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Report

CAP Strategic Plans shadow assessment of environmental needs

Hungary

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1. INTRODUCTION

Science is unequivocal on the need to move fast to sustainable farming; the future Common Agricultural Policy (CAP) legislative texts as agreed among the co-legislators in June 2021 recognise that greater environmental and climate ambition is required and have made this an explicit requirement for Member States.

A major feature of the future CAP involves a fundamental change in the delivery approach towards one in which all CAP support (both Pillar 1 and Pillar 2) is focused on performance, delivering results against a set of EU objectives considering national and regionally identified needs. The so-called CAP strategic plans will be at the heart of this new model and could likely, if used at their full potential, help support a transition towards sustainable farming across the EU. However, given the significant flexibilities, which Member States used under the current CAP (for Pillar 1 greening payments) to maintain the status quo instead of increasing environmental performance, some doubts remain as to the final level of environmental ambition in the future CAP strategic plans.

A noticeable difference between the CAP in 2013 and what was recently agreed upon for the future CAP is that unlike under the current greening regime, Member States will have to justify their intervention logic and implementation choices on the basis of needs and pre-established objectives. This can potentially boost environmental ambition, since the previous lack of justification provided by the Member States regarding their greening implementation choices was indeed identified as one of the main reasons leading to very limited environmental and climate impacts (Alliance Environnement and Ricardo-AEA, 2018).

Another major difference between the current and future CAP is that the latter is being implemented in the context of the Green Deal, the most ambitious environmental narrative to date that sets out a strategy for the EU with climate and the environment at its centre. As a first step towards achieving this, a suite of new policies, notably the Farm to Fork Strategy and the Biodiversity Strategy, is envisaged. Agriculture and food are key sectors for the delivery of the objectives on the table and the CAP is the most important EU policy mechanism to deliver sweeping agricultural change, with the capacity to significantly impact agricultural practices. Even if in the legislative texts as agreed among the co-legislators the link made between the Green Deal objectives and the CAP strategic plans remain relatively weak and not legally binding, these plans can still be harnessed as effective mechanism to meet them.

It remains unclear exactly how these evaluations of needs will guide Member States' intervention logics, since they are finalising the drafting of their plans and the European Commission has not explicitly stated how it will evaluate these national assessments and use them for its own approval process in 2022.

Focus of the report

This report aims at: 1) providing Hungarian and EU stakeholders and decision makers with evidence-based material to inform Hungarian CAP strategic plan intervention logic, and 2) providing a reference point for the evaluation of the Hungarian government's own needs assessment in their CAP Strategic Plan. Similar reports have been drafted for other EU Member States in Germany, France and Spain.

This report begins with an evidence-based evaluation of the state of the environment and climate in Hungary. This evaluation looks at past trends, outlook, and relevant policy objectives/targets in five key areas: climate, biodiversity, water, soil, and air quality. Second, the report introduces a list of needs in the farming sector based on that evaluation. The report then moves to priority actions, followed by suggestions for intervention measures and insights into harmful measures.

Finally, the report outlines the Green Deal objectives that relate to the needs and actions identified in the report.

2. STATE OF THE ENVIRONMENT

2.1 Climate

2.1.1 Climate mitigation

Past trends and outlook

In 2019, total net greenhouse gas emissions in Hungary were 59.7 million tonnes of CO2 equivalent (e), which is approximately 35% lower than in 1990. Emissions fell sharply in the early 1990s and between 2005 and 2013 but then steadily increased until 2018. Agricultural practices[1] account for 11.8% of total (net) emissions or 6.9 million tonnes of CO2e (2019) including the negative emissions of cropland and grassland. This translates into gross emissions of 7.1 million tonnes of CO2e and a removal of 0.2 million tonnes of CO2e by cropland and grassland areas – this latter accounted for under the LULUCF sector. Agricultural emissions (including cropland and grassland emissions/removals accounted under LULUCF) are now still below the level they were in 1990 but the bulk of this reduction occurred in the early 1990s and emissions from the sector have started to rise recently. This is on the one hand linked to the increased use of fertilisers and to an expanding cattle population both contributing to higher gross emissions. At the same time, removals have been fluctuating and decreasing especially in cropland areas that are expected to become net emitters. The Hungarian National Energy and Climate Plan projects net agricultural emissions to reach 7.6 million tonnes of CO2e (gross emissions: 8.0 million tonnes of CO2e; removals: 0.4 million tonnes of CO2e) in 2035 and remain stable until 2040 considering existing measures (WEM). With additional measures (WAM) in place, net emissions are projected to fall to 7.0 million tonnes of CO2e by 2035 (gross emissions: 7.4 million tonnes of CO2e; removals: 0.4 million tonnes of CO2e) and remain stable afterwards. Whilst under the WEM scenario, the relative contribution of the sector to the total GHG emissions would remain comparable with the current situation, i.e. 11.8% in 2019 vs 12.2% in 2040), under the WAM scenario other sectors are expected to reduce their emissions more rapidly increasing the share of agriculture to 14% of total GHG emissions in 2040).

Agricultural emissions are dominated by agricultural soils linked to a great extent to mineral fertilisation (52%), followed by enteric fermentation (28%) and manure management (15%). The relatively low level of emissions of methane and nitrous oxide expressed per hectare of utilised agricultural area (UAA) reflects a low level of intensification of agricultural activities.

[1] CRF3 + 4b+4c

Relevant policy objectives/targets

There is no quantified emission reduction target for the agriculture sector. Under the Effort Sharing Regulation, which covers the building, transport, waste and agriculture sectors, Hungary's 2030 greenhouse gas emission reduction target is -7% compared to 2005. In addition, the Hungarian climate protection law sets economy-wide reduction targets for 2030 (-40% vs 1990) and for 2050 (climate neutrality). Hungary plans to meet its 2030 targets without major reductions in agricultural emissions. As noted above, the Hungarian NECP foresees net agricultural emissions to increase (with existing measures) or remain stable (with additional measures) until 2035. The sector's contribution to the 2050 climate neutrality target remains unclear.

