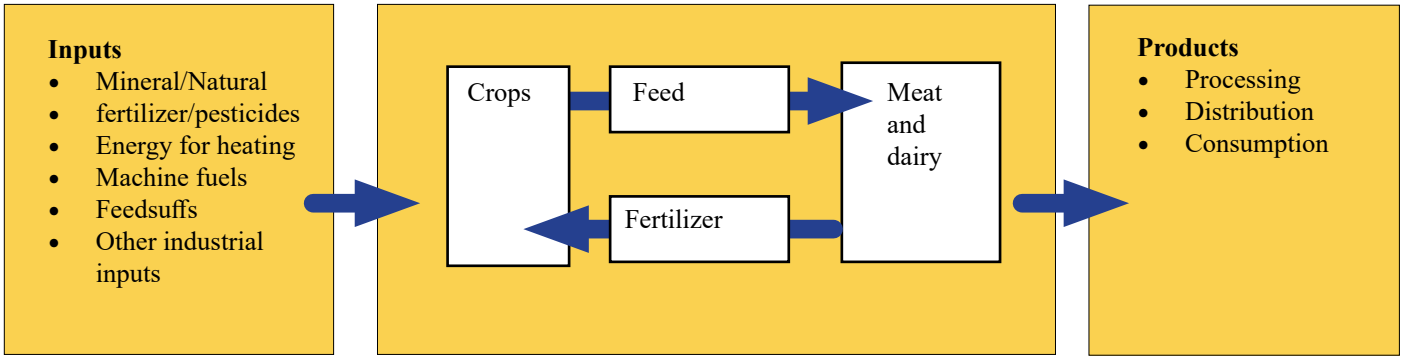
The Sustainable Edge project is financed by ENOVA SF and our financial sector partners: Oslo Pensjonsforsikring, CICERO Shades of Green AS, Nysnø, Sparebank 1 SMN, Sparebank 1 Nord-Norge, SR-Bank, Samspar and Sparebank 1 Østlandet. Thank you also to our partners Finans Norge and Schjødt.

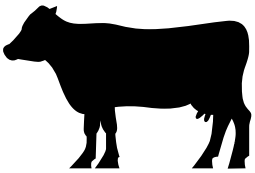
Please note this assessment focuses on climate-related issues and risks. Other environmental and social aspects may be noted, but assessing material social, ethical and governance issues are outside the scope of the assessment. We discuss governance specifically in the context of climate governance, this should not be viewed as a substitute for a full evaluation of the governance of the sector and does not cover, e.g., corruption.

CICERO Center for International Climate Research
P.O. Box 1129 Blindern
N-0318 Oslo, Norway
Phone: +47 22 00 47 00
E-mail: post@cicero.oslo.no
Web: www.cicero.oslo.no

Emissions

Main sources





NOTE: Emissions vary greatly among production types. Meat and dairy production is most emission intensive due to ruminant methane emissions, but with large internal variations. Meat from cattle raised exclusively for beef is 80% more emission intensive than meat from combined meat/dairy cattle (2)

Scope 1

Relevant emissions:

- Livestock methane (digestive processes and natural fertilizer: 2.63 Mt CO2e (1)
- Nitrous oxide from fertilizer storage and use: 1.74 Mt CO2e (1)
- Emissions from conversion of wetland to croplands:
- 0.40 Mt CO2e (3)
- Fossil fuels for machinery:
- 0.33 Mt CO2e (3)

Potential: to reduce scope 1 emissions

Largest potential in production shifts towards less emission-intensive products
Farm-level measures on a technical level:

- Improved feed and manure handling
- Biogas capture
- Avoid wetlands conversion
- Fossil fuel substitution

Practices to enhance soil carbon in agricultural land
Sector-wide measures include R&D and breeding to improve productivity

[3] Key source: Winther et al. (2020)

Scope 2

Relevant emissions:

- Purchased electricity and heat for buildings and operations (not estimated)
- Fossil fuel energy for heating: 0.05 Mt CO2e (1)

Potential: to reduce scope 2 emissions

- Energy efficiency and fossil fuel substitution in buildings, especially in greenhouse horticulture production

No specific targets for scope 2

Scope 3

Relevant emissions:

- Industrial fertilizer production
- Production of herbicides and other industrial inputs
- Indirect land-use change potentially associated with imported feedstuffs (soy etc.)
- Processing industry and distribution-related emissions
- Consumption and waste management

Potential: to reduce scope 3 emissions

- There are large opportunities for emission reductions in food waste, estimated at 1.3 Mt CO2e in total over the 2021-2030 period.
- Indirect emissions from imported feedstuffs are to some extent being addressed by feed importers.

