9

Agriculture

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A high population pressure (due to urbanisation) and various space claims put increased pressure on agriculture, resulting into a gradual loss of agricultural land (*Kerselaers 2012*, *Rogge and Kerselaers 2013*, *Bergen et al. 2014*). Belgium is following the European trend in this respect, although in recent years (2006-2012), the decline has slowed down to some extent (*Landscapes in transition, EEA 2017*, *BE-landcover 2012, EEA 2017B*). This trend is also visible in the coastal zone[1], although with a differentiation in pressure between coastal and hinterland municipalities. Agriculture however, as an integral part of the agro-nutritional system, remains of an important economic value. As such, total Belgian exports of agricultural trade products are worth 45 billion euros, or 8% of the total within the EU-28, with an agricultural trade surplus of 6.5 billion euros in 2017 (*LARA 2018*). Agriculture in the coastal area is also economically important and, from a historical perspective, lies at the basis of the land reclamations and the creation of valuable agricultural landscapes (cultural-historical as well as ecological, for example the historical permanent grasslands) that result from this. In addition, agriculture also has a significant impact on the marine environment through, for example, the supply of nutrients such as nitrogen and phosphorus which can lead to eutrophication of the coastal waters (60% of the effluent nitrate and 31% of the effluent phosphate derives from agriculture (*OSPAR QSR 2010*)). Eutrophication especially constitutes a problem in the Southern North Sea and English Channel (*OSPAR Commission 2017*), despite a decrease in nutrient concentrations compared to 1990. However, these nutrients originate from all over the country and not only from agriculture in the coastal zone. Measurements by the Flemish Environment Agency (*VMM*, *MAP-Meetnet*, *Nutriënten in oppervlaktewater in landbouwgebied 2017*) show no improvement in the concentration of nitrates and phosphates in surface water in recent years, hence the eutrophication status of our coastal waters remains problematic (*OSPAR Commission 2017*). A further reduction of nitrates and phosphates from all sources is therefore still important for achieving a good status for the ground water, surface water and coastal waters (see theme **Nature and environment**) (*Ferreira et al. 2010*, *Voortgangsrapport Mestbank 2013*, *Mestrapport 2017*). By contrast, marine influences can also put pressure on coastal agriculture, in particular through salinisation of the soil (see **9.4.3 Salinisation of the coastal area**). In addition to these mainly negative interactions, it should also be noted that agriculture in the coastal zone provides many ecosystem services (e.g. protection against erosion, enhanced biodiversity, water regulation, etc.), but because of the marine focus of the Compendium for Coast and Sea, these won't be discussed further in this chapter.

9.1 Policy context

An important part of the agricultural policy is determined at the European level by the Common Agricultural Policy (CAP) of the *Directorate-General for Agriculture and Rural Development* of the European Commission (for more information: *The European Union in brief: Agriculture 2017*). For the period 2014-2020, the CAP is much more integrated into the overall *EU 2020 strategy*[2]. As in the previous period, the European agricultural policy is still embodied at the Flemish level by two so-called cornerstones: direct support with a focus on financial income support and rural development programmes that address broader themes such as landscape development, nature value and social cohesion (*LARA 2014*, *Investeren in landbouw in België: 2014-2020 (2016)*, *LARA 2018*).

At the Flemish level, the agricultural policy is developed by the Flemish minister of Agriculture and Fisheries (see also *Policy memorandum 2014-2019. Agriculture and Fisheries*). The *Agriculture and Fisheries Department* is responsible for the preparation, implementation and evaluation of the policy. The policy is supported by the Research Institute for Agriculture, Fisheries and Food (*ILVO*), Flanders' Agricultural Marketing Board (*VLAM*) and the Strategic Advisory Council for Agriculture and Fisheries (*SALV*).

By means of research and information centers, the provinces play an important role in the councelling, education, short chain and innovation with regard to agriculture. The provincial authorities also have 'indirect competences' concerning the permit policy, spatial planning and the maintenance of non-navigable waters of the 2nd category (*website province West Flanders*, *Provincie West-Vlaanderen, Meerjarenplan 2014-2019*). Furthermore, the agricultural policy is linked to other policy domains and authorities such as the Flemish environment and spatial policy and the federal Agency for the Safety of the Food Chain (*FASFC*). The developments in the international/European and Flemish agricultural policy are discussed in detail in the following publications: *LARA (2014)*, *Investeren in landbouw in België: 2014-2020 (2016)* and *LARA 2018*. A broader overview of the legal context with regard to agriculture is provided in the *Codex Coastal Zone, theme Agriculture*.

[1] Unless stated otherwise, coastal zone refers to the 10 coastal communities ((Blankenberge, Bruges, Knokke-Heist, Bredene, De Haan, Middelkerke, Ostend, De Panne, Koksijde en Nieuwpoort) and the 9 hinterland communities (Damme, Jabbeke, Zuienkerke, Diksmuide, Lo-Reninge, Gistel, Oudenburg, Alveringem en Veurne).

[2] Constitutes the EU agenda with key issues the EU wants to address by 2020. The EU 2020 strategy's core objective is to address the structural weaknesses in the European economy by aiming for sustainable, structural and inclusive growth. The EU's objectives are translated at national level.