2.1.2 Climate adaptation

Past trends and outlook

In the Hungarian Climate Strategy agriculture is identified as the most vulnerable sector to climate change, with both slow onset changes and extreme weather events posing a significant threat to farming. Climate impacts vary across regions (Map 1) but drought, hail, storm, spring frost and flood risks are considered to be the most prevalent ones. There is no comprehensive database about climate-related damages in agriculture. In 2019, insurance companies paid out HUF 7.5 billion (approx. EUR) for farmers for weather related crop damages, which only represents a fraction of total climate-related damages (MABISZ, 2020). In 2015-2017, every third insurance claim submitted by crop producers was linked to hail damages. Following the installation of the national hail mitigation system, the share of hail related claims in all crop insurance claims fell substantially.

Annual mean temperature is expected to rise further, while precipitation will likely become more unevenly distributed leading to warmer and drier summers and more frequent intense rapid rainfall events. Spring crops (e.g., corn) could be more adversely affected by these changes, while autumn crops, including wheat, barley and rapeseed, may actually benefit from climate change. This is mainly because the average monthly precipitation at the end of winter and spring, which is key for autumn crops, is expected to increase, but the deteriorating summer water balance will no longer affect these crops. Invasive species, pest and disease are on the other hand expected to become more prevalent. In the livestock sector intensive animal husbandry is more vulnerable to climate change than more traditional breeds that have better adaptability due to their genetic characteristics and extensive husbandry technologies. A key challenge for livestock farming in more general will be the predictability of domestically produced feed and water supply (Ministry of Innovation and Technology, 2018).

Relevant policy objectives/targets

There is only one quantitative adaptation target set for the Hungarian agriculture sector that is to increase the size of irrigated area by 100,000 ha by 2024, which represents a 70% increase compared to 2016. The National Adaptation Strategy includes a number of short, medium, and long-term adaptation actions but these are often general and not framed as specific objectives or targets. (Ministry of Innovation and Technology, 2018)

Map 1: Potential impacts of climate change in Hungary

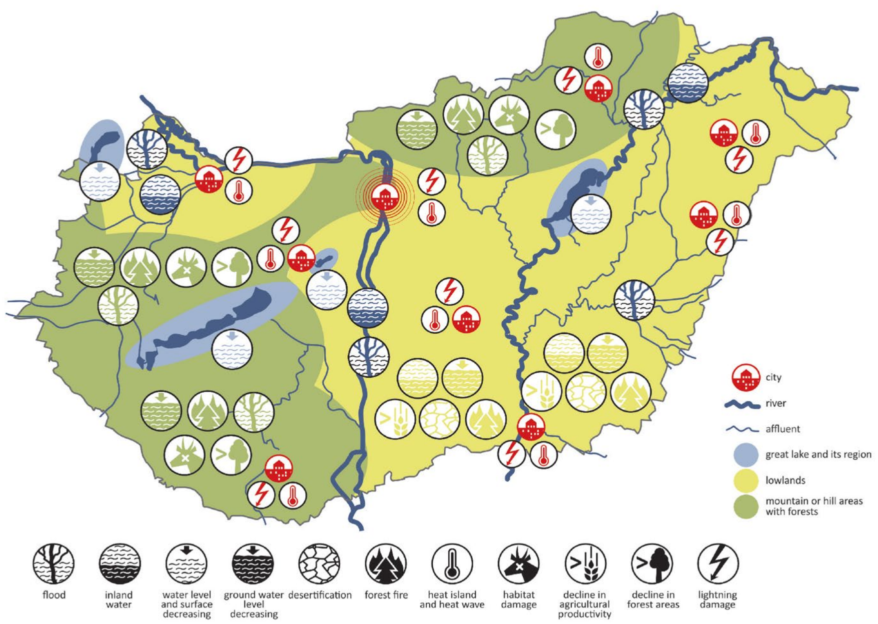


Table 1: State of climate overview table

CLIMATE * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Mitigation				
Adaptation			n.a.	n.a.

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.2 Biodiversity

2.2.1 Common species: Farmland birds and pollinators

Past trends and outlook

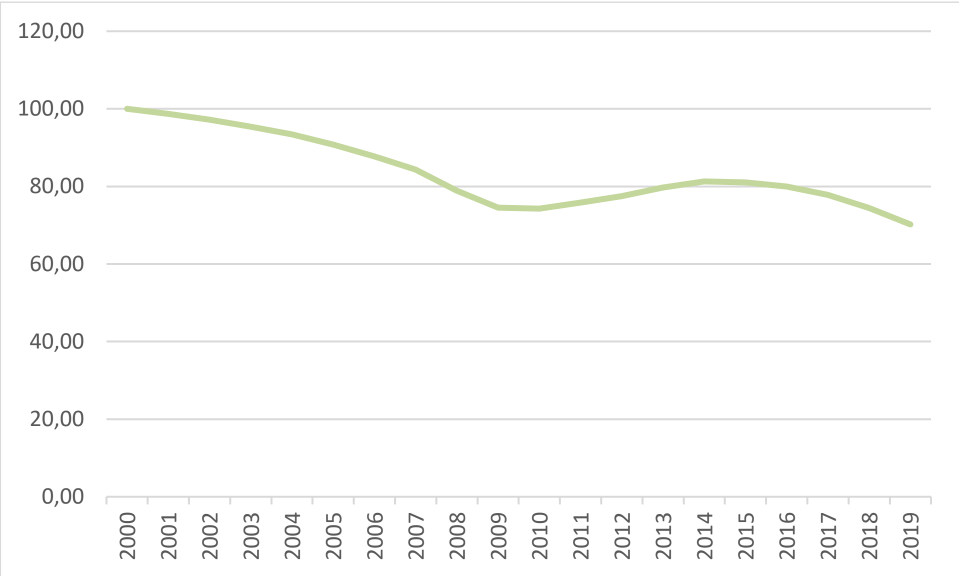
Biodiversity in agricultural areas has been decreasing. The Hungarian Farmland Bird Index (FBI) shows a continuous, albeit slowing, decline of 29.8% between 2000 and 2019 (Figure 1), which corresponds to an average annual decline of approximately 1.5%. Migratory birds seem to be the most. This is partly linked to the threats on their migratory routes and wintering grounds but the intensification of the agricultural sector has also been identified as a major contributor (MME, 2020). The highest decline can be observed in areas utilised for intensive arable production. Amongst others this is linked to the loss of natural, non-productive areas on arable land, increased pesticide use (sales volumes of pesticides have tripled since 2000), shrinking crop diversity and inappropriate water retention. On intensively managed grassland areas, where the FBI is more stable, inappropriate mowing practices and less diversity have been identified as important threats to biodiversity (AAM Consulting et al., 2016). High Nature Value farmlands are disappearing rapidly due to agricultural intensification (EEA, 2019), whilst the share of fallow land and landscape features in the agricultural area is below the EU average (European Commission, 2020a).

