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Commission Response
to
Council Decision (EU) 2022/2572 of 19 December 2022

requesting that the Commission submit a study complementing the impact assessment of the proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115.

Executive Summary

Council Decision (EU) 2022/2572 of 19 December 2022[1] requested the Commission to submit to the Council a study complementing the impact assessment of the proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115, and to propose follow-up actions, if appropriate, in view of the outcomes of the study. This proposal for a sustainable use of plant protection products regulation[2] ('SUR proposal') was adopted on 22 June 2022 as part of a package of measures to reduce the environmental and health footprint of the EU's food system and to help mitigate the economic losses that we are already suffering due to climate change and biodiversity loss.

The Commission does not always have the granular and Member State specific data, and particularly on pesticide use, that Member States have, which limits the ability to provide Member State and crop-specific analysis. Regulation (EU) 2022/2379 of the European Parliament and of the Council[3] will in the future provide valuable statistics on pesticide use to enable more precise monitoring of progress towards further pesticide reduction targets.

In response, this study provides information on the specific aspects listed in the Council Decision. These include: (i) the potential impact of the SUR proposal on food production in the EU and on food and feed prices; (ii) the potential consequences for food and feed availability in the EU; (iii) the potential impacts of increased administrative burden on competitiveness and profitability of small and medium-sized farms; (iv) the availability of alternatives to plant protection products and the potential increased risk of introduction and spread of harmful organisms in the EU; (v) the potential impact of banning the use of plant protection products in sensitive areas, especially in areas used by the general public and in human settlements; and (vi) the potential impact of the proposed restriction concerning the use of plant protection products on forest stands and forest dependent biodiversity[4]. It confirms the conclusion of the evaluation and impact assessment that there is a need to revise the Sustainable Use of Pesticides Directive[5] to address important policy issues such as poor and variable implementation across Member States, the lack of national targets and the need to protect sensitive areas. It also supports the measures set out in the SUR proposal. It further reaffirms the objectives of the SUR proposal and the SUR pesticide reduction targets, noting that since the SUR proposal was adopted the EU and all EU Member States have adopted the Kunming-Montreal Global Biodiversity Framework at the Fifteenth meeting of Parties to the

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[1] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study *(OJ L 331, 27.12.2022, p. 6)*.

[2] Proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD)).

[3] Regulation (EU) 2022/2379 of the European Parliament and of the Council of 23 November 2022 on statistics on agricultural input and output, amending Commission Regulation (EC) No 617/2008 and repealing Regulations (EC) No 1165/2008, (EC) No 543/2009 and (EC) No 1185/2009 of the European Parliament and of the Council and Council Directive 96/16/EC (OJ L 315, 7.12.2022, p. 1).

[4] Throughout this study, the term 'pesticides' is generally used to refer to plant protection products.

[5] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

United Nations Convention on Biological Diversity (COP15) and subscribed to a globally binding target of 'reducing the overall risk from pesticides and highly hazardous chemicals by at least half including through integrated pest management (IPM), based on science, taking into account food security and livelihoods' by 2030. This global target is fully in line with the SUR pesticide reduction targets set out under the SUR proposal.

The potential impact of the SUR proposal on **food and feed availability** in the EU, and the possibility of increased dependence on imports as well as reductions of exports, will depend on the potential effect on crop yields. This needs to be seen from two angles – an unmanaged or badly managed reduction in pesticide use may indeed lead to yield reductions, but a well-managed transition will not have such negative effects. At the same time, it is also clear that, in the medium and long terms, the lack of pollinators will also reduce crop yields, indeed the trend is already visible today. It should be noted that the SUR pesticide reduction targets are for 2030, and this time-period, plus the time for the entry into application for various proposed measures, means there is a managed transition with time to introduce alternatives and make gradual changes. The information provided in **Chapter 1 (economic issues)** of this study highlights several studies that already provide quantitative data on the potential impact on agricultural yields for the main crop types in the EU if pesticide use and risk were to be reduced by 50%. Given the lack of empirical data on pesticide use, the published impact studies have used broad assumptions of yield decline or have used crop- and region-specific estimates of yield declines based on expert opinions. The largest yield impacts in these studies were estimated to occur in crops that have limited relevance for food and feed security, such as grapes, hops and tomatoes. These estimates of potential yield impacts should be seen as an upper limit due to several factors that are not considered in these studies (this is explained in more detail later in this study). A significant reduction in pesticide use and risk may also be achieved in non-food and non-feed sectors, thereby helping to meet the SUR pesticide reduction targets without any impact on food security, food production, availability or prices. The existing variations in current pesticide use between similar farms also suggests that it can be reduced without significant repercussions on crop yields.

A key element of the SUR proposal is that it allows Member States to decide, in their national action plans, how to apply the SUR national pesticide reduction targets, taking account of the need to protect production of specific crops, in specific regions or by specific practices. They can thus limit the impact of the measures, distributing them to less critical areas. Very significant progress towards achieving the Farm to Fork pesticide reduction targets has already been achieved by substituting low-risk pesticides for higher risk pesticides without having any effect on crop yields. A broad variety of alternative agronomic and technological strategies also make it possible to reduce pesticide use and risk while maintaining crop yields. Many precision agriculture technologies permit the targeted and controlled application of pesticides or provide alternatives to pesticides. These are supported by the SUR proposal and a range of associated measures, including through the use of Common Agricultural Policy (CAP) funding.

Chapter 2 (administrative burden) compares the additional administrative burden for small and medium-sized farms of the SUR proposal compared to the existing Sustainable Use of Pesticides Directive, which is calculated as 10 hours per year per farm. Depending on the hourly tariff used, this could equate to a cost of EUR 161-210 per year per farm, including non-wage labour costs and a standard 25% for overheads. This can be compared with the administrative burden on farmers in other areas arising from compliance with EU legislation or rules. For example, a study analysing administrative burden arising from the Common Agricultural Policy assessed the average cost related to aid administration in the EU to be around

EUR 220 per farm. There could be an additional cost of EUR 180 per year for such small and medium-sized farms to obtain annual obligatory 'strategic advice' under the SUR proposal, although providing such advice via group or online/remote means could reduce this cost significantly. Member States could decide to compensate farmers for these costs via common agricultural policy (CAP) Strategic Plans. Evidence from the impact assessment and the supporting external study suggests that farmers could partially or even fully recoup the cost of advice received from the savings generated by the reduced use of pesticides. The Commission does not have precise, harmonised EU-level data to quantify the potential impact of such an increased administrative burden on the competitiveness and profitability of small and medium-sized farms. Concerning the terminology and specific request included in the Council Decision, there is no standard EU definition of what constitutes a small or medium-sized farm. In this context, the Statistical office of the EU (Eurostat) normally uses parameters for farm physical size, or economic size, or for separation of family/non-family farms[6]. It is to be expected that the Member States' definitions differ substantially, especially since there are significant variations in the type of farming practised (e.g. greenhouses versus field crops). There are also many ways in which the co-legislators can reduce and mitigate any additional potential costs and administrative burden, especially for small and medium-sized farms.

The request in the Council Decision to consider the availability of alternatives to plant protection products is covered in **Chapter 3 (alternatives to chemical pesticides).** It should be noted that several measures to increase the knowledge and spreading of holistic IPM principles and relevant tools are already in progress, strongly supported by research and innovation. The Commission has already established a legal framework for accelerated approvals of low-risk and biological control pesticides (such as data requirements for approval of microorganisms) and is taking steps to extend this to a broader range of types of biocontrol. The Commission has also suggested how the co-legislators might consider certain possible changes during negotiations that might further facilitate the market in low-risk and biological control pesticides. With the framework provided by the Commission, with action being taken by industry and with Member State authorities setting the appropriate priorities and providing the necessary resources, it appears that sufficient tools will be available within the timeframe of the SUR pesticide reduction targets to achieve the required reduction in chemical pesticide use and risk without unacceptable implications on food security or food affordability.

Chapter 4 (sensitive areas) notes that a published Commission non-paper on sensitive areas that was submitted to the European Parliament and to the Council on 15 November 2022[7] sets out various options for the use of biological control and low-risk pesticides in all sensitive areas and for all but the more hazardous pesticides in agriculture within ecologically sensitive areas – including all pesticides authorised for use in organic farming. The primary purpose of proposing restrictions on the use of pesticides in sensitive areas is to protect human health and the environment. Public and urban areas are protected primarily because of the higher risk of human exposure. Areas protected under environmental legislation for habitats or water protection reasons are prioritised because of their ecological importance. A transition towards pesticide-free management may require a change in visual aesthetics, in urban areas in particular, and to the overall approach to weed management. This can be done without affecting overall financial costs but with positive effects on the environment. There are challenges (especially in cemeteries

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[6] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Farms_and_farmland_in_the_European_Union_-_statistics#Farms_in_2020

[7] pesticides_sud_sur-non-paper_en.pdf (europa.eu)

and sports grounds), but many technical solutions are available to substantially reduce the use and risk of pesticides in such areas without any negative economic impacts. Concerning agricultural areas Good Agricultural and Environmental Condition standard 8 will limit the use of pesticides in non-productive areas independently of the SUR. An additional requirement to use only low-risk pesticides or biological control in a 3-metre buffer zone around those non-productive areas could make a contribution to the biodiversity function of the non-productive areas and features. In practice, the buffer zone will mostly be required for farms with more than 10 hectares of arable land where the limitation on pesticide use due to the buffer zone will be less relative to the overall size than it would be for a smaller farm.

Allowing only biological control and low-risk pesticides in urban areas covered by watercourses or water features, recreational/ bathing water and areas designated for the protection of economically significant aquatic species is expected to have a negligible impact on agriculture. Given the environmental importance of surface water and the negative medium-term outlook for water quality, it appears prudent to introduce such a restriction. The Commission non-paper on sensitive areas includes various options for the protection of drinking water resources. In addition to the aims of protecting human health and the good status of water bodies, there is also a high economic cost (borne by the consumer) that arises from the need to treat water polluted by pesticides. There are therefore strong economic reasons to address contamination at source, in line with the prevention-at-source principle. The inclusion of Natura 2000 and areas protected under national legislation and areas reported to the nationally designated protected areas inventory (the Common Database on Designated Areas (CDDA)) will help to protect rare and threatened species and rare natural and semi-natural habitat types and to maintain, enhance, or restore the integrity, connectivity and resilience of all ecosystems.

Concerning the Council request to provide a quantification of the impacts of the proposed restriction concerning the use of plant protection products on forest stands and forest dependent biodiversity, it should be noted that the Commission does not possess data at EU level on pesticide use in forest stands, although research shows that such use is rare compared with use in agriculture. As pesticide restrictions in forest stands are part of wider proposed restrictions on pesticide use in sensitive areas, the Commission has also provided information on this point.

As regards the potential increased risk of introduction and spread of harmful organisms in the EU, the SUR proposal will help to address biodiversity loss and the availability of alternatives to chemical pesticides. The SUR proposal already provides for exceptions to allow pesticide use for control of harmful organisms in relation to restrictions in sensitive areas to mitigate that risk. Consideration could potentially be given during the negotiations to further expanding this in certain circumstances and possible options are set out in the Commission non-paper on sensitive areas, while further potential options are included in this study.

Glossary

Term or acronym	**Meaning or definition**
AKIS	Agricultural Knowledge and Innovation System
AMIS	Agricultural Market Information System
BTSF	Better Training for Safer Food
CAP	Common Agricultural Policy
CAPRI Model	Common Agricultural Policy Regional Impact Analysis
CDDA	Common Database on Designated Areas, or nationally designated protected areas inventory
COCERAL	European association of trade in cereals, oilseeds, rice, pulses, olive oil, oils and fats, animal feed and agrosupply (*Comité du Commerce des céréales, aliments du bétail, oléagineux, huile d'olive, huiles et graisses et agrofournitures*)
COP	Cereal, oilseed, and protein crop
COP15	Fifteenth meeting of Parties to the United Nations Convention on Biological Diversity
COPA-COGECA	Committee of Professional Agricultural Organisations-General Confederation of Agricultural Cooperatives
CORINE	Coordination of information on the Environment
DG	Directorate-General
DG AGRI	Directorate-General for Agriculture and Rural Development
DG SANTE	Directorate-General for Health and Food Safety
EAA	Economic accounts for agriculture
EEA	European Environment Agency
EFSA	European Food Safety Authority
EIP-AGRI	European Innovation Partnership for Agricultural productivity and sustainability
EU27	The 27 EU Member States
Eureau	European Federation of National Associations of Water Services
Eurostat	Statistical office of the EU
F2F1	First Farm to Fork Strategy pesticide use and risk reduction target to reduce the use and risk of chemical pesticides by 50% by 2030
F2F2	Second Farm to Fork Strategy pesticide use and risk reduction target to reduce the use of the more hazardous pesticides by 50% by 2030
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FAS	Farm Advisory Service
GAEC	Good Agricultural and Environmental Condition
GBIF	Global Biodiversity Information Facility
GDP	Gross domestic product

GSA	Geospatial aid application
GSBI	Global Soil Biodiversity Initiative
IACS	Integrated Administration and Control System
IBMA	International Biocontrol Manufacturers' Association
IFPRI	International Food Policy Research Institute
IPBES	Intergovernmental science Policy Platform on Biodiversity and Ecosystem Services
IPM	Integrated pest management
IPPC	International Plant Protection Convention
ITPS	Intergovernmental Technical Panel on Soils
JRC	Joint Research Centre of the European Commission
LAU	Local administrative unit
LPIS	Land Parcel Identification System
LUCAS	Land use/ cover area frame statistical survey
NGO	Non-governmental organisation
NGT	New Genomic Technique
NOEC	No observed effect concentrations
OECD	Organisation for Economic Co-operation and Development
PAE	Pesticide application equipment
PPP	Plant protection product
R&D	Research and development
R&I	Research and innovation
SCBD	Secretariat of the Convention on Biological Diversity
SME	Small and medium-sized enterprise
SMR	Statutory Management Requirement
SUR proposal	Proposal of the European Parliament and of the Council for a regulation on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD))
TF	Types of farms
UBA	German Federal Environment Agency (*Umweltbundesamt*)
UEFA	Union of European Football Associations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
WDPA	World Database of Protected Areas
WEcR	Wageningen Economic Research

Introduction

Following the request made by the Council to the Commission in Council Decision (EU) 2022/2572[8], the Commission has prepared additional inputs to complement the impact assessment for the proposal for a sustainable use of plant protection products regulation[9] ('SUR proposal').

This additional input addresses the specific requests set out in Article 1 of the Council Decision:

> *Chapter 1 – Economic issues* (**page 9**) addresses points (a), (b) and (c) of the request, which concern the quantitative impacts of the SUR proposal on food production in the EU, on food and feed availability in the Union and on food and feed prices.
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> *Chapter 2 – Administrative burden* (**page 89**) addresses point (d) of the request, which concerns impacts on competitiveness and profitability of small and medium-sized farms.
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> *Chapter 3 – Alternatives to chemical pesticides* (**page 123**) addresses point (e) of the request, which concerns the availability of alternatives to plant protection products.
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> *Chapter 4 – Sensitive areas* (**page 140**) addresses points (f) and (g) of the request, which concern the impact of the SUR proposal on agricultural production in sensitive areas and the use of plant protection products on forest stands and forest-dependent biodiversity. It also partially covers the issue in point e) of the potential increased risk of introduction and spread of harmful organisms in the EU.

Previously identified data limitations remain, and this is particularly the case as regards the level of pesticide and crop-specific use data at EU level in Member States. Consequently, it is not possible to further quantify the impact on agricultural yields for the main types of relevant crops and pesticides individually, while taking into account, in the context of setting the SUR national pesticide reduction targets[10], the specific conditions in the Member States, including different climate regions. This is fully explained in Chapter 1 (economic issues) of this study.

On the other hand, the Commission has updated its analysis using data made available since the impact assessment, including updated pesticide sales data now available to the Commission, new results of studies and publications from a review of scientific literature, contacts with scientific institutes with relevant research outcomes and information received from Member State competent authorities and particular cities.

[8] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).

[9] Proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD)).

[10] Throughout this study, the term 'SUR pesticide reduction targets' is used to refer to the targets set out in Articles 4 and 5 of the SUR proposal, including their likely impact. The term 'Farm to Fork pesticide reduction targets' is used to refer to the targets as set out in the Commission Farm to Fork Strategy, including trends in progress to date and modelling studies of the Farm to Fork targets.

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Chapter 1 – Economic issues

Summary

This study has been conducted following the publication of the Council Decision (EU) 2022/2572[11] ('the Council Decision'), which requested the Commission to submit a study complementing the impact assessment of the proposal for a sustainable use of plant protection products regulation[12] ('SUR proposal'). The study aims to address the concerns of the Council that the impact assessment does not consider the long-term impacts of the SUR proposal on food security, as the impact assessment was conducted prior to Russia's invasion of Ukraine.

The Commission has already conducted an analysis of the drivers of food security, published in January 2023 as a Staff Working Document (Analysis of main drivers on food security (europa.eu)), which concluded that agrochemicals, including chemical pesticides, can have a detrimental effect on soil, health, and biodiversity and this, in turn, is a major threat to food production and food security. The analysis further concluded that the short-term effect of the use of pesticides is not significantly affected by Russia's invasion of Ukraine and explained the need to transition away from a pesticide-centric food production system.

Section 1.1 of this chapter summarizes the evidence on food and feed security impacts of Russia's invasion of Ukraine. In the short-term, high energy and fuel prices may result in mechanical weeding being a costly alternative compared with crop protection via chemicals (e.g. herbicides). However, in the medium-term energy markets are expected to ease and Russia's invasion of Ukraine is not expected to have a significant impact on global food markets. In fact, in the current 2022/23 marketing season, EU agricultural markets have already partly absorbed the short-term impacts resulting from the war, which leads experts to anticipate no considerable disruptions in a medium-term context (2030, EU Medium-Term Agricultural Outlook).

This study focuses on addressing the following points from the Council Decision, a) economic impacts on food production and yields, b) consequences on the availability of feed and food and finally c) potential impact on food and feed prices. It includes updated analysis of data and consideration of developments since the impact assessment was carried out, such as the evolution of progress towards the Farm to Fork pesticide reduction targets and technological and policy developments.

The information presented in this chapter is complemented by later chapters addressing other points in the Council Decision: point d) on profitability of small and medium-sized enterprises, point e) on alternatives to chemical pesticides and point f) on sensitive areas

Several studies already provide quantitative data on the potential impacts on agricultural yields for the main crop types in the EU if pesticide use and risk were to be reduced by 50 %, as described in section 1.2 of this chapter. Given the absence of empirical data on pesticide use, impact studies have used broad assumptions of yield decline or have used crop- and region-specific estimates of yield declines based on expert opinions. The largest yield impacts in these studies were estimated to occur in crops that have limited relevance for food and feed security.

These estimates of potential yield impacts should be seen as an upper limit due to several factors that are not considered (see sections 2 to 4 of this chapter). In summary, the studies

[11] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).

[12] Proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD)).

assumed that a) the full 50 % reduction in pesticide use and risk takes place immediately and must occur for all pesticides, all crops and across all areas, b) no positive ecological feedbacks on agricultural yields are generated through the pesticide reduction, and c) there will be no agronomic and technological progress that may support a pesticide reduction without yield impacts, all of which are likely to lead to an overestimation of negative effects. Sections 2 and 3 of this chapter show that:

i) a significant reduction in pesticide use and risk may occur in non-food and non-feed sectors, thus allowing reduction without impact on food security, food production, availability or prices. The specific Articles of the SUR proposal and the options in the Commission non-paper on sensitive areas (particularly urban and public areas) are designed to support this.

ii) the existing variations in current pesticide use between similar farmers suggests that it can be reduced without significant repercussions on crop yields and indicates sub-optimal application of IPM practices.

iii) the variation in pesticide use on specific crops could be exploited in national plans which in turn would flatten the EU-wide yield shocks (if any) across different commodities. The SUR proposal already allows Member States through their national action plans to apply subsidiarity and take measures in relation to different crops, regions or practices that would limit the effects and distribute those effects across different areas.

iv) since the 2017 baseline, significant progress towards the Farm to Fork pesticide reduction targets has already been achieved by substituting low-risk pesticides for higher risk pesticides without reducing crop yields.

v) the Farm to Fork target on organic farming will deliver part of the SUR pesticide reduction target, estimated to be around one third of the SUR pesticide reduction target.

vi) a reduction in pesticide use and risk will improve ecosystem services that will directly benefit crop yields through a range of mechanisms (e.g. natural pest control, pollination services, and soil health).

vii) a broad variety of alternative agronomic and technological strategies make it possible to reduce pesticide use and risk while preserving crop yields.

Strategies to support the reduction in pesticide use and risk without affecting crop yields are already available (see further section 4 of this chapter and Chapter 3 (alternatives to chemical pesticides) of this study. These strategies are supported by a range of associated measures being undertaken in parallel to the SUR proposal, and indeed supported by the SUR proposal, which has the implementation of IPM at its core. The sound integration of agronomic and technological tools is formulated into the IPM principles. Precision agriculture technologies permit the targeted and controlled applications of pesticides or provide alternatives to pesticides, and again are supported by both the SUR proposal and by the use of CAP funding. Decision support systems are designed to improve spatiotemporal pesticide use and in doing so lower the need for pesticide use. New breeding techniques may provide varieties with durable resistances and tolerances to key pests which in turn could enable a system-wide rethinking of crop protection. Improvements in agro-ecological design, both at field- and landscape-level, support pest prevention and in doing so could further lower dependency on chemical pesticides while possibly increasing crop yields through improved ecosystem services. To facilitate the adoption of alternatives to pesticides, outreach to farmers is necessary to build confidence in the efficacy of low-pesticide food production systems. The role of independent advisors in the SUR proposal is intended to facilitate this. The required food system transformation may be supported through financial mechanisms within the CAP budget, and again this is expanded in the increased possibility of using such funding for all the requirements of the SUR applicable at farm level in Article 43 of the SUR proposal (see section 5 of this chapter).

The impacts on food and feed availability in the EU and the possibility of increased dependence on imports as well as reductions of exports are largely dependent on the impacts on crop yields (see section 1.2 of this chapter). Studies that estimated impacts on yields if pesticide use were to be reduced generally suggested an increase in prices, a decline in exports, and an elevated dependency on imports, by model-design. The limitations of these estimates presented above (sections 2 to 4 of this chapter) equally apply here. In other words, if crop yields are impacted to a considerably lower degree than assumed in the existing modelling studies, imports, exports, and prices will equally be lower than those simulated in existing studies.

The potential impact on food and feed prices is again dependent on the impacts on crop yields (see section 1.2 of this chapter). Broadly speaking, increases in crop prices are expected to be transmitted more directly to higher feed prices that would affect livestock producers through higher production costs. The share of commodity costs compared with total production costs for food products is smaller than for feed. Therefore, higher crop prices would not be transmitted in similar magnitudes to the consumers of food products. Arguably, if EU-wide crop yields are less affected due to any or all of the points mentioned above, prices will be less affected as well.

1. The current role of pesticides in food and feed security

Plant pests and diseases can cause considerable impacts on crop yields, and in turn food and feed security. The Food and Agriculture Organization estimates that plant pests cost approximately USD 220 billion annually.[13] Globally, up to 40 % of crops are lost each year due to plant pests and diseases (Renault et al., 2022; Savary et al., 2019). Globalisation with the associated increase in international travel and trade can unintentionally spread pests and diseases, which may lead to significant impacts on crops, native plants and the environment (Hulme, 2021).

Keeping healthy crops has become more challenging due to climate change and the associated changes in pest habitats (Lawton et al., 2022), and possible reductions in pesticides' efficacy due to different environmental conditions (Matzrafi, 2019). According to the International Plant Protection Convention (IPPC), rising temperatures likely will influence pest movement and establishment in unprecedented ways.[14] An increased presence of plant pests, and occurrence of drastic outbreaks, are stressors that may reduce yields of crops, leading to an overall lower production, with repercussions for food and feed security. Global yield losses of wheat, rice, and maize are projected to increase by 10 to 25 % per degree of global mean surface warming due to insect pests alone (Deutsch et al., 2018).

Consequently, sound crop protection is pivotal to safeguard food and feed security. Whereas globally, significant shares of harvests are lost to pests and diseases (Oerke, 2006; Savary et al., 2019), losses in the EU are considerably lower due to the high level of pest and disease management in place. While farmers apply a multitude of agronomical and technological strategies to minimize pest and disease impacts in their fields, currently a key tool remains the use of pesticides (Aktar et al., 2009; Sharma et al., 2019). Pesticides, defined as plant protection products in Article 2(1) of Regulation (EC) No 1107/2009 of the European Parliament and of the Council[15] on the placing of plant protection products on the market, include herbicides, fungicides, and insecticides, and are based on a wide range of chemical compounds that impair or kill weeds, fungi, and/or insects, respectively. Each year, farmers apply millions of tonnes of pesticides on fields across the world (Sharma et al., 2019; Tang et al., 2022). In the EU, 355 000 tonnes of pesticides were sold in 2021 according to the Statistical office of the EU (Eurostat)[16]. Across the EU Member States, generally less than 1 % of all active substances are used in forestry.[17] While the quantity of pesticides sold in the EU has remained relatively stable, the Farm to Fork pesticide reduction targets have shown a significant reduction in pesticide use and risk in recent years[18] (see section 2.4 of this chapter). This indicates that while the volume of pesticides has not changed, there is a trend towards using lower risk pesticides.

In the scientific literature, pesticides are referred to as *damage abatement inputs* (Lichtenberg & Zilberman, 1986). Damage abatement inputs reduce potential shortfall rather than further increase output (Lansink & Carpentier, 2008). This has analytical implications when measuring pesticides' contribution to crop yields, and in turn to food and feed security. Namely, pesticides safeguard the maximum yield, which itself is determined by other environmental, agronomic, and economic factors (Licker et al., 2010). By safeguarding against downward yield risk, pesticides support yield stability. However, the magnitude of the risk managed depends, among

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[13] Scientific review of the impact of climate change on plant pests (fao.org)
[14] International Year of Plant Health – Final report (fao.org)
[15] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).
[16] Agri-environmental indicator - consumption of pesticides - Statistics Explained (europa.eu)
[17] Forest vegetation management in Europe: current practice and future requirements (hal.science)
[18] Farm to Fork targets - Progress (europa.eu)

other things, on the pest pressure in an area within a particular year. For most pests and diseases, the weather conditions are critical determinants of pressure and impact (Olatinwo & Hoogenboom, 2014). For example, farmers in view of a weather forecast of high humidity use many fungicides preventively. As weather forecasts are inherently uncertain, some fungicide applications will have therefore managed disease impact that would have occurred while others would have not been necessary (Lázaro et al., 2021). Studies in Denmark, the Netherlands and France have estimated the overuse of pesticides at 10 % to 20% (Guyomard et al., 2020). The estimation of pesticides' contribution to crop yields (or quality) is complicated and depends on the statistical specification used, (possibly unobserved) pest pressure, pest resistances to the used pesticides, action on neighbouring farms, and the general production risk of the farmer (Frisvold, 2019).

There are acknowledged economic and social benefits associated with the use of pesticides (Carvalho, 2017; Popp, 2011), such as safeguarding yields by eliminating or reducing competition from weeds and attacks by pests, but also by reducing potential post-harvest losses and damage. In the absence of sound alternatives, a reduction in pesticides can have repercussions on crop yields (Dewar, 2017; Kauppi et al., 2021; Mahillon et al., 2022; Viric Gasparic et al., 2021). The use of pesticides has been integrated into the overall approach to ensuring the availability of low-priced fruits and vegetables of good quality, which makes them affordable for consumers. By reducing harvest losses, the use of pesticides also reduces demand for land for food production which in turn makes more land available for other uses, e.g., amenity, natural parks, and protection of biodiversity. Lastly, the European plant protection industry is a significant economic player on the world market and an important employer in Europe.[19]

1.1 Food and feed security considering Russia's invasion of Ukraine

The analysis of the potential impacts of the SUR pesticide reduction targets put forward by the SUR proposal on the agricultural sector were all conducted before Russia's invasion of Ukraine, which shocked the world and caused significant disturbances in global agricultural markets.