9.2 Spatial use

In Flanders, the areas reserved for agricultural purposes are registered in the Flemish spatial structure plan (*RSV*) as the 'agricultural structure'. The mandatory regulations of the RSV demand that the Flemish Region demarcates a specific area for agriculture (750,000 ha), as well as for nature and forest, in the regional spatial structure plans or in the regional spatial implementation plans. Regional plans were reaffirmed when a consensus between the nature, forest and agriculture sector was present (*AGNAS* strategy). In addition to the demarcation in the RSV and the reaffirmation of the agricultural area, it is possible to further refine this demarcation through the spatial implementation plans (SIPs). The proposed timing of 10 years to complete this demarcation (foreseen in 2007) was not achieved. This is due to the size of the assignment, the interference with other spatial processes and the area-oriented consultation in drawing up the plans to implement the zoning changes (SIPs). Despite the fact that the deadlines have passed, the *Department Environment* continuous to work on this demarcation.

The process of the demarcation of the agricultural areas in the Coast-Polders-Westhoek region started in 2004. During this demarcation phase, a new integrated approach was used which took agriculture, nature and forest simultaneously into account. In consultation with the municipalities, provinces and stakeholders, a *spatial vision* (*ruimtelijke visie*) was drafted which indicates the most important structures: connected areas prohibited for agriculture, valleys for nature development, etc. The consultation process eventually resulted in 95,100 ha of reaffirmed agricultural area in the Coast-Polders-Westhoek region (*Danckaert 2013*). The regional spatial implementation plans (RSIPs) for agriculture, nature and forest in this region can be consulted on the website of the RSV (*ruimtelijk structuurplan Vlaanderen*). Besides the further implementation of the Flemish spatial structure plan, the Government of Flanders is also preparing a new *Beleidsplan Ruimte Vlaanderen* with new planning concepts on themes as 'the productive landscape' in which, *inter alia*, attention is paid to food production (see also *Groenboek. Vlaanderen in 2050: mensenmaat in een metropool? Beleidsplan ruimte Vlaanderen 2012*, *Witboek Beleidsplan Ruimte Vlaanderen*).

Within the framework of a new spatial development policy, the *Department Environment* of the Government of Flanders provides area-specific 'Territorial Development Programmes' with the aim of bringing together relevant stakeholders and realising short and medium term achievements on the basis of common objectives. In this capacity, the province of West Flanders has a cooperation agreement with the Department Environment within the so-called *T.OP. Coastal Zone* (see a.o. theme **Safety against flooding**).

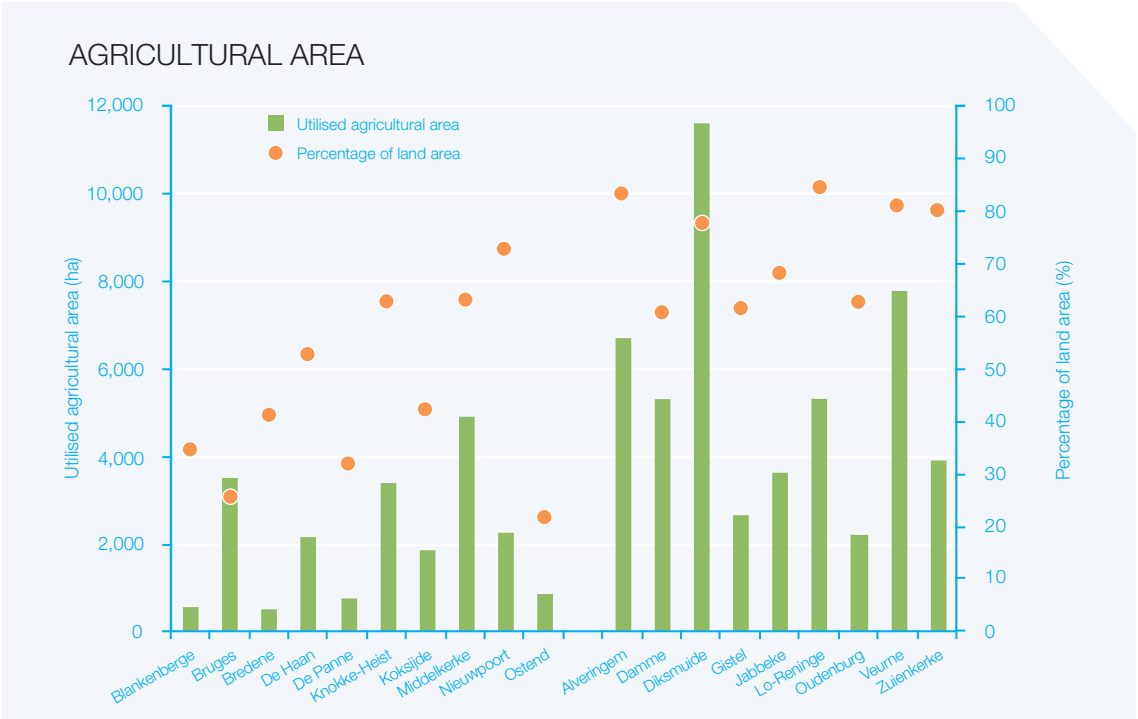

Figure 1. Utilised agricultural area in the coastal and hinterland municipalities in ha in 2018 and the percentage of the agricultural area relative to total area of the municipalities (Source: *Agriculture and Fisheries Department based on FPS Economy – Statbel*).