In addition to intensification, land abandonment has been identified as another major issue. Between 1990 and 2013 the size of abandoned farmland has almost doubled from 1.07 ha to 1.93 ha. Grassland areas have been particularly effected (Csíder, I. 2014).

Agricultural genetic resources are also at risk, several traditional (fruit and vegetables) varieties are not cultivated anymore partly because of economic reasons and partly because farmers do not have sufficient knowledge about their cultivation (Hungary's 6th National Report for the Convention on Biological Diversity).

Pollinators are also at risk and there is no red list published about pollinators groups population.

Figure 1: Common farmland bird index in Hungary (2000=100)



Relevant policy objectives/targets

One of the specific objectives in the Hungarian Biodiversity Strategy (2015-2020) is the stabilisation of the Farmland Bird Index by 2020 through the creation, improvement, and restoration of green infrastructure on agricultural areas, in general. This objective will likely not be met and it remains unclear if and how the next biodiversity strategy, which is not yet available, will address this particular issue. Finally, there is no national pollinator plan as yet.

2.2.2 Protected species and habitats

Past trends and outlook

A negative trend can be observed in the conservation status of species and natural habitats protected by the EU Nature Directives. In the 2013-2018 period approximately 87% of habitats and 65% of species were in unfavourable status. In the previous (2007-2012) reporting period these values were 80% and 63% respectively, although some of these changes might be linked to methodological issues (including the availability of better/new data) rather than reflecting genuine changes. Across all types, the conservation status of habitats in Hungary is worse than the EU average. Grassland habitats are a particular concern, currently none of these habitats have a favourable conservation status. Agriculture has been identified as a threat/pressure in 42% of all habitat assessments (83% of the assessments of grassland habitats) and 48% of all species assessment. The most frequently reported agriculture-related threats are the abandonment of grassland management, intensive grazing or overgrazing by livestock and the use of plant protection chemicals of grassland).

Policy targets and objectives

Increasing the role of agriculture in biodiversity conservation is one of the strategic area in the Hungarian Biodiversity Strategy (2015-2020). The relevant overarching objectives include the preservation of agricultural genetic resources and the promotion of sustainable, diverse, mosaic-patterned agriculture. Amongst the more specific objectives are:

- Area of agricultural land covered by AECM reaches 2 million hectares
- Great Bustard population increases to 1,700
- Halting the loss of grassland areas
- 1.2 million ha of land cultivated in a way to improve agricultural biodiversity
- Stabilisation of FBI at 100 (i.e. level it was in 2000)
- increasing the usage of meadows and pastures for animal husbandry by at least 10%
- increasing the total size of the areas under ecological farming subject to environmental and landscape protection requirements to 350,000 hectares

Table 2: State of biodiversity overview table

Biodiversity * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Common species : Farmland birds				
Protected species and habitats				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.3 Soil

2.3.1 Loss of soil biodiversity and soil organic matter

Past trends and outlook

There is relatively little information available about the state of soil biodiversity in Hungary. The assessment of potential threats to soil biodiversity suggests moderate-high to high potential risk for all three components of soil biodiversity in Hungary, including soil microorganisms, soil fauna and soil biological function. A study covering multiple EU Member States, identified the intensive use of agricultural soil (e.g. high level of pesticide and mechanisation) as the only threat with high potential for all three components of soil biodiversity (Orgiazzi et al., 2016).

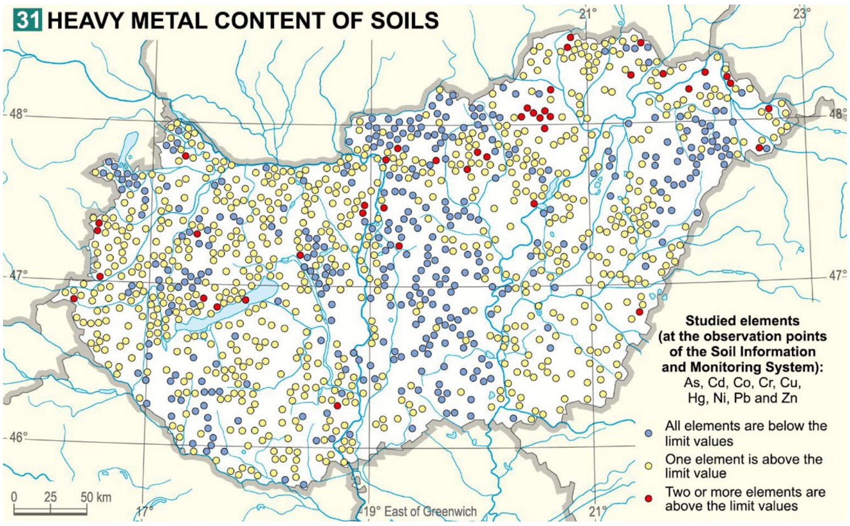
Soil organic content varies across in regions but in general it is low in Hungary, especially in croplands and areas with permanent crops (Brogniez et al., 2015). Mean soil organic content in arable land is approximately 20.5 g kg-1 (2015), which is less than half of the EU average. Soils with the highest organic matter content are found in the country's boggy regions, including the Kis-Balaton area and the Hanság). There are no sufficiently long datasets that would allow the assessment of historical changes of soil organic content, but the loss of soil organic content has been identified as a challenge in Hungary's Soil Protection Action Plan. The annual loss of soil organic matter is estimated to be around 1.5 million tonnes, which is linked to the degradation of the humus-rich topsoils (Pásztor et al., 2018).