1.1.1 Immediate impacts

Although many fundamental elements of agricultural markets have been affected, the Russian invasion of Ukraine has had no major impact on pesticide availability and affordability. As mentioned in EC (2023)[20] an increase in transport and energy costs due to the Russian aggression in Ukraine may have resulted in a modest increase of pesticides prices in the EU, but likely to a considerably lesser extent than for fertilisers, and did not result in disruption to the supply of pesticides. So far, it appears that a reduction in pesticide use, of a similar magnitude to the expected reduction in fertiliser use due to the increased price of fertilisers, for 2022/23, may not occur autonomously. Spikes in energy and fuel prices may result in short term effects, such as for example, mechanical weeding being a less attractive alternative to herbicides, making crop protection via chemical tools more competitive.

[19] CP industry economic footprint- Oxford Economics.pdf (croplifeeurope.eu)

[20] Analysis of main drivers on food security (europa.eu).

1.1.2 Medium-term impacts

Despite the short-term disruptions brought along by lower production of cereals and oilseeds in Ukraine and the reduced exports from the Russian Federation, the impact of this on the feasibility of reaching the SUR pesticide reduction targets without putting at risk food or feed security is negligible for two main reasons.

Short-term disruptions are typically absorbed by markets within a few years.

First, the SUR pesticide reduction targets set out in the SUR proposal are set for 2030. The 2022 editions of the two main medium-term outlooks for agricultural markets (Organisation for Economic Co-operation and Development (OECD) Food and Agriculture Organization of the United Nations (FAO) and Directorate General (DG) AGRI) consider that the disruption caused by Russia's invasion of Ukraine will have no impact in 2030. In fact, short-term disruptions are typically absorbed by markets within a few years and are not assumed to affect markets in a medium to long-term context (i.e., the COVID pandemic[21] or the African swine fever outbreak in China[22,23] were treated similarly in previous years). This is evident from a comparison of the projected production levels of the 2021 (pre-invasion) editions to the 2022 ones (Table 1).

Table 1. World production (million tonnes) forecasted to 2030 by the 2021 (pre-invasion) and 2022 (post-invasion) for main crops affected by Russia's invasion of Ukraine in different mid-terms outlooks.

Commodity	**OECD-FAO**[24] **(for World)**		**DG AGRI**[25] **(for EU)**	
	Pre-invasion	*Post-invasion*	*Pre-invasion*	*Post-invasion*
Wheat	839.7	833.3	127	137
Maize	1,312.2	1,320.9	68	64
Vegetable oils	246.9	246.5	16	16

Therefore, from a medium-term baseline perspective, the war is assumed to end within the next one or two years (even if not stated explicitly). This is for example the case in the 2022 OECD and EU agricultural medium-term outlooks from which the data for Table 1. Under this assumption, the impacts of the Russian invasion of Ukraine on the analysis of the impacts of SUR proposal in 2030 should be minimal. However, simulations undertaken to understand the impacts in the unlikely event that the war were to continue until 2030, do show that such a

[21] EC (2020), EU agricultural outlook for markets, income and environment, 2020-2030. European Commission, DG Agriculture and Rural Development, Brussels, EU agricultural outlook for markets, income and environment 2020-2030 - Publications Office of the EU (europa.eu).

[22] EC (2019), EU agricultural outlook for markets and income, 2019-2030. European Commission, DG Agriculture and Rural Development, Brussels, EU agricultural outlook for markets and income 2019-2030 - Publications Office of the EU (europa.eu).

[23] OECD/FAO (2021), OECD-FAO Agricultural Outlook 2021-2030, OECD Publishing, Paris

[24] OECD/FAO (2021), OECD-FAO Agricultural Outlook 2021-2030, OECD Publishing, Paris & OECD/FAO (2022), OECD-FAO Agricultural Outlook 2022-2031, OECD Publishing, Paris.

[25] EC (2021), EU agricultural outlook for markets, income and environment, 2021-2031. European Commission, DG Agriculture and Rural Development, Brussels & EC (2022), EU agricultural outlook for markets, income and environment, 2022-2032. European Commission, DG Agriculture and Rural Development, Brussels

situation could have significant impacts on the global grain markets. The 2022 edition of the OECD-FAO outlook, for example, concludes that a full loss of Ukraine's wheat exports combined with a 50 percent loss of Russia's wheat exports would lead to an increase of global wheat prices by 34%.

It is important to note though, that such price increases would lead to considerable increases in grain exports from the other main exporting countries, so most of the lost Ukrainian grain exports are expected to be replaced by grain from other sources which can increase their production (see below). Thus, the impact of a persistent conflict would not affect the availability of grain, but rather its affordability. Preliminary global export figures for March 2023[26] point to an increase in global wheat production and trade in 2022/23 as compared with 2021/22, thus corroborating these results. For example, wheat supply has increased in Kazakhstan by nearly the total value of Ukrainian exports pre-war. Also rice production is expected to reach peak value thanks to an extremely favourable crop in India. The latest forecasts from the Agricultural Market Information System (AMIS) initiative of the G20[27] foresees increases in world production of wheat, rice and soybean productions ranging from 2 to 7 per cent. Even in the Middle East and north African regions, which is highly dependent on imports from the Black Sea region, the loss of Ukrainian exports only has a modest impact on food consumption of around -0.5 percent according to the Commission's simulations. In the EU, the impact on food consumption is negligible.

Evidence that markets have already start absorbing the shock

Secondly, even before 2030, it can be seen that agricultural markets have already started absorbing the shock resulting from the war. Looking into the Commission's short-term outlook for agricultural markets, the last pre-invasion edition[28] predicted a 2021/22 EU cereals production of 292.2 million tonnes and a 30.4 million tonnes production of oilseeds. Both figures represented a 4.9% and 3% increase compared with the previous 5-year average. The first edition after the invasion[29] further increased the production levels in the EU for the 2022/23 season, mainly driven by the response of producers to the higher prices induced by the disruption of Ukraine's and Russia's exports. The increase in production was partly not realised due to an exceptionally hot and dry spring in the EU[30] for cereals, while oilseed production was not affected and even further increased due to the derogation to allow sowing of crops on fallow land. Production of oilseeds managed to compensate the loss of supplies from Ukraine. The latest available edition of the short-term outlook[31] foresees a fall in cereal production to 265 million tonnes in the EU mainly driven by the drought conditions and high input prices, together with an ease of high cereal prices after the supply from Ukraine was recovered thanks to the Black Sea initiative. 2023 has also seen a continuation of the high production levels for

[26] USDA (2023). Grain: World Markets and Trade. March 2023. Grain: World Markets and Trade | USDA Foreign Agricultural Service

[27] AMIS Market Monitor No. 106 March 2023 - Agricultural Market Information System: Home (amis-outlook.org)

[28] EC (2021), Short-term outlook for EU agricultural markets, Autumn 2021 (Edition 31). European Commission, DG Agriculture and Rural Development, Brussels, short-term-outlook-autumn-2021_en_0.pdf (europa.eu).

[29] EC (2022), Short-term outlook for EU agricultural markets, Spring 2022 (Edition 32). European Commission, DG Agriculture and Rural Development, Brussels, short-term-outlook-spring-2022_en_0.pdf (europa.eu).

[30] EC (2022), Short-term outlook for EU agricultural markets, Summer 2022 (Edition 33). European Commission, DG Agriculture and Rural Development, Brussels, short-term-outlook-summer-2022-highlights_en.pdf (europa.eu).

[31] EC (2023), Short-term outlook for EU agricultural markets, Spring 2023 (Edition 35). European Commission, DG Agriculture and Rural Development, Brussels short-term-outlook-spring-2023_en.pdf (europa.eu).

oilseeds driven by the exceptionally high prices for the commodities, with a record production expected for 2024.

In the same sense, the assessment of the impact of the Russian invasion of Ukraine made by the International Food Policy Research Institute (IFPRI) just after the invasion[32] focused on the high shares in global markets of Russia's and Ukraine's exports. This share was above 20% for wheat, barley and sunflowers and above 70% for sunflower oil. The main concern was that this concentration was even higher for specific regions of the world, with North Africa and the Middle East importing over 50% of their cereal needs and a large share of wheat and barley from Ukraine. The disruption of this export flow could have significant impacts on the availability and affordability of food in those regions. The overall impacts of the war would lead to 22.3 million more people at risk of undernourishment in 19 least developed countries (less than 2% of the total population in the countries analysed) and more than half of this would be driven by higher fuel and fertilizer prices and not by higher food prices (Arndt et al., 2023). At global level, the concern was more about the impact of natural gas and fertilizer prices on agricultural costs and how those could translate into even higher prices. Impacts on production were rarely mentioned with more concerns around the risk that some countries may seek to insulate domestic producers by restricting exports, further aggravating the price shocks as seen during the 2007-2008 and 2010-2011 food crises (Abay et al., 2023).

One year later what has happened is that as the war continued through 2022, international markets adjusted and adapted, and — while high prices and other problems persist — the worst-case scenarios for agricultural trade and food security were largely averted[33]. The adverse impact on the EU internal market was concentrated in Member States neighbouring Ukraine, which triggered specific support to primary producers in those countries financed from the Common Agriculture Policy. By August 2022 prices had fallen back to pre-war levels. Importers adjusted to market disruptions and found alternative suppliers. The partial re-opening of ports through the Black Sea Grain Initiative helped facilitate additional exports from Ukraine. However, maize and wheat production in Ukraine are still projected to be 40% down from pre-war levels[34] approximately 80% of those reported from the 2014 season before Ukraine started its agricultural expansion. In May, price volatility levels for wheat and maize reached the highest levels in more than 10 years, but by early February 2023 they had fallen back to within historical ranges. The main lesson of 2022 is that global markets have generally worked well when not impeded by government measures like export restrictions, although the Commission will continue to monitor closely the situation in most vulnerable, frontline Member States.

In summary, when revisiting the impact assessment of the SUR proposal with the existing evidence of the impact of the Russian aggression on Ukraine it can be seen that:

a) The war has had no visible effect on pesticides availability.
b) There might be an increase in the price competitiveness of herbicides as a control option due to the higher costs associated with fuel, which is a main input for mechanical alternatives.

[32] Glauber, J. & Laborde, D. (2022). How will Russia's invasion of Ukraine affect global food security? IFPRI Blog posted on 24.02.2023 - [How will Russia's invasion of Ukraine affect global food security? | IFPRI : International Food Policy Research Institute]

[33] Glauber, J. (2023). Ukraine one year later: impacts on global food security. IFPRI Blog posted on 23.02.2023 - [Ukraine one year later: Impacts on global food security | IFPRI : International Food Policy Research Institute]

[34] Martyshev, P., Nivievskyi, O. & M. Bogonos (2023). Regional war, global consequences: Mounting damages to Ukraine's agriculture and growing challenges for global food security. IFPRI Blog posted on 27.03.2023 - [Regional war, global consequences: Mounting damages to Ukraine's agriculture and growing challenges for global food security | IFPRI : International Food Policy Research Institute]

c) Agricultural markets so far have been capable of providing a supply response based on economic fundamentals.
d) Impacts are mainly on wheat and sunflowers, for which the potential worst-case impacts on yields of reduced pesticide use are expected to be comparatively low (see next section of this chapter).
e) Member States have the ability to choose pesticide reductions in use on different crops.
f) Within the medium-term time scale for the implementation of the SUR proposal it could be expected that the short-term economic impacts of the conflict on agricultural markets would not affect the conclusions of the different studies, nor the additional insights provided in the different sections of this chapter.

1.2 Existing evidence on the potential negative impacts of a pesticide reduction

Several publications have attempted to provide estimates of the potential impacts of achieving the Farm to Fork targets, including the SUR pesticide reduction targets. These publications cover a broad range of methodologies, including computable general equilibrium models (Beckman et al., 2020), partial equilibrium models for the agricultural sector (Barreiro-Hurle et al., 2021; Bremmer et al., 2021; Henning et al., 2021), extrapolation of assumptions to actual market data (COCERAL and Unistock, 2021; Noleppa & Cartsburg, 2021), and farm-level simulations (Guyomard et al., 2020). While methodologically diverse, the analyses were generally conducted under similar assumptions, as will be discussed shortly. None of the publications can be considered a fully-fledged impact assessment of the policy, but their results provide some insights into the economic impacts of policy decisions limiting the use and risk of pesticides. These modelling studies suggested that, without proper adaptation, EU crop production might be negatively affected by a pesticide reduction. In turn, there may be an impact on the EU trade balance from increased imports and a decline in EU exports of agri-food products to third countries.

These assessments, in general terms, introduce assumptions as regards the change in farming practices that may result from reducing pesticide use, under assumptions as regards related impacts on yields (i.e., the impacts were not derived through data-driven estimations but rather expert-elicitations or explorative assumptions). There are, however, various limitations to these modelling exercises. For instance, Barreiro-Hurle et al. (2021) assumed a reduction in costs associated with the lower use of pesticides, an increase in other costs (e.g., due to higher efforts for mechanical weeding), and an increase in the use of cover crops as a pest management alternative (Table 2). While modelling changes in expenses is easily implemented in economic models, an accurate yield response function to assess the effects of a lower pesticide use on yields is lacking. In turn, a general assumption of a yield loss of 10 % was made (Barreiro-Hurle et al., 2021). The 10 % yield reduction was, however, not well supported by evidence nor does this estimate account for potential differences across crops and bioclimatic regions. Alternative strategies to pesticides that do not result in yield losses were not assessed (further discussed below). Possible changes on the demand side were also not included - for example, changes in the products consumed (Tang et al., 2022), or price-mediated nudges toward low-pesticide production (Nielsen et al., 2023). Hence, it is likely that all analyses produced worst-case estimates (Barreiro-Hurle et al., 2021), which arise out of a limited representation, or a lack of representation, of the ability of the EU food system to adapt and innovate.

Table 2 Simulated EU27 supply changes, relative to a baseline projection to 2030, for the individual Farm to Fork targets and the combined scenario. Source: Barreiro-Hurle et al. (2021)

	Pesticide reduction	**Increased land under organic**	**Increased area under high-diversity**	**Reduction *in* gross nitrogen**	**Combined**
Total agricultural output	-2.7	-0.4	-2.1	-7.0	-11.2
Cereals	-7.9	-4.4	-6.0	-3.3	-14.9
Oilseeds	-11.0	-6.4	-2.3	-1.6	-15.5
Vegetables and Permanent crops	-10.4	-5.0	-0.3	-0.1	-12.1
Pasture	-0.4	1.0	0.5	-11.1	-10.0
Dairy Cows	-0.3	0.3	-0.7	-7.4	-10.1
Beef meat activities	-0.9	0.1	-1.2	-10.5	-14.3
Pig fattening	-1.0	-0.4	-0.7	-12.2	-15.5
Sheep and Goat fattening	-1.9	-1.4	-0.6	-6.4	-10.0
Poultry fattening	-1.7	-0.8	-0.9	-11.2	-15.9

Another related study, conducted by Wageningen Economic Research (WEcR), was published in December 2021 (Bremmer et al., 2021). The main advantage of this report is the case-study design with elicited yield impacts of reduced pesticide use based on a selection of 25 country/crop combinations (Table 3). The main disadvantage is that the pesticide reduction was overly pessimistic and various positive ecological feedbacks following a pesticide reduction were ignored (discussed below). Furthermore, the elicitation did not take account of potential technological progress until 2030. The study concluded on a variable yield loss, with greater effects on perennial crops, and a considerable potential impact on trade with third countries. Estimates ranged from a yield decline of 2 % to 28 %, depending on the crop and region. The impact from the pesticide reduction was elicited by discussing, at farm level, the best approaches for a reduction. Namely, through reducing the total volume, or switching to lower risk alternatives, through IPM, or precision application technology. Next, the costs of such a change were assessed to assess potential price effects due to quality losses. The analysis of the questionnaires indicated that a potential yield-effect is mostly determined by the availability of alternatives. While it was suggested that reaching the Farm to Fork pesticide reduction targets would result in yield losses in some crops (e.g. grapes in France), in other crops no effects on yield nor cost were anticipated in the same region (e.g. maize in France). For maize, substituting low-risk pesticides for high-risk pesticides was found to be feasible. The study was recently updated with an assessment on potential impacts to greenhouse production (Bremmer et al., 2023). Here, yield impacts were suggested to be difficult to assess but yield losses in the production of vegetables up to 20 % were proposed to be possible.

Both of the WEcR reports were commissioned by industry (Croplife Europe and Croplife International and Glastuinbouw) and were not peer reviewed.

As will be further discussed below, while this is not presented as such in the WEcR reports, these results speak for a reduction potential with minimal impacts on yields, and in turn food and feed security. This is because the SUR pesticide reduction targets do not mandate a flat-rate reduction of 50 % across all crops but rather allow for a strategic targeting, taking national circumstances into account, such that impacts on production are minimized. It should be noted that the SUR proposal does not mandate a total 50 % reduction in use of all chemical pesticides. Since the risk indicator gives a higher weighting to pesticides in higher risk categories, a 50 % reduction in the risk indicator can be achieved by reducing a smaller number of higher risk pesticides, thus giving Member States further flexibility in designing their strategies to meet the SUR national pesticide reduction targets.

Table 3 Elicited yield (price) effects of a pesticide reduction in different crops and countries. Source: (Bremmer et al., 2021)

	Finland	France	Germany	Italy	Poland	Romania	Spain
Wheat	0 (0)	-5 (0)	-10 (0)			-7 (-5)	
Rapeseed	0 (0)		-10 (-5)		-13 (0)		
Sugar beet		-3 (0)	-15 (-5)		-10 (-15)		
Maize		0 (0)				-4 (0)	
Apples				-8 (-6)	-20 (0)		
Tomatoes				-20 (-10)			-20 (0)
Grapes		-28 (0)		-20 (-5) / -6 (0)			0 (0) / -18 (0)
Olives				-30 (0)			-13 (0)
Citrus				-7 (0)			-10 (0)
Hops			-20 (-10)		-8 (-1.5)		

Another analysis was published in 2021 by the United States Department of Agriculture (USDA) Economic Research Service (Beckman et al., 2020). The report was based on some broad assumptions about the possible application of the EU Green Deal strategies and assessed potential implications of the combined policies (including the pesticide reduction) at a global level. However, it should be noted that the measures set out in the SUR proposal cannot have any extra-territorial application outside the EU. The report suggested a 12 % reduction in agricultural yields and a 17 % increase in prices due to the application of the whole range of targets (pesticide reduction, antimicrobial resistance, fertiliser reduction, and 10 % set-aside land) at EU level. As with most of the other studies, the report did not assess possible mitigating measures such as precision agriculture, new pesticides coming on the market, implementation of improved IPM, reduction in food waste, etc.

Henning et al. (2021) published a non-peer-reviewed study commissioned by the food and feed industry (Grain Club). Similar to Barreiro-Hurle et al. (2021), the study used the Common Agricultural Policy Regional Impact Analysis (CAPRI model) to simulate potential impacts of various Green Deal targets. Namely, i) a reduction in mineral fertilizer use by 20 %, ii) a reduction in pesticide use by 50 %, iii) a reduction in the nitrogen-balance surplus by 50 %, iv) a share of high diversity landscape features of at least 10 %, and v) a share of organic farming of at least 25 %. The study finds that the reduction of the nitrogen-balance surplus has the strongest production effect, with a 20 % decline in beef that is suggested to increase beef prices by 58 %. A decline in yields of 21.4 and 20 % for cereals and oilseeds, respectively, was suggested to increase their prices by 12.5 and 18 %. The production impacts were suggested to result in a decline in the trade balances and possible leakage effects of greenhouse gas emissions, with assumptions of a yield decline of 10 % and an increase in 'other costs' by 50 %, following the reduction in pesticide use, imposed in the study. This modelling work, therefore, suffered from the same data limitations faced in Barreiro-Hurle et al. (2021) – i.e., the unavailability of data on the actual yield-responses to pesticide reductions.

Possible price effects of potential yield declines can be anticipated with the price *elasticities* for each crop. The term elasticity describes the degree of price responses following changes in production quantity, and vice versa. While a discussion of analytical complications when estimating these parameters is out of scope for this study, it is critical to note that the elasticity parameters are fundamental to economic market-models and a key driver for simulating price changes following production shocks. The CAPRI model used for policy-assessments by the European Commission (e.g., Barreiro-Hurle et al., 2021; Henning et al., 2021) is one such model. The crop-specific distributions of feed and food elasticities from CAPRI across the EU-27 Member States are depicted in Table 4. For example, a 1 % decline in apple production may lead to a 2 % increase in prices whereas a 1 % decline in the production of soya may lead to a 6.7 % increase in prices. With regard to sector competitiveness, the price effects of the simulated production changes due to the pesticide reduction in Barreiro-Hurle et al. (2021) and Henning et al. (2021) resulted in an increase of agricultural income. This is precisely a consequence of the general inelasticity of the demand of food products, which can result in price increases per unit that can compensate the income loss provoked by lower production levels, leading to higher total income generated.

While this reflection on the underlying parameter values gives indicative insights into the potential price responses following a decline in production, the values must be interpreted with caution. First, the CAPRI model more comprehensively simulates market-feedbacks through trade and changes in market balance (human consumption, feed and biofuels use, etc.), which may result in adaptations through substitutions that will ultimately affect the simulated price change. Hence, while the elasticity values are key drivers for price change, other parameters (e.g., cross-price elasticities) are determinants of the final price response as well. Second, the food and feed value chains are considerably different from one another. Commodity inputs generally stem from a smaller share of the total costs in the production of food, for which processing steps generally account for a larger share of the production costs (Morrison Paul & MacDonald, 2003).[35] Consequently, while the elasticity values[36] for food in Table 4 are larger than for feed, an increase in commodity price would likely not be transmitted in full to the final food product prices given that the crop price increase would affect a smaller share of the overall production costs. In turn, price effects for the final food products would be considerably below the indicative values presented via the crop elasticities. Conversely, feed-costs are generally a considerable share of the total production costs for livestock producers.[37] Hence, potential price increases for crops likely transmit more directly into production cost increases for feed, which may affect livestock producers in stronger ways than consumers of final food products. Having said that, our presentation of own-price elasticities does not account for the fact that in feed production some level of substitution of agricultural inputs is possible. This substitution would allow producers to shift away from crops that experience higher price increases, thereby reducing the increase in production costs for feed to a certain extent.

[35] FAOSTAT

[36] As noted above, the term elasticity describes the degree of price responses following changes in production quantity, and vice versa.

[37] EU feed autonomy (europa.eu)

Table 4. Distribution of crop-specific elasticities across the EU-27 Member States as used for calibration of the CAPRI model. The values correspond to the percentage of the price increase if production declines by one percent.

		Food			**Feed**			
		Minimum	*Mean*	*Maximum*		*Minimum*	*Mean*	*Maximum*
Apples		2.00	2.08	2.21		2.00	2.33	11.40
Barley		1.87	1.94	2.33		0.45	0.49	0.71
Citrus fruits	2.05	2.21	2.72			2.00	2.00	2.00
Grain maize		1.90	2.11	2.98		0.46	0.57	1.54
Oats		1.88	1.96	2.17		0.49	0.52	0.60
Olive oil		0.60	0.88	2.31		2.00	2.00	2.00
Potatoes		2.02	2.18	2.42		2.00	2.40	24.18
Protein-rich feeding						0.39	0.65	1.11
Pulses	2.00	2.05	2.57			0.49	0.52	0.59
Rape seed		1.93	2.00	2.03		0.64	0.80	1.14
Rice	1.91	2.01	2.33			0.48	0.55	2.00
Rye	1.88	2.01	2.26			0.47	0.54	0.61
Soya cake		6.67	6.67	6.67		0.48	0.60	1.20
Sunflower cake		6.51	6.64	6.67		0.46	0.48	0.51
Wheat		2.77	4.61	6.67		0.44	0.49	0.82

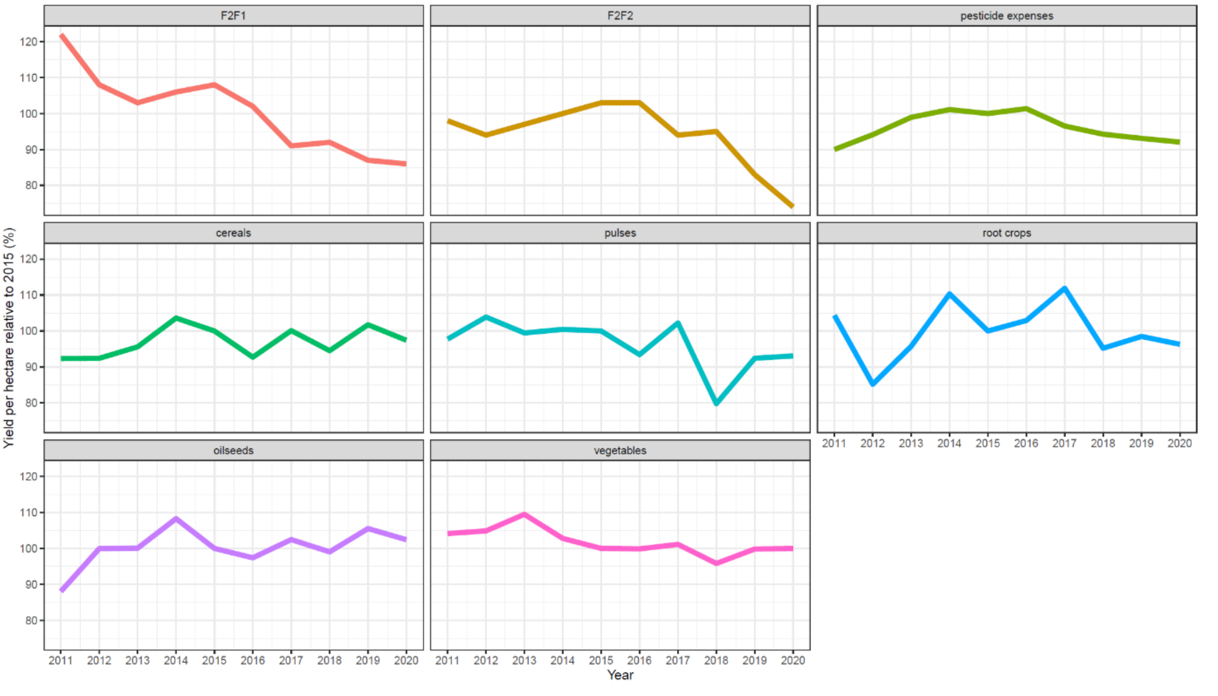
While a discussion of elasticities is a considerable simplification of the underlying market dynamics, the estimates provide a perspective on potential price effects associated with yield losses. None of the studies mentioned above was able to employ a data-driven estimation of crop-specific yield responses to a pesticide reduction. Consequently, in view of the lack of data, the imposed assumptions of a 10 % yield decline should be met with scepticism. What the elasticities tend to illustrate is that the SUR national pesticide reduction targets, which can be achieved by means that vary greatly from crop to crop, could consider among other aspects also the anticipated crop-and-region-specific price effects if yields were assumed to decline. Member States could therefore take various aspects into account when designing in their national action plans their strategy to reach the SUR national pesticide reduction targets, namely, i) the current intensity of pesticide use in different crops, ii) the availability of alternative management approaches in different crops, and iii) possible repercussions on food and feed prices if production were to decline. This is discussed further in section 2 of this chapter.

It is worth noting that the largest impacts were elicited to occur in some of the crops that play a relatively minor role for food and feed security concerns (c.f. Table 3). Food and feed security concerns of potential yield impacts first must be addressed through a more nuanced perspective on which crops actually contribute to food and feed security. According to the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) wheat and its products provide a major part of the calorie and protein supply. Olives, sunflowers, and rapeseed contribute sizeable shares to the fat supply. Barley, maize, potatoes, and wheat contribute sizeable quantities to feed use in livestock production. Hence, if evidence collection were to suggest that sizeable yield impacts from a lower pesticide use in those crops must be expected and that no alternatives to pesticide exists, other crops may be targeted to achieve the SUR pesticide reduction targets.