Targets

- Target to reduce food waste included in aspirational target mentioned under Scope 1 (comprising the main part of this target)

Climate risk management

Current risk management

- There is high awareness of physical climate risk in most industry bodies, but not necessarily of likely changes in risk-factors at the farm level
- The industry has acknowledged the need to reduce emissions, and is working for the establishment of incentives to enable technical mitigation measures
- There is less willingness to accept new regulation, or to encourage or prepare for dietary changes that may impact production levels for some products (meat in particular)
- Insurance and compensation systems are in place to cover climate-related damages, but these systems may be put under pressure if weather extremes increase dramatically
- There is also a lock-in of certain production forms and types in the industry due to investments and loans for equipment and buildings. Horticulture has been less vulnerable to drought as irrigation systems were in place

Key opportunities

- Increasing consumer awareness on the environmental impact of food may increase demand for specific products and favor responsible producers
- If warming remains within manageable limits, it may contribute to productivity gains due to longer growth season and to the viability of new production forms. Utilizing this will likely require enhanced R&D, competence building and new farm-level investments

Key pitfalls

- Changes in agricultural production and food prices globally may impact Norwegian agriculture in unforeseen ways, e.g. by increasing the price of feed and other imported production inputs
- Growing need for biomass and biofuels for climate mitigation measures in other sectors may increase competition for land

Disclosure and integration of climate risk

- Disclosure of climate risk and environmental impact
- Farms provide extensive reporting on their production through the domestic support system
- Some emission-specific reporting is required to receive support for environmental measures (such as improved manure handling)
- There are currently no requirements to assess or disclose climate risks at the farm level

Integration of climate risk in operations / decisions

- The industry-standard quality control tool (KSL) incorporates some basic physical risk aspects in its farm-level quality audit procedures
- An industry-wide effort («Klimasmart landbruk») is under way to make targeted climate Agricultural Counselling (production-specific capacity building and quality control) available to farmers, including a calculator tool to assess emissions and mitigation potential
- Agricultural Counselling is or will be made available through existing agricultural consulting providers (e.g. NLR or Tine, depending on production type)

Regulations and scenario information

Policies in Norway

- So far, Norwegian agriculture has been exempted from CO2 pricing and most other climate regulation
- By 2030, Norway will be required to reduce emissions not covered by the EU ETS by 40% from 2005 levels
- As the second largest emission sector outside of the EU ETS, the agricultural sector will be under increasing pressure to reduce emissions over the next decade
- A non-binding agreement between the government and main agricultural producer organizations was signed in June 2019, committing all parties to work towards lowering emissions during the 2021-2030 period
- The government has established an aspirational goal of achieving cumulative emission reductions of 5 Mt CO2e in the agricultural sector over the same period
- The sector is highly regulated and thus very sensitive to changes in domestic support structures. Climate policy targets may trigger structural changes in production support

EU Taxonomy

The March 2020 version of the EU Taxonomy includes three sub-sectors of shipping: A1.2 Growing of perennial crops, A1.1 Growing of non-perennial crops and A1.4 Livestock production. The following activities are included in in taxonomy:

A1.2 Growing of perennial crops and A1.1 Growing of non-perennial crops that meet the following principles:

1. Demonstrate substantial avoidance or reduction of GHG emissions from production and related practices[2] ; and
2. Maintain and increase existing carbon stocks for a period equal to or greater than 20 years through the application of appropriate management practices.[3]

Production on wetlands, continuously forested areas, peatland and land spanning more then one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 % [4].
A1.4 Livestock production that meet the following principles:

1. Demonstrate substantial avoidance or reduction of GHG emissions from livestock production (including animal management, storage and processing of manure and slurry, and management of permanent grasslands)[5]
2. Maintain existing sinks and increase sequestration (up to saturation point) of carbon in permanent grassland.[6,7]

---

2. This can be demonstrated in either of the following ways: The essential management practices are deployed consistently over the applicable perennial crop production area each year OR Reduction in GHG emissions (gCO2e) in line with the following trajectory For example, a 20% reduction in GHG emissions would be required by 2030 compared to emissions in 2020, and a 30% emissions reduction would be required by 2040 compared to 2020

3. This can be demonstrated in either of the following ways:
-The essential management practices^ are deployed consistently over the applicable perennial crop area each year
OR -Above and below ground carbon stocks (tC/ha) to be increased progressively over a minimum 20-year period*
* Noting the following exception: For soils specifically, where it can be demonstrated that saturation levels have been reached, no further increase in carbon content is expected. In this case, existing levels should be maintained

4. See taxonomy for detailed description and exceptions

5. This can be demonstrated in either of the following ways: -The essential management practices are deployed consistently over the applicable livestock operation each year OR- Reduction in GHG emissions (gCO2e) in line with the following trajectory. For example, over the 10 year period of 2020-2030, a 20% reduction in GHG emissions would be required. Over the 20 year period of 2020-2040, a 30% reduction in GHG emissions would be required.