Areas of the agricultural structure are described in the spatial structure plan of the province of West Flanders (*PRS-WV*). For our focus area, the eastern and western polder area (parts of the spatial structure in the PRS-WV) are important for the agricultural structure. Few agricultural activities are still present in the coastal zone (subarea *Kustruimte, Westkustruimte, Oostendse ruimte* and a part of *Brugse ruimte*) due to strong urban pressure, economic developments (e.g. harbour of Zeebrugge) and increased nature protection.

The instrument of land exchange consolidation has been developed to achieve a solid agricultural structure, as described in the spatial planning (see above). In Flanders, the Flemish Land Agency (*VLM*) is responsible for these land exchange consolidation projects. The purpose of this instrument is to improve the economic exploitation of the agricultural enterprises as well as to improve the areas for nature and recreational purposes. An overview of all development projects (general projects, rural projects, land planning projects, land exchange consolidation projects and nature development projects) is given in the *project database* of the VLM-website.

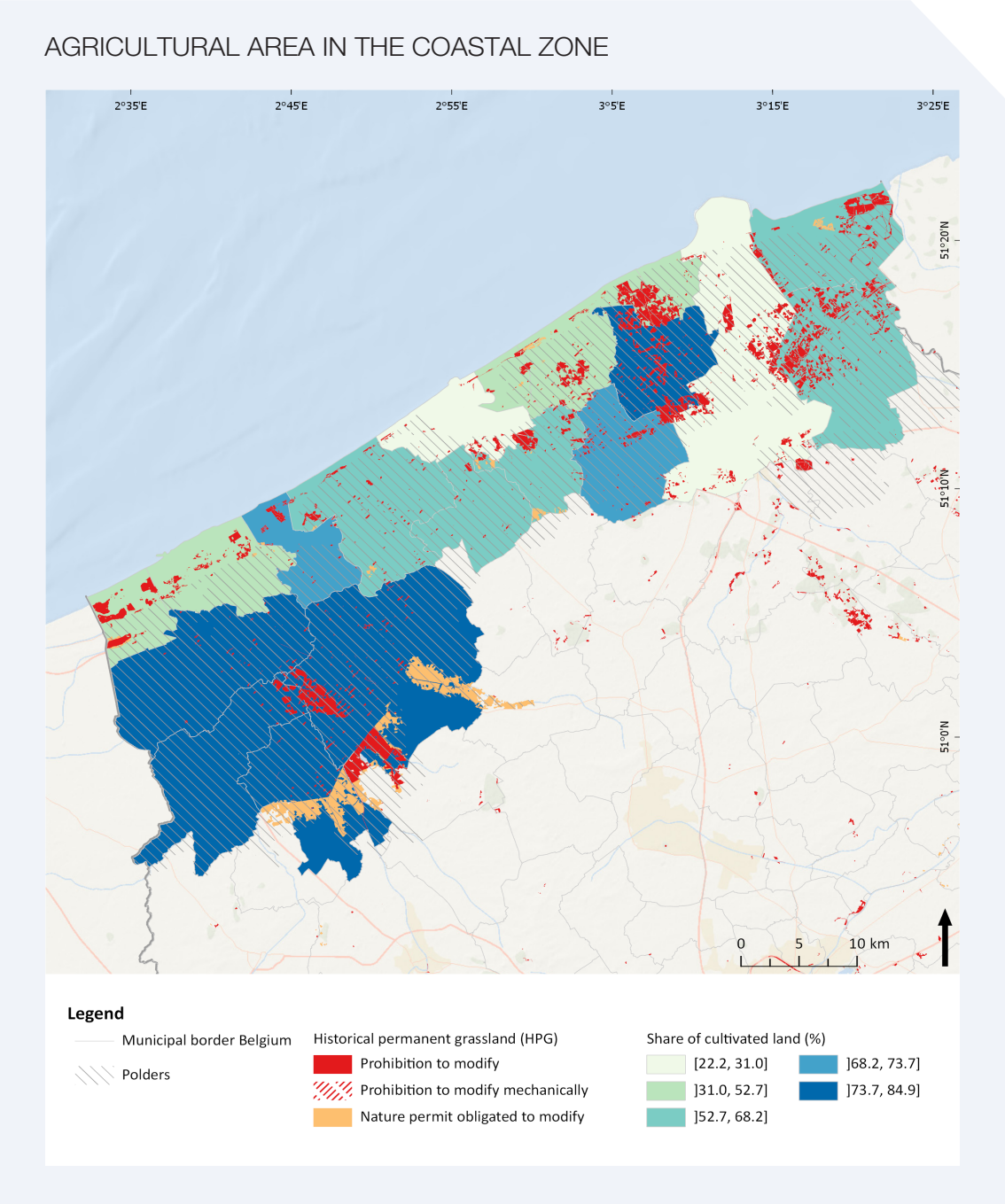

Figure 2. The agricultural area in the coastal zone (Source: VMM (GDI-Vlaanderen), Agency for Nature and Forest, Statbel 2017).