Lastly, it may be worth looking beyond the existing modelling studies and assess whether empirical changes in production have been observed in the last years. The progress toward the Farm to Fork pesticide reduction targets has been computed for the years 2011 to 2020 with the baseline being the years 2015 to 2017. Figure 1 depicts i) the EU-wide development of the two indicators used to track the Farm to Fork pesticide reduction targets (F2F1 and F2F2), ii) EU-wide expenses for pesticides which were deflated using a general consumer price index (the harmonised index of consumer price) to account for the general inflation, and iii) production of food and feed security relevant crop-groups. The panel data on production was interpolated with the average of the nearest non-missing observations to correct existing data-gaps in Eurostat. Next, the total production figures by Member State were standardized to yields per hectare to account for expansions and retractions of the area of production over the years. The Member States' contribution to the overall EU production was used to compute a weighted-average yield per hectare for the EU. Lastly, the values across years are visualized relative to the baseline period of 2015 to 2017 to ease the comparison with the pesticide use and risk indices.

As shown in Figure 1, the F2F1 dropped from 122 points in 2011 to 86 in 2020 and representing an EU-wide progress of 14 % from the baseline 2015 to 2017 values. Similarly, the F2F2 declined to 74 points in 2020 which represents a progress of 26 %. At the same time, EU-wide expenses for pesticides have remained nearly constant suggesting that the underlying transformation in the pesticide use and risk has not caused significant cost increases. While annual variation is evident from the graphs on production, the average yields per hectare across the EU for cereals, pulses, root crops, oilseeds, and vegetables do not exhibit a clear downward trend as would be suggested by the modelling studies mentioned above that had assumed direct yield repercussions following any reductions in pesticide use and risk.

Figure 1 EU-wide development of the Farm to Fork pesticide reduction targets, expenses for pesticides, and yields per hectare from 2011 to 2020. Source: Eurostat



Box 1. Takeaway points of section 1

1) Sound crop health management and yield stability are critical to safeguarding food and feed security, especially in a changing climate and given the increasing interconnectedness of landscapes due to globalization.

2) Russia's invasion of Ukraine may have had a short-term impact by making switching to mechanical alternatives to pesticides more expensive, but there is no impact identified in terms of increased prices of pesticides. The main crops affected have shown a relatively low yield impact from pesticide reduction and the agricultural market has provided a supply response such that the short-term impact of the conflict on agricultural markets is not seen to have an effect.

3) Studies assessing the impact of the Farm to Fork pesticide reduction targets concluded that there were varying levels of potential yield impact, with the largest impacts estimated to occur in crops that play a relatively minor role for food and feed security. Farmers and Member States can also then substitute crops or prioritise pesticide reductions in crops that have little or no impact on food security.

4) To the best of our knowledge, none of the existing studies modelling achievement of the Farm to Fork pesticide reduction targets has investigated how a strategic and crop-specific approach to a SUR national pesticide reduction target may affect production levels; instead, an immediate flat rate 50 % pesticide reduction across all crops and for all pesticides was assumed which led to worst-case estimates.

5) Even under worst-case yield shocks, modelling work suggests an increase in agricultural income because of price responses.

6) The significant progress made in the reduction in pesticide use and risk monitored between 2011 and 2021 reflects a consistent downward trend which has improved significantly in the 2018-2021 period. This decrease has not been attributed to any significant cost increase or yield effect for major crops, and thus has had no effect on food security.

7) The requirements of the SUR proposal will not apply for some time because a delay is envisaged between entry into force and entry into application. By the time the requirements of the SUR proposal apply it is predicted that a significant decrease in the SUR pesticide reduction targets will already have been met. In addition, several legal obligations apply later than the general date of application and the SUR national pesticide reduction targets do not have to be reached until 2030. Thus, there is built-in time to manage the transition, bring alternatives to the market and reduce any short-term effects.

2. A decomposition of the SUR pesticide reduction targets

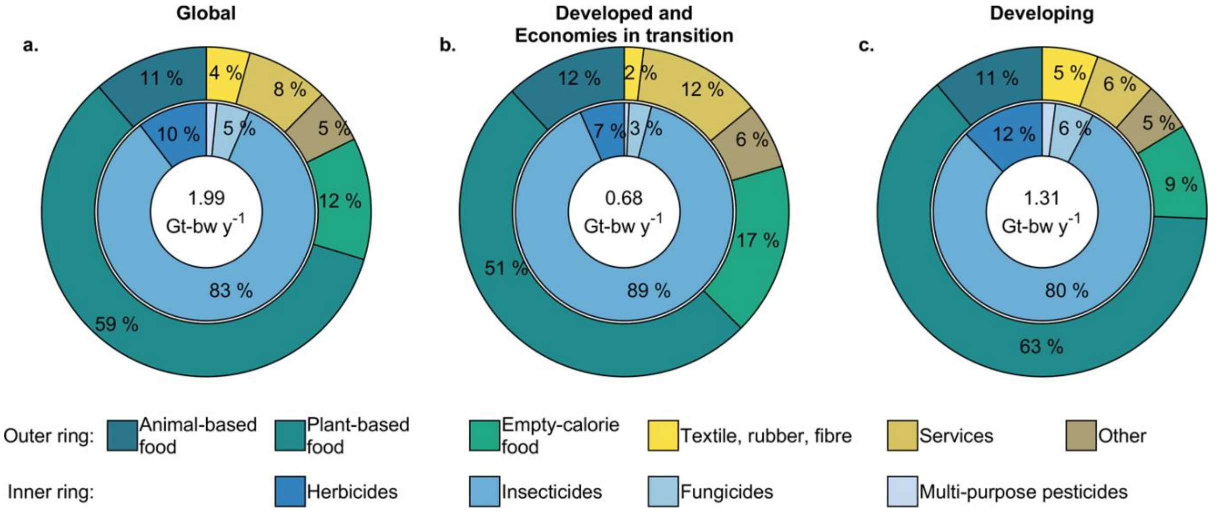
A critical oversight of many of the modelling studies mentioned above on potential impacts of reducing pesticides was the (implicit) assumption that pesticides use and risk will be halved in all crops and across all geographic areas. In the following analysis, it is demonstrated that a debate on potential food and feed security risks related to a reduction in pesticide use and risk must take various aspects into account that were unfortunately largely overlooked in the described analyses. A decomposition of the SUR pesticide reduction targets is essential to shed light on the share of the 50 % pesticide reduction in use and risk that will not only affect crops that are relevant to food and feed security, but also crops for which alternatives to pesticides are lacking. This section reviews evidence on i) the potential for pesticide reduction in non-food areas, ii) the existing variations, and in turn reduction potential, in the current pesticide use within the same crops, iii) pesticide use intensity across crops and implications of that for a strategic design of national reduction plans, iv) the feasibility of substituting high-risk pesticides with low-risk ones, and v) the synergies with the Farm to Fork organic farming target. Lastly, vi) food and feed security relevant feedbacks of a pesticide reduction through improved provisions of ecosystem services, and vii) the availability of alternative tools, are such critical aspects that there are separate sections of this chapter on those points. All these aspects have been largely absent in the existing studies on potential impacts of achieving the Farm to Fork pesticide reduction targets. In turn, the estimates of potential impacts provided above should be seen as an upper limit (Barreiro-Hurle et al., 2021).

2.1 Pesticide use and risk reduction in non-food sectors

Part of the reduction will come from reduction in pesticide use in urban and transport areas, sport and leisure facilities, non-agricultural parts of ecologically sensitive areas, agricultural land devoted to non-productive features, etc. Arguably, a reduction in pesticide use outside agricultural fields will have no implications for crop yields nor food and feed security. While many citizens may not be aware of this, pesticide use in Europe is currently not restricted to food and feed production. Pesticides are used to manage green spaces in parks, playgrounds, sport facilities, private gardens, roads and railways, airports, non-edible crops such as cotton and ornamental horticulture, etc. The SUR proposal specifically addresses pesticide use and risk in ‘sensitive areas’, which among other areas comprise urban areas. While the level of contribution from reduction in non-agricultural use of pesticides is expected to differ across Member States, evidently not the full 50 % reduction in use and risk will fall on food and feed production.

Concerning the raised food and feed security concerns, it is worth noting that a considerable share of the current pesticide footprint embedded in consumption (including imports) is related to products and services that are not essential to food and feed security. In developed economies, the aggregate of the pesticide footprint linked to the consumption of textiles, services, other, and ‘empty-calorie food’ (i.e., foods that have little to no nutritional value) accounts for a share of 37 % in developed countries (Tang et al., 2022) (Figure 2). The shares are very similar for the EU-27 (Fiona Tang, *personal communication*). Around a third of the total pesticide footprint is internationally traded. These estimates do not account for pesticide use in non-cropland (e.g., urban areas). Arguably, even under the assumption of yield impacts, a reduction in pesticide use in these sectors would have little to no repercussions for food and feed security.

Figure 2 Decomposition of the pesticide footprints across sectors. Source: (Tang et al., 2022).



In view of the fact that some of the 50 % reduction will come from reduced pesticide use in non-agricultural areas as well as in non-food and non-feed crops, it becomes evident that the studies mentioned above assumed larger shocks than applicable. Barreiro-Hurle et al. (2021) provided estimates of the expected changes in crop yields for a 50 % and a 30 % reduction in pesticide use. While the rather pessimistic assumption of a flat-rate reduction across all crops still applies, the 20 % difference of the pesticide reduction already resulted in lower estimates for the worst-case yield impacts (Table 5). In turn, it is clearly necessary to acknowledge that the 50 % reduction does not in its entirety fall onto agricultural areas as assumed in the existing evidence on impacts.

Table 5 Simulated EU27 supply changes, relative to a baseline projection to 2030, for a pesticide reduction at two different levels. Source: Barreiro-Hurle et al. (2021)

	50% reduction	***Rescaled to a 30% reduction***
Total agricultural output	-2.7	-1.6
Cereals	-7.9	-4.7
Oilseeds	-11.0	-6.6
Vegetables and Permanent crops	-10.4	-6.2
Pasture	-0.4	-0.2
Dairy Cows	-0.3	-0.2
Beef meat activities	-0.9	-0.5
Pig fattening	-1.0	-0.6
Sheep and Goat fattening	-1.9	-1.1
Poultry fattening	-1.7	-1.0

2.2 Variations in the current pesticide use

Pesticides use intensity depends on many aspects, ranging from i) biological factors such as pest abundance, local climate, soil type, regional crop diversity, over ii) agronomic factors such as decisions on tillage, sowing date, variety susceptibility, fertilisation, crop rotation, the use of precision agriculture, to iii) economic factors such as the expected yield and the on-farm economic and financial situation (Andert et al., 2015; Lechenet et al., 2016). The multitude of relevant factors results in a considerable spatial variations in pesticide use on a global scale (Tang et al., 2021; Tang & Maggi, 2021), and even in 'geographically speaking' small countries (Habran et al., 2022). Various studies have found sizeable variability in pesticide use not only across different years and between different regions within a country, but also across farms that essentially faced the same environmental and socio-economic conditions (Andert et al., 2015; Lechenet et al., 2017; Nause et al., 2021). This illustrates the importance of farmers' personal decision-making process, which is, amongst other factors, determined by their attitude to production risks (Frisvold, 2019; Rommel et al., 2022). Globally, around a third of the cross-country differences in the pesticide pollution risk is linked to differences in the underlying food systems and pesticide regulations (Wuepper et al., 2023). These existing variations, both at farm- and country-level, in turn speaks for a considerable reduction potential. Raising awareness of the environmental implications as well as signals by peers are crucial drivers for farmers' motivation in reducing pesticide use (Bakker et al., 2021). This reduction potential has not been accounted for in the studies on potential impacts. The existing variations imply that some farmers could reduce their use without any impacts on crop yields or food and feed security.

2.3 Crop-specific pesticide intensity

The magnitude of the pesticide-intensity varies considerably across crops and regions (Habran et al., 2022; Lechenet et al., 2016, 2017; Tang et al., 2021, 2022). In turn, Member States will likely reach their SUR national pesticide reduction targets not through a flat-rate reduction across all crops and areas but rather through a strategic targeting; for example, targeting specific crops that contribute more strongly to their current aggregate pesticide use and risk, and/or targeting crops for which management alternatives are readily available or on which pesticides with higher intensity are used. There are two critical implications of this. Namely, Member States particularly concerned with food and feed security might prioritize reductions in pesticide use in high-intensity crops that are not relevant to food and feed security. As different Member States may prioritize different crops under consideration of their national circumstances, even under the assumption that there are indeed adverse effects on yields following the reduction in pesticides, the crop-specific supply-shocks across the EU would be considerably more evened out across commodities compared with the modelling studies reviewed above. To recall, the modelling studies assumed a 50 % pesticide use cut in all crops across all Member States, and of all pesticides. This approach to the SUR pesticide reduction targets seems unlikely, as national decision-makers could reflect strategically on their current use patterns across crops.

To further illustrate the variations across Member States and cropping systems, Table 6 depicts a measure of partial productivity across the EU-27 Member States and nine different farm-types using data from the Farm Accountancy Data Network for averages between 2018 and 2020. The measure of partial productivity is the output value divided by the expenses for pesticides, with both in euro. It can be seen that, in general across Member States, specialized cereal, oilseed, and protein crop (COP) farm-types have the lowest productivity score whereas specialist horticulture the highest. However, different Member States have different pesticide productivities for different farm-types and decision-makers might target the least productive farm-types when designing their national pesticide reduction plan. When using data on pesticide expenses, however, it remains unclear whether higher expenses are due to a higher use of pesticides or conversely because products with less harmful active substances are more expensive. To enable a sound analysis of pesticide-productivity in different crops and countries, pesticide use data are necessary. The critical need for pesticide use data is also specifically addressed in Regulation (EU) 2022/2379 of the European Parliament and of the Council[38] and in the SUR proposal.

Similarly, different crops have different relative profit margins across different Member States. Figure 3 depicts the quantiles of the country-specific distribution of crop profit margins. Grids coloured in yellow indicate that this particular crop is, compared with other crops, relatively more profitable in a particular country. Vegetable production in green houses and flower production generally have the highest margins per hectare across countries. However, for other crops (e.g. apples, berries, and potatoes) considerable variations exist across countries. Crops with higher profit margins can be expected to be able to better cope with potential cost increases due to, for example, improved IPM practices or use of precision farming tools that facilitate reduced pesticide use. When designing the SUR national pesticide reduction targets, Member States could take the economic situation of different crops into account.

Arguably, these different analyses are a simplification and national reduction plans should consider various indicators. However, clearly there are variations in i) land-use across Member States, ii) national cultures and cuisines with associated preferences for foods, iii) pesticide intensity across crops, iv) risk-levels of the applied pesticides, v) availability for alternatives to pesticides across different crops, and vi) margins that allow for cost increases associated with alternative management approaches across different crops. Consequently, despite the shared objective of a 50 % reduction in pesticide use and risk variations in national strategies can be expected and indeed are built into the approach to national action plans in the SUR proposal. This heterogeneous response in turn would spread the potential impacts on yields (if any were assumed) across various commodities, which would even out the supply-shock considerably below what has been assumed in existing modelling studies (c.f. section 1.1 of this chapter).

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[38] Regulation (EU) 2022/2379 of the European Parliament and of the Council of 23 November 2022 on statistics on agricultural input and output, amending Commission Regulation (EC) No 617/2008 and repealing Regulations (EC) No 1165/2008, (EC) No 543/2009 and (EC) No 1185/2009 of the European Parliament and of the Council and Council Directive 96/16/EC (OJ L 315, 7.12.2022, p. 1). Note that the first PPP use data collection under that Regulation is to be carried out for the reference year 2026.

Figure 3 Crop-specific quantiles of the country-specific distribution of economic margins per hectare. Source: (Kremmydas et al., 2021)

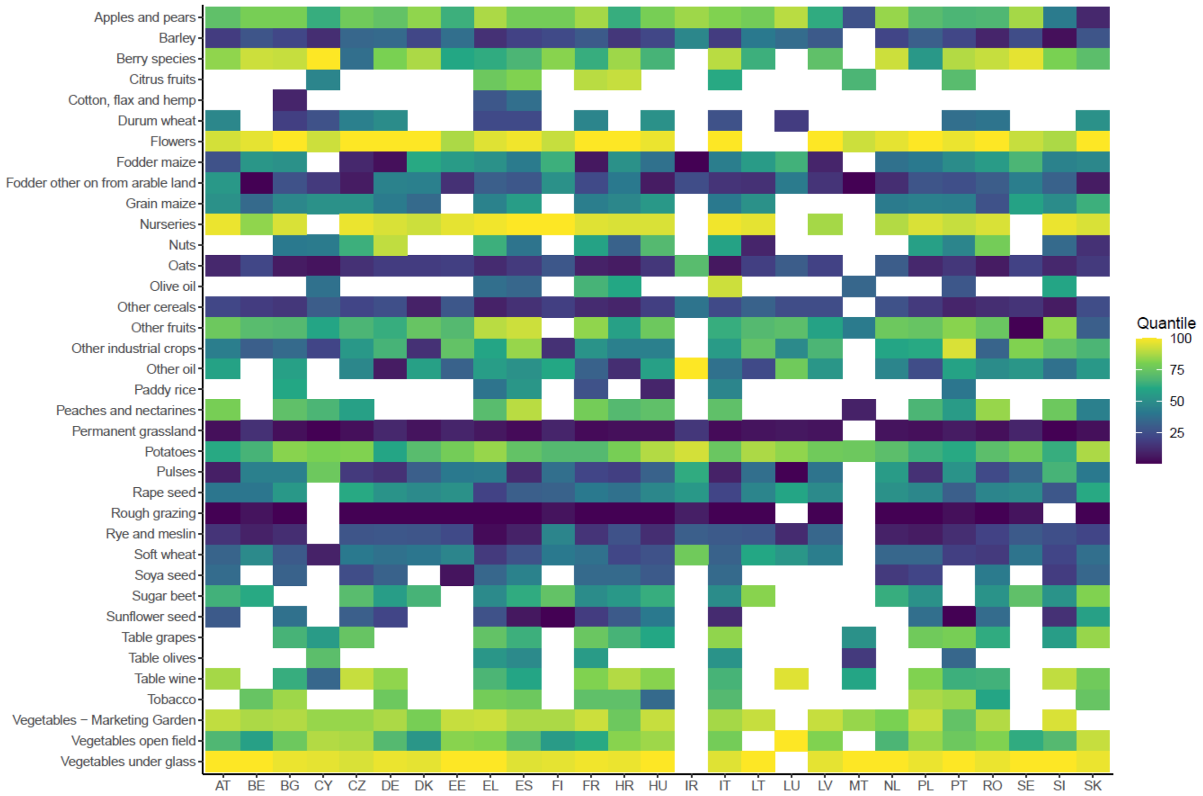


Table 6 Output values divided by expenses for pesticides (partial productivity) across the EU for different farm-types, averaged for the years 2018 to 2020. Source: Farm Accountancy Data Network (FADN)

Member State	Specialist COP*	Specialist field-crops	Specialist horticulture	Specialist wine	Specialist orchards fruits	Specialist olives	Permanent crops	Mixed crops	Mixed crops and livestock
(AT) Austria	16.4	17.0		25.2	13.2			18.6	15.6
(BE) Belgium		10.6	49.4		13.2			10.5	8.7
(BG) Bulgaria	11.3	18.9	24.8	7.7	10.0			12.9	15.3
(CY) Cyprus		16.1	14.8	13.5	10.7		13.5	13.8	22.9
(CZ) Czechia	7.6	9.5	53.1	19.1	8.4			12.4	8.8
(DE) Germany	8.6	12.2	77.2	30.4	13.6		14.3	13.1	10.2
(DK) Denmark	11.4	11.4	71.1		28.1			17.6	12.8
(EE) Estonia	10.9	22.9	91.2		144.3				12.2
(EL) Greece	13.6	12.7	14.6	12.4	12.4	28.1	20.0	16.3	22.5
(ES) Spain	16.5	13.9	20.4	18.9	14.7	18.0	19.1	16.9	21.7
(FI) Finland	13.0	16.3	86.1						19.6
(FR) France	7.0	10.2	60.2	23.3	16.7		20.8	15.0	7.3
(HR) Croatia	9.3	10.7	31.2	14.4	11.1	35.4	25.2	12.3	18.2
(HU) Hungary	11.3	14.7	40.5	12.2	7.6			10.9	12.0
(IE) Ireland	9.3								9.1
(IT) Italy	13.5	20.5	33.3	23.0	16.7	28.2	19.2	20.7	22.3
(LT) Lithuania	10.3	13.8	45.8		27.2			22.8	14.6
(LU) Luxembourg		10.5		23.6					8.6
(LV) Latvia	8.5	22.1						34.0	14.9
(MT) Malta		35.0	28.6					26.9	24.8
(NL) Netherlands		9.4	44.8		16.3			21.1	10.1
(PL) Poland	11.0	14.6	68.1		12.7			21.8	13.4
(PT) Portugal	9.9	11.7	19.3	21.4	16.1	15.3	31.5	17.8	22.7
(RO) Romania	12.1	18.7	24.4	9.1	13.2		13.4	17.0	16.7

(SE) Sweden	13.0	19.1	72.3						14.5
(SI) Slovenia	12.9	19.5	25.6	29.4	10.6		13.8	20.2	23.2
(SK) Slovakia	7.5	9.1							8.7
EU27 (2020)	**10.0**	**13.1**	**37.7**	**22.2**	**14.6**	**21.1**	**19.5**	**16.9**	**10.8**
*COP = cereals, oilseed, and protein crops									

2.4 Substitution of pesticides

The Farm to Fork Strategy announced two Farm to Fork pesticide reduction targets for reducing the use and risk of pesticides. Farm to Fork pesticide reduction target 1 is computed as a weighted aggregate for chemical pesticides that takes into account not only used quantities but also the level of risk entailed in the use of the respective active substance as a weighting factor. The weighting depends on the risk-class of a given active substance. Low-risk active substances receive a weighting of 1, normal active substances a weighting of 8. 53 of the approximately 453 active substances approved for use in the EU fall into the category 'candidates for substitution' (more hazardous active substances) with a weight of 16 and emergency derogations of unapproved active substances receive a weighting of 64. In turn, it is possible that a mere substitution from high-risk pesticides to low-risk alternatives delivers progress toward the SUR pesticide reduction targets, as well as environmental and health benefits, without affecting the availability of chemical management tools for farmers, or the overall volume of pesticide sales.[39] The underlying motivation for the weighting is that more hazardous pesticides cause more drastic externalities and could be prioritised in the strategies for reduction. Taking the toxicity of pesticides into account is pivotal as a reliance on quantities alone may lead to favouring more toxic pesticides that can be used in lower amounts, which can result in elevated toxic loads in non-targets (Bub et al., 2023; Cech et al., 2022; Schulz et al., 2021).

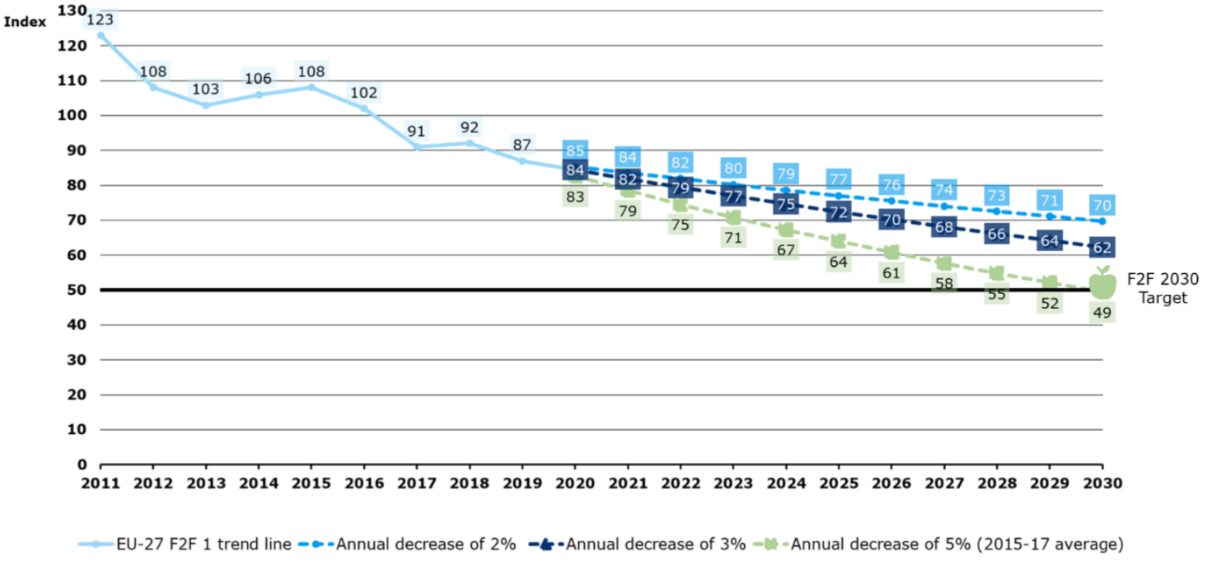
Achieving Farm to Fork pesticide reduction target 2 (i.e., the reduction in the use of more hazardous pesticides) would result in an automatic drop of around 10 % for the index that measures Farm to Fork pesticide reduction target 1. At EU-level from the 2015 to 2017 baseline to 2021, a 33 and 21 % reduction compared with the baseline period was already observed for Farm to Fork pesticide reduction target 1 (Figure 4) and 2, respectively. An extrapolation of the current trend line taking into account the historical data shows that further reductions can be expected in a no-change scenario, in the range of 1 and 5 % per year at an EU level. At the same time, the quantity of pesticides sold remained relatively constant over that period, and agricultural production has remained unaffected by this substitution of pesticides. In other words, the reduction already achieved mostly came from the withdrawal of high-risk pesticides and an expanded portfolio of, and/or increased sales/use of, low-risk alternatives without significant effects on EU production or food and feed security. The ability to monitor progress towards further pesticide reduction targets will be significantly improved when more detailed and disaggregated data are available under the data collected by Regulation (EU) 2022/2379 of the European Parliament and of the Council[40] (Mesnage et al. 2021).

During discussions between DG for Health and Food Safety (SANTE) and Member States' authorities, various Member States indicated that the substitution of pesticides was the main driver for the achieved progress toward the Farm to Fork pesticide reduction targets. Scientific advances already contribute via the development of low-risk alternatives such as bee-friendly insecticide alternatives (De La Peña et al., 2023), integrated agroecological approaches (Jactel et al. 2019; Riemens et al. 2022) as well as via approaches to dose rate optimization/reduction (Bažok, O'Keeffe, et al., 2021; Lázaro et al., 2021).

[39] For substitution of chemicals at the workplace see also Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) (OJ L 131, 5.5.1998, p. 11).

[40] Regulation (EU) 2022/2379 of the European Parliament and of the Council of 23 November 2022 on statistics on agricultural input and output, amending Commission Regulation (EC) No 617/2008 and repealing Regulations (EC) No 1165/2008, (EC) No 543/2009 and (EC) No 1185/2009 of the European Parliament and of the Council and Council Directive 96/16/EC (OJ L 315, 7.12.2022, p. 1).

Figure 4 Current and projected trend of the F2F1 under various scenarios.