2.3.2 Soil pollution

Past trends and outlook

Based on a recent assessment of heavy metal content in agricultural topsoils of the EU, no major contamination issues can be identified in Hungary (Toth et al., 2016). The analysis did not find any detectable traces of lead, cadmium, copper, antimony or zinc contamination on agricultural land. On the other hand, the concentration of nickel, chromium and arsenic concentration exceeded the guideline value in multiple regions.

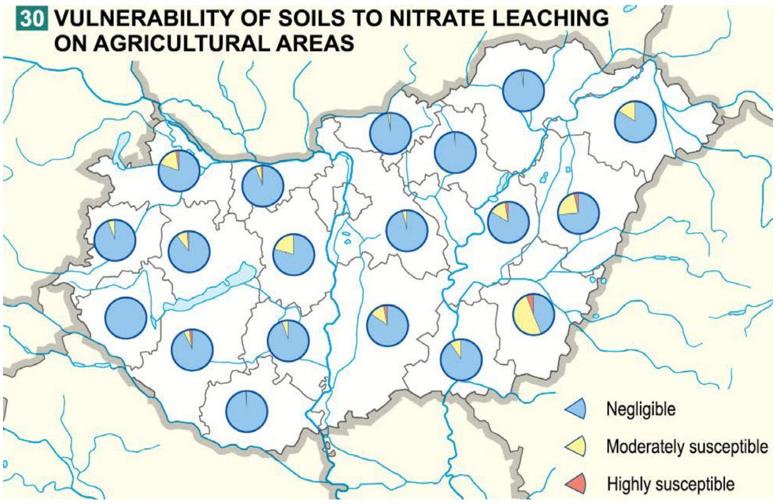
Figure 2: Heavy metal content of Hungarian soils



Source: Kerenyi et al., 2018

With regards nutrient balance, Hungary soils are subject to a Nitrogen surplus and a Phosphorus deficit. In 2017, the level of Nitrogen surplus stood at 33kg/hectare but it varies greatly between years with no clear trends. In general, the risk of nitrate leaching is low throughout the country with the exception of the Alföld and Kisalföld regions, where the risk is moderate (Figure).

Figure 3: Vulnerability of soils to nitrate leaching



Source: Kerenyi et al., 2018

2.3.3 Erosion and other relevant issues

Large areas in Hungary are affected by one or more of the following natural factors: erosion, extremely high sand or clay content, extremely acidic or alkaline soil reaction, waterlogging and shallow depth. Whilst these are natural conditions, they call for appropriate site-specific land use and management practices. Also, some of these characteristics are further accelerated by human activities:

- Around 2.8% of the total agricultural area is affected by moderate to severe water erosion (vs 6.6% EU average) causing the loss of 1.6 million tonnes of soil each year. Arable and permanent crop areas are more affected by erosion than permanent meadows and pasture (Panagos et al, 2020). Soil conservation cultivation methods are not common (**Error! Reference source not found.**), more than 40% of arable land is left bare in winter (Eurostat, 2020a) and the majority of arable land under tillage is tilled conventionally (Eurostat 2020b). In terms of geographical distribution, agricultural areas in the east, south-east regions have a lower proportion of severe erosion than in the other parts of the country. Since 2000, estimated soil loss by water erosion has slightly decreased (European Commission, 2021)

- 26% of Hungarian soils are strongly or moderately, while 20% are slightly acidic. The "Nyírség" and Transdanubian Hills regions are more susceptible to acidification. The three main causes of soil acidification are excessive fertiliser use, acidic atmospheric deposition and the disposal of acidic industrial by-products and wastes.

- 8% of Hungarian soils are affected by human induced salinisation/alkalisation, which is often linked to irrigation practices. Typically, these soils are also more susceptible to physical degradation, including structure destruction and compaction.

- Approximately one third of Hungarian soils are moderately or highly susceptible to physical degradation. The high degree of soil disturbance and inappropriate agrotechnics further accelerates the problem.

2.3.4 Soil Relevant policy objectives/targets

There are no specific, legally binding targets in relation to soils in Hungary. The Soil Protection Action Plan sets out some high level, general objectives (e.g. effective soil protection, information sharing and capacity building, infrastructure development focusing on data). The Hungarian Biodiversity Strategy also lists the promotion of soil conservation amongst its activities but without linking it to any specific target

In addition, the EU has several non-binding strategies and frameworks regarding soil health. The EU is currently preparing a new EU Soil Strategy. As part of the EU Biodiversity Strategy, this initiative aims to preserve soil health "*to help achieve land degradation neutrality by 2030*" (EC, 2021). The Farm to Fork Strategy also aims to reduce nutrient losses by at least 50% while ensuring no deterioration in soil fertility. This will reduce the use of fertilisers by at least 20 % by 2030.

Table 3: State of soil overview table

Soil * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Loss of soil biodiversity and soil organic matter			n.a.	n.a.
Soil erosion and other issues			n.a.	n.a.

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.4 Water

2.4.1 Water quantity

Past trends and outlook

Around three quarters of Hungarian groundwater bodies have good quantitative status, which is less than the EU average, but total water abstraction has decreased significantly in Hungary since 2000. Cooling (linked to electricity production) remains the main reason for abstraction in the country (72% of total abstractions in 2012). In 2012, approximately 12% (or 322 million m^3) of the abstracted water was for agricultural purposes, which is a significantly lower than in 2000 (721 million m^3) (Eurostat, 2021). In 2016, slightly more than half of the irrigable UAA was irrigated (i.e. 140,000 ha out of 262,000ha) and the irrigation system in the country is considered outdated (European Commission, 2019). Furrow irrigation is dominant. Abstraction for irrigation affects 42% of the groundwater bodies (EEA, 2018b).

Relevant policy objectives and targets

In response to warmer and drier climate conditions (especially during the summer period), the Hungarian government is aiming to significantly increase the size of irrigated area by 100,000 hectares by 2024 relying mainly on surface water sources (OECD, 2020). This may put pressure on water bodies.