Table 1. Summary of the number of farms in the coastal zone (2018) and the total agricultural surface area (ha) at the municipal level.

Municipality	Number of farms in the coastal zone (2018)	Agricultural area (ha)
Blankenberge	18	601
Bruges	126	3,573
Damme	178	5,434
Jabbeke	120	3,696
Zuienkerke	82	3,912
Knokke-Heist	91	3,575
Diksmuide	357	11,750
Lo-Reninge	160	5,315
Bredene	8	535
Gistel	79	2,612
Middelkerke	151	4,784
Ostend	24	822
Oudenburg	74	2,219
De Haan	56	2,272
Alveringem	205	6,666
De Panne	19	732
Koksijde	49	1,850
Nieuwpoort	50	2,255
Veurne	200	7,845
Total municipalities	**2,049**	**70,450**

The agricultural area in the coastal zone constitutes a total surface area of about 70,450 ha (figure 1 and table 1). This corresponds with 11.3% of the agricultural area in Flanders (Source: *Agriculture and Fisheries Department based on FPS Economy – Statbel*).

All parcels registered by the Agriculture and Fisheries Department, and their cultivation can be downloaded in GIS format from the Geopunt website (*www.geopunt.be*). The spatial layout of the agricultural areas in the coastal zone is shown in figure 2.

9.3 Societal interest

In the coastal and hinterland municipalities, 2,045 agricultural and horticultural enterprises were active in 2018 employing 4,075 people. This corresponds to 8.8% of all agricultural enterprises in Flanders and 6.8% of employees in agriculture. Within the coastal region, agriculture represents approximately 2.2% of the workforce (*RESOC 2019*, *Agriculture and Fisheries Department based on FPS Economy – Statbel*). The majority of both the enterprises and the employment in the coastal zone are located in the hinterland municipalities (figure 3). The specialisation of these companies, based on the standard output (more info: *Danckaert et al. 2009*), concerns primarily the production of crops and the rearing of cattle, pigs and poultry (see table 2) (Source: *Agriculture and Fisheries Department based on FPS Economy – Statbel*), see also the specific theme agriculture and horticulture in (*West Vlaanderen Ontcijferd 2018*)).

The agricultural enterprises in the coastal zone account for 136,276 cows, 656,305 pigs, 6,483 sheep (2016), 2,254 goats (2016) and 3,517,935 poultry units (Source: *Agriculture and Fisheries Departments based on FPS Economy – Statbel*).

An as yet small but strongly growing sector in the coastal zone is that of organic farming. In 2017 the area used for organic farming (including land in conversion) amounts to 473 ha, an increase of 114% relative to 2012. If we consider the total agricultural area in the coastal zone, this currently amounts to a modest 2.8% (figures requested from the *Agriculture and Fisheries Department* based on *TÜV Nord Integra* and *Quality Partner*).

In addition to an economic importance, agriculture provides various ecosystem services with a productive, regulatory and cultural function. Producing ecosystem services include the production of food and feed, energy and fibre. In terms of regulatory services, there are benefits in terms of climate regulation, water quality and erosion control. The cultural ecosystem services are mainly situated within the conservation of open space (see a.o. theme **Nature and environment**) and agricultural tourism. More information on agriculture and ecosystem services, see *Van Gossum et al. (2016)* and *Dumez et al. (2017)*.

For other figures on agriculture, please visit the *website* of the Agriculture and Fisheries Department.

Table 2. Number of enterprises in the coastal area in 2017, broken down by specialisation (Source: *Agriculture and Fisheries Department based on FPS Economy – Statbel*).

Specialisation	Number of enterprise in the coastal zone (2017)
Agriculture	523
Horticulture	78
Milk production	240
Beef production	255
Mixed cattle breeding	182
Other grazing livestock (sheep, etc.)	81
Pigs and poultry	259
Mixed enterprises	408
Total of enterprises	**2,026**