To illustrate this substitution effect further, Figure 5a below presents the trend in the approval of low-risk active substances in the EU. As part of the action plan accompanying the Farm to Fork Strategy, the Commission has adopted four Implementing Regulations regarding the data requirements, the approval criteria, and evaluation principles for active substances that are microorganisms and the pesticides containing them with the objective of facilitating access to the market for these pesticides (Commission Regulations 2022/1438, 2022/1439, 2022/1440 and 2022/1441).[41] Figure 5b presents the trend in the application for new active substances and clearly shows that the share of new dossiers for biopesticides is increasing over time. As explained in the associated input on alternatives a number of measures are being taken to facilitate this market-based response and facilitate and prioritise the bringing of these biocontrol active substances to the market. This market-based response to societal concerns in relation to more hazardous pesticides can be expected to continue

[41] Commission Regulation (EU) 2022/1438 of 31 August 2022 amending Annex II to Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards specific criteria for the approval of active substances that are micro-organisms (OJ L 227, 1.9.2022, p. 2); Commission Regulation (EU) 2022/1439 of 31 August 2022 amending Regulation (EU) No 283/2013 as regards the information to be submitted for active substances and the specific data requirements for micro-organisms (OJ L 227, 1.9.2022, p. 8); Commission Regulation (EU) 2022/1440 of 31 August 2022 amending Regulation (EU) No 284/2013 as regards the information to be submitted for plant protection products and the specific data requirements for plant protection products containing micro-organisms (OJ L 227, 1.9.2022, p. 38); Commission Regulation (EU) 2022/1441 of 31 August 2022 amending Regulation (EU) No 546/2011 as regards specific uniform principles for evaluation and authorisation of plant protection products containing micro-organisms (OJ L 227, 1.9.2022, p. 70).

Figure 5 Trends in the approval of low-risk active substances in the EU since 2009 (a); and trends in the applications for approval of new active substances in the EU since 1996 (b). Sources: ccxlii, ccxliii.

Figure 5 (a)

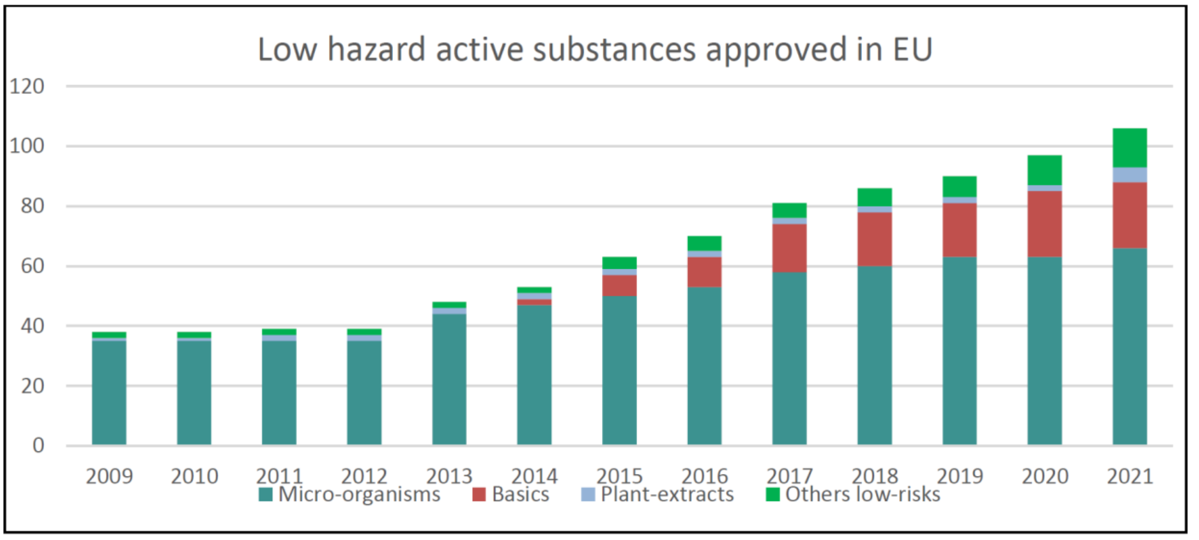
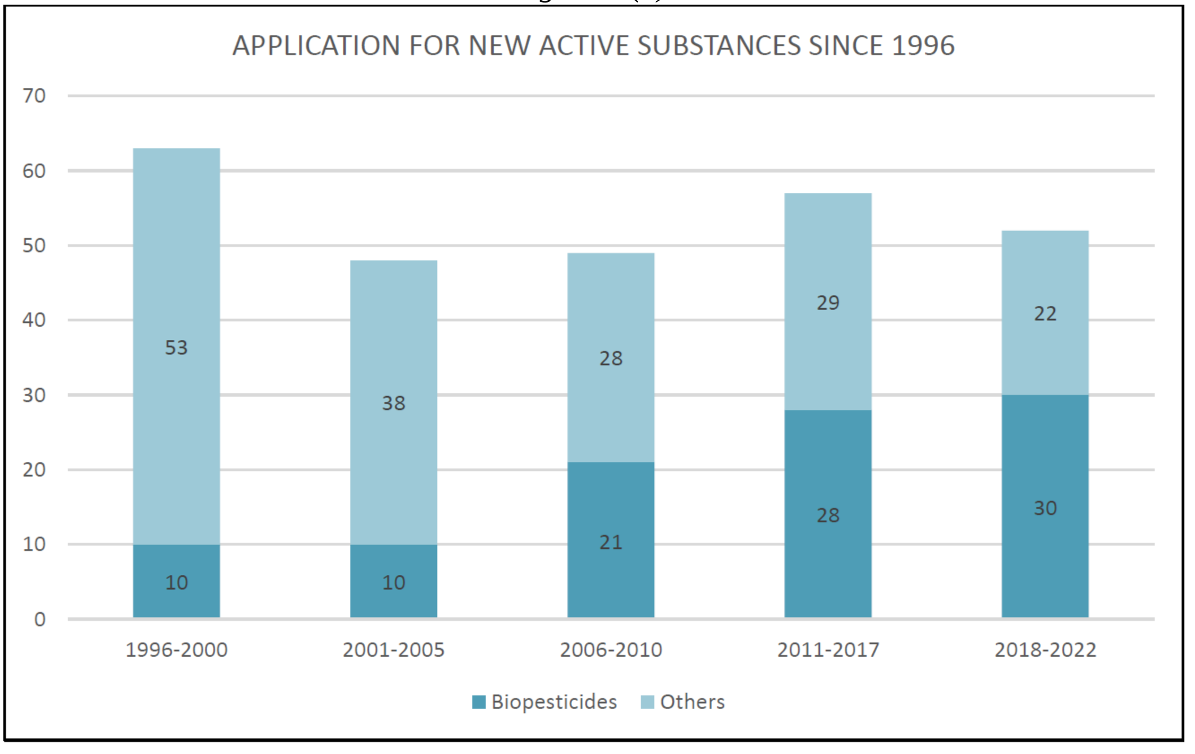


Figure 5 (b)



2.5 Organic farming

The Green Deal proposed a comprehensive set of strategies that include an ambition to work with nature to protect our planet and health. The previous section of this chapter discussed the considerable market-driven substitution where low-risk pesticides are substituted for more hazardous pesticides within conventional food systems, and the considerable progress towards the Farm to Fork pesticide reduction targets such substitution has already generated. In line with this, a reduction in the quantities and risk of active substances used is reflected in the transition of conventional to organic farming. Organic production is a system of rules about agricultural production, marketing, imports labelling and control that aims at producing and processing food and feed at lower environmental costs.[42] The organic production rules, including the use of pesticides and fertilisers, are laid down in Regulation (EU) 2018/848 of the European Parliament and of the Council[43] In Europe, organic farming legislation limits chemical inputs in organic farming, which is thus linked with a reduction in the use of chemical pesticides (Benbrook et al., 2021; Wuepper et al., 2023), and is also reflected by a considerable reduction in pesticide residues detected in organic foods (European Food Safety Authority, 2021). The Farm to Fork Strategy establishes a clear target of increasing the share of the agricultural area in the EU subject to organic farming from the current 9 % [44] to 25 % by 2030. A relevant effect of this expansion of the area under organic farming would be a reduction in the use of agricultural inputs such as mineral fertilizers and chemical pesticides. Previous research suggests that 25 % of area under organic farming would decrease the fertilizer and pesticide purchases by 12.7 % and 14.5 %, respectively.[45] Hence, nearly a third of the first SUR pesticide reduction target could possibly be achieved through the target on organic farming. This is another critical contribution to the decomposition of the SUR pesticide reduction target, which has clearly been ignored in the modelling studies mentioned above that had generally assumed a full 50 % reduction in pesticide use and risk in all crops.

The associated measures on increased availability of biocontrol alternatives (which could be used in organic farming) would favour and support organic farming as more tools would be available. The Commission non-paper on sensitive areas[46] specifically suggests for the co-legislators an option for the use of products approved for organic farming in ecologically sensitive areas, thus providing a synergy with the target for increased organic area.

[42] Environmental impacts of achieving 25% organic land - A study (organicseurope.bio)

[43] Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007 (OJ L 150, 14.6.2018, p. 1).

[44] Developments in organic farming - Statistics Explained (europa.eu)
[45] Page 68 in
Research for AGRI Committee - The Green Deal and the CAP: policy implications to adapt farming practices and to preserve the EU's natural resources (europa.eu)
[46] pesticides_sud_sur-non-paper_en.pdf (europa.eu)

Box 2. Takeaway points of section 2

1) Part of the progress towards the SUR pesticide reduction targets will come from reduction in pesticide use in non-agricultural areas (e.g., urban areas, sport and leisure facilities, private gardens, non-agricultural ecologically sensitive land, etc.). Furthermore, the aggregate of the pesticide footprint linked to the consumption of textiles, services, other, and 'empty-calorie food' (i.e., foods that have low nutritional value) accounts for a share of close to 37 %. Arguably, a reduction in pesticide use and risk in non-agricultural areas or non-food and non-feed crops would have no repercussions on food and feed security.

2) Current pesticides use intensity depends on many aspects. Various studies have found sizeable variability in pesticide use not only across different years and between different regions within a country, but also across farms that essentially faced the same environmental and socio-economic condition. Existing variations, both at farm- and country-level, in turn speaks for a considerable reduction potential.

3) Variations in current pesticide use and economic conditions across Member States will likely result in a diversity of national pesticide use reduction strategies that would spread potential supply shocks (even if any were assumed) across commodities and in turn result in lower impacts as were assumed in existing studies.

4) Considerable progress towards the Farm to Fork pesticide reduction targets has already been achieved from the pesticide reduction targets' reference baseline period of 2015-2017, without evidence that this has affected EU production or food and feed security.

5) Regulatory measures at EU level have been achieved to foster the access of low-risk pesticides to the market but their implementation by Member States will be central to realise the SUR pesticide reduction targets.

6) Progress towards achieving the Farm to Fork target of an expansion of the area under organic farming in the EU to 25 % would also be expected to result in a considerable decline in pesticide purchases and use.

7) The ability to monitor progress towards the SUR pesticide reduction targets will be significantly improved when data is available Regulation (EU) 2022/2379 of the European Parliament and of the Council[47], facilitating the development of more precise pesticide use indicators and targets after 2030.

[47] Regulation (EU) 2022/2379 of the European Parliament and of the Council of 23 November 2022 on statistics on agricultural input and output, amending Commission Regulation (EC) No 617/2008 and repealing Regulations (EC) No 1165/2008, (EC) No 543/2009 and (EC) No 1185/2009 of the European Parliament and of the Council and Council Directive 96/16/EC (OJ L 315, 7.12.2022, p. 1).

3. Food and feed security relevant feedbacks of a pesticide reduction

Besides the pesticides' intended function as damage control agents, their use also leads to unintended consequences, so called *externalities*. The consequences for the environment and human health from misuse of, and accidents with, these chemicals are of societal concern (Carvalho, 2017; Edlinger et al., 2022; Köhler & Triebskorn, 2013; Nicolopoulou-Stamati et al., 2016; Sharma et al., 2020).[48] Pesticide residues are found in soils, surface water, groundwater, non-target plants, food and feed, animals and humans (Aktar et al., 2009; Popp et al., 2013; Sharma et al., 2019); some pesticides can remain in the environment for years and accumulate in soils and water (Sharma et al., 2020). Exposure to operators due to accidents with neurotoxic pesticides have led to widespread serious chronic mental conditions such as Parkinson's disease among farmers (Costa et al., 2008).

While being used to minimise production risks, certain pesticide applications can also reduce overall production costs. This raises the question as to whether environmental and societal externalities are properly internalized into the product prices in the current markets (Finger et al., 2017; Grovermann et al., 2017; Popp et al., 2013; Steingrímsdóttir et al., 2018). A failure to internalize societal costs into the products' price leads to an excessive use, which not only goes beyond the environmentally sustainable level but also the optimal level from an economic point of view (Frisvold, 2019; Steingrímsdóttir et al., 2018). A recent paper published by the German Environment Agency[49] mentions that current annual costs of biodiversity loss due to intensive agriculture in Germany alone have been estimated to amount to EUR 50 billion. While a valuation of ecosystem services remains challenging (de Groot et al., 2010), societal benefits of the 2009 thematic strategy EU pesticide regulation package overall have been estimated at EUR 15 to EUR 54 billion, equating to EUR 70 to EUR 250 per EU household.[50]

The assumption that continuing the pesticide dependent production practices of the last decades may safeguard the EU's food and feed security in the long run is a considerable fallacy. A reluctance to change the current system-design would instead likely continue to contribute to the downward spiral that led to the degradation of natural resources in the first place; and very likely result in serious risks to food and feed security. While pest management in the EU food system is currently pesticide-centric, the notion that a continuation of this is in any way a safer path that would ensure food and feed security is very much unsupported by the scientific evidence, as will be discussed in the next section of this chapter. Various environmental stressors, from climate change, over soil erosion, to a loss of biodiversity, have already started to affect EU food systems. The use of pesticides generates unintended effects, so-called *externalities*, which are a significant contributor to many agro-environmental problems. Many of these externalities adversely feedback to crop yields, and in turn also to food and feed security.

[48] How pesticides impact human health and ecosystems in Europe — European Environment Agency (europa.eu)

[49] Towards sustainable plant protection | Umweltbundesamt

[50] Study on the cumulative health and environmental benefits of chemical legislation - Publications Office of the EU (europa.eu)

3.1 Biodiversity loss

Biodiversity loss and ecosystem collapse are among the most serious threats humanity will face in the next decades. The world already lost an estimated EUR 3.5 to EUR 18.5 trillion Euros per year in ecosystem services from 1997 to 2011 due to land-cover change and an estimated EUR 5.5 to EUR 10.5 trillion per year due to land degradation.[51] Biodiversity is crucial for safeguarding the EU's and global food and feed security. A rich biodiversity underpins healthy and nutritious diets and improves rural livelihoods by supporting agricultural productivity (Dainese et al., 2019). There is an overwhelming scientific consensus that biodiversity loss threatens mankind's food systems in unprecedented ways, putting food security and nutrition at serious risk.[52]

The EU's biodiversity strategy for 2030[53], one of the flagship initiatives under the European Green Deal, is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems. The strategy aims to put Europe's biodiversity on a path to recovery by 2030 and contains specific actions and commitments[54]. The biodiversity strategy stipulates that at least 10% of agricultural area should be under high-diversity landscape features, and that the uptake of agro-ecological practices should be significantly increased. In addition, the Farm to Fork Strategy sets the objective that at least 25% of agricultural land should be under organic farming. This will open space for biodiversity in productive parts of agricultural landscapes and support the transition to a sustainable food production system. To aid biodiversity recovery in agricultural ecosystems, it is also critical to reduce pressure from chemical pollutants and other substances.

The SUR proposal, adopted by the European Commission in June 2022, proposes legally binding SUR pesticide reduction targets at EU level to reduce by 50% the use and the risk of chemical pesticides and the use of the more hazardous pesticides[55] by 2030, and proposes measures to improve IPM, where chemical pesticides can only be used once all non-chemical options are exhausted. The SUR proposal obliges Member States to adopt legally binding SUR national pesticide reduction targets corresponding to the SUR EU pesticide reduction targets. It also restricts pesticide use in sensitive areas, including in areas that sustain pollinator species that are at risk of extinction.

To restore damaged ecosystems across Europe and enable the long-term sustained recovery of biodiverse and resilient nature, the European Commission adopted a first EU-wide proposal for a regulation of the European Parliament and of the Council on nature restoration[56] (Nature Restoration Law proposal) in June 2022. It entails an overarching restoration objective coupled with binding targets for specific ecosystems. Action on restoration in agricultural land includes restoring ecosystem functions and services, of which animal pollination is one of the most essential. Proposed obligations on agricultural ecosystems include ensuring the recovery of grassland butterflies and farmland bird populations, restoring and rewetting peatlands, and increasing the share of agricultural land with high-diversity landscape features. In addition, Member States are obliged to reverse the decline of pollinators by 2030. A reduction in

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[51] https://ec.europa.eu/commission/presscorner/api/files/attachment/865555/factsheet-business-case-biodiversity_en.pdf.pdf factsheet-business-case-biodiversity_en.pdf (3).pdf

[52] Factsheet: EU 2030 Biodiversity Strategy (europa.eu)
[53] resource.html (europa.eu)
[54] resource.html (europa.eu)
[55] This term is to be understood throughout this report as referring to more hazardous plant protection products as defined in Article 3(5) of the SUR proposal.
[56] Proposal for a regulation of the European Parliament and of the Council on nature restoration (2022/0195(COD)).

pesticide use and risk as proposed under the SUR proposal will be instrumental to reach this target.

Soils host over 25 % of all biodiversity on our planet (FAO Intergovernmental Technical Panel on Soils (ITPS), Global Soil Biodiversity Initiative (GSBI), Secretariat of the Convention on Biological Diversity (SCBD), 2020). In the EU, there are 2.8 million potentially contaminated sites (Paya Perez & Rodriguez Eugenio, 2018), and 83 % of agricultural soils show residues of chemical pesticides (Joint Research Centre of the European Commission (JRC) work on Land use/cover area frame statistical survey (LUCAS) 2018 in progress). In addition to agricultural soils with nutrient inputs at levels risking eutrophication, cropland soils are losing carbon at a rate of 0.5 % per year. Around 24 % of land suffers from unsustainable water erosion rates (Paganos et al., 2020). Approximately 23 % of land is characterized by high density subsoil due to compaction (Montanarella & Panagos, 2021). Lastly, 25 % of land is at high or very high risk of desertification in Southern, Central, and Eastern Europe (Prăvălie et al., 2017). The costs associated with soil degradation in the EU already exceed EUR 50 billion per year.[57] For six land degradation processes (water erosion, loss of phosphorus, loss of carbon due to soil erosion and land use change, sediments removal and management of contaminated sites), the JRC estimated a cost of 15 billion per year. The 12 million hectares of agricultural land in the EU that suffer from severe water erosion are estimated to lose around 0.43 % of their crop productivity annually, with estimated annual cost of EUR 1.25 billion (Panagos et al., 2018).

Presently, conventional agriculture accounts for around 91% of the agricultural areas in the EU.[58] In areas in which agricultural inputs, such as fertilizers and pesticides, are used intensively, direct pressure on biodiversity can be observed. Pesticides are among the pollutants that can adversely affect soil-, field-margin-, and water-organisms, thereby contributing to environmental degradation and ecosystem service losses that may lead to repercussions for food and feed security. Globally, around 64 % of agricultural land is at risk of pesticide pollution and 31 % is at high risk (Tang et al., 2021). Among the high-risk areas, 34 % are high-biodiversity regions and therefore at risk of serious environmental damage from pesticide pollution (Tang et al., 2021). These are global estimates, and the numbers may differ for the EU. Various studies attempted to quantify the societal costs of pesticides. The adverse effects of pesticides on pollinators (Desneux et al., 2007; Johansen, 1977; Sponsler et al., 2019; Tosi et al., 2022) threaten ecosystem services with an estimated worth of hundreds of billions of dollars (Gallai et al., 2009; Losey & Vaughan, 2006). Annual losses in developing countries due to effects of pesticides on non-target organisms were estimated at $8 billion (Aktar et al., 2009). In the United States, inadvertent resistance building in pests from pesticide applications was estimated to cost $10 billion per year (Sexton et al., 2007). Nevertheless, a comprehensive meta-analysis of the aggregate monetary externalities of pesticide-centric management, and particularly in an EU context, is, to the best of our knowledge, not available.

Undoubtedly, some of the externalities of pesticide use have direct impacts on farming activities that will lead to negative impacts on food and feed security. Biodiversity is crucial for safeguarding EU and global food and feed security (FAO, 2019), by supplying many vital ecosystem services, such as soil and water quality, nutrient cycling, soil respiration, pollination, natural pests control, and by providing habitat for wildlife (Chagnon et al., 2015; Dainese et al., 2019). A rich biodiversity makes food systems and livelihoods more resilient to shocks and stress (Chagnon et al., 2015; Dardonville et al., 2022), including those caused by climate change. The adverse effects of pesticides on flora and fauna, in turn, are of particular relevance

[57] EU soil strategy for 2030 (europa.eu)

[58] .Developments in organic farming - Statistics Explained (europa.eu)

when discussing the relationship between pesticides and crop yields, food and feed security, and prices.

In relation to food and feed security, the loss of functional biodiversity directly translates into the decrease of several critical ecosystem services (Grab et al., 2019; Greenop et al., 2021; Hooper et al., 2012; Marshman et al., 2019). The unprecedented decline in biodiversity and the associated functions has led to the exploration of desperate alternatives via anthropogenic solutions. For example, attempts are made to replace the loss of pollinators and the pollination service they provide by managed pollinators and/or artificial pollination. The labour costs for hand pollination of agricultural crops were estimated at 90 billion Dollars per year in the United States alone.[59] The loss of predators of pests and the natural pest control service they provide is being substituted with the use of more chemical pesticides. The loss of soil biodiversity and the nutrient cycling service is being substituted with the use of more mineral fertilisers. This substitutive action, besides being costly, may not provide outcomes comparable to the ones provided by natural processes, such as the improvement of fruit quality and the economic value provided by insect pollination (Garratt et al., 2014).

Evidence shows that restoring agroecosystems can have positive impacts on food productivity and food and feed security through higher yields, improved nutritional content, and a stronger resilience and stability against climate-change-related as well as socio-economic disturbances (Liquete Garcia et al., 2022). More (bio)diverse and resilient agricultural ecosystems also reduce the dependence on imports. The restoration of nature can therefore be seen as an insurance policy for the EU’s long-term food and feed security. A reduction in pesticides use must certainly be part of the solution to achieve such a restoration.

The following analysis restricts discussion on externalities that have repercussions on crop yields, and subsequently on food and feed security. Adverse impacts on, for example, human health and freshwater systems are omitted as they do not directly relate to crop yields. Nevertheless, these externalities generate societal and environmental costs that must certainly be considered by decision makers.

3.2 Natural pest control

A rich biodiversity is essential for natural pest control (Albrecht et al., 2020; Bonato et al., 2023; Díaz-Siefer et al., 2022; Gong et al., 2022). In other words, adverse effects of pesticides on biodiversity can reduce the natural pest control, which in turn leads to an elevated need for pesticides to manage crop health. This so-called *pesticide dependency* in agriculture is a complex challenge and often characterized as a treadmill (Hedlund et al., 2020). The degree of dependency is, among other factors, related to the bioclimatic conditions and the plant species cultivated (Popp et al., 2013). The contribution to pest control of natural enemies of crop pests has been estimated to account for at least 50 % of pest control occurring in crop fields (Pimentel et al., 2005).

Agronomic designs, e.g. flower strips, can support natural pest control. Martin et al. (2019) found a 1.4-fold increase in pest control and a 1.7-fold increase in pollination within landscapes with a higher field-edge density. Albrecht et al. (2020) estimated that intact flower strips and hedgerows enhance pest control by 16 %, whereas Tschumi et al. (2015, 2016) found a 40 to 61 % reduction in pest-induced crop damage near wildflower strips. In some crops, the natural pest control via flower strips can therefore be an effective alternative to insecticides (Tschumi

[59] The Business of Bees: An Integrated Approach to Bee Decline and Corpor (routledge.com)

et al., 2015; Tschumi, Albrecht, Collatz, et al., 2016). Furthermore, the inclusion of flower strips can in some cases translate directly into higher crop yields (Mei et al., 2021; Tschumi, Albrecht, Bärtschi, et al., 2016). However, such agronomic designs may also play a role as a reservoir for polyphagous pests and diseases which could necessitate control of organisms that, without flower strips, do not pose risks.

While studies quantifying the overall value of natural pest control at the EU scale are missing, individual studies on single crops/regions can be illustrative of the importance of this service. The economic value provided by natural pest control on wheat in South-East England alone has been estimated to be around £2.3 million over a 5 years period (Zhang et al., 2018). Daniels et al. (2017) estimated a farm income loss related to a lack of natural pest control between EUR 89 and EUR 2187 per hectare annually. In North America, the value of natural pest control by insects alone has been estimated at 4.5 billion USD annually (Losey & Vaughan, 2006).

Ecosystems influenced by agriculture have generally experienced a dramatic loss of terrestrial and aquatic biodiversity, beyond pollinators (Chagnon et al., 2015). For example, this is demonstrated by a 57 % decline of European farmland birds between 1980 and 2017.[60] Agricultural intensification, and in particular pesticides and fertiliser use, have been established as the main pressure for most bird population declines in Europe, especially for invertebrate feeders (Rigal et al., 2023). Besides their critical role in the food web, wild birds are also known to reduce crop damage and pest abundance while increasing crop yields through natural pest control (Díaz-Siefer et al., 2022). Pesticides can affect birds directly through ingestion of pesticide-treated seeds or contaminated insects, or indirectly through a general reduction in food resources. A high number of contaminated mammals with a broad mixture of active substances was found in French samples, with no statistical difference between conventional and organic fields (Fritsch et al., 2022). Similar to birds, mammals have critical roles in the agro-ecosystem, among others, due to predation of weed seeds and invertebrates (Fritsch et al., 2022).

Arguably, several factors are driving the biodiversity decline and in turn the loss of natural pest control. Nevertheless, it is scientific consensus that pesticides are a major part of the problem. That the current use of chemical pesticides, especially insecticides and fungicides, is a key driver of biodiversity loss across the EU has been established (Chagnon et al., 2015; Potts et al., 2010).[61] Available data links intensive agriculture, with its use of pesticides with hazardous active substances, with serious environmental problems especially in aquatic ecosystems.[62] While aggregated EU-level data on the relationship between the intactness of natural pest control and the use of pesticides is lacking, in general across scientific disciplines there is a widespread consensus that pesticide application is having an adverse impact on biodiversity. These adverse impacts can result from a direct poisoning of non-target organisms on the treated fields (or in proximity of such), as well as through a reduction in food resources for non-target organisms.

[60] European Indicators | PECBMS - PECBMS

[61] Pesticide sales — European Environment Agency (europa.eu)

[62] European waters -- Assessment of status and pressures 2018 — European Environment Agency (europa.eu)

3.3 Pollination services

The unprecedented loss of biodiversity threatens food systems globally, putting food and feed security and nutrition severely at risk (Goulson et al., 2015; Marshman et al., 2019; Potts et al., 2016). Next to natural pest control, pollination services are severely impacted by this adverse trend. While the main cereal staple foods are self-pollinated, pollinators do influence 35 % of global human food supply (Marshman et al., 2019; Tscharntke et al., 2012). Consequently, pollinating insects, especially wild pollinators (Garibaldi et al., 2013; Goulson et al., 2015; Weekers et al., 2022), provide vital ecosystem services to crops and wild plants. Over half of the global Gross domestic product (GDP) depends on nature and the services it provides. More than 75 % of global groups of food crops rely on animal pollination (Klein et al., 2007; Potts et al., 2016). In the EU, around 84 % of crop species and 78 % of wild flower species depend, at least in part, on pollinators. At global level, pollinators are required for reproduction of almost 90 % of angiosperms (Tscharntke et al., 2012). In the EU, 31 % of the income generated through crop production depends on pollinators (Schulp et al., 2014). There is no shortage of evidence, nor any lack of consensus, that pollinators are pivotal to food and feed security and that current food systems with the associated use of pesticides are adversely affecting them (Marshman et al., 2019; Potts et al., 2010, 2016).