Hungary has failed to achieve the EU Water Framework Directive objectives of achieving good quantitative status of all groundwater bodies by 2020. Amongst its priorities, the National Water Strategy aims at promoting water retention and storage capacity. At the same time, as an adaptation measure to increasing drought risk, the Hungarian government foresees a significant increase in the size of irrigated agricultural areas by 2024, relying mainly on surface water sources. Currently, the share of irrigated UAA is low (around 2.6%) but it has been increasing with an above EU average rate (European Commission, 2020). Farmers have to pay for the abstracted water and since 2017 a "pressure multiplier" has been in place charging a 20% premium on water users based on the quantitative status of surface and groundwater bodies (OECD, 2020).

2.4.2 Water quality

Past trends and outlook

More than three quarters of surface water bodies in Hungary are in moderate to bad ecological status[2], which is one of the highest proportions in the EU, and 46% have 'unknow' chemical status[2] (European Commission, 2020). Regarding groundwaters, 21% of are failing to achieve good chemical status. Comparing the first and second river basin management plans (RBMPs), the overall ecological status of surface water bodies, no substantial improvements can be identified: in the 2nd RBMP 10% of the classified water bodies have at least good ecological status, while in the 1st RBMP their share was 9% (EEA, 2018a). However, according to the reported data under the WFD available the EEA WISE portal, Hungary does not expect to reach good ecological status by 2027 in 70% of its surface water bodies, currently in poor status and significantly affected by diffuse pollution pressure. On the other hands projections suggests that by 2027, 91% of groundwater bodies will have good ecological status/potential.

The main pressures on water bodies in Hungary are hydromorphological pressures (83% of all water bodies affected), followed by diffuse source pollution (36% of surface water bodies and 21% of the groundwater) (EEA, 2018b). Agriculture has been identified as one of the main sources of these pressures linked to physical and hydrological alternations and nutrient (both nitrates and phosphates) and pesticide pollution from the sector (EEA, 2018 b; OECD, 2019). Hungarian soils are subject to a nitrogen surplus and a phosphorus deficit and the nitrate concentration in water is slowly increasing since 2004 in 15% in groundwaters and in 24% of surface waters bodies (European Commission, 2020). Also, "*7% of the monitoring stations in groundwater and 1.5% of the monitoring stations in surface water had average values equal to or exceeding 50 mg nitrate per L during the reporting period (2012-2015)*" (European Commission, 2020; European Commission, 2019 b).

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[2]Ecological status "*looks at the abundance of aquatic flora and fish fauna, the availability of nutrients, and aspects like salinity, temperature and pollution by chemical pollutants*" along with morphological features. Chemical status relates to the presence of regulated chemical pollutants (EC 2010).

Relevant policy objectives and targets

The Water Framework Directive aims to achieve good qualitative status of all water bodies. To do so, the Hungarian National Water Strategy and the RBMP aims at improving the ecological status of water bodies. But beyond addressing mainly the nutrient balance and applied quantities, the RMPB also focuses on the transport pathways of diffuse pollution (leaching and erosion). The measures proposed to address diffuse pollution combine for example land use and management interventions, including the promotion of landscape features (e.g., terraces to limit erosion). However, many of the measures are implemented on a voluntary basis.

Table 4: State of water overview table

Water * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Water quality				
Water quantity				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

2.5 Air quality

Past trends and outlook

In 2016, the total emissions of ammonia amounted to 87 kilotonnes (kt). Agriculture was responsible for 90% (or 78kt) of these emissions. The main sources of agricultural ammonia emissions are bovine production, manure and mineral fertilisers. After a sharp decline in the 1990s, which was linked to the economic transition, agricultural ammonia emissions were relatively stable until the mid 2000s but have been increaseing steadily since 2009. This is linked to the increasing livestock number in the beef and veal sectors as well as to the increase in fertiliser use (Eory et al., 2019).

Relevant policy objectives and targets

The National Emission reduction Commitments Directive (NEC Directive) established ammonia reduction targets for each member states. Hungary is commited to reduce its ammonia emissions by 10% from 2020 to 2023 and by 32% for any year from 2030. The targets will need further assistance in the CAP Strategic Plan.

Table 5: State of air overview table

Air * **	Past trends and outlook		Prospects of meeting policy objectives/targets under the assumption of unchanged policy	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Air quality				

** Evaluation made by the author from the information above*
*** Colour code: red = deteriorating trends/not on track; yellow = trends show a mixed picture/ partially on track; green: improving trends/on track.*

3. SUMMARY OF NEEDS PER ISSUE

3.1 Climate

Mitigation: There is a need to address GHG emissions from agriculture to enable the sector to make a fair and proportionate contribution to the economy-wide emission reduction goals. Even with additional measures in place, agricultural emissions are not foreseen to decline, putting more pressure on other sectors to cut net emissions and especially on the forest sector to increase removals and thereby compensate for agricultural emissions.

Therefore, further efforts are needed to decrease gross agricultural emissions. At the same time Hungary has large arable lands on mineral soils providing scope for SOC enhancement on cropland areas, which are currently sinks but expected to become a net emitter.

Adaptation: To address the main climate impacts on agriculture, including droughts, hail, storm, spring frost and flood risks, there is a need to:

- modernise the irrigation system and improve water management efficiency in general, to be able to address water imbalances;
- improve the resilience of crop production, focusing primarily on spring crops that are expected to be hit harder by the impacts of climate change;
- adapt livestock housing systems to lower heat stress;
- prepare the sector for increased pest and disease risk.

3.2 Biodiversity

Farmland biodiversity is threatened because of the current farming practices. Hungary needs to address the adverse impacts of agricultural intensification on biodiversity by:

- stopping the current fragmentation and land use changes and restoring natural, non-productive areas and features in the agricultural landscape to protect farmland birds and pollinators habitats;
- reducing the use of agrochemicals;
- better monitoring of agricultural biodiversity so as to implement an ambitious action plan for protecting and restoring biodiversity on farmland within a short period (especially for pollinators on which Hungary lacks a comprehensive data and action plan);

- develop extensive farming practices. Increasing farmers' knowledge and public awareness about traditional varieties.