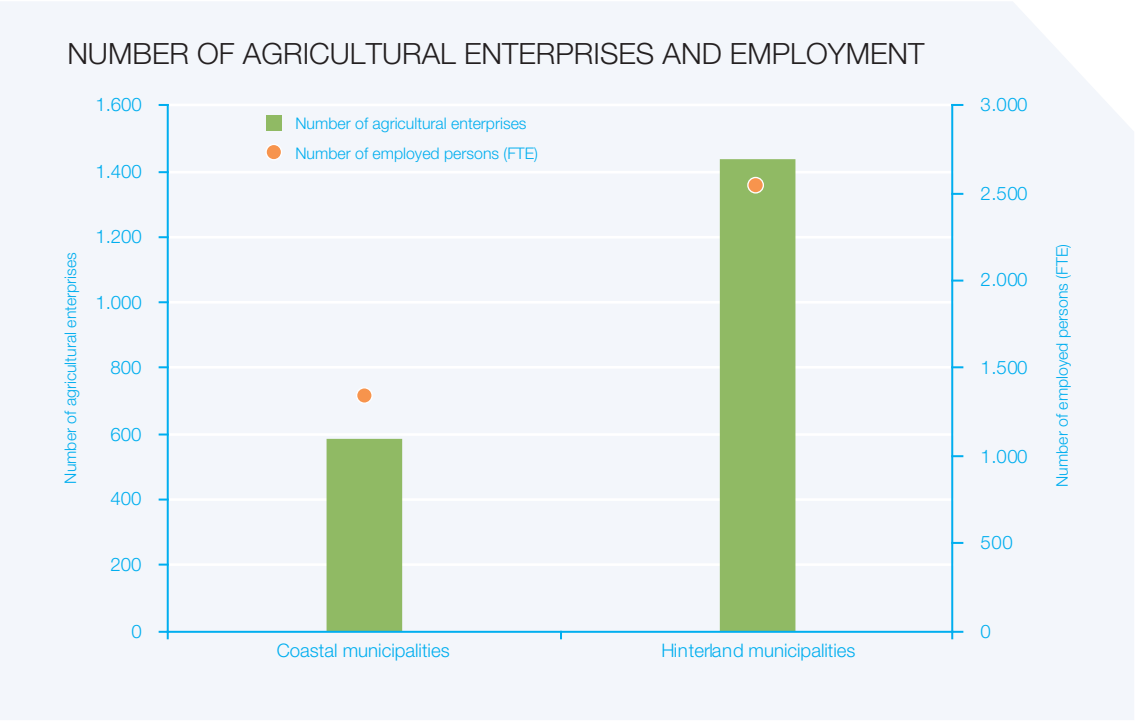

Figure 3. Number of agricultural and horticultural enterprises and employed persons in the coastal and hinterland municipalities in 2018 (Source: *RESOC 2019*, *Agriculture and Fisheries Department based on FPS Economy – Statbel*).

9.4 Impact

In the section 'impact', the (general) effects of agricultural activities on the ecosystem are discussed, as well as the indirect effects of these activities on the marine environment (eutrophication). In addition, the phenomenon of salinisation is discussed. Although salinisation is primarily caused by other human activities, it has a considerable effect on the agricultural activities in the coastal zone with a potentially more prominent role in the near future due to climate change.

9.4.1 Effects on the ecosystem

The different effects of the agricultural activities on the environment in Flanders (not specific for the coastal area) are listed in *Wustenberghs et al. (2007)*, *LARA (2014)*, *Vlaams Regionaal Indicatorenrapport (VRIND 2017)*, *MIRA systeembalans (2017)* and *LARA 2018*. A description of the ecosystem of the polder area is discussed in the theme **Nature and environment**. The effects on the ecosystem include, *inter alia*:

- The use of chemical products for crop protection (more information: *Lenders et al. 2013*, *Van Esch et al. 2012*);
- The use of water (more information: see **9.4.3 Salinisation of the coastal area**, e.g. *Lenders et al. 2013*);
- The use of energy (more information: *Lenders et al. 2013*);
- The impact on soil quality (e.g. compaction resulting in salinisation) and erosion sensitivity (*Erosie in Vlaanderen 2015*);
- Eutrophying emissions (more information: see **9.4.2 Eutrophication of the coastal waters**, *Overloop et al. 2011*, *Overloop 2013*, *Voortgangsrapport Mestbank 2013*, *Mestrapport 2017*);
- Acidifying emissions;
- The emission of greenhouse gasses;
- The emission of particulates;
- Waste production;
- The impact on spatial use;
- The reduction in biodiversity.

A summary of the most recent facts and figures can be found on the *VMM* website with interesting publications from the *Agriculture and Fisheries Department*.

9.4.2 Eutrophication of the coastal waters

The use of fertiliser in agriculture which reach the coastal waters through watercourses has, along with a number of other actors, played an important role in the increase of nutrient concentrations (nitrogen (N), phosphorus (P)) in aquatic ecosystems (*State of Europe's seas 2015*). An excessive nutrient supply or 'eutrophication' amplifies phytoplankton production potentially leading to changes in ecosystem structure, habitat destruction and biodiversity loss (*André et al. 2010*). The issue of eutrophication is covered by descriptor 5 of the MSFD and is described in *Ferreira et al. (2010)*, which also outlines the conditions for a good environmental status.

A clear downward trend was observable in the 1990s, however during the last few years (2006-2014), a stagnation can be observed in the amount of dissolved N and P in our coastal waters (*OSPAR IA 2017*). A trend confirmed by land-based measurements (*Mestrapport 2017*, *Fysisch-chemische kwaliteit oppervlaktewater 2016*, *Nutriënten in oppervlaktewater in landbouwgebied 2017*, *VMM* MAP-Meetnet). Furthermore, in addition to river transport of nutrients, atmospheric inputs also cause concern (*OSPAR QSR 2010*, *OSPAR Commission 2017*). The eutrophication of coastal waters was studied in detail in the *AMORE* (*AMORE project BELSPO*), *AMORE II* (*AMORE II project BELSPO*) and *AMORE III projects* (AMORE III project *phase 1* and *phase 2 BELSPO*) (more information: *Lancelot and Rousseau 2004*, *Rousseau et al. 2006*, *Lancelot et al. 2007*, *Lancelot et al. 2009*). A centralisation of knowledge and information on eutrophication in the southern part of the North Sea took place in 2014 as part of the *ISECA project*. The *NewSTHEPS* project (2014-2019) (*NewSTHEPS project BELSPO*) is carrying out concentration measurements under the MSFD on chemical pollutants, including N and P, in our coastal zone.