The EU Pollinator initiative was the first-ever EU framework to tackle the decline of wild pollinators. The European Commission has recently adopted the communication 'A new deal for pollinators'[63] revising the 2018 EU Pollinators Initiative. This responds to increasing calls for measures, including from the European Court of Auditors[64] and the European Citizens' Initiative 'Save bees and farmers'[65], to improve pollinator conservation and tackle the causes of their decline and its consequences on food security, human health, quality of life and ecosystems. Insects, particularly pollinators, are key indicators of the health of agroecosystems and are vital for agricultural production and food security. As mentioned in the communication 'A new deal for pollinators' and shown by evidence, intensive agriculture and pesticide use are causing biodiversity and pollinator loss, together with other factors such as land-use change and urbanisation, climate change and invasive alien species.

The Nature Restoration Law proposal[66] includes a specific legally binding target for Member States to reverse the decline of pollinator populations by 2030 and achieve an increase thereafter. It also provides for an obligation for regular monitoring of pollinators. Under the Nature Restoration Law proposal, Member States are expected to submit national restoration plans to the European Commission showing how they will meet the targets. They would also be required to monitor and report on progress.

The SUR proposal sets legally binding SUR pesticide reduction targets and proposes measures to improve IPM, ensuring that chemical pesticides are only used as a last resort option. The SUR proposal also restricts pesticide use in sensitive areas, including in areas that sustain pollinator species that are at risk of extinction.

At EU-level, only the pollination services provided by bees has been estimated to account for 8 to 20 % of the total yield value of pollination dependent crops or 10 billion euro (Vallecillo et al., 2019). A complete pollinator loss would translate into a decline of production across all

[63] eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0035&from=EN

[64] Special Report 15/2020: Protection of wild pollinators in the EU — Commission initiatives have not borne fruit | European Court of Auditors (europa.eu)

[65] European citizen initiative 'Save bees and farmers

[66] Proposal for a regulation of the European Parliament and of the Council on nature restoration (2022/0195(COD)).

crops over current consumption levels of 12 % for fruits and 6 % for vegetables (Gallai et al., 2009). The absence of pollinators was estimated to result in a 7 % reduction in crop production in the EU (Schulp et al., 2014). These estimates of production impact do not account for the fact that pollinators fulfil a pivotal role in the ecological food webs in general (Chagnon et al., 2015). To recall, Barreiro-Hurle et al.'s (2021) worst-case estimates of production losses associated with a reduction in pesticide use and risk was 2.7 % of EU's total agricultural output (Table 5), and the USDA's worst-case estimate for a scenario in which the entire Green Deal policies are globally enforced was a 12 % decline in crop yields. Hence, irrespective of all the arguments put forward in this report on why these estimates should be seen as an upper-bound, evidently the impact of a pollinator loss alone (i.e., ignoring natural pest control and soil health) is expected to be worse than the most extreme estimates of a yield-decline due to the reduction in pesticide use and risk. The reduction in pesticide use and risk, however, is only part of the solution to prevent a collapse of pollinators in the EU.

The pollinators' abundance and diversity can directly increase crop productivity (Garibaldi et al., 2016), and quality (Stanley et al., 2015). A diverse community of pollinators, including wild species, generally provides more effective and stable crop pollination than any single species, such as honeybees (Garibaldi et al., 2013). Pollination limitation due to a lack of pollinators is a common cause of lower crop yield (Klein et al., 2007; Reilly et al., 2020). For example, studies identified increases in crop yield following the introduction of wildflower strips and field margins in farmlands (Mei et al., 2021). A higher abundance of bees leads to higher crop yields and gross margins, ranging from 15 to 40 %, therefore directly benefiting farmers (Catarino et al., 2019). While oilseed rape may self- and wind-pollinate, the presence of insect pollination was found to increase yields by 20 to 35 % (Bommarco et al., 2012; Perrot et al., 2018). Maintaining high floral diversity and perennial floral plantings is essential for the effectiveness of these pollinators. In turn, there is a clear antagonism between pesticide use and bee abundance (Catarino et al., 2019). Adverse effects of pesticide use on bees are not limited to lethal doses but also arise through a continuous exposure at sub-lethal levels (Siviter, Richman, et al., 2021; Stanley et al., 2015; Tosi et al., 2022; Woodcock et al., 2016). The antagonism likely also extends to flower-visiting insects in broader terms (Uhl & Brühl, 2019). While quantifying this critical contribution in monetary terms is challenging, a recent study conservatively estimated the global value of animal pollination to crop production at EUR 158 to 412 billion per year (Stout et al., 2016). Collectively, pollinators provide more than EUR 14 billion per year to the market value of European crops (Intergovernmental science Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2016), and up to over EUR 1500 per hectare.

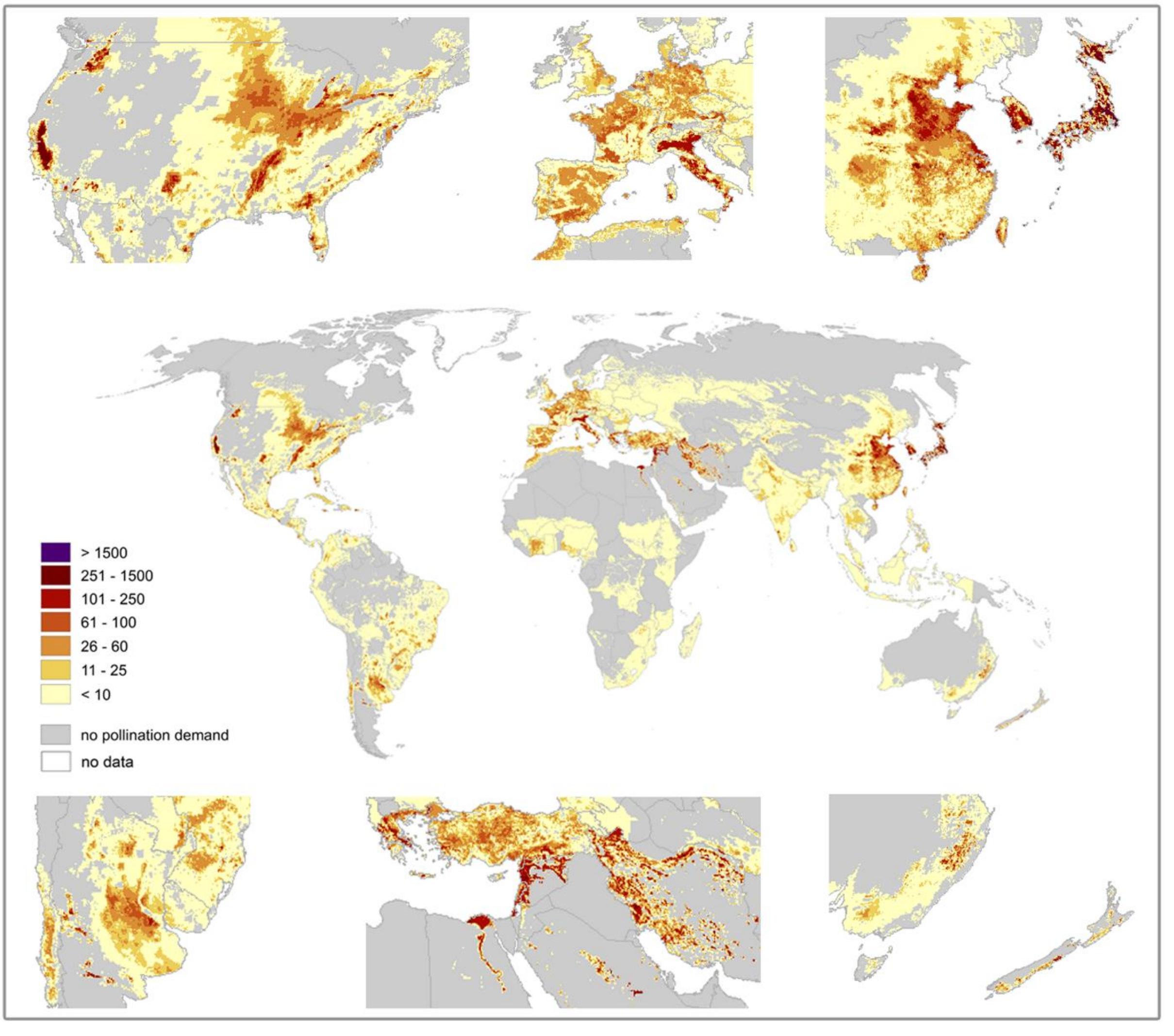
In addition to the evidence in relation to food quantity, pollinated crops are vital globally for food and feed security also in relation to their importance as sources of micronutrients. Around 90 % of the crops that provide vitamin C, 70 % of those providing vitamin A, and the majority of those providing, calcium, fluoride, and folic acid requiring pollination (Eilers et al., 2011; Potts et al., 2016). A collapse of pollination services could therefore lead to elevated rates of preventable diseases, with estimates suggesting a potential of 1.4 million additional deaths annually because of dietary deficiencies (Smith et al., 2015).

Mediterranean Europe is among the hotspots for the economic benefits associated with pollination services (Lautenbach et al., 2012) (Figure 6). Despite this, in October 2020 the European Commission published the results of the EU-wide ecosystem assessment, which also included insects-pollination services (Maes et al., 2020). The results revealed that 50 % of the land cultivated with pollinator-dependent crops faced a deficit in pollinators.[67] The drastic

[67] FarmToFork_ComparisonTable_A4_RV_Fev_2022_01.indd (europa.eu)

decline in bees and other pollinating insects in the last 50 years is a complex problem with several driving factors (Goulson et al., 2015; Meeus et al., 2018). However, that pesticides contribute to the decline of bees has been established (Goulson et al., 2015; Rundlöf et al., 2015), and this negative effect is aggravated by other anthropogenic drivers (Knauer et al., 2022; Siviter, Bailes, et al., 2021).

Figure 6 Estimated benefits of pollination services in the year 2000 in euro per hectare. Source: (Lautenbach et al., 2012)



A drastic decline in both wild and domesticated pollinators has been reported in several regions of the world (Potts et al., 2010; Powney et al., 2019). Globally, around 17 % of pollinator species face extinction. There are widespread reports that populations of pollinators and other flying insects have strongly declined over the last decades in Europe (Barendregt et al., 2022; Hallmann et al., 2017, 2020; Møller, 2019; Vogel, 2017).[68] On average across these national or regional reports, insect populations have been declining by about 20 to 30 % per decade, or 2 to 3 % annually. At EU-level, between 1991 and 2018 the populations of common grassland butterflies have decreased by 25 %.[69] The decline in insect populations is also impacting the

[68] [Bugs-Matter-2021-National-Report.pdf (buglife.org.uk)]

[69] [The European Grassland Butterfly Indicator: 1990…-2011 — European Environment Agency (europa.eu)]

populations of their natural predators, particularly in agro-ecosystems. While the populations of all common birds in the EU declined by 12 % and the populations of common forest birds declined by 5 % between 1990 and 2021, the populations of common farmland birds have declined by 36 % during that period according to EBCC and Birdlife[70].

Recent assessments (extensive review provided by Mamy et al. (2022)) show that pesticide use is linked to a wide range of direct (both lethal and non-lethal) and indirect effects on biodiversity, contributing to observed declines in populations of bees and other organisms (birds, bats, earthworms, aquatic plants, fish, and amphibians, among others). In some cases, the negative impacts can be connected to recently banned active substances such as neonicotinoid insecticides, whose toxicity to bees, terrestrial mammals and birds is well documented, or the insecticide chlorpyrifos in relation to bats. However, a growing body of evidence suggests that several currently approved active substances also have adverse effects, for example glyphosate on non-target plants (relevant as food plants for pollinators) or cypermethrin (a pyrethroid) on non-target animal species, to name just a few.

In view of this, a constant monitoring scheme of pesticide exposure to pollinators is called for (Kaila et al., 2022). In this regard, the European Commission currently implements the INSIGNIA project,[71] which monitors environmental pollution, including pesticides, using honeybees as sentinels. The project has been funded by the European Parliament.

3.4 Soil health

Soils are the basis for agricultural food production (D’Hose et al., 2014). They also act as a buffer against climate change risks to food and feed security. Soil health is also a pressing global issue that sits at the heart of four UN conventions (United Nations Convention on Biological Diversity (UNCBD), United Nations Convention to Combat Desertification (UNCCD), IPBES, and United Nations Framework Convention on Climate Change (UNFCCC) and of the Sustainable Development Goals. Soils host over 25 % of all biodiversity on our planet (FAO, ITPS, GSBI, SCBD, 2020), and they are the foundation of the food chains for humans and animals alike. As a majority of food comes from terrestrial sources, the ability to provide sufficient, safe, and nutritious food and a range of vital ecosystems services such as clean water, habitats for biodiversity, nutrient cycling, and carbon storage depends on maintaining soil health, for example through a reduction in pollutants such as pesticides (Kibblewhite et al., 2008).

The EU soil strategy for 2030[55] stresses the importance of soil biodiversity for ecosystem health and sets out specific actions to better understand and protect soil biodiversity, in particular by using the activities of the Horizon Europe Mission, A Soil Deal for Europe[56]. Halting and reversing the loss of soil biodiversity is an essential aspect of the strategy’s vision to achieve healthy soils by 2050. As the EU’s largest terrestrial ecosystem, healthy soils sustain many sectors of the economy while soil degradation is costing the EU several tens of billion euro per year[72]. The soil strategy builds on and significantly contributes to several of the objectives of the Green Deal, the Farm to Fork, biodiversity and chemicals strategies and the zero pollution action plan. Sustainable soil management practices are part of broader agro-ecological

[70] Home | EBCC - EBCC

[71] Insignia-EU – PREPARATORY ACTION FOR MONITORING OF ENVIRONMENTAL POLLUTION USING HONEY BEES (insignia-bee.eu) Grant number: 09.200200/2021/864096/SER/ENV.D.2

[72] Estimated at EUR 50 billion in the report of the Mission board for Soil health and food (2020), ‘Caring for soil is caring for life’, Caring for soil is caring for life - Publications Office of the EU (europa.eu)

principles which are at the heart of the farm to fork and biodiversity strategies and their targets to bring back at least 10% of agricultural area under high-diversity landscape features, to reduce nutrient losses and risk and use of chemical pesticides by 50% by 2030, to increase the proportion of agricultural land under organic farming and to increase soil organic matter. Moreover, prevention of soil pollution remains one of the most effective and cheapest ways to ensure clean and healthy soils in the long term. This can be done, for example, by more efficient fertiliser application or reduced pesticide use and risk[73]. The SUR proposal translates the Farm to Fork pesticide reduction targets into legally binding SUR pesticide reduction targets and proposes measures to improve IPM where chemical pesticides are only used as a last resort option.

The main drivers of soil degradation in Europe are human activities, such as intensive agriculture, drainage, and the spread of persistent pollutants such as certain pesticides (Ankit et al., 2020; Kibblewhite et al., 2008). Of all management factors, pesticide residues are suggested to have the biggest influence on the soil microbiome (Walder et al., 2022). Effects of pesticides range from direct impacts through acute or chronic toxicity, to indirect effects (e.g., through continuous sub-lethal exposure) that alter behaviour, functional roles, and/or the food web dynamics (Chagnon et al., 2015).

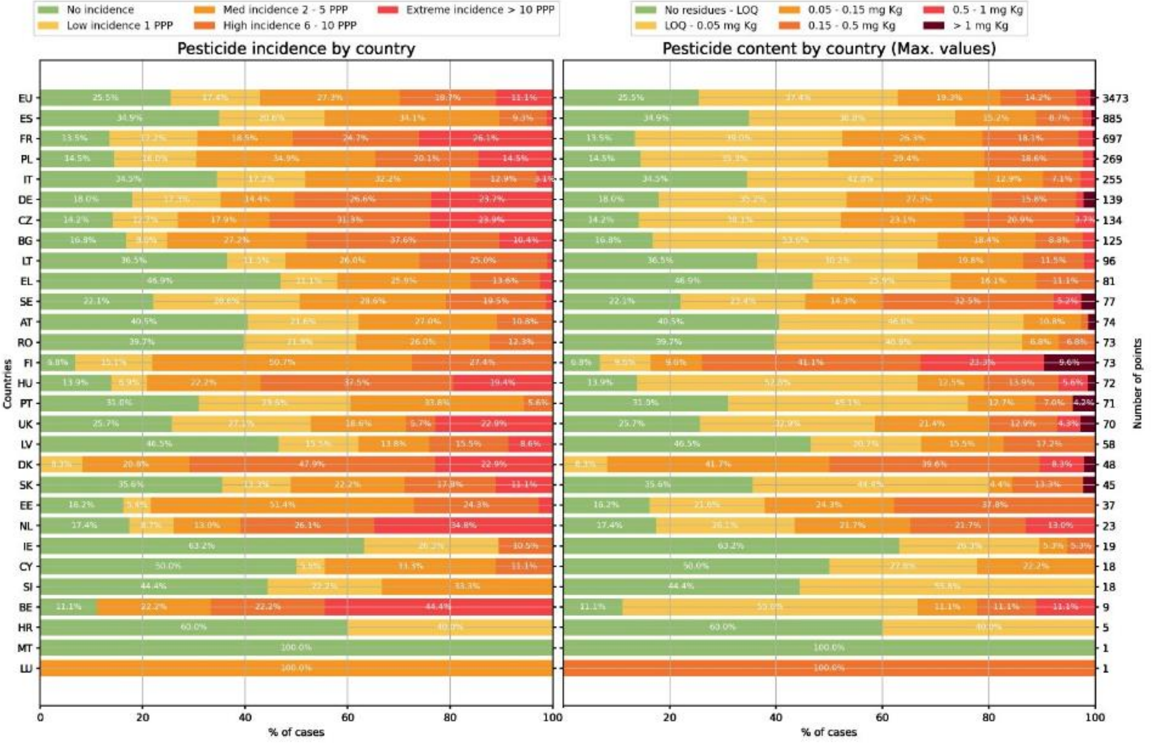
Around 60 to 70 % of soils in the EU are not healthy (Veerman et al., 2020), with severe degradation processes continuing to put pressure on systems.[74] Unsustainable land use and management as well as emissions of pollutants such as pesticides advance the degradation of soils across the EU. The pesticide residues in EU soil samples are considerable (Hvězdová et al., 2018), because many of the soil ecosystem services are biologically mediated (Chagnon et al., 2015). In 2019, the distribution of 76 pesticide residues was evaluated in 317 agricultural topsoil samples across 11 EU Member States and 6 cropping systems (Silva et al., 2019). Over 80 % of the samples contained pesticide residues (25 % of samples had residues of one active substance, and 58 % of samples had residues of multiple active substances). Glyphosate and its metabolite AMPA, DDTs, and the broad-spectrum fungicides boscalid, epoxiconazole, and tebuconazole were the most frequently detected compounds (Silva et al., 2019).

The European Commission's Joint Research Centre is currently preparing a technical report on pesticide contaminations in EU soils based on sampling data from LUCAS. In summary, 25.5 % of EU soil samples show no presence of pesticides residues. For most of the EU soil samples (57.1%) at least 2 different residues were detected, and of those, 29.8% comprised more than 5 different residues with 11.1 % of samples holding more than 10 different pesticides residues. Most of the EU soil samples (62.1% total) present concentrations levels classified as low to no detection, and from those, 37.8 % presented concentrations above the detection limit. On the other hand, 37.9 % of samples show pesticide residues concentrations above 0.05 mg Kg, being 17.9% of the total above the 0.15 mg Kg threshold, and 3.6% above the 0.5 mg Kg-1. As expected, samples from cropland present the highest incidence of pesticide residues with 85.8% of samples presenting at least one pesticide residue, while in grassland areas the low incidence class is less represented, whereas 48.0% of the samples present at least one pesticide residue. On the pesticide residue content, more than half of the soil samples from cropland (52.4%) present maximum pesticide residues concentrations below 0.005 mg Kg-1, but an important number of samples (22.9%) evidence concentration values above 0.15 mg Kg-1 (Figure 7).

[73] COM(2021) 699 final

[74] The European environment — state and outlook 2020: knowledge for transition to a sustainable Europe — European Environment Agency (europa.eu)

Figure 7 Pesticide incidence in EU and EU Member States (left) by number of soil samples (right) as measured in LUCAS 2018 samples. Source: (Joint Research Centre, in preparation)



Next to pesticides, various agricultural inputs and management approaches impact soil health. The fertiliser use and intensity of production are strongly related to pest pressure albeit under complex interdependencies. Pesticides reduce the functioning of beneficial plant symbionts in soils, which has critical implications for the nutrient transfer to crops (Edlinger et al., 2022). A decrease in the efficiency of nutrient uptake can affect crop yields and/or lead to higher applications of fertilizer with the associated increase in production costs and eutrophication (Bebber & Richards, 2022; Darch et al., 2014). A higher fertiliser use in some crops results in a greening of the plant that can attract certain pests, in turn demanding a higher pesticide use. Conversely, nutrient deficiencies lower the general resilience of the plant, which may affect the impacts under varying levels of pest or disease pressure. The use of pesticides adversely affects soil biota involved in nitrogen fixation which may lead to an elevated need for fertilizers with the associated environmental repercussions (Fox et al., 2007).

While these system design choices are already being addressed, for example through improved guidance on IPM and payments linked to eco-schemes, a fundamental challenge remains the fact that a landscape-wide food system design implies a coordination of a large number of independent farmers with personal preferences and objective functions (Schneider et al., 2021). While this is challenging, in a Dutch sample, farmers' collective action was found to be a driver of farmers' motivation to lower pesticide use (Bakker et al., 2021).

A high diversity of functional organisms is pivotal to soil health (Banerjee & van der Heijden, 2023; Kibblewhite et al., 2008). Unhealthy soils will lower the yield potential while also being less resilient to extreme weather events (D'Hose et al., 2014). This will lead not only to increased impacts of climate change, but also to a higher volatility in crop yields (Anderson et al., 2020). The current levels of degradation of soils could result in serious food and feed security concerns. Unfortunately, the restoration of soils is a time-consuming task. For some soil degradation processes, such as the loss of soil carbon, erosion, compaction, or soil sealing, it can take decades or even hundreds of years to restore the proper soil status. Residues of pesticides used in conventional production can be detected in soils even after two decades under organic production (Riedo et al., 2021). Therefore, it is important to apply sustainable soil management practices that prevents soil degradation processes.

Soil degradation results in a decline of the biodiversity of essential soil organisms, which affects the efficiency in nutrient cycling and productivity, which negatively influences the yield potential and therefore food and feed security. Nowadays, agricultural soils are contaminated with a broad mixture of pesticides which causes substantial stress on the soil biota and in turn soil health (Panico et al., 2022; Pelosi et al., 2014; Tang & Maggi, 2021; Walder et al., 2022). Ammonia-oxidizing bacteria, archaea, and sulphur-oxidizing bacteria are among the organisms which are sensitive to pesticide pollution, with various studies confirming a considerable decline in their abundance in contaminated soil samples (Feld et al., 2015; Karas et al., 2018; Wan et al., 2014). These bacteria are critical contributors to the nutrient cycle that convert, e.g., nitrogen into forms that are usable by plants (Tang & Maggi, 2021). Similarly, nitrogen-fixing rhizobia bacteria are known to be adversely impacted by pesticide use with direct repercussions on their recruitment, nodule production, nitrogenase activity, and crop yields (Fox et al., 2007; Laatikainen & Heinonen-Tanski, 2002; Riedo et al., 2021). The pesticides' disruption of signalling between host plants and rhizobia bacteria leads to an elevated need for fertilization with the associated environmental repercussions (e.g. eutrophication). Pesticides also affect various other soil organisms with critical roles in the soil ecosystem; for example, by disrupting enzymatic activities, increasing mortality rates, decreasing fecundity and growth, and adversely affecting feeding rates, all leading to a substantial reduction in the abundance of earthworms (Maggi & Tang, 2021; Panico et al., 2022; Pelosi et al., 2014). C. Pelosi et al. (2021) detected at least one pesticide in all sampled soils and in 92 % of sampled earthworms in France, with 46 % of earthworms sampled showing contamination levels which pose a high risk of chronic toxicity. The prevalence of contamination of soils and earthworms with Glyphosate were comparable and spanned samples taken from conventional cereal fields, fields under organic farming, and hedgerows (Pelosi et al., 2022).

Soil conservation measures (e.g. increased vegetation cover throughout the year, reduced tillage) and crop management are key measures to restore the soil fertility on arable lands. Improvements to the soil structure, the water retention capacity, and soil organic content may be achieved through better crop diversification. To restore the crucial soil biodiversity, a reduction in pesticides is essential (Walder et al., 2022). All these changes will benefit crop yields and consequently food and feed security. Evidently, addressing the decline in soil health across the EU is a multifaceted challenge. A reduction in pesticide use, however, is certainly one of the elements that can contribute to the necessary restoration of soil health.

Box 3. Takeaway points of section 3

1) Besides the pesticides' intended function as damage control agents, their use also leads to unintended negative consequences, so called *externalities*.

2) Pesticides are among the pollutants that that adversely affect soil-, field-margin-, and water-organisms, particularly if not used in IPM strategies and according to the authorised uses, thereby potentially contributing to environmental degradation and ecosystem service losses that can lead to repercussions for food and feed security.

3) The adverse effects of pesticides on biodiversity can reduce natural pest control, which in turn leads to an elevated need for pesticides to manage crop health.

4) A high pollinator abundance and diversity directly benefits the productivity of insect-pollinated crops. Pesticides adversely affect pollinator abundance and diversity, thereby causing unintended negative effects to food and feed security.

5) Pesticides negatively affect various soil organisms with critical functions, which among other aspects affects soil fertility and in turn food and feed security.

4. Tools for the transition to low-pesticide food systems

Broadly speaking, there is consensus on the need to move away from chemical pesticide-centric food systems, both in the public domain and in academia (Aktar et al., 2009; Bakker et al., 2021; Chagnon et al., 2015; Köhler & Triebskorn, 2013; Mustafa et al., 2021; Sharma et al., 2019, 2020; Tang et al., 2021, 2022; Wuepper et al., 2023). The EU and all EU Member States adopted the Kunming-Montreal Global Biodiversity Framework at the Fifteenth meeting of Parties to the United Nations Convention on Biological Diversity (COP15) and subscribed to a globally binding target of 'reducing the overall risk from pesticides and highly hazardous chemicals by at least half including through IPM, based on science, taking into account food security and livelihoods' by 2030. This global target is fully in line with the SUR pesticide reduction targets set out under the SUR proposal.

Such a view on the need to reduce risks emerging from pesticides is underpinned by observations that '*Truth-seeking* actors can find ample evidence for pesticides' adverse effects on environmental and human health' (Hofmann et al., 2023, p. 430). However, it is pivotal that such reduction efforts not only target quantities at the expense of using lower amounts of more toxic active substances, which may lead to elevated toxic loads (Bub et al., 2023; Cech et al., 2022; Schulz et al., 2021).

Arguably, a successful transition towards a lower pesticide use in agriculture and forestry must build on the diversity of knowledge on complementary strategies for crop protection, which is overarchingly formulated in the IPM principles. However, this transformation must take a systems-perspective which acknowledges the multifaceted nature of this challenge (Jacquet et al., 2022). Such a transition will minimize the negative impacts of pesticides on food and feed security (i.e., supporting ecosystem services which may promote yields and resilience) and the environment, while assuring that pesticides' intended functions (i.e., supporting yield stability through targeted applications and providing an emergency tool against severe pest and disease outbreaks) are utilized.

While the severity of the pest impacts is expected to increase due to climate change (Deutsch et al., 2018), also the availability of alternative solutions to widespread chemical pesticides is expected to widen. A systemic change to how pests are managed can be achieved with widespread implementation of IPM and intensity of use can be reduced with improved prediction of pest risk, early detection, and targeted application of pesticides. A broadening of the perspectives on plant health through a holistic view, i.e., the 'One Health' approach, will likely be conducive toward positive changes in crop-, animal-, human-, and ecosystem-health. In addition, research and development (R&D) and innovation promoting low intensity solutions, such as nature-based agriculture, agro-ecology, organic farming, mixed farming, agro-forestry, etc. can enhance natural protection of crops while increasing their productivity. In what follows, some agronomic and technological avenues for sustainable crop protection practices that may redesign food systems going forward will be sketched; this list is by no means exhaustive.