3.3 Soil

Agricultural soils in Hungary suffer from pollution due important use of nitrogen fertiliser and from to erosion and soil acidification. The sector needs to:

- extend soil conservation cultivation methods (e.g. soil coverage and appropriate tillage methods);
- halt the loss of humus rich topsoils;
- reduce the use of agrochemicals;
- improve irrigation practices;
- avoid unnecessary soil disturbance on agricultural land (e.g., through appropriate agrotechnics).

3.4 Water

Hungary still has a long way to go to reach the Water Framework Directive objective, so the county needs to improve the quality and quantity of its water bodies. Accordingly, several needs can be highlighted:

- improve the monitoring of its water bodies status to start measuring and identifying the main issues;
- reduce the pressure on water bodies from inputs, and particularly from nitrogen and pesticides;
- improve irrigation infrastructure and explore natural water retention measures to be able to address water imbalances without putting too much pressure on water bodies.

3.5 Air

Hungary needs to address ammonia emission linked to the livestock sector and to the application of manure and mineral fertilisers.

Table 6: Summary of the information from Sections 2 and 3 on the past trends and outlook and associated needs for each environmental issue

Theme	Past trends and outlook	Policy objectives/targets	Needs
CLIMATE			
Mitigation	• In 2019, agricultural practices accounted for 12% of total GHG emissions. • Emissions from the sector have been increasing since 2013, which trend is expected to continue. • Main emission sources: agricultural soils, enteric fermentation and manure management. • Cropland areas (currently still sinks) are expected to become net emitters in the future	• No quantified emission reduction target set for the sector. • -7% by 2030 (vs 2005) under the ESR • -40% economy wide reduction target by 2030 (vs 1990) • - economy wide climate neutrality by 2050	• Reduce emissions from agricultural land and livestock • Enhance SOC on cropland areas
Adaptation	• Amongst the main risks are drought, hail, storm, spring frost, flood, pests and disease. • Further increase in annual mean temperature and more water imbalances are projected for the future • Uneven vulnerabilities across sectors: spring crops and intensive livestock farming could be more adversely affected	• Increase the size of irrigated area by 100,000 ha by 2024 (~70% increase vs 2016)	• Address water imbalance • Modernise irrigation system • Improve resilience of crops • Adapt livestock housing • Prepare for increased pest and disease risk

BIODIVERSITY			
Common farmland species	• FBI declined by 30% between 2000 and 2019, highest decline occurred in intensive arable areas. • Positive link between some targeted RDP measures (e.g. AECM) and farmland biodiversity.	• Stabilisation of FBI by 2020 • Area of agricultural land covered by AECM reaches 2 million hectares • Great Bustard population increases to 1,700 • Halting the loss of grassland areas • 1.2 million ha of land cultivated in a way to improve agricultural biodiversity	• Crop diversification • Restoration of natural, non-productive areas • Reduction in the use of agrochemicals
Protected species and habitats	• Large share of protected species & habitats is in unfavourable status, incl. 100% of agricultural habitats • Agriculture is one of the main threats/pressures		
WATER			
Water quality	• Surface water bodies in general are in poor ecological status, and trends are negative • Ground water bodies are in above EU average condition • Diffuse agricultural pollution (nutrients, pesticide) is a main pressure on water bodies	• Good qualitative and quantitative status under the WfD	• Reduce the pressure on water bodies from nitrogen and phosphorous inputs and pesticide • Improve water management efficiency and address water imbalances
Water quantity	• Share of irrigated UAA is low but has been increasing with an above EU average rate • Irrigation system is outdated • Share of groundwater bodies with good quantitative status remains below EU average		• Reduce nitrate and pesticide concentrations in water by stopping diffuse pollution from phytosanitary products, especially nitrate fertilizers.

SOIL			
Loss of soil biodiversity and SOC	• Only limited information available, all three components of soil biodiversity face high risks • In general, low SOC • Significant loss of soil organic matter due to degradation of humus-rich topsoils	N.a.	• Soil conservation • Reduction in the use of agrochemicals • Protection of humus rich topsoils • Limit soil disturbance on agricultural land
Soil pollution	• No major heavy metal contamination • Generally low risk of nitrate leaching		
Soil erosion and other issues	• Less prone to water-related erosion with arable & permanent crop areas more affected • 40% of arable land left bare in the winter, conventional tillage remains a prevalent practice		
AIR			
Ammonia concentration	• Agriculture was responsible for 90% (or 78kt) of ammonia emission. They were relatively stable until the mid 2000s but have been increaseing steadily since 2009. • The main sources of agricultural ammonia emissions are bovine production, manure and mineral fertilisers.	Ammonia reduction targets from the NEC Directive: • -10% from 2020 to 2023 • -32% for any year from 2030 its ammonia emissions.	• Address ammonia emission linked to the livestock sector and to the application of manure and mineral fertilisers

4. LIST OF MOST RELEVANT MANAGEMENT PRACTICES RESPONDING TO THE NEEDS

4.1 Climate mitigation and adaptation

- Relevant farming practices to reduce methane emissions are improving manure management and storage as well as reducing livestock numbers. Changing feeding strategies, including optimised feeding and potentially also feed additives can also contribute to reduction of methane emissions.
- Nitrogen emissions can be reduced by improving the efficiency of fertiliser use (improved nutrient planning, use of catch crops/cover crops) and reducing livestock density in most intensive livestock regions.
- Practices to improve soil organic content include conservation and/or zero tillage and soil coverage in the winter period.
- Increasing resilience of crop production can be achieved through improved crop rotations and sustainable soil management practices that maintain soil fertility and productivity and protect from soil compaction and erosion, as well as investment in efficient irrigation, provided that overall abstraction remains sustainable. Breeding more resilient plant and animal species can also improve resilience in the sector. Adjustments in animal housing will be likely necessary in response to the expected temperature changes. In addition, addressing water imbalances, including through the promotion of nature-based water retention measures and improved irrigation infrastructure should play an important role.