9.4.3 Salinisation of the coastal area

Salinisation, the process of brackish or salt ground water penetrating the soil root layer, has a considerable impact on agriculture in the coastal area. As a result, salt accumulates in the soil (*Peeters 2013a*, *Peeters 2013b*), which has a detrimental effect on the crops. Naturally, a distribution of fresh and saline / brackish groundwater occurs in

the coastal area. In the zone of phreatic groundwater, a freshwater lens lies above a layer of salt / brackish water which allows for traditional agriculture in the polder area. From an agricultural perspective it is important to have a freshwater lens that is sufficiently thick, but without the soils becoming too watery. This freshwater lens acts as a buffer to the intrusion of saltwater in the hinterland (*Van den Eynde et al. 2011* (CLIMAR project *phase 1* and *phase 2* BELSPO) and the *CLIWAT project*), but it contains interruptions along the coast. The current division between fresh and salt water is the result of a complex history in which human activities, such as water extraction for drinking water supply and agriculture, large-scale infrastructure works (e.g. land reclamation, harbour expansion, tunnels, drainage, etc.) and interventions in water management (e.g. water level management, drainage systems, etc.), play an important role. Hydrological interventions in the coastal zone may thus in the short term lead to changes in the fresh-salt water distributions and in the long term possibly to salinisation (*Vanleberghe and Vanhoutte 2001*, *Vandenbohede et al. 2009*, *Vandenbohede et al. 2010*, *Vandenbohede et al. 2012*, *Stroomgebiedbeheerplan voor de Schelde 2016-2021*). In the future, sea level rise and extreme droughts caused by global warming may also increase the salt pressure towards shallow ground and surface water (*Vandenbohede et al. 2012*, *Vandenbohede and Lebbe 2012*, *Zwaenepoel et al. 2016*).

This led, *inter alia*, to a revision of the salinisation maps (*dov.vlaanderen.be*) of De Breuck (1974 and 1989) that were based on measurements from the 1960s and 1970s with the aim of accurately determining the current salinisation status and identifying potential bottleneck zones. This happened in 2010 (CliWat project) for the central coastal area (Nieuwpoort-Zeebrugge) (*Vandenbohede et al. 2010*), within the framework of the *ScaldWIN project* (*Lebbe et al. 2012*) and in 2014 for the eastern coastal area (*VMM 2016*). Based on these studies, it can be concluded that the freshwater balance is currently fairly stable (*Vandenbohede et al. 2010*, *Zwaenepoel et al. 2016*, *VMM 2016*). Nevertheless, in the exceptionally dry summer of 2017, water shortages occurred in the agricultural land of the coastal region along with related salinisation problems (*Droogterapport 2017*). Furthermore, recent studies place salinisation within the context of climate change (e.g. *De Waegemaeker et al. 2013*), which highlights the need for a long-term perspective on the hydrology of the coastal region. A detailed determination of the fresh-saltwater balance for the entire coast and polder region was recently carried out as part of the *Topsoil project* (phase 1).

9.5 Sustainable use

The implemented policy at international and European level (Treaty of Lisbon, the EU 2020 strategy, CAP, etc.) to achieve a sustainable agriculture is described in detail in the *LARA (2014)*. In the report, several interlinked sustainability themes in agriculture are discussed such as water management, manure management plan (*mestactieplan*), biodiversity, bio-economy, etc. Furthermore, recommendations and measures to reduce or avoid the environmental impact of agriculture in Flanders are listed in *Wustenberghs et al. (2009)*, *Van Steertegem (2009)*, *Zwaenepoel et al. (2016)* and *MIRA systeembalans (2017)*. *Gobin et al. (2008)* and *Maertens et al. (2016)* discuss the adaptation possibilities and mitigation strategies of Flemish agriculture to climate change in more detail, and in *Mathijs et al. (2012)*, *LARA/VIRA 2016*, *MIRA systeembalans 2017* and *LARA 2018* there is a broader focus on the sustainability of both food production and consumption from a transition perspective. Various studies which focus on sustainable agriculture are also being carried out by the engineering department of the Agriculture and Fisheries Department (website of the *Agriculture and Fisheries Department*). These include *inter alia*: *Bergen (2013)* (Agro-ecology), *Danckaert et al. (2013)* (Food Footprint), *Dumez et al. (2014)* (New perspectives for agriculture and policy) and *Bergen et al. (2014)* (Challenges for Flemish agriculture).

The sustainable compatibility of several user functions in coastal areas (housing, tourism, recreation, agriculture, industry, nature, etc.) is discussed within the European recommendation for Integrated Coastal Zone Management (IC(Z)M) (COM (2002) 413). The compatibility of different sectors in the polders on the coast is discussed in a case study of the *Uitkerkse Polder* (Blankenberge) (*Bogaert et al. 2002*).

Measures and regulations for certain effects linked to agricultural activities that are of specific importance to the coastal zone are discussed below.