4.1 Integrated Pest Management (IPM)

IPM principles were first introduced by Stern et al. (1959). IPM describes the careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of pesticides and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment. An important role in IPM is played by biological control: the use of natural enemies against pests and diseases. This can be done by the one-off release of natural enemies against invasive pests (classical biological control), the repetitive release of insects or micro-organisms against recurring pests (augmentative biological control) or the protection of the elements in the agro-ecosystem in which naturally occurring beneficial insects occur (conservation biological control). IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms and uses chemical control only when all other control means are exhausted.

The Sustainable Use of Pesticides Directive[75] provides a more operational translation of IPM by laying out eight general principles. Namely, (i) prevention and suppression, (ii) monitoring, (iii) decision-making, (iv) non-chemical methods, (v) pesticide selection, (vi) reduced pesticide use, (vii) anti-resistance strategies, and (viii) evaluation. Sound IPM is a knowledge-demanding and context-specific systems approach, which consequently utilizes a wide range of tools and technologies (Barzman et al., 2015; Göldel et al., 2020; Veres et al., 2020). Hence, crop protection is more and more acknowledged to be more nuanced than an exclusive reliance on pesticides, and particularly chemical pesticides. In the public consultation conducted during the impact assessment of the SUR proposal, more tailored IPM guidance was viewed as positive by pesticide users and industry (110 out of 151) as well as non-governmental

[75] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

organisations (NGOs) and civil society organisations (21 out of 22). Product-specific information on which pesticides may best complement holistic IPM schemes could be useful (Böckmann et al., 2019). The impact assessment also found current implementation of IPM to be at sub-optimal levels. Supporting better uptake, however, could play a major role in reducing pesticide use and risk as IPM limits the use of chemical pesticides as a last resort. The SUR proposal therefore aims to improve the application and enforcement of IPM through requiring the development and use of crop-specific rules which is key to making it implementable and enforceable on the ground, and the keeping of IPM registers to demonstrate compliance.

In this respect, sharing the extensive information on IPM approaches developed for years is key for the uptake of IPM by the farming community and beyond. This was the purpose in particular of the pilot project '*Farmer's Toolbox for Integrated Pest Management*' conducted between December 2020 and November 2022 in which over 1300 IPM strategies and over 270 crop-specific guidelines from 24 EU countries were identified and made available in a common database.[76] The conclusions show that most of the guidelines can be directly used by farmers (72 %) and more than half (53 %) are used by authorities for controlling the implementation of IPM by farmers. Table 7 shows the coverage of existing crop-specific guidelines by country and type of crop. Around 96 % of Member States have guidelines on arable crops, followed by fruits and vegetables, viticulture, and other crops. From the 273 crop-specific guidelines in EU countries, 145 guidelines are used by authorities for controlling the current implementation of IPM by farmers. Currently, only seven countries control the implementation of IPM guidelines. In addition, the demonstration and knowledge exchange are key to further promoting the implementation of IPM practices.[77]

To facilitate this the SUR proposal includes steps to increase the implementation of IPM. The IPM general principles set out in the SUR proposal need to be translated into clear crop-specific rules to be implemented by farmers and to enable checks by national authorities. This does not mean that more demanding voluntary recommendations, beyond binding rules, may not be developed by national authorities to complement the implementation of the general principles, these voluntary practices being eligible to classical CAP financing. The SUR proposal also includes the promotion of independent advice that is intended to facilitate the farmer to make relevant decisions on a case-by-case basis.

[76] Farmer's Toolbox for Integrated Pest Management (europa.eu)

[77] IPMworks

Table 7 Overview of existing IPM guidelines across Member States

	Crops coverage					
Country	**Arable crops**	**Viticulture**	**F&V**	**Ornamental**	**Horizontal**	**Others**
Austria	X	X	X	-	-	X
BE-Wallonia	X	X	X	X	-	X
BE-Flanders	X	X	X	-	X	X
Bulgaria	X	X	X	-	-	X
Cyprus	X	X	X	-	-	X
Czech Republic	X	X	X	-	-	X
Germany	X	-	-	-	-	X
Denmark	X	-	-	-	-	-
Estonia	X	-	-	-	-	-
Spain	X	X	X	-	-	X
Finland	X	-	X	-	-	-
France	X	X	X	-	-	X
Greece	X	X	X	-	-	X
Croatia	X	X	X	-	-	-
Hungary	X	X	X	-	-	-
Ireland	X	X	X	-	-	X
Italy	X	X	X	-	-	X
Lithuania	X	-	X	-	-	-
Latvia	X	-	X	-	-	X
Poland	X	X	X	-	-	X
Portugal	X	X	X	-	-	X
Slovenia	X	X	X	-	-	-
Slovakia	-	X	X	-	-	-
Sweden	X	-	X	-	-	X
Percentage	**96%**	**71%**	**88%**	**4%**	**4%**	**67%**

During bilateral discussion held between DG SANTE and Member States' authorities regarding the progress made in achieving reductions in the Farm to Fork pesticide reductions targets, many Member States highlighted the positive correlation between the implementation of IPM and progress toward achieving the Farm to Fork pesticide reduction targets. Success factors for IPM implementation include linking IPM with financial support, targeted training for farmers, and the availability of a broad set of crop-specific IPM guidelines. However, other Member States expressed concerns about the potential to further reduce pesticide use based on IPM implementation as the current level of implementation was suggested to be close to its maximum.

4.2 Precision- and smart-farming

Technological developments can also play a role in reducing the quantity of pesticides used. Technology enables a more tailored management of crop health by acknowledging inter- and intra-field variability. The use of novel tools is broadly referred to as *precision farming* or *smart farming*, depending on the tool. The use of technologies for pest prediction, early detection, and application can significantly reduce the use of pesticides (Marković et al., 2021). However, current adoption levels in the EU are low (Barnes et al., 2019), which in turn implies an untapped potential for reducing pesticide use and risk without repercussions on crop yields.

The potential of technology to reduce pesticide use can be achieved via four main pathways: accurate prediction of outbreaks, pest identification, better spray deposition, and optimization of pest and disease control operations. The reduction in pesticide use and risk is possible via lower dosages (mainly due to better application and improved detection through analytical support on the environmental and climatic conditions), lower treatment frequencies (mainly due to prediction and decision support systems), and through the replacement of pesticides with alternative measures (mainly related to automated mechanical weeding replacing herbicide use). At the same time the reduction in pesticide use decreases the health risk for the worker being exposed to these potentially hazardous pesticides[78]. Based on a systematic literature review carried out by the European Commission's Joint Research Centre and the Agricultural University of Athens, the rate of research outputs related to precision/smart farming and pesticide reduction has been increasing in recent years. Since 2020, more than 50 papers per year have been published on related topics. While research related to pest prediction has mainly occurred before 2012, most of the outputs relate to pest detection (76 % of studies). However, research and innovation on application optimization is considerably increasing since 2017, which is likely a result of the recent commercialization of cheaper and more effective sensors.

Precision farming with the aim of reducing pesticides has been studied for both arable (60 % of studies) and permanent crops (40 % of studies). Regarding the types of pests addressed via precision farming research, most research to date has focused on weeds. This is likely a consequence of multiple approaches to manage weeds. Namely, via precision application of herbicides and the full replacement of herbicides through automatized mechanical weeding. The latter can reach accuracy rates close to 90 % for sugar beet and soy bean (Kunz et al., 2015), or maize (Quan et al., 2022), and close to 100 % in tomato (Raja et al., 2020).

Reduction in pesticide use and risk due to adoption of precision farming also leads to ancillary benefits in terms of improved water and soil quality (mentioned in more than 50 % of the studies identified in the systematic review) and biodiversity (mentioned in 45 % of the studies identified in the systematic review). Importantly, the use of precision farming in pest detection, as well as pesticide application is generally reported to not have any negative impact on overall pest control. Furthermore, the benefits are achieved with an improved productivity due to input and labour savings in more than 90 % of the studies analysed.

Regarding pest prediction and identification via data gathering, a significant number of sensors are utilized in precision farming to map the spatial and temporal variability of various parameters and assist farmers with their management decisions. Commercial Red-Green-Blue, multispectral, hyperspectral, and thermal cameras, as well as other sensors like Light Detection and Ranging as well as weather stations are used alone or in combination. These sensors allow to estimate crucial indicators like crop vigour and pest severity. After some transformations of raw inputs (e.g., using spectral vegetation indices in the case of optical sensors), this information can lead to the identification of management zones and the administration of variable rate inputs such as pesticides (Anastasiou et al., 2023; Ioannou et al., 2019). In addition, the measurements from these sensors can be used in forecasting necessary pesticide applications (e.g., by predicting the local pest infection). Such analytical support is derived by

[78] See Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) (OJ L 131, 5.5.1998, p. 11).

determining when and where key parameters, for example, the number of consecutive hours with high humidity, have been exceeding predetermined specific criteria. Examples of pesticide savings due to improved predictions are considerable; with reductions ranging from 75 to 86 % for fungicide use for tomato and potato (Khattab et al., 2019), and up to 60 % for cherry orchards (Ioannou et al., 2019). While the pesticide reduction potential is currently favouring herbicides (with up to a 96 % reduction (López-Granados et al., 2016)), other pesticides such as insecticides may be considerably reduced as well (e.g. up to 36 % (Miranda et al., 2019)).

Data and digitalization have the potential to reshape the agricultural sector in unprecedented ways (Mondejar et al., 2021; Rolandi et al., 2021; Talaviya et al., 2020). An increasing interconnectedness of analytical insights range from soils,[79] over crops (Acharya, 2022; Granwehr & Hofer, 2021; Shafi et al., 2019), to remote sensing based analyses of the environment and crop health (Hornero et al., 2020; Zarco-Tejada et al., 2018). Such advances in analytical capabilities will, and in part already do, enable spatio-temporal support in crop protection that improves the precision with which food systems may be managed (Cros et al., 2021). Improved analytical support on crop health is needed to consider variations in disease pressure, which in turn improves farmers' judgement on whether pesticide applications are needed in a given location at a given point in time (Jalli et al., 2020; Jørgensen et al., 2020). Furthermore, such technologies permit targeted, more nuanced, applications of pesticides (Mogili & Deepak, 2018; Shafi et al., 2019; Talaviya et al., 2020; Zangina et al., 2021), or provide alternatives to pesticides (Machleb et al., 2020; Talaviya et al., 2020; Weis et al., 2008; Xiong et al., 2017). Many technologies are now available for assessing and managing the spatial and temporal variability of the physical, biological, and chemical properties of soils. Global positioning systems, geographic information systems, yield monitors, and remote and proximal sensors can be used to identify crop variability possibly linked to pests, while automatic guidance of farm machinery and variable rate pesticide application technologies are used to target application and reduce the amount of inputs, including pesticides (Talaviya et al., 2020). Improvements in the decision support systems, over conventional calendar-based rules, can more than halve fungicide use without increasing disease risk and without yield reductions (Jørgensen et al., 2020; Lázaro et al., 2021; Prahl et al., 2022).

Developments of precision application of pesticides follows the principles of variable rate technology used for nitrogen use optimization. Developments in application modes to reduce pesticide use relate both to the use of different platforms (e.g. unmanned aerial vehicles, spraying robots) as well as technological components included in tractor-mounted sprayers. Such developments are crop and location specific but significant savings have been reported for orchards (over 50 % (Chen et al., 2013; Vieri et al., 2013)), arable crops (over 75 % (Carballido et al., 2013)) and vineyards (over 60 % (Nackley et al., 2021)). A summary of the identified savings in the reported field trials using precision application options is presented in Table 8. Evidently, with the exception of fungicides in wheat, savings are around or above 50 % and the tools cover a considerable variety of crops. Arguably, precision farming approaches and the use of digital and data technologies in general, can and should go hand in hand with other farming/ production approaches, such as IPM, organic farming or agro-ecology.

In many cases the use of precision farming technologies result in reducing inputs which generate a saving to the farmer. The technology is often transferable also and results in associated savings in reduced other inputs, such as fertilisers and seed.

[79] European Soil Database & soil properties - ESDAC - European Commission (europa.eu)

Table 8 Overview of the pesticide saving potential from precision application found in the scientific literature.

Crop	Pesticide Class	Reduction achieved (average if multiple data reported)	reference
Orchards	Not specified	50%	doi.org/10.4081/jae.2013.313
		53%	doi.org/10.13031/trans.56.9839.
		31%	doi.org/10.3390/ijerph14070715.
		43%	doi.org/10.13031/trans.12455
		46%	doi.org/10.25165/j.ijabe.20181101.3183
	Insecticides	98%	doi.org/10.3390/agronomy9100608.
Sugar beet	Herbicides	76%	doi.org/10.5424/sjar/2013113-3812.
Winter wheat	Fungicide	8%	doi.org/10.1002/ps.4225
	Herbicide	50%	doi.org/10.1007/s11119-022-09888-1.
	Fungicide	45%	doi.org/10.1007/s11119-022-09888-1.
Maize	Herbicides	96%	doi.org/10.1007/s13593-016-0405-7.
Cotton	Insecticides	75%	doi.org/10.1016/j.cropro.2017.07.016.
	Herbicides	79%	doi.org/10.3390/rs10020285.
Potato	Not specified	25%	doi.org/10.1007/s11540-018-9357-4.
Sunflower	Herbicides	37%	doi.org/10.3390/rs10020285.
Olives	Not specified	54%	doi.org/10.1016/j.compag.2019.04.040.
Vineyard	Not specified	70%	doi.org/10.21273/HORTTECH04794-21.

4.3 Plant breeding

IPM is centred around varieties with biotic tolerance or resistance to key pests (Birch et al., 2011; Lamichhane et al., 2018). In principle, resistance is defined as the reduction in the multiplication of the pest or pathogen whereas tolerance defines the degree of a loss, or lack thereof, of the plants' performance under pest or pathogen pressure (Ferrero et al., 2020).

The use of tolerant and resistant varieties is one of the principles of IPM and an increased availability of resistance traits provides additional tools for farmers to make choices that will prevent pest populations and reduce the need for pesticide usage. In the context of the SUR proposal, plant breeding is required for organic varieties, for intercropping, for crop diversification, for soil microbiome interactions, all approaches with proven potential to reduce the use of chemical pesticides as preventive measures (Hovmøller et al., 2023; Saunders et al., 2019).

Plant breeding may broadly be described by three phases (Ceccarelli, 2015). First, genetic variability is generated through crossing of available elite varieties, the introduction of exotic germplasm, the inducement of mutations, or by using genetic engineering techniques. Second, promising recombinants or mutants are selected and tested. Lastly, the variety is commercialized and, ideally, adopted by farmers. The difficulty of introducing a new trait, e.g. a resistance to a certain pathogen, into a marketable variety strongly depends on the heritability of the trait and the generation time of the plant species (Ceccarelli, 2015). Notably, the source of the genetic variability has considerable implications for the resources needed for selecting and testing the recombinants. Often, the main time- and resource-sink that breeders face is not the process of introducing the trait of interest but rather the procedure of removing undesirable genetic material that was inadvertently inherited during the crossing of parental lines (Tracy, 2004). As the germplasm of wild species remains an invaluable source of biotic resistances and other agronomic traits (Lee, 1998; Nelson et al., 2018; Tanksley & McCouch, 1997), resources spent on removing genetic drag in conventional breeding programs are significant. *New Genomic Techniques* effectively prevent genetic drag. In turn, the development time and costs of new varieties is reduced and, more importantly, the technologies enable the introduction of multiple resistance genes into market-ready varieties in which quality traits of the original variety remain unchanged. Varieties with *stacked* resistances enable a system-wide rethinking of crop protection, which allows for significant reductions of pesticides, e.g. fungicides by 80 to 90 %, without affecting yields (Haverkort et al., 2016; Kessel et al., 2018).

4.4 Agroecology

The current intensity of pesticide use is critically determined by the present system design. With the increase in more intensive and mechanised agriculture of the green revolution, the agricultural system has moved to an approach to manage pests based mainly on the use of chemical pesticides. At the same time, diminishing returns in crop yields in response to increased fertilizer applications point to ecological changes possibly linked to the use of pesticides (Fox et al., 2007). The standardization of farming systems with less biodiversity at farm level (mono-cropping, fewer rotations, varietal uniformity, etc.) and landscape level (larger plots, removal of hedges, a concentration on a smaller number of crops, etc.) increases the risk of pest outbreaks (Albrecht et al., 2020; Bonato et al., 2023). It has long been recognized that the landscape configuration and composition is closely related to pest spread and therefore also the impact (Bonato et al., 2023; Epanchin-Niell et al., 2010, 2012; Topping et al., 2015). The strong reliance on chemical control, through selective pressure, results in the development of pests' resistance to the applied chemicals; which may lead to an increase in pesticides use or a shift to different active ingredients with the associated mixture effects on the environment (Tang & Maggi, 2021).

The intensity of production influences the level of natural pest control, the attractiveness of fields for pests, and the economic risk of pest and disease outbreaks (Albrecht et al., 2020; Bonato et al., 2023; Díaz-Siefer et al., 2022). Agricultural diversification aims at intentionally designing functional biodiversity to cropping systems at various spatial and temporal scales, which enhances biodiversity, nutrient cycling, soil fertility, water regulation, and pest control without compromising crop yields (Tamburini et al., 2020). Landscape variations and organic farming practices can enhance flora and fauna richness or abundance in agroecosystems by more than 50 % (Stein-Bachinger et al., 2021). Complex spatial configurations of crops, e.g., intercropping or strip-cropping, can require less pesticide use while also being more productive (Albrecht et al., 2020; Breitenmoser et al., 2022; Li et al., 2023). While increased agro-ecological diversity holds promise in reducing the dependency on pesticides (Tamburini et al., 2020), these designs complicate agricultural intensification as they may limit the scalability of equipment and processes. Support for technological progress that addresses this bottleneck is therefore needed to ensure the economic viability at a larger scale.

A sound integration of agro-ecological principles, both at field- and landscape-level, supports the prevention of pest and disease impact (Petit et al., 2020; Ricci et al., 2019). A system-rethinking based on agronomic principles can enable significant reductions to pesticide use, e.g. herbicides through alternative weed management (Petit et al., 2015; Vasileiadis et al., 2015), while at the same time bringing about other benefits and ecosystem services (e.g. carbon storage, soil and quality). At farm-level, various agronomic decisions may determine the resilience to pest and disease outbreak, and in turn the need (or lack thereof) to apply pesticides. Farmers generally practice a temporal rotation of crops that allows for an optimization of nutrient use, a reduction in pests, and improvements to the soil biota with feedbacks to crop yields (Bažok, Lemić, et al., 2021; Dias et al., 2015; Furlan et al., 2022; Jalli et al., 2021). Similarly, improved spatial configurations (e.g., intercropping, strip-cropping) of crops can enable natural pest control both at field- and landscape-level (Boudreau, 2013; Ditzler et al., 2021; Juventia et al., 2021; Ricci et al., 2019). Complex landscapes, in turn, can lower pesticide use (Nicholson & Williams, 2021). Intercropping can support nutrient access, suppress weeds, and provide flower resources to pollinators. Such improvements in the agronomic design, for example under-sowing oats with clovers, can in turn achieve the needed support of pollinators while being an alternative to herbicides without any yield reductions (Boetzl et al., 2023). Furthermore, legumes are known to replenish nitrogen in the soils and improve the health of *Rhizobium* bacteria which convert atmospheric nitrogen into forms usable by plants (Fox et al., 2007). This speaks to the synergetic restoration potential of alternative food system designs which may, on first thought, 'only' aim at substituting pesticides; in this case by supressing weeds.

Pest populations are spatial phenomena by nature (Turchin, 2013). Consequently, Knipling (1980) introduced the idea of area-wide pest management via collective action. More and more landscape-wide designs of crop protection are promoted in which total pesticide usage, as opposed to farm-level usage, is optimized (Epanchin-Niell et al., 2010; Topping et al., 2015). Just as temporal problems involve choosing a strategy that comprises a path of decisions which are interdependent across time (Fousekis & Stefanou, 1996), optimal control in a spatial system involve simultaneously choosing actions across an interconnected landscape (Epanchin-Niell et al., 2012). Differences in the landscape configuration can also result in differences in the environmental burden from pesticides (Topping et al., 2015, 2016). A pivot to a more holistic landscape-perspective requires communication and coordination among farmers, which is increasingly facilitated through better communication technologies (Dara, 2019; El Bilali & Allahyari, 2018; Tao et al., 2021). In a Dutch sample, farmers were aware of the benefits of such coordination in controlling pests (Bakker et al., 2021).

4.5 Behaviour and capacity building

Despite the promising results reported above, widespread adoption of these alternatives to chemical pesticides remains limited. Many farmers currently struggle to change their pest management practices (Lamine, 2011), and chemical pest control remains the mainstream option for farmers when dealing with pests (Pretty et al., 2018). Besides classic barriers related to investment costs and lock-ins due to past investment decisions, farmers' decision-making is also based on personality and cultural or ideological motivations. According to Bakker et al. (2021) attitude, injunctive norms, descriptive norms, and perceived behavioural control all emerged as significant predictors of intentions to adopt alternatives to chemical pesticides. Also, beliefs in lack of efficiency of alternatives and demand for undamaged products by retailers further hinder the adoption. Results from a Delphi survey of 175 experts on crop protection and agronomy carried out by the Joint Research Centre highlight that perceived lack of usefulness of alternatives to chemical pesticides is the main barrier to adoption, even more so than the cost of the investments related to precision agriculture. In order to overcome this, outreach to, and inclusion of, farmers in both advisory and research activities is crucial as an awareness of alternatives to pesticides is fundamental to support their confidence in transitioning to low-pesticide management systems (Bakker et al., 2021).

The Delphi survey mentioned above shows that precision farming can play a key role in reducing pesticide use and risk. This is consistent across crops and types of pests. Over 70 % of respondents stated that they expect that the uptake, in particular for precision application, will have increased by 2030. Higher levels of adoption will be mainly driven by the interaction between farmers and providers of machinery. The main policy intervention that may facilitate adoption is the provision of financial support to reduce investment costs, as well as the promotion of advisory services to increase perceived usefulness and familiarity with these novel solutions to manage crop health.

A key hurdle for adoption is the perception of farmers that substituting pesticide use for alternative control measures is a risk-increasing activity. Broadly speaking, farmers are familiar with the use and application of pesticides and have experiences regarding the products' effectiveness. The adoption of alternatives may require developing new skills and gaining context-specific knowledge. These additional efforts together with the uncertainty regarding an alternative's effectiveness likely hampers uptake of novel approaches to crop health, as it increases the subjective perception regarding the riskiness of the production activities. The perceived risk also influences farmers in following pesticide use recommendations (Möhring, Wuepper, et al., 2020). There is ample evidence that farmers on average are risk averse, which implies that they consider losses as more important than gains and that they tend to overestimate the probability of improbable events (Rommel et al., 2022). In turn, an actionable approach to manage perceived risks associated with novel technologies that are intended to substitute pesticides is an aspect that cannot be neglected. A promising avenue of future research may be the bundling of such technologies with insurance schemes. Support to farmers through the provision of independent advice at least annually, plus the availability of crop-specific rules, are written into the SUR proposal as ways of providing support to such decisions and dealing with risk.

A sound management of the production risk via insurance tools can nudge farmers to adopt alternatives and lower their pesticide use. There is some evidence that such an approach might enhance adoption and lead to a reduction in pesticide use. Mao et al. (2023) and Möhring et al. (2020) show how crop insurance significantly decreases farmers' use of fertilisers and pesticides, albeit that the latter might be offset by an expansion of the area under cultivation. Similar findings are reported for the positive effect of combining insurance with reduction in nitrogen inputs (Metcalfe et al., 2007). The limited experience of combining IPM with insurance in Europe shows that IPM for maize can be promoted using mutual funds (Furlan et al., 2015; Furlan & Chiarini, 2017). Such approaches are more realistic and implementable under the approach provided for in the SUR proposal to allow Member States to use CAP funding for implementation of the SUR proposal at farm level, without an imposed baseline.

Box 4. Takeaway points of section 4

1) A successful transition must build on the diversity of knowledge of complementary strategies for crop protection, which is overarchingly formulated in the IPM principles. Sound IPM is a knowledge-based and context-specific system, which consequently utilizes a wide range of approaches, tools and technologies.

2) Existing technologies permit targeted, more nuanced, applications of pesticides, or provide alternatives to pesticides. Improvements in decision support systems can already reduce pesticide needs by over 50 %, and precision farming tools make it possible to reduce up to 96 % in specific crops.

3) Varieties with stacked resistances enable a system-wide rethinking of crop protection, which allows for significant reductions of pesticides. New breeding techniques could support the development of such varieties, and in a shorter timescale.

4) A sound integration of agro-ecological principles, both at field- and landscape-level, supports the prevention of pests and diseases thereby reducing the need for pesticides, while at the same time also providing other ecosystem services. Evidence suggests that such design improvements can also directly lead to increased crop yields.

5) A key hurdle in the adoption of IPM and novel technologies is the uncertainty farmers face regarding their effectiveness and proper use, and sometimes the high investment costs (e.g. of precision agriculture tools). In order to overcome this, advice and demonstration of practices, including farmer to farmer learning, as well as outreach directly to farmers, is crucial to support their confidence in transitioning to low-pesticide management systems.

6) Insurance schemes can create greater willingness in farmers to engage in alternatives to chemical pest control and support choices of otherwise risk-averse farmers.

5. Funding and supporting the transition

The Common Agricultural Policy (CAP) includes multiple measures providing funding to farmers for practices and investments beneficial for the sustainable use of pesticides. The revised Regulation (EU) 2021/2115 of the European Parliament and of the Council[80] (CAP Strategic Plans Regulation), which has been applicable since January 2023, strengthens these funding possibilities (with e.g., the new eco-schemes) and Member States will have a wide range of interventions and other policy instruments to make a coherent toolbox for farmers helping to meet the Farm to Fork objective for the pesticides reduction. In addition, the Copernicus programme, the Earth observation component of the EU's Space programme, is now helping to simplify and modernise CAP monitoring through offering detailed and timely information on crops and farmland.[81]

First and foremost, most of the funding directly provided to farmers and other CAP beneficiaries (such as all direct payments in the form of income or environmental support and a number of rural development payments) is subject to the condition to adhere to Good Agricultural and Environmental Condition and meet Statutory Management Requirements (GAECs and SMRs) under the mechanism known as 'conditionality'[82]. SMRs and GAECs include the most relevant provisions for farmers of the current Sustainable Use of Pesticides Directive[83] and the SUR proposal (once adopted). Depending on the Member State certain IPM practices can be part of the requirements of conditionality and therefore not supported by additional CAP payments (on the basis of their eligibility criteria). This support would only be allowed for improvements that go beyond the baseline requirements of SMR and GAECs. Other such IPM practices designed by Member States as voluntary may therefore be funded by eco-schemes and management commitments (see below).

However, to support the transition towards an ambitious reduction in the use of pesticides, the Commission has proposed, in the SUR proposal, a derogation to allow additional funding, through the CAP Funds, for implementing obligations resulting from the SUR Regulation – even if normally required as SMRs or GAECs (thus in the baseline) – during a period of 5 years after its entry into force. Member States may thus, if the SUR Regulation were adopted as proposed, choose to provide additional funding for these practices related to pesticide reduction. There is, nevertheless, no 'new' money provided for by the SUR proposal in the CAP budget and Member States will have to use the available budget.