6. Permanent grassland is land used to grow grasses or other herbaceous forage, either naturally (self-seeded including 'rough grazing') or through cultivation (sown), and which is more than five years old.

7. Specifically, Maintain and increase existing carbon stocks for a period equal to or greater than 20 years through the application of appropriate management practices. This can be demonstrated in either of the following ways:
-The essential management practices are consistently deployed over the applicable permanent grassland area each year OR-Above and below ground carbon stocks shall increase progressively over a 20-year period*
* Noting the following exception: For soils specifically, where it can be demonstrated that saturation levels have been reached, no further increase in carbon content is expected. In this case, existing levels should be maintained

Where livestock production does not include permanent grassland, only principle 1 applies.
Production on wetlands, continuously forested areas, peatland and land spanning more then one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 % .[8]
The current EU taxonomy draft sets additional requirements in the area of "Do no significant harm" in terms of physical risk assessment, building materials, water consumption etc.

The current draft also requires minimum social safeguards, currently defined as meeting the International Labour Organisation (ILO) Core Labour Practices

Global scenarios

IPCC reports cover the agricultural sector in two ways: Physical risk to food production systems is described in the WGII report (ch. 7), while mitigation options are discussed in the WGIII report (ch. 11). The recent special reports on 1.5C and land use both cover agriculture. IEA scenarios do not include the agricultural sector.

8. See taxonomy for detailed description and exceptions

CICERO Shades of Green & analyst perspective

CICERO Dark Green for the sector[9]

- The largest emission reduction potential is in shifting production towards less emission-intensive products.
- Meat and dairy production is far more emission intensive than other types of production
- Production change would however require corresponding dietary change among consumers to avoid leakage, and there are also large variations among different forms of meat production
- (e.g. combined meat and dairy vs suckling cows, types of feed and breeding, etc.)
- Flexibility in production may be the best way of meeting potential changes in demand and regulation
- A number of optimization measures at the farm level can also contribute to emission reductions, including improved manure handling, drainage, soil carbon sequestration, and reduced or delayed tilling
- Relevant measures vary widely depending on geography, production type and other factors. Farm-specific assessments and plans are required – no «one-size-fits-all» path to dark green
- Sector-wide R&D and breeding programmes will be necessary to further decrease emission intensity within each production type

Current best practice -activities

★ Farm resources should be directed towards the least emission-intensive production types possible

★ Biogas capture and fossil fuel substitution are direct, technical measures that reduce emissions and should be implemented wherever possible

★ No wetlands should be converted for crop production or other purposes

Current best practice - governance

★ Targeted Agricultural Counselling on physical risk as well as emission reduction options at the farm level. Established Agricultural Counselling providers will increasingly be able to provide this, but no certification system exists as of yet

★ Certification is available for conversion to organic farming (Debio). However, the climate benefits of organic farming are uncertain and not well documented, so this certification is by itself insufficient

9. The Shades of Green methodology assesses alignment with a low-carbon resilient future. CICERO Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. For more information see: https://www.cicero.green/our-approach

Data and indicators for climate risk disclosure

Historic data

Figure 1 illustrates how greenhouse gas emissions from the agricultural sector (yellow, right axis) has been relatively constant despite overall growth in production value (blue, left axis) over the last 20 years, indicating improvements in overall emission intensity. Figure 2 on the right shows agricultural emission sources (in kt CO2eq.), illustrating the dominant role of methane and other livestock-related emissions in overall sector emissions. (Note: These figures are for 2015, source (4))