9.5.1 Measures against eutrophication

In the North-East Atlantic Ocean, OSPAR has created a *common procedure (2013)* for the identification of the eutrophication status (*OSPAR IA 2017*). In cases where this classification results in so-called problem areas, the OSPAR environmental strategy requires that contracting parties, individually or jointly, take measures to reduce or eliminate the anthropogenic causes of eutrophication. This procedure serves as a framework to identify the actions described in *OSPAR Strategy (2010-2020) (2010)* with the aim of achieving and maintaining a healthy marine environment free from eutrophication by 2020 within the OSPAR region. The uniform monitoring and classification

strategy is described in the '*eutrophication monitoring programme (2005 – updated 2013)*' (see also *OSPAR website*). At the European level, the issue of eutrophication is covered by various directives within the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD). The Nitrates Directive (91/676/EC) is an integral part of the Water Framework Directive (WFD, 2000/60/EC) which, *inter alia*, imposes an obligation to achieve a good surface and groundwater quality by 2015. It includes substances that contribute to eutrophication, such as N and P, in its list of main pollutants. The Nitrates Directive more specifically aims to reduce the leaching of nitrates from agriculture (*Goffin et al. 2007*). Other directives under the umbrella of the WFD also have a link to eutrophication, such as Directive 91/271/EC on urban waste water and Directive 2008/1/EC concerning integrated pollution prevention and control.

In the Marine Strategy Framework Directive (MSFD) (2008/56/EC), eutrophication is included as descriptor 5 for determining the environmental status in the marine environment. The criteria and methodological standards for the determination of a good environmental status with regard to eutrophication as currently applied by OSPAR are described in *Ferreira et al. (2010)*. In addition, the MSFD is incorporated into Belgian legislation by the RD of 23 June 2010 on the marine strategy for the BNS.

The WFD is translated at the Flemish level into the decree on integrated water management (decree of 18 July 2003) (for implementing decisions and amendments see *website Coordination Committee on Integrated Water Policy*) and partially at the federal level into the RD of 23 June 2010 concerning the establishment of a framework for achieving good surface water status (see also *FPS Public Health, Safety of the Food Chain and Environment 2009*). In addition, the MSFD was incorporated into Belgian legislation by the RD of 23 June 2010 on the marine strategy for the BNS.

At the Flemish level, the Nitrates Directive is translated into the Manure decree, which deals with the quality status with regard to diffuse pollution of groundwater and surface water by agriculture and horticulture. The decree was adopted on 23 January 1991 and has since been substantially modified on a number of occasions. The new Manure decree of 22 December 2006) has been in force since 1 January 2007, with the fifth Manure Management Plan (MAP-V) applying to 2015-2018 (for implementing decisions and amendments see *VLM website*). This renewed manure management plan aims to break the current stagnation in water quality (Management Programme for the implementation of the Nitrate Directive, *Mestrapport 2017*). Since 2011, the Government of Flanders, in cooperation with ILVO, has been providing a so-called 'research platform for sustainable fertilisation' to accompany the Manure Management Plans. The aim of this forum is to bring together stakeholders from policy, research and practical organisations and to facilitate and coordinate research on sustainable nutrient use in agriculture. An overview of the recently completed and current studies can be found on the website of the *VLM* and in the *Mestrapport 2017*. Furthermore, nutrient limiting agricultural practices also come up in the *PDPOIII* in the context of a sustainable CAP (see **9.1 Policy context**) and in the *MIRA systeembalans 2017*. An up-to-date overview of the manure legislation can be found on the *VLM* website.

On 23 April 2014, the Government of Flanders decided to establish a Programmatic Approach to address atmospheric nitrogen deposition (*PAS*). The PAS programme (2014-2031) aims to tackle the problem of eutrophying and acidifying atmospheric deposition of nitrogen, of which about two-thirds comes from the agricultural sector, in special areas of conservation under the European Habitats Directive (Directive 92/43/EC) by means of source-oriented (at the emission side) and effect-oriented measures. A number of steps are anticipated in the implementation of this programme: a transition phase (2014-2015), a provisional PAS (2015-2019) and a final PAS (from 2019 onwards).

The *VMM* disposes of a monitoring network for the water quality, which has been expanded since 1999 to include specific monitoring points for agriculture (see the water quality *geoportal*). In *Lancelot et al. (2011)* the costs and ecological efficiency of measures in *inter alia* agriculture to prevent eutrophication in the Southern Bight of the North Sea were modelled (see also AMORE III project *phase 1* and *phase 2* BELSPO, and *TIMOTHY project* BELSPO).

9.5.2 Measures against salinisation

The European Communication COM (2012) 46 provides an overview of the implementation of the Thematic Strategy for Soil Protection since its establishment in COM (2006) 231. This includes *inter alia* soil degradation through salinisation. Furthermore, intrusions of salt water were also included in the WFD (2000/60/EC) and the Groundwater Directive (2006/18/EC) as parameters for the quantitative and qualitative status of groundwater (see also *VMM 2008*).

The WFD has been translated into Flemish legislation by the decree of 18 July 2003 concerning integrated water management (*website Coordination Committee on Integrated Water Policy*). In the *river basin management plan for the Scheldt 2016-2021*, a number of measures are included in a 'Coastal and Polder System Action Programme'

consisting of three groups of measures[3] that describe a collection of groundwater body specific actions to combat groundwater salinisation. A detailed overview of all actions can be consulted on the website *integraalwaterbeleid.be*. Furthermore, the WFD is also partly incorporated into Belgian legislation by the RD of 23 June 2010 concerning the establishment of a framework for achieving good status of surface waters. The management and monitoring (*VMM MAP-meetnet*) of the quality of ground and surface water is a core task of *VMM* (operational water management department). More information: *Vandenbohede et al. 2010* and the legislation listed in the *Codex Coastal Zone, theme Groundwater extraction*.