4.2 Biodiversity

Effective measures to protect and promote biodiversity in Hungary are mainly related to the reduction of pesticide and fertiliser use and the restoration of natural, non-productive areas, including fallow land and landscape features. Halting the loss of high nature value farmland areas and improving grassland management can also make an important contribution to biodiversity conservation. Relevant measures in intensive production systems include more diversified crop production as well as reduced reliance on pesticides and fertiliser (e.g. through biological pest control and more efficient fertilisation techniques). Organic farms have a much higher share of grassland and a lower management intensity than conventional producers and are therefore of great important for the promotion of biodiversity.

4.3 Water

Diffuse water pollution linked to agricultural production can be addressed through more efficient nutrient management. Relevant practices range from improved manure storage and fertilisation (e.g. precision farming accompanied with other good management practices such as crop rotation with legumes, nitrogen inhibitors) to the use of cover/catch crops and conservation tillage. Soil and nutrient management plans can provide a structured and comprehensive approach to identify and implement appropriate practices. Better alignment with the principles of integrated pest management can help address pesticide-related pollutions through the promotion of physical and biological pest management practices. To protect the quantitative status of water bodies, nature-based water retention measures and irrigation infrastructure improvements should be implemented.

4.4 Soil

Soil properties in Hungary are mainly threatened by soil erosion, acidification, salinisation/alkalisation (salt accumulation) as well as other physical degradation processes (e.g. compaction). Many of the previously identified measures can help prevent soil erosion, e.g. improved tillage practices, permanent soil coverage (mulching). Other relevant practices to address acidification, salinization/alkalization and compaction include sustainable liming, improved irrigation practices (i.e. avoiding local over-irrigation to prevent secondary salt accumulation) and limiting mechanistic pressure by agricultural machinery and risks of soil compaction.

4.5 Air

Ammonia emission from agriculture can be addressed by approving the efficiency of fertiliser use as well as by reducing livestock numbers and improving manure storage.

Table 7: Summary table – Example of measures

Measures	Agricultural practices	CLIMATE		WATER		BIODIVERSITY		SOIL			AIR	Safeguards/ Comments	Targeting
		Mitigation	Adaptation	Quantity	Quality	Common species	Protected area species	Loss of soil biodiversity	Loss of SOM	Soil erosion	Ammonia pollution		
Land management	**Improved crop rotation**	X	X	X	X	X	X	X	X	X		Should be genuine rotation over years and not "crop diversification"	Arable land
	Inclusion of legumes in crop rotation	X	X						X				Id.
	Switch from intensive row crops (i.e., water, fertiliser, intensive or SOM-consuming crops)	X	X	X	X				X	X		Choice of crop has to be regionally specific, e.g., switching beets or maize to cereals or intercropping	Erosion and water scarcity areas
	Cover crops / Catch crops	X*	X	X	X				X	X		Mechanical destruction only	Arable land
	Mulching and leaving crop residues		X	X	X				X	X		Agronomic practice to be adapted to local conditions regarding the quantity of mulch and residues	Id.
	Reduced or no tillage	X*	X	X	X			X	X	X		Without herbicide application	Id.
	Landscape features, hedges, flowering strips	X	X	X	X	X	X	X	X	X		Not only preservation of existing features but also and more importantly creation of new features	Id.

	Conversion of arable land to grassland	X*	X	X	X	X	X	X	X	X		Should be permanent grassland, not simply including grass into the rotation	High erosion risk areas
	Field grass margins	X*	X	X	X	X	X	X	X	X			Id.
Biocontrol	**Biological control of pests and diseases**		X		X	X	X	X				Amend existing approval procedures for biological agents to increase their availability	All crops
Organic farming	**Conversion to and maintenance of organic farming**		X	X	X	X	X	X	X	X	X	Needs support for knowledge transfer	All regions
Agroforestry	**New agroforestry**	X	X	X	X	X	X	X		X		Local and resilient tree species should be used	Arable areas with large field sizes.
	Landscape features (including hedgerows and woody field margins)	X		X	X	X	X	X	X	X		Local and resilient tree species should be used	Arable areas with large field sizes.
High nature-value farming	**Conservation of typical orchards and extensive grasslands (e.g., reduced fertiliser, fewer cuts, later cuts)**	X	X		X	X	X	X	X	X	X	Reducing livestock densities in combination with more extensive management would help to contain livestock numbers within climate-compatible boundaries	All regions where HNV is still found.

												and reduce pressure on farmland species.	
Livestock management	**Reducing max livestock density**	X			X	X	X			X	X	Maximum livestock densities should be regionalised with a view to reflecting the real capacity of each region to feed their animals	Most intensive productions as first targets
Livestock management	**Improved livestock health management**	X	X								X		All livestock
	Solid manure application from animals on straw				X			X	X	X	X	Agronomic practice to be regionalised according to local soil types, etc.	Mixed farms
	Improved grassland management (e.g., choice of grass varieties, grazing patterns)		X			X	X	X	X	X		Double objective: to further increase carbon capture and to regenerate biodiversity.	All grassland areas
Knowledge transfer	**Operational groups and demonstration farms (EIP-Agri)**	X	X	X	X	X	X	X	X	X	X	Should make the link between science and practice. Using digital means and dedicated social network would help accelerate the transition.	Build a dense network across the country for environmental issues

Advisory services	**Targeted advice to farmers to accompany the agro-ecological transition**	X	X	X	X	X	X	X	X	X	X	Avoid one-size-fits-all advice. An approach along natural regions should be promoted (by contrast with advice per production).	Young farmers and new installation s

*** These are measures that mainly relate to the maintenance and improvement of Soil Organic Matter (SOM).**

No go measure box

The box below highlights the measures to avoid as they will be counterproductive in achieving the identified needs.