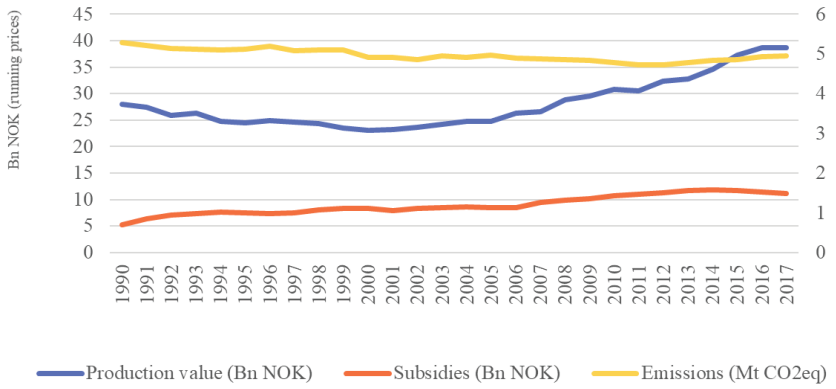


Figure1: greenhouse gas emissions from agriculture

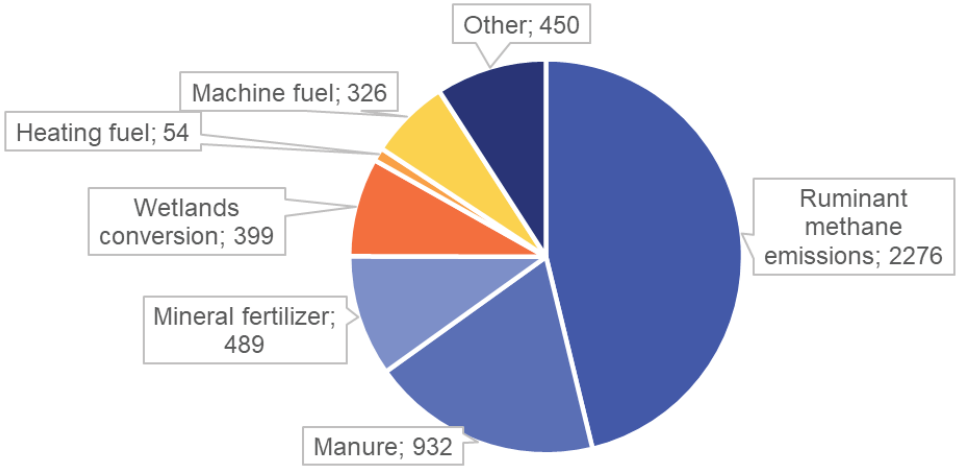


Figure 2 agricultural emission sources

Available types of data

Sectoral emissions at the national level

- Statistics Norway: https://www.ssb.no/klimagassn

Calculator for farm-level emissions and reduction potential

- Developed under "Klimasmart landbruk"

Official estimates of emission reduction potential

- Report from government expert group ("Teknisk arbeidsgruppe jordbruk og klima")

Potential difficulties in attaining / using existing data

- Reliable farm-level emission data are not available.
- So far, the calculator being developed under "Klimasmart landbruk" is only available through agricultural counsellors, and only for some production types.

Indicators which would improve climate risk disclosure[10]

Transition risk

Preliminary indicators and metrics
Improved farm-level emission data, e.g. from land use, ruminants and equipment
Information on potential for production shifts in response to demand-side changes
A farm-level plan for reducing emissions and managing risk, with farm specific indicators. Agricultural Counselling, Agricultural Extension Services, or equivalent should be used assess emission reduction potential and physical risks, and a plan should be developed to address these.

Physical risk

Preliminary indicators and metrics
Estimates on hydrotechnical investment needs (drainage, irrigation etc)
Information on the use of counselling to assess physical risk

Key analyst questions for all companies in this sector

1. What is the emission intensity of your production and are you taking any steps to reduce this? (note that a calculator for farm-level emissions and reduction potential has been developed under "Klimasmart landbruk)
2. What are your options to diversify in a less emission-intensive direction, e.g. in response to demand-side changes or new regulation? (note that this could include changes to the current crop/ husbandry practices as well as shifting away from the most emissions intensive types of production. Diversification is impacted by physical factors (land availability and suitability for different production forms) as well as training and competence.)
3. What are the key physical risks for your farm? Are you aware that there is consulting available to assess physical climate risks and/or emission reduction potential? Have you received or considered this for your farm?

9. Please note that these are preliminary indicators and metrics that will be further developed. As the methodology and data availability evolves, we expect adjustments to the list. Also note that within the sector there are many different busines models and different indicators and metrics may be more relevant depending on the company under assessment.

Notes and Sources

(1) Emission figures from 2018. Source: Miljøstatus.

(2) Source: Bob van Oort & Nina Holmelin (2019). Klimagassutslipp fra norsk mat. CICERO Report 2019:05.

(3) Note: These emissions are not counted as part of the agricultural sector's emissions in Norway's national GHG inventory, but are directly attributable to agriculture as part of other sectors (the LULUCF sector for wetlands conversion and transportation/mobile sources for machinery). Emission figures are from 2015. Source: Norway's National Inventory Report (2017).

(4) Source: Norway's National Inventory Report (2017).