'*Climate Change in the Polders - Choosing fresh or salt?*' (*Zwaenepoel et al. 2016*) provides an overview of several solution strategies based on domestic and foreign research projects (with a focus on the Dutch context). Also discussed are the challenges posed by a changing hydrology and the current knowledge gaps in the field of agriculture in the Flemish polder region. In addition, two research projects were recently launched on new agricultural strategies in the context of water scarcity and salinisation of the Flemish polders. For example, phase two of the Interreg *Topsoil* project tries to develop local pilot projects with the help of stakeholder participation in order to improve freshwater availability for farmers. In addition, the Interreg North Sea Region project *SalFar* is developing innovative farming methods for growing crops on saline soils by using test sites in different regions. In Flanders, the research focuses on the socio-economic barriers to saline agriculture and also the salinification problem along with the potential of saline agriculture in the Flemish coastal region through stakeholder participation is investigated.

The Agriculture and Fisheries Department also provides support for sustainable water use in agriculture in the form of a *praktijkgids water in de land- en tuinbouw* on sustainable and efficient agricultural methods and techniques.

In the study *ontwerpopgaven van Metropolitaan Kustlandschap 2100*, two different development scenarios were proposed for the water management in the coastal polder, being one integrated water system or compartmentalisation[4] (*De Waegemaeker et al. 2012*). In this context, the adaptation of agriculture to an increasing saline seepage that may occur in the future is discussed. A second study by LABO RUIMTE, '*Stedelijk Systeem Kust*', with clear interfaces to MKL2100 investigates challenges and opportunities in urban space (and undeveloped space) to guarantee a sustainable coastal area in the future. One of the elements discussed is the achievement of sustainable water management in the polders.

9.5.3 Protection of historical permanent grasslands (HPGs)

In the coastal polders, historical permanent grasslands (HPGs) are present which are used for agricultural purposes but are valuable from an ecological point of view as well. The HPGs are defined in the decree of 21 October 1997 as "*a semi-natural vegetation consisting of grassland characterised by long term use as grazing pasture or hay meadows with either cultural/historic value or a species-rich vegetation of herbs and grasses where the environment is characterised by the presence of ditches, streams, pools, prominent micro relief, springs or seepages*". The decree mentioned above and the subsequent implementation decisions stipulate that HPGs are subject to a prohibition on, or require authorisation for, the modification of the vegetation and physical features (relief and small landscape elements, such as pools and streams) depending on their destination status in spatial planning.

In order to achieve an effective protection of the grasslands, an inventory has been made with the exact location of the HPGs (*De Saeger et al. 2013*). In the Flemish coalition agreement (2014-2019), the government has committed itself to initiate a protection programme based on a map subsequent to a public inquiry. In 2015, the Government of Flanders decided to protect 8,000 of the 12,000 acres of grasslands. A part will be protected by means of nature legislation whereas another part will be covered by the European agricultural policy. For example, the CAP (*Investeren in landbouw in België 2014-2020 (2016)*) provides for a financial reward for farmers who pay attention to natural resources such as HPGs in the form of bonuses.

[3] The three measure groups: Protected and water-rich areas – part ground water, Quantity ground water, Contamination of ground water.
[4] Building on coastal design research within the CcASPAR project: Climate Change and Changes in Spatial Structures Research Project.

Legislation reference list

Overview of the relevant legislation at the international, European, federal and Flemish level. For the consolidated European legislation we refer to *Eurlex*, the national legislation can be consulted in the *Belgisch staatsblad* and the *Justel-databanken*.

European legislation

Title	Year	Number
COM: Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe	2002	413
COM: Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Thematic Strategy for Soil Protection	2006	231
COM: Report of the Commission (COM): The implementation of the soil thematic strategy and ongoing activities	2012	46
Council Directive concerning urban waste-water treatment	1991	271
Council Directive concerning the protection of waters against pollution caused by nitrates from agricultural source (Nitrate Directive)	1991	676
Council Directive on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)	1992	43
Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive)	2000	60
Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Groundwater Directive)	2006	18
Directive concerning integrated pollution prevention and control	2008	1
Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)	2008	56
Treaty of Lisbon	2007	

Belgian and Flemish legislation

Abbreviation	Title	File number
Decree of 21 October 1997	Decreet betreffende het natuurbehoud en het natuurlijk milieu	1997-10-21/40
Decree of 18 July 2003	Decreet betreffende het integraal waterbeleid	2003-07-18/72
Decree of 22 December 2006	Decreet houdende de bescherming van water tegen de verontreiniging door nitraten uit agrarische bronnen	2006-12-22/32
RD of 23 June 2010	Koninklijk besluit betreffende de vaststelling van een kader voor het bereiken van een goede oppervlaktewatertoestand	2010-06-23/04
RD of 23 June 2010	Koninklijk besluit betreffende de mariene strategie voor de Belgische zeegebieden	2010-06-23/05