- Horizontal AgriEnviroment-Climate Measure (AECM) cropland schemes that have little or even negative environmental impacts, especially on biodiversity. The ex-post evaluation of the 2007-2013 RDP identified Natura 2000, agri-environmental payments as well support provided for areas facing natural constraints as measures with positive impact on farmland biodiversity. One exception was the integrated cropland scheme (one type of agri-environmental payment in the 2007-2013 period), which had no measurable positive impact on farmland biodiversity, anecdotal evidence even suggests that it might have negatively affected biodiversity.
- Unconditional voluntary coupled support (VCS) for livestock – maximum livestock density should a precondition of VCS;
- Replacing crop rotation with crop diversification (both are needed);
- Precision agriculture that only increases efficiency of input-intensive systems and only delivers small reductions in pesticide and fertiliser use, rather than as an accompaniment to practicing integrated pest management (e.g. crop rotation, ecological infrastructures, biological control and use of chemical control as a last resort)
- Expansion of irrigation system without sufficient safeguards for protecting water quality and quantity;
- Investment measures that can promote intensification, like housing for intensive livestock farms, or machinery that increases soil compaction;

5. INTERVENTION MECHANISM EXAMPLES

The following examples illustrate how certain different CAP instruments (such as *eco-schemes*, agri-environment and climate measures) could be used to fund the different measures listed in section 4. Just one example is given per category of need, therefore, it is not an exhaustive list. Other potential measures like investment support are also not included. Further, different interventions can fulfil multiple goals, for examples the preservation or restoration of extensive permanent grassland can contribute to climate mitigation, biodiversity and water quality at the same time.

	Practices	Corresponding instruments Pillar 1	Corresponding instruments Pillar 2			
Corresponding needs in the national context		Conditionality/ Eco-schemes	Environmental climate and other management commitments	Natural or other area-specific constraints[3]	Cooperation (EIP-AGRI OGs)	Knowledge and information
CLIMATE						
Climate mitigation	Changes in manure storage and management	Setting requirements for manure application & storage (e.g. more precise spreading) GAEC 6: restrictions on the use of manure on slope	Setting requirements for manure application & storage (e.g. more precise spreading)		Support collaborative initiatives, e.g. shared machinery and infrastructure	Provide advice and support for farmers

[3] In the Rural Development Programmes, it is possible to prescribe ANC conditions for certain measures e.g. for higher support (investments).

Climate adaptation	Natural water retention	Eco-schemes to protect areas with high soil water retention capacity and setting requirements for soil cover	More ambitions requirements for soil cover crops e.g., combined with habitats creation for farmland species and zero pesticide use	Option no tillage	Exchange of good practices and best farm business strategies for cover crops.	Appropriate cover crop varieties and timing of planting to minimize risks of secondary pests and diseases Method to avoid pesticide use when destroying cover crops
			BIODIVERSITY			
Biodiversity protection and restoration	Restoration of landscape biodiversity	Eco-schemes for landscape features	Establishment and management of biodiversity areas including landscape features (additional area)	Flowers strips, landscape features	Exchange of good practices	Biodiversity needs, most appropriate management for specific habitats and species
	Pesticide reduction – biocontrol	IPM as an eco-conditionality criteria Biocontrol as an eco-scheme	Zero chemical pesticides	Flowers strips, landscape features	Test fields, demonstration farms network	Systemic approach to farm management, insect biology, biocontrol solutions
			WATER			
Water quality (nitrates)	Nutrient management	Eco-schemes for precision farming that achieve nutrient balance and have clear	Nutrient management plan included within a whole farm approach		Exchange of good practices, support collaborative initiatives, e.g. shared machinery	Advice for farmers on nutrient management covering water protection aspects

		environmental objectives				
SOIL						
Soil protection and regeneration	Organic farming	Crop rotation Converting arable farms to organic farming (3 years)	More demanding rotations included within a whole farm approach	Option no tillage	Converting farms to organic	Eco-intensification[4] Weed control in no tillage organic
AIR						
Air quality	Manure management)	Eco-conditionality to align with the measures in *the code of good agricultural practices that falls under the National air pollution control programme (NAPCP) (NEC Directive)*	Setting requirements for manure application & storage (e.g. more precise spreading)		Support collaborative initiatives, e.g. shared machinery and infrastructure	Provide advice and support for farmers

[4] Low-input, ecosystem-based, knowledge-intensive farming systems (Tittonell, 2014).

6. ALIGNMENT BETWEEN RECOMMENDED MEASURES AND THE GREEN DEAL

The management practices described in section 4 and the examples of intervention mechanisms given in section 5 have been chosen because their impact will help achieve the headline targets of the Green Deal (see box 1 below as a reminder).

Box 1: Green Deal headline targets

Climate law

Legally binding target of net zero greenhouse gas emissions by 2050 (2030 reduction target of 55 %, at least, compared to 1990 levels)

Farm to Fork

- *Reduce by 50% the overall use and risk of synthetic chemical pesticides and the use of more hazardous pesticides by 50% by 2030*
- *Reduce nutrient losses by at least 50%, while ensuring that there is no deterioration in soil fertility. This will reduce the use of fertilisers by at least 20% by 2030*
- *Reduce by 50% sales of antimicrobials for farmed animals and in aquaculture by 2030*
- *At least 25% of the EU's agricultural land under organic farming by 2030*
- *The Commission will propose legally binding targets to reduce food waste across the EU by 2023.*

Biodiversity strategy

At least 10% of agricultural area is under high diversity landscape features

Measures have multiple goals and impacts and in their strategic plans, Member States should prioritise measures that have the highest number of incidental benefits to reduce the risk of trade-offs. For example, maintaining permanent grassland will help keep carbon in the soil and help fulfil the carbon neutrality target by 2050. Furthermore, this measure positively impacts biodiversity on the condition that they are extensively managed, both in terms of inputs and other management practices include stocking densities and grazing or mowing regimes, it will therefore help achieve the biodiversity strategy target. As another example, biocontrol reduces pesticide use while also fostering new governance approaches on the farms, in line with the SDGs and the EU Green Deal objectives (Hulot and Hiller, 2021).

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Annex 1

Ex-ante analysis	SWOT analysis	Assessment of needs	Public/ stakeholder consultation	Final intervention strategy	First draft	Strategic environmental assessment	Second draft submitted to the EC	Approval of the CAP CSP
May 2020	Nov 2020	Nov 2020	May 2021	May 2021	Currently being drafted			

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