Secondly, the CAP includes interventions which allow for the funding of the sustainable use of pesticides. Eco-schemes, which are a type of direct payments to farmers, may be provided by the Member States in their CAP Strategic Plans in order to finance beneficial practices going beyond the baseline, including the sustainable use of pesticides and organic farming. Overall, as a result of CAP Plans implementation by Member States, 23% of the direct payments budget is devoted to financing practices that contribute to environmental, climate and animal welfare

[80] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013 (OJ L 435, 6.12.2021, p. 1).
[81]. ESA - Sentinels modernise Europe's agricultural policy
[82] In strict terms, this is not a support scheme as such but a link between CAP payments and the respect of legal requirements (such as those under the Sustainable Use of Pesticides Directive and SUR proposal) by way of a system of reduction in CAP payments granted to the farmer in case of infringement.
[83] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

objectives. Practices beneficial for the environment and climate may also be supported by rural development Management Commitments (formally known as Agri-Environmental and Climate Measures). While Eco-schemes fall under the so-called first pillar and may support only farmers, Management Commitments fall under the so-called second pillar and may support more broadly land managers (such as farmers but also associations, foresters, etc.). While eco-schemes cover mostly annual commitments and payments, management commitments may finance longer-term commitments for beneficial farming practices. Overall, 48% of the rural development budget will be devoted to financing practices or investments that contribute to environmental, climate and animal welfare objectives, including interventions for a better management of pesticides.

Box: The CAP support to pesticide risk and use reduction in numbers

When drafting their CAP Strategic Plans Members States were required to link the CAP interventions to different results indicators. Pesticide reduction is listed as among the areas of action at least 2 of which must in principle be included in eco-schemes and the interventions one or more of which must be included in certain sectoral interventions. In addition, at least 15% of expenditure for each operational programme must link to objectives that include pest and disease resilient production practices and protection and enhancement of biodiversity and sustainable use of natural resources.[84] Reviewing the data available on 31st March 2023 it can be seen that in total expenditures adding up to EUR 33 660 million have been identified as contributing to pesticide reduction in the CAP, representing 10% of the total EU CAP budget (Table 9). The total public expenditure is higher as rural development measures have compulsory national co-financing.

Table 9. EU contribution under the CAP related to pesticide reduction results indicator (millions of euro)

Country	**Direct Payments**	**Rural Development**	**Total**
Austria	-	529.12	529.12
Belgium*	159.28	107.38	266.66
Bulgaria	214.76	206.77	421.53
Croatia	-	225.86	225.86
Cyprus	44.97	27.81	72.78
Czech Republic	1,191.88	224.47	1,416.35
Denmark	346.17	-	346.17
Estonia	124.12	21.60	145.72
Finland	-	169.09	169.09
France	8,557.69	1,169.26	9,726.95
Germany	2,297.39	3,316.87	5,614.25
Greece	1,769.39	499.20	2,268.58
Hungary	995.00	726.33	1,721.33
Ireland	-	531.47	531.47
Italy	1,819.79	1,432.91	3,252.70
Latvia	201.48	162.54	364.02
Lithuania	315.71	245.82	561.52
Luxembourg	32.59	8.34	40.94
Malta	8.56	5.00	13.56
Netherlands	963.90	423.91	1,387.81
Poland	82.21	973.79	1,056.00
Portugal	664.42	3.48	667.90
Romania	-	748.07	748.07
Slovakia	513.01	224.38	737.39
Slovenia	56.16	178.21	234.37
Spain	-	789.22	789.22
Sweden	350.72	-	350.72

[84] See Articles 31(4)(f), 46(e), 47(1), 50(7)(a) and 58(1)(a)(iv) of Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013.

EU27	Million EUR	20,709.20	12,950.89	33,660.09
	% of CAP Budget	8.01	16.65	10.01

* Belgium submitted two CAP strategic plans (one for Flanders and one for Wallonia). The reported figures are the sum of budgets allocated in both of them.
Source: own elaboration based on approved CAP strategic plans

In addition to the expenditure from basic payments, some Member States[85] declare that their expenditure in certain additional programmes also contributes to pesticides reductions. However, the expenditure for these specific sectors is only reported for the total programme while only a limited number of the interventions included contribute to pesticide reduction. Therefore, adding the financial allocation for these specific programmes as CAP expenditure contributing to pesticide reduction would lead to a significant overestimate. Thus, they are not taken into account in the reported figures.

The sectoral policy for certain products under the CAP also makes available instruments to promote the sustainable use of pesticides, complementing the funding possibilities since direct payments have a lesser impact in certain sectors where there is often an intense use of pesticides. This is the case for instance in the sector of fruits and vegetable where Regulation (EU) 2021/2115 of the European Parliament and of the Council[86] (CAP Strategic Plans Regulation) provides that national Operational Programmes must devote part of the budget to environmental practices such as IPM or pesticides reductions. In addition, farmers will also be encouraged, as part of the Rural Development interventions, to invest in new technologies that can allow the implementation of some of the pesticide reduction practices. Lastly, financial risks incurred by farmers using alternative to pesticides may also be funded by the CAP Rural Development instrument for Risk Management (insurances, mutual funds).

More broadly, under the CAP, Member States must provide advice to farmers on a number of issues, including sustainable use of pesticides with e.g., IPM or precision agriculture, through the so-called Farm Advisory Services (FAS). The FAS must be linked to research and innovation networks in the Agricultural Knowledge and Innovation System (AKIS). The CAP can finance knowledge transfer, such as setting-up FAS and the use of FAS by farmers. In addition, the CAP also provides funding for Operational Groups (OGs) under the European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI). OGs are project-based and support the development of innovations seeking solutions to a certain (practical) problem by groups of relevant actors in a bottom-up manner. From over 2788 OGs which were operational in April 2023, 447 are working on finding solutions for the sustainable use of pesticides[87]. These include for example apps to schedule pesticides applications for vineyards in Spain or to monitor pests and diseases in Italy. As part of its Better Training for Safer Food initiative DG SANTE is also providing training for competent authorities for Members States officials and advisors during the period 2018-2022[88].

[85] Austria, Belgium, Czech Republic, Germany Italy and the Netherlands for Fruit and Vegetables; Italy also for Olive oil and table olives and potatoes.
[86] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013 (OJ L 435, 6.12.2021, p. 1).
[87] EIP-AGRI activities related to sustainable use of pesticides | EIP-AGRI (europa.eu)

[88] BTSF ACADEMY : Search results (europa.eu)

In addition, the EU Research and Innovation framework programmes, Horizon 2020 and Horizon Europe, help to develop a wide range of tools for the prevention, early detection, monitoring, control and management of plant pests and diseases, along with promoting breeding of plant varieties with improved characteristics like pest resistance. Since 2014 over 64 plant-health-related projects with a total budget of over EUR 333 million have been funded[89]. Moreover, research and innovation (R&I) action on integrated crop management, agroecological approaches and low-input strategies are key areas also covered.[90] Knowledge and innovative solutions are made available to advisors and farmers through Thematic[91] and Advisory Networks[92] funded by EU R&I programmes. In addition, under Horizon Europe, a co-funded R&I partnership on agroecology[93] is expected to be tentatively launched in 2024. One of its aims will be to maximise the potential of agro-ecology to reduce and phase out the use of pesticides in agriculture, and to maximise the contribution of farming to biodiversity protection and nature restoration. The total tentative budget would be EUR 300 million.

Lastly, the EU CAP Network also supports farmers in the transition towards the sustainable use of pesticides. In April 2023 a workshop 'Innovative arable crop protection - using pesticides sustainably' was organised in Amsterdam. It focused on exchanging knowledge and sharing innovative, inspirational practices that support farmers, advisors and other stakeholders to ensure greater uptake of non-chemical plant protection methods in arable crops by using economically and ecologically sustainable approaches.

[89] Plant Health factsheet: factsheet-agriresearch-plant-health_en_0.pdf (europa.eu) Figures comprise Horizon 2020 Societal Challenges 2 and Horizon Europe Cluster 6 projects, including Work Programme 2023-2024 expected projects.

[90] Agriculture, forestry and rural areas (europa.eu)

[91] Examples of relevant Thematic Networks: Accelerating Innovative practices for Spraying Equipment, Training and Advising in European agriculture through the mobilization of Agricultural Knowledge and Innovation Systems | INNOSETA | Project | Fact sheet | H2020 | CORDIS | European Commission (europa.eu)

[92] Topic in Horizon Europe Cluster 6 Work Programme 2023-2024: Developing EU advisory networks to reduce the use of pesticides. See wp-9-food-bioeconomy-natural-resources-agriculture-and-environment_horizon-2023-2024_en.pdf (europa.eu)

[93] SRIA_rev23-02-2023.pdf (scar-europe.org)

Box 5. Takeaway points of section 5

1) The Common Agricultural Policy (CAP) includes multiple measures providing funding to farmers for practices and investments beneficial for the sustainable use of pesticides where these practices and investments are more demanding than regulatory obligations (the baseline).

2) To support the transition towards an ambitious reduction in the use of pesticides, the European Commission has however included in the SUR proposal a provision to exceptionally allow funding by the CAP of practices resulting from the implementation of the SUR proposal (required as eligibility conditions for any direct payment) during a period of 5 years after entry into force.

3) The Eco-schemes, which are a type of additional direct payments to farmers, may finance beneficial practices going beyond the baseline, including the sustainable use of pesticides and organic farming.

4) Farmers will also be encouraged, as part of the Rural Development interventions, to invest in new technologies that can allow the implementation of some of the pesticide reduction practices.

5) Financial risks entailed by farmers using alternative to pesticides may also be funded by the CAP second Pillar' instrument for Risk Management (insurances, mutual funds).

6) EU-funded research and innovation projects develop, demonstrate and disseminate IPM solutions, which are made available through thematic and advisory networks, supporting farmers in the transition towards the sustainable use of pesticide.

7) Beyond the CAP, Member States may also use national funds to promote the reduction in use and risk of pesticides by means of various approaches adapted to the national context (taxation, certificates of pesticides sparing, financial instruments, etc.),

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Chapter 2 – Administrative burden

Contents

Summary

Council Decision (EU) 2022/2572[94] ('the Council Decision') requests information on the quantified impacts of increased administrative burden in the proposal for a sustainable use of plant protection products regulation[95] ('SUR proposal') on competitiveness and profitability of small and medium-sized farms. There is no standard EU definition of what constitutes a small or medium-sized farm. It is to be expected that the Member States' definitions differ substantially, especially since there are significant variations in the type of farming practised (e.g. greenhouses versus field crops). A variety of hourly tariffs are available[96] for different categories of workers at EU and individual Member State levels to quantify possible administrative burden, for example EU hourly average earning of EUR 16.10 for elementary occupations or EUR 21.00 for skilled agricultural and fishery workers. Data have already been presented in the impact assessment and the supporting external study to quantify extra administrative burdens of the SUR proposal, compared with the present Sustainable Use of Pesticides Directive[97]. It is also possible for farmers and other professional pesticide users to outsource or sub-contract some of these tasks to specialist contractors which has the potential to realise certain economies of scale and some cost efficiencies in completing such tasks and potentially reduce the total associated administrative burden to small and medium-sized farmers.

In this chapter the European Commission assesses the potential extra administrative burden of the provisions of the SUR proposal compared with the present Sustainable Use of Pesticides Directive for small and medium-sized farms (as professional pesticide users) as 10 hours per year per farm. (Depending on the hourly tariff used this could equate to a cost of EUR 161-210 per year per farm, including non-wage labour costs and a standard 25% for overheads). This can be compared with the administrative burden on farmers in other areas arising from compliance with EU legislation, for example a study analysing administrative burden arising from the CAP assessed the average cost related to aid administration in the EU to be around EUR 220 per farm[98], or about 2% of total costs. There could be an additional cost of EUR 180 per year for such small and medium-sized farms to obtain annual obligatory 'strategic advice' under the SUR proposal, although providing such advice via group or online/remote means could significantly reduce this cost. Evidence from the impact assessment and the supporting external study[99] suggests that farmers could partially or even fully recoup the cost of advice received from the savings generated by the reduced use of pesticides.

The Commission does not have precise data to quantify the potential impacts of such an increased administrative burden on competitiveness and profitability of small and medium-sized farms. The

[94] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).
[95] Proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD)).
[96] Statistics | Eurostat (europa.eu)
[97] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).
[98] Analysis of administrative burden arising from the CAP - Publications Office of the EU (europa.eu)

[99] pesticides_sud_eval_2022_ia_report.pdf (europa.eu)

Commission non-paper on sensitive areas[100] also stated that constructive discussions with Member States should continue on other key issues covered by the SUR proposal, such as administrative burden, for which appropriate solutions can be found. There are also many ways in which the co-legislators can reduce and mitigate additional potential costs and burden, especially for small and medium-sized farms, for example support under the CAP through the National Strategic Plans, alternative national funds, introducing some possible exemption thresholds in the SUR proposal for small and medium-sized farms, reducing the detail or frequency of some of the record-keeping or other administrative legal obligations outlined in the SUR proposal or specifying that obligatory strategic advice to professional pesticide users (and small and medium-sized farmers in particular) be provided at a lower frequency than annual and/ or via a less costly route than by individual physical visits to farms such as advice being delivered to groups of farmers, to farmers growing the same or similar crops, or using online means to deliver this advice.

1. Increased administrative burden of the SUR proposal

The European Commission's Better Regulation Toolbox[101] (a means for the Commission to implement its Better Regulation guidelines and principles) specifies that administrative burden consists of administrative activities carried out because of legal obligations. Administrative net costs are assessed by multiplying the average cost of the required administrative activity (Price) with the total number of activities performed per year (Quantity) and by subtracting the cost of administrative activities removed (at EU/national level). The average cost per activity can be estimated by multiplying a tariff (based on average labour cost per hour and including non-wage labour costs and additional cost of overheads, 25% by default as specified in Better Regulation Toolbox) and the time required per action (hours). The quantity will be calculated as the frequency of required action multiplied by the number of entities (farms/farmers) concerned. The issues of SUR national pesticide reduction targets (which are addressed to Member State competent authorities and not individual farmers or pesticide users) and possible impacts due to a possible prohibition of pesticide use in sensitive areas are addressed in Chapter 1 (economic issues) and Chapter 4 (sensitive areas) of this study addressing specifically Article 1(1) (a), (b), (c) and (f) of the Council Decision.

Eurostat's 2018 Structure of earnings survey, Labour Force Survey data for Non-Wage Labour Costs[102] gives a variety of hourly tariffs for different categories of workers at EU and individual Member State levels, for example for:

- Elementary occupations: EU hourly average earning of EUR 16.10 with a range from EUR 2.90 in Bulgaria to EUR 34.00 in Denmark;
- Service workers and shop and market sales workers: EU hourly average earning of EUR 18.60 with a range from EUR 3.00 in Bulgaria to EUR 32.40 in Denmark;
- Plant and machine operators and assemblers: EU hourly average earning of EUR 19.10 with a range from EUR 3.80 in Bulgaria to EUR 41.50 in Denmark;

[100] pesticides_sud_sur-non-paper_en.pdf (europa.eu)
[101] br_toolbox-nov_2021_en.pdf (europa.eu)
[102] Statistics | Eurostat (europa.eu)

- Skilled agricultural and fishery workers: EU hourly average earning of EUR 21.00 with a range from EUR 3.00 in Bulgaria to 36.10 in Denmark;
- Craft and related trades workers: EU hourly average earning of EUR 21.40 with a range from EUR 4.20 in Bulgaria to EUR 42.60 in Denmark.

The Better Regulation Toolbox states that the effort of assessment should remain proportionate to the scale of the administrative costs imposed by the legislation and should be determined according to the principle of proportionate analysis. The Toolbox states that there is no need to assess the administrative costs when these are bound to be insignificant, for instance, when little equipment is required, if the amount of time per action is small and the frequency low. Such decisions on a lack of specific administrative costing should be taken on a case-by-case basis and should be justified. In order to keep assessment of costs at a reasonable level and ensure comparability of results, the Toolbox states that estimates will be based on standard assumptions simplifying the complex reality of the EU.

As described in the impact assessment, the main increased administrative burdens of the SUR proposal on professional pesticide users (and in particular small and medium-sized farms as specified in the Council Decision), compared with the existing legal obligations under the Sustainable Use of Pesticides Directive[103], are considered to be as follows. It should be noted that, in line with the European Commission digital strategy[104] and digital by default principle, some of the electronic record-keeping provisions of the SUR proposal (for example on pesticide use records, see below) are considered to offer the potential to reduce overall administrative burden compared with current legal requirements that such records be kept for example in paper form:

- **Compulsory electronic IPM record-keeping (assumed time required of 6 hours per year on average per small and medium-sized farmer):** such record-keeping (to be differentiated from pesticide use record-keeping described below) is believed to be not presently required in almost all Member States. It should be noted that the implementation of IPM has been legally obligatory for professional pesticide users (including any small and medium-sized farms included therein) under the Sustainable Use of Pesticides Directive, although record-keeping on IPM is not specifically required or specified under the Sustainable Use of Pesticides Directive. The results from the impact assessment (and from the supporting external study survey with national authorities) suggested that no Member State so far has a mandatory electronic IPM record-keeping in place. Only one Member State has a system for voluntary record-keeping on IPM in place (Finland). Another Member State (Denmark) has a system in which they require farmers to answer questions regarding IPM. Competent authorities in other Member States such as Belgium use documented checklists to assess how IPM is being implemented by professional pesticide users and electronic monitoring dashboards have been used to record or assess IPM implementation in other Member States such as the Netherlands. The external study supporting the impact assessment states that the IPM record-keeping framework could take the form of a decision-making tree with an assumption that, on average, a farmer would have to spend around 6 hours per year on recording decisions in such a framework. The external study states that estimation on time spent is based on observations from the

[103] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).
[104] European Commission Digital Strategy (europa.eu)

existing IPM-recording system in Finland in which farmers can voluntarily record IPM measures. The time is purely for recording and not for field observations and planning, which is part of the normal IPM implementation process and not the actual recording. It should also be mentioned that many farmers, in general, already record all agronomic practices from land preparation to harvest and that the time assumed here is for transferring information into the recording framework to be provided by the national authorities. It can be assumed that the time needed could be significantly reduced by potentially using the existing management systems under the Integrated Administration and Control System[105] (IACS) of the CAP. The IACS system provides for a geospatial aid application (GSA) system which farmers use to declare the agricultural land subject to their aid claim under the CAP. If Member States use the said system for IPM record-keeping, this could lead to a significant alleviation of the administrative burden for record-keeping. It should be noted, however, that the IACS system was not originally designed to include pesticide or IPM record-keeping linked to the SUR proposal and there might be in certain cases a need for adaptation. Moreover, it is important to also note that this system would not normally be expected to be used for record-keeping linked to non-agricultural pesticide use or that portion of agricultural use not linked to or supported by the CAP. It could also be assumed that the administrative burden for this record-keeping would decrease over time if additional recording of IPM practices as required by the SUR proposal gets more standardised and streamlined. The SUR proposal specified that electronic IPM record-keeping could be included in an electronic register for pesticide use records (see sub-point below on requiring pesticide use records to be kept in electronic form). Electronic recording systems would normally be expected to have predefined alternatives/drop-down menus that would make the recording easier and quicker. However, in different climatic and geographical zones experiencing higher or lower pest pressure and varying crops grown, the time spent on such record-keeping could of course be potentially higher or lower than the assessment made by the impact assessment and the supporting external study;

- **Applying for a derogation for the aerial spraying of pesticides (no extra assumed time per year per small and medium-sized farmer compared to existing system of applying for such derogations under the Sustainable Use of Pesticides Directive):** a requirement to apply for a derogation for aerial spraying exists already in Member States under the Sustainable Use of Pesticides Directive. The external study supporting the impact assessment stated that the costs and administrative burden associated with this policy option would be equivalent to a no change scenario compared with the current Sustainable Use of Pesticides Directive. The study noted that few derogations are granted by Member States for aerial spraying and no information is available on derogations concerning drones. Some Member States entirely prohibit aerial spraying under the Sustainable Use of Pesticides Directive and indicated in the supporting external study survey that they plan to continue this prohibition under the SUR proposal, meaning that professional pesticide users (including small and medium-sized farmers therein) in those countries might not be able to apply for these derogations at all, thus not presenting an additional administrative burden for them to prepare and submit such applications. Given that the present Sustainable Use of Pesticides Directive already requires derogation applications to be submitted for aerial spraying, retaining this derogation system under the SUR proposal would not be considered

[105] See: [Managing payments (europa.eu)]()

to present a significant additional administrative burden for small and medium-sized farmers. It is also possible that small and medium-sized farmers might be less likely to apply for, and carry out, aerial spraying compared with larger farmers owing to the costs involved in carrying out such spraying, size of areas to be covered/sprayed in a time and cost-effective way and the cost and overheads potentially associated with the aerial application equipment to be used. The SUR proposal foresees that in the future spraying by drones might be exempted from the need to apply for an aerial spraying derogation, which would reduce the administrative burden accordingly if spraying was being performed using drones;

- **Requiring pesticide use records to be kept in electronic form (assessed to represent a potential reduction in time per year per small and medium-sized farmer compared to presently keeping such records in paper form):** Commission Implementing Regulation (EU) 2023/564[106] as regards the content and format of the records of plant protection products kept by professional users will require pesticide use records to be in electronic form in all Member States from 1 January 2026. Compulsory electronic pesticide use records are already in place in Member States such as Denmark and Slovakia and planned to become compulsory in Spain. The Commission does not have information on the proportion of professional pesticide users (including small and medium-sized farms) who may be already voluntarily keeping in electronic form their pesticide use records required under Regulation (EC) No 1107/2009 of the European Parliament and of the Council[107], but it is entirely plausible and realistic to assume that a significant number of farmers, including small and medium-sized farms, may be using computer or mobile phone software applications to keep farm records, including on pesticide use. Commission Implementing Regulation (EU) 2022/1173 foresees that, where relevant for CAP interventions for sustainable and reduced use of pesticides under Articles 31 and 70 of Regulation (EU) 2021/2115 of the European Parliament and of the Council[108], the GSA shall contain information on the use of pesticides on parcels. Member States may decide to use this information in respect to the record-keeping of pesticides laid down in Article 67(1) of Regulation (EC) No 1107/2009. The external study supporting the impact assessment stated that potentially combining IPM and pesticide use record-keeping in one electronic system could minimise administrative burden for pesticide users (small and medium-sized farmers in the context of the Council Decision). The SUR proposal also foresees that such IPM and pesticide use record-keeping be accommodated in a single electronic system to facilitate relevant synergies and efficiencies and minimise any extra associated

[106] Commission Implementing Regulation (EU) 2023/564 of 10 March 2023 as regards the content and format of the records of plant protection products kept by professional users pursuant to Regulation (EC) No 1107/2009 of the European Parliament and of the Council (OJ L 74, 13.3.2023, p. 4).
[107] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).
[108] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013 (OJ L 435, 6.12.2021, p. 1).

administrative burden for professional pesticide users, including small and medium-sized farms;

- **Applying for a derogation to use pesticides in sensitive areas (assumed time required would vary, zero hours if a small and medium-sized farmer is outside the scope of sensitive areas definition, 0-4 hours per year depending on the crops grown and pesticide used if a small and medium-sized farmer is inside the scope of sensitive areas definition):** although the Sustainable Use of Pesticides Directive obliged Member States to take action to minimise or prohibit the use of pesticides in sensitive areas, the Commission's evaluation of the Sustainable Use of Pesticides Directive and supporting external study concluded that many Member States did not implement this provision in a comprehensive or effective manner. Against this background, the Commission is not aware if many Member States have already introduced a derogation system for users to apply to use pesticides in such areas. The impact assessment states that professional pesticide users would face costs and an administrative burden to submit derogation applications if they needed to use pesticides in sensitive areas. The administrative burden to apply for such an individual derogation could be expected to be similar to that for pesticide users to apply for an aerial spraying derogation, for example 1 hour to prepare and submit such a derogation application, although the frequency of applying for a derogation to use pesticides in sensitive areas might be higher compared with submitting derogation applications to carry out aerial spraying. The SUR proposal states that such derogations to apply pesticides in sensitive areas could have a duration of 60 days and the Commission non-paper on sensitive areas[109] suggests that this could be for a longer duration of 120 days. The additional burden for small and medium-sized farms could thus be estimated to be in a range of 0-4 hours per year. If a small or medium-sized farm is not located in a sensitive area this provision and administrative burden of applying for such derogations and displaying public notices when spraying is carried out would not be expected to be applicable at all to those farms. The Commission non-paper on sensitive areas identifies various possible options to the co-legislators on how the proposed provision on sensitive areas could be adapted to protect agricultural production while still minimizing risks to health and the environment, for example as regards land areas to be included in the definition of sensitive areas, or not, and pesticides to be used in such areas, or not;

- **Receiving annual advice from an independent advisor (estimated cost of €180 per year to receive and record such advice, which could be potentially funded by the CAP and/or the costs reduced if the advice was provided in a group setting or by remote/virtual means. Implementing the advice would also be expected to reduce the quantity and potential costs of pesticides used):** The impact assessment states that introducing this requirement would increase the direct cost of advisory services for professional pesticide users (including any small and medium-sized farmers therein) but the supporting external study also assumed and concluded that the change would lead to a decrease of pesticide use overall (due to increased quality of the service and decoupling from commercial interest) which may balance the increased costs. The external study supporting the impact assessment stated that the costs from the change of this advisory

[109] pesticides_sud_sur-non-paper_en.pdf (europa.eu)

system could be partly balanced by higher subsidies or support to independent advisory structures. Member States may also make full use of their FAS established under the CAP, which would reduce the costs for national administrations and the administrative burden for farmers. Such support for compulsory advice could be potentially funded under the CAP, under the derogation to the funding of legal requirements provided for in the SUR proposal or additional national support schemes if established by the Member States, under the derogation to the funding of legal requirements provided for in the SUR proposal. For additional voluntary advice the CAP can also support overheads and ancillary expenses of advisory services and possibly also the cost of advice for farmers where it is charged and where Member States decide to support it. The SUR proposal does not specify how such annual advice shall be provided, whether in-person or by written or electronic means, whether on an individual basis or as group advice to farmers growing the same crops or using similar pesticides. Taking account of the system already applied in certain Member States (e.g. France), the external study supporting the impact assessment estimated a cost of EUR 180 per year for smaller farms for obligatory 'strategic advice'. It is assumed, based on a national assessment of the system applied in France, that the provision and implementation of such advice would lead to a decrease of pesticide use overall which may partially, or even totally, outweigh the increased costs of obtaining the advice. In an assessment of the French advisory system mentioned in the external study, it was estimated that farms could save up to 25% of their pesticide input costs, which in some cases could more than offset the additional costs for obtaining the advice;

- **Registering pesticide application equipment (PAE) in a register and updating these registration details when the equipment is bought or sold or permanently removed from use (time per year per small and medium-sized farmer assessed to be negligible since registration would only take very limited time and would be a one-off cost either when buying or selling equipment):** such registers of varying levels of complexity already exist in many Member States, as mentioned in the external study supporting the impact assessment. The impact assessment states that registration would only take a very limited amount of time and would be a one-off cost (for example when buying new equipment) and those costs can be considered generally negligible. Assuming a PAE inspection frequency of once every 3 years, a turnover of 10% of PAE annually and 5% of PAE being removed from use annually, the administrative burden on individual small and medium-sized farms <u>annually</u> to update such PAE registration details is assessed as being negligible;

- **Requirement for professional pesticide users to be trained to purchase and use pesticides (no extra assumed time per year per small and medium-sized farmer compared to existing system of training applying under the Sustainable Use of Pesticides Directive):** in the external study supporting the impact assessment, it is stated that Member States indicated that they have already implemented such a training requirement under the Sustainable Use of Pesticides Directive. It is therefore concluded that there would be no additional cost or administrative burden expected for individual small and medium-sized farmers resulting from the SUR proposal. The impact assessment states that for rolling out the training, it is assumed that only little cost would occur since almost all countries can build on a well-established training system.

The administrative tasks mentioned above could be estimated to amount in total to up to 10 hours per year for a professional pesticide user (small or medium-sized farm in the specific context of the Council Decision), 6 hours for IPM record-keeping, 0-4 hours for applying for derogations to use pesticides in sensitive areas, plus a cost of EUR 180 per year to receive obligatory strategic advice. This burden could be counterbalanced by time and cost efficiencies gained in converting from paper to electronic pesticide use records and reduction in pesticide use and costs from implementing the obligatory strategic advice received. On an individual case-by-case basis, depending on the climatic zone, whether the farm is located in a sensitive area, crops grown, pesticides used and application techniques such as aerial spraying being used or not, the administrative burden could be either higher or lower for individual farmers and pesticide users and small and medium-sized farmers in particular in different Member States. Using the skilled agricultural and fishery workers an EU hourly average earning tariff of EUR 21.00 would imply a cost of EUR 210 per year per farm (10 hours multiplied by hourly tariff of EUR 21.00). Using the lower elementary occupations an EU hourly average earning of EUR 16.10 would imply a cost of EUR 161 per year per farm (10 hours multiplied by hourly tariff of EUR 16.10). The estimated cost of EUR 180 per year for smaller farms to obtain annual obligatory 'strategic advice' would be in addition to this, although, as stated earlier, it could be mitigated by potential savings in the cost and use of pesticides based on implementation of the advice received or advice being provided in a less costly way, for example by remote/electronic means or to groups of farmers at the same time who grow the same crops and use similar pesticides, with potential costs and burdens thus being collectively shared or individually reduced by such means.

2. Defining small and medium-sized farms

The concepts of small and medium-sized farms are not formally defined at EU level or in a standardised way. In this context, Eurostat normally uses parameters for farm physical size, or economic size, or for separation of family/non-family farms. In Regulation (EU) 2021/2115 of the European Parliament and of the Council[110] (Articles 28 and 29) reference is made to the concept of small farms. The definition of small farms under the CAP is also left to the discretion of Member States. Member States opting for the payments for small farmers have accordingly defined small farms in their CAP strategic plans, as approved by the Commission. However, this definition of small farms is done with a perspective of simplification of the management of CAP support. It may be the case that small farms in the context of the CAP are large farms in economic terms (e.g. specialised horticulture) and this definition is not in many cases relevant for the use of pesticides. A definition of what is to be considered a 'small or medium farm' is context-specific. What is considered small from the perspective of the SUR proposal differs from what is small from the perspective of Directive 2010/75/EU of the European Parliament and of the Council[111] (the Industrial Emission Directive) or with respect to a subsidy beneficiary for example.

[110] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013 (OJ L 435, 6.12.2021, p. 1).

[111] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast) (OJ L 334, 17.12.2010, p. 17).

At EU level, farms can be classified according to their annual calculated standard output, under EUR 8 000, > EUR 8 000 to < EUR 250 000, > EUR 250 000. Supporting tables below show at EU and individual Member State level the average number of persons working on farms in the Member States in 2016 in these different categories and the share of farms and agricultural area in the different economic size classes, share of farms in the different area size classes and share of utilised area in the different area size classes.

Classification based on economic size (calculated standard output)

In trying to establish the number of small and medium-sized farms that might experience an increased administrative burden linked to the SUR proposal, as requested in the Council Decision, it should be noted that the Commission does not receive from Member States any precise information on the number of professional pesticide users in each of their national territories, or the distribution of these professional pesticide users between different farm types and sizes and also non-agricultural use. Broadly-speaking, one could consider three distinct groups of farms in the EU:

(i) semi-subsistence farms, which are agricultural holdings producing primarily for their own consumption;

(ii) small and medium-sized farms (in this context, in terms of economic size measured by standard output, and not physical size of the farm) that are generally family-run businesses; and

(iii) large agricultural enterprises which are more likely to have a legal form or be cooperatives.

These distinctions are made clearer by analysing farms in terms of their economic size. Of the EU's 9.1 million farms, 3.4 million had a standard output below EUR 2 000 per year and were responsible for only 1 % of the EU's total agricultural economic output[112]. These very small farms are at the (semi-)subsistence end of the farming scale; about two-thirds of such farms in the EU consumed more than one half of their own production in 2016. Semi-subsistent farmers in this category would not all be expected to be professional pesticide users themselves or to fall within the scope of many of the provisions of the SUR proposal (or existing Sustainable Use of Pesticides Directive[113]) or any associated administrative burden. A further 2.5 million farms had an economic output within the range of EUR 2 000 - EUR 8 000 per year. Together these very small and small farms accounted for two-thirds (65.6 %) of all farms in the EU in 2020. In contrast, 294 000 farms (3.2 % of the EU total) each produced a standard output of EUR 250 000 per year or more in 2020 and were responsible for a majority (58.6 %) of the EU's total agricultural economic output; these farms could be considered as large in economic terms and would thus <u>not</u> be expected to fall into the category of small and medium-sized farms referred to in the Council Decision.

It is also not known to what extent small and medium-sized farms using pesticides may outsource the use of pesticides to specialist contractors who have more expertise and experience in the use of pesticides and, through potential economies of scale and specialisation, may be able to somewhat reduce any associated administrative burden on the small and medium-sized farms (through possible cost efficiencies by the task being performed by a highly specialist contractor,

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[112] Main source: Integrated Farm Statistics [Data - Agriculture - Eurostat (europa.eu)]

[113] [Directive 2009/128/EC of the European Parliament and of the Council] of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

although it should be made clear that the farmer would still be obliged to pay the contractor for their work and tasks performed). The European Organisation of Agricultural, Rural and Forestry Contractors has estimated that more than 50% of agricultural work in the EU is executed by contractors and for some specialised harvesting activities this figure can rise to over 80% or 90%[114]. It is, however, not known for all Member States to what extent pesticide use (and some of the associated administrative burden) is outsourced by farmers, and small and medium-sized farms in particular, to professional contractors

Classification based on quantity of pesticide used

An alternative way of defining small and medium-sized farms and assessing any associated administrative burden would be to consider the quantity of pesticide use on each farm and assume that the administrative burden would be proportionate to the pesticide use. This would require a definition of small and medium-sized farms in relation to their pesticide use. Some farms although small in physical size might still use a high amount of pesticides (e.g. production in greenhouses), or vice versa. Since pesticide use data are currently not available to the Commission, data on costs of crop protection materials, available at farm level in the FADN[115], could be used as a potential proxy. Total farm-level costs of crop protection materials could be considered as a proxy for total use and farm level pesticide costs per hectare a proxy for use intensity (see Table 10). Large levels of variation in such parameters are recorded between Member States and within Member States between different crop production sectors. However, on average the higher the economic size of the holding, the higher the costs of crop protection materials (per farm and per hectare, see Table 11). For results by country see Tables 13a, 13b, 14a and 14b in the further supporting tables below.

Table 10 FADN-survey based economic results of farms, by types of farms (TF8 groups) in EU27

The results are calculated as averages for years 2018-2020.	**Annual average for FADN survey in EU27**	(1) Fieldcrops	(2) Horticulture	(3) Wine	(4) Other permanent crops	(5) Milk	(6) Other grazing livestock	(7) Granivores	(8) Mixed
(SE300) Crop protection costs (€/farm)	**3 034**	5 022	5 562	4 336	2 444	1 438	483	3 838	2 154
Crop protection cost, € / ha (SE300/SE025)	**82**	100	832	277	200	32	11	96	67

[114] Ceettar sectors

[115] FADN concerns a sample of EU farms consisting of about 80 000 farms representative for EU and Member State professional farms (not subsistence farms), stratified per region based on physical and economic size and farm type

Table 11 FADN-survey based economic results of farms, by classes of economic size of farms (classes of Standard Output) for EU27

The results are calculated as averages for years 2018-2020.	**Annual average for FADN survey in EU27**	(3) 4 000 - < 8 000 EUR	(4) 8 000 - < 15 000 EUR	(5) 15 000 - < 25 000 EUR	(6) 25 000 - < 50 000 EUR	(7) 50 000 - < 100 000 EUR	(8) 100 000 - < 250 000 EUR	(9) 250 000 - < 500 000 EUR	(10) 500 000 - < 750 000 EUR	(11) 750 000 - < 1 000 000 EUR	(12) 1 000 000 - < 1 500 000 EUR	(13) 1 500 000 - < 3 000 000 EUR	(14) >= 3 000 000 EUR
(SE300) Crop protection costs (€/farm)	**3 034**	224	510	841	1 526	3 024	6 798	13 748	20 353	26 127	37 055	56 470	111 759
Crop protection cost, € / ha (SE300/SE025)	**82**	39	46	51	55	61	81	109	121	122	123	128	135

Source of data for the two tables above is FADN survey results. Table 10. can be reproduced from data published in https://agridata.ec.europa.eu/extensions/FADNPublicDatabase/FADNPublicDatabase.html. It should be noted that the FADN database is planned to be re-calculated to use new parameters, and consequently these extracted results may slightly change as a result. Table 11. uses a more detailed disaggregation of economic sizes than available in the above online database. That disaggregation follows the table in point B ECONOMIC SIZE CLASSES OF HOLDINGS of Annex V of Commission Implementing Regulation (EU) 2015/220[116].

Regarding the differences between the type of farms (sectors), horticulture farms have much higher costs of crop protection materials, followed by wine, other permanent crops and cereals farms. The administrative burden to be expected will in addition be dependent on the variety of crops on the farm, variety of pesticide products used, the number of treatments required, as well as the variety of alternatives to pesticide use for pest control.

In addition, farms using less pesticides and more alternative pest controls techniques may have a higher administrative burden in case they have to report more techniques in detail, for example in their IPM records.

One can also assume a relationship between the automation of reporting and the (economic) size of the farm. For farms with a large/intense use of pesticides it makes more sense to invest in automation of the application (and recording), which entails a larger initial investment cost but lower operating costs per application. For smaller farms the initial investment in automation may be lower, but the variable operating costs relatively higher. For example, small scale farmers might not have the financial resources or scale to invest in the latest, best-equipped, more expensive machinery (or informatics tools) which automatically generate the data and could input these data into a farm management information system (and could thus be potentially used for administrative purposes). The initial investment of these smaller farmers could be lower (e.g. a tractor without digital features) but they might need to collect and input the relevant data and records data manually or in less efficient ways which will increase their operating costs vis-à-vis the larger scale farmers.

[116] Commission Implementing Regulation (EU) 2015/220 of 3 February 2015 laying down rules for the application of Council Regulation (EC) No 1217/2009 setting up a network for the collection of accountancy data on the incomes and business operation of agricultural holdings in the European Union (OJ L 46, 19.2.2015, p. 1).

3. Quantified impacts on profitability of small and medium-sized farms

The Better Regulation toolbox states that profitability can be measured by net profit margin or return on assets. The impact assessment supporting study states that the agricultural sector generates a lower economic return than other economic sectors. Farmers receive around 40-50% less income than workers in other sectors, a situation in turn motivating the CAP to further support the economic viability of farmers. The SUR proposal foresees potential financial support under the CAP for an initial 5-year period for farmers to comply with the requirements of the SUR proposal. As an example of administrative burden in other areas, a study analysing administrative burden arising from the CAP[117] assessed the average cost related to aid administration in the EU to be around EUR 220 per farm, or about 2% of total costs. However, this estimate does not take into account Member State and sector specificities.

The European Commission, through Eurostat, possesses agricultural census data[118] for a large number of potential analyses, relating for example to farm numbers, age and sex of the farmers, labour force, other activities, rented or own land, turnover and specialisation. The Commission does not however have information on the economic situation at individual farm level, except for the farms that take part in the FADN survey which, however, does not focus on small farms. The agricultural census data mentioned above do not cover farm income. This makes it difficult to objectively and quantitatively assess what could be the potential implications of the administrative burdens mentioned above on the competitiveness and profitability of farms in general and small and medium-sized farms in particular, as requested in the Council Decision.

As previously stated, the theoretical turnover (as expressed in standard output and as shown in the supporting tables below) could be a criterion for fixing the classification of small – medium – large farms: for example, < 8,000€ would be small, 8,000€ – 250,000€ – medium and >250,000€ would be large. However, it has to be noted that this theoretical turnover does not indicate in any way the actual income of the farmer, as no inputs have been valuated and subtracted from the potential revenues the turnover represents.

An alternative means of potentially trying to assess profitability but concluded overall not to be helpful in trying to respond to the specific Council Decision request, would be to use economic accounts for agriculture (EAA) data[119] on factor income and entrepreneurial income for agriculture as a whole and not classified by size of farms. The agricultural factor income represents all the value engaged in agricultural production activity (land, capital and labour), which is the gross value added adjusted for the consumption of fixed capital, subsidies and taxes on production. Within EAA, the entrepreneurial income account makes it possible to measure income, which is similar to the concept of current profit before distribution and taxes on income, as customarily used in business accounting. The balancing item of this account is entrepreneurial income. In the case of sole proprietorships, entrepreneurial income represents, on the one hand, the compensation of the work performed by the agricultural holder (and the work of non-salaried family members)

[117] Analysis of administrative burden arising from the CAP - Publications Office of the EU (europa.eu)

[118] Database - Agriculture - Eurostat (europa.eu)

[119] Database - Agriculture - Eurostat (europa.eu)

and, on the other hand, the income remaining with the enterprise, without it being possible to separate these two components (the term 'holder' as used here naturally refers to all persons who run sole proprietorships in this industry). It is, therefore, a mixed income. Like any other industry, however, the agricultural industry comprises production units that belong to different types of institutional units – companies and sole proprietorships – and there is a difference between entrepreneurial income generated by sole proprietorships and that generated by units organised as companies. In the latter case, it represents net entrepreneurial income as it excludes any labour income (compensation of work has to be regarded as compensation of paid labour even if it relates to the administrators and shareholders of the company). For example, if the farmer is a private person, they may not pay themselves a salary but rather the net profit of the farm accrues to them in place of a salary. If the farm is structured as a company, it is possible that the farmer may have an executive role receiving a salary. This means that the profit (called here entrepreneurial income) can in fact both be the salary of the farmer (depending on how the company is set up) or the company profit margin.

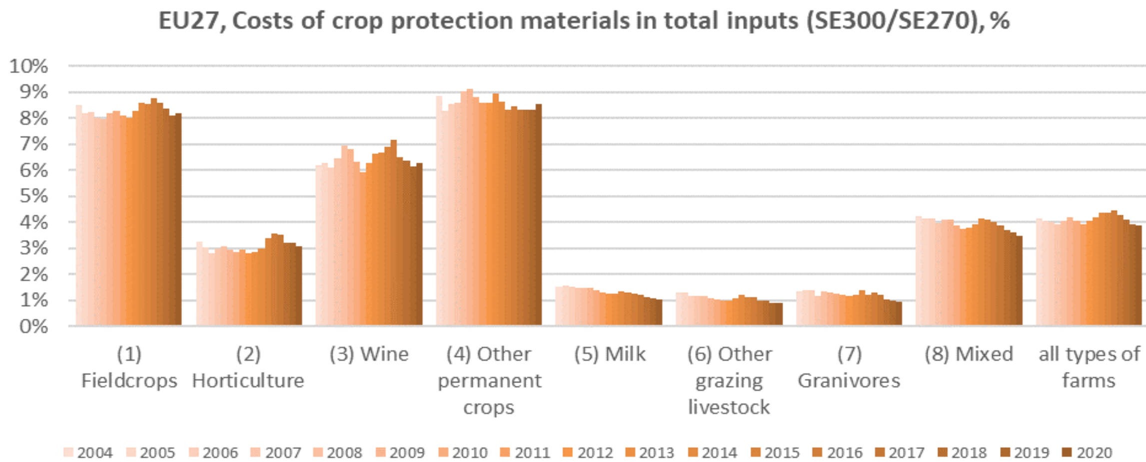
FADN (sample of about 80 000 professional farms in EU) provides detailed data on farmers' income and the different cost factors, for example relating to costs of crop protection materials and products (these do not include services, nor any administrative costs). Based on these FADN data, on average in the EU, costs of crop protection materials are 9% of the total input costs for field crop farms. It is difficult however to relate these crop protection costs directly to administrative costs and burden linked to the SUR proposal. FADN data suggest that the average ratio between costs of crop protection materials and income of field crop farms ranges between 20 to 35% in the EU. Agricultural incomes are generally assessed as being low in the EU, about 50% of the average wage in the economy[120].

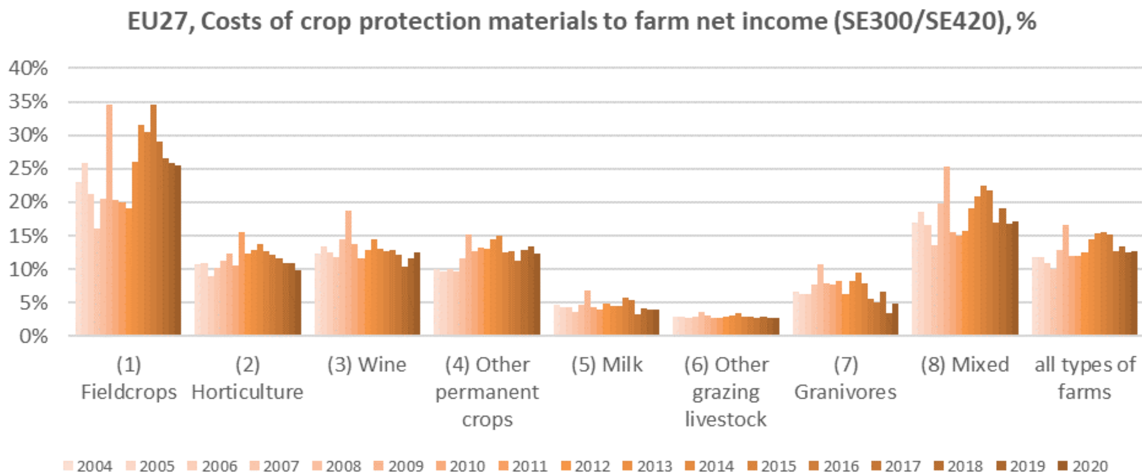
The FADN Dashboard[121] provides some aggregated data for many FADN variables. The table below shows average Farm Net Income for EU farms, disaggregated by type of farms (TF14) and Economic size (which could be potentially used as a proxy for 'farm size'). The income could be potentially used as an indicator of profitability and the calculated increased administrative burden in monetary terms could be compared to the farm income to assess whether it is significant or not. To note that the Table headings and categorisations relate to Economic Size/ thresholds as a measurement of farm size rather than actual physical farm size/ area farmed, given that Economic Size is one of the design dimensions of the FADN survey. These FADN data are per farm, not per individual farmer. Depending on turnover and productivity levels and different types of production and crops grown, farms may be physically bigger or smaller in terms of areas farmed in different Member States for the same category of Economic Size. A more detailed breakdown of the FADN Dashboard data per individual Member States could lead to data representativeness issues owing to the sample sizes of number of farms in individual Member States involved. It should also be noted that net farm income can occasionally be negative depending on the year and type of farming practised.

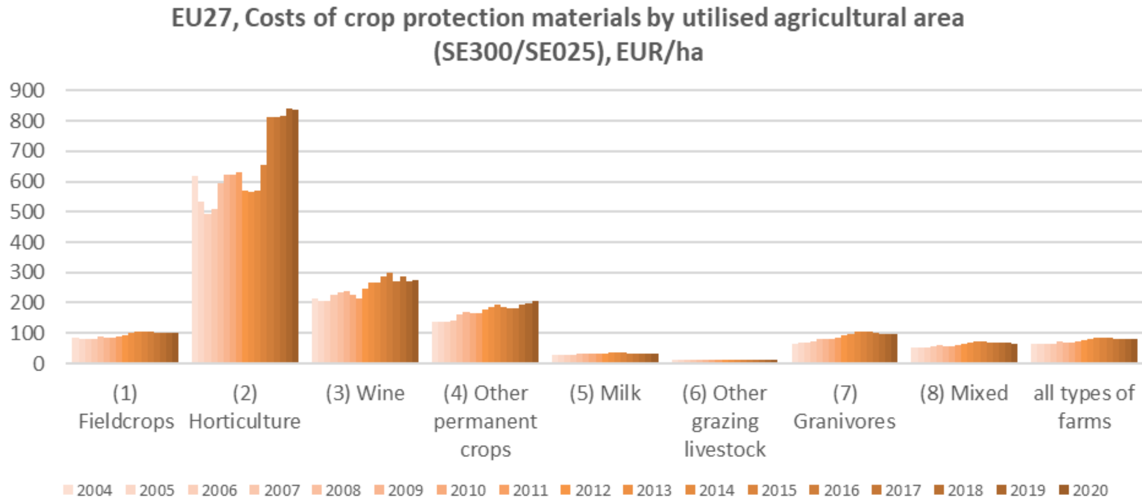
[120] Jobs and growth in rural areas (europa.eu)
[121] FADN PUBLIC DATABASE SO (europa.eu)

Table 12: Average 2020 annual EU Farm Net incomes by sector and economic threshold for EU-27 (expressed in EUR per farm, by types of farming and economic size classes). Source FADN dashboard.

14 Types of Farming	**Economic Size**	(1) EUR 2 000 - < EUR 8 000	(2) EUR 8 000 - < EUR 25 000	(3) EUR 25 000 - < EUR 50 000	(4) EUR 50 000 - < EUR 100 000	(5) EUR 100 000 - < EUR 500 000	(6) >= EUR 500 000
(15) Specialist COP		2,270	8,177	15,463	29,096	58,827	214,799
(16) Specialist other fieldcrops		2,961	8,990	17,189	29,100	58,512	151,406
(20) Specialist horticulture		3,182	13,469	19,430	37,258	83,673	327,125
(35) Specialist wine		6,117	10,411	19,280	33,740	69,280	211,641
(36) Specialist orchards – fruits		5,543	15,459	23,523	43,865	85,782	395,128
(37) Specialist olives		4,020	12,630	24,462	45,590	126,274	-
(38) Permanent crops combined		5,771	11,393	22,744	37,377	75,514	177,530
(45) Specialist milk		1,659	6,632	16,706	29,366	62,487	168,554
(48) Specialist sheep and goats		2,434	10,802	20,803	34,691	44,680	388,593
(49) Specialist cattle		2,195	7,342	12,713	22,174	44,221	206,291
(50) Specialist granivores		864	4,890	17,612	24,609	46,677	196,570
(60) Mixed crops		2,212	9,215	20,710	35,742	60,251	251,456
(70) Mixed livestock		716	5,677	11,446	21,766	39,997	108,653
(80) Mixed crops and livestock		2,241	7,087	14,086	24,545	50,030	130,848







These charts cover EU24 for 2004-2006, EU26 for 2007-2012, EU27 for 2013-2020. Source of data for the charts above: FADN survey results. The charts can be reproduced from data published [FADN PUBLIC DATABASE SO (europa.eu)]

4. Quantified impacts on competitiveness of small and medium-sized farms

The Better Regulation toolbox states that EU initiatives are likely to affect competitiveness when they affect at least one of the following drivers:

– a sector's capacity to produce products at a lower cost and/or offer them at a more competitive price (cost/price competitiveness). The cost of an enterprise's operations includes the cost of inputs (including resources such as raw materials and energy) and production factors which may be directly or indirectly affected by the policy proposal;

– the quality or the originality of a sector's supply of goods or services (innovative competitiveness);

– technological development and innovation (of products and/or processes) are of primary importance for both the cost of inputs and the value of outputs;

– effective market competition and undistorted access to markets including inputs and materials, public procurement, etc.;

– the sector's market shares in international markets, which reflect the comparative advantages of the European industries in international perspective.

Competitiveness aspects may be divided into a number of separate pillars: capacity to innovate, cost and price, international competitiveness and Small and medium-sized enterprise (SME) competitiveness. Overall cost and price competitiveness link to the cost of doing business which includes cost of intermediate inputs and production factors. Capacity to innovate relates to the capacity of the business to produce more and/or higher quality products and services that meet better customers' preferences.

The Council Decision sought input on the potential impact of the administrative burden on the competitiveness of small and medium-sized farms. Considering the fact that farmers outside the EU would not be expected to comply with such requirements, the first question to be answered is whether these administrative burdens are likely to have a significant effect on the sectoral competitiveness of these farms. This should consider the cost and price competitiveness, capacity to innovate and international competitiveness.

Points to be considered include:

(1) affected sectors;

(2) identified impacts on these sectors of policy options;

(3) qualitative estimate of the nature and magnitude of impacts; – How big is the expected impact?; – Is it a direct or indirect result of the intervention?; – When is it expected to occur?; – Is the impact transitory or permanent (duration of the impact)?;

(4) the probability that the impact will take place; – How likely is the impact?; – Does it depend on critical assumptions?

The effect on the sector's international competitiveness also needs to be considered, if a policy proposal is likely to increase costs for EU producers (by e.g. introducing stricter requirements on the EU market) and if their non-EU competitors do not face the same requirements. A recent OECD paper[122] identifies two policy routes to improve agriculture's environmental performance while maintaining the benefits of global markets. The first route relies on 'direct' environmental policies, such as market-based instruments or regulations, which are rapidly effective in limiting environmental impacts but may require additional complementary policies to limit their potential competitiveness and leakage impacts. The second route involves alternative policies acting on agricultural supply, demand, or through private sector engagement, which limit competitiveness and leakage impacts but may require time to be environmentally effective.

As an example, more detailed and electronic records on the use of pesticides, application of IPM and use of advisors and PAE could add to the capacity to innovate for farmers and other professional pesticide users (including for small and medium-sized farmers). Independent and trained advisors may help farmers (including small and medium-sized farmers) to apply more advanced, efficient and effective techniques and products in overall plant protection treatments.

International competitiveness could be boosted by more effective and efficient measures being taken in the EU to reduce the use and risk of pesticides in line with the objectives of the SUR proposal (supported and verified by relevant administrative records and confirmations). This could be used to improve the international image and marketing attractiveness of EU agriproducts (including from small and medium-sized farms) as being potentially produced in a healthier, more environmentally friendly and more sustainable way.

The Better Regulation toolbox also highlights that if certain sectors are disproportionately affected or disadvantaged from a competitiveness perspective, possible mitigating measures could be considered with the aim of achieving the policy objectives without compromising the competitiveness of EU industries. Such possible mitigating measures would include:

• Full or partial exemption of certain sectors or subsectors, which might include less onerous compliance requirements or deeming a certain subset of rules not applicable to certain sectors;

• Extended transition/compliance periods before the rules come into force or where lighter compliance requirements are set for the introductory phase;

• Varying requirements by type and/or size of business or type of product/service, for example for SMEs.

However, when considering potential mitigating measures, it is also always important to consider the relevant trade-offs. For instance, excessively extending transitional periods or varying requirements by type of business may entail a risk of reducing the effectiveness of the initiative and may privilege certain types of enterprises and, therefore, harm fair competition. It is worth noting that in terms of mitigation measures, the SUR proposal foresees financial support to be provided under the CAP for farmers (including small and medium-sized farmers where relevant), which could also help to mitigate the additional administrative burdens and costs imposed.

In assessing potential impacts on SME, the Commission uses as a relevant data source Eurostat's Structural Business Statistics. However, these statistics currently exclude the agricultural sector so the Commission does not possess the usual value added/turnover data that would be available for

[122] Pursuing higher environmental goals for agriculture in an interconnected world : Climate change and pesticides | OECD Food, Agriculture and Fisheries Papers | OECD iLibrary (oecd-ilibrary.org)

SMEs in other sectors. Eurostat has recently released a newer version of the Structural Business Statistics covering more sectors (but with fewer variables), but agriculture is still not included in this newer version. Eurostat makes available EAA data every year under Regulation (EC) No 138/2004 of the European Parliament and of the Council[123]. The EAA are a satellite account of the European System of Accounts and provide relevant data on volumes, values and prices of pesticides. Additionally, Eurostat produces quarterly and annual agricultural price indices with detailed information on the evolution of pesticides prices. However, these data are aggregated for the agricultural industry as a whole, without details by size of the enterprise / agricultural holding.

COPA-COGECA (Committee of Professional Agricultural Organisations-General Confederation of Agricultural Cooperatives) does publish some reports on profitability index at EU level and for individual countries. According to COPA-COGECA[124] and Eurostat data[125], in 2017, the EU agricultural industry produced a total output value of € 427 billion. 50% of this value came from crops, 40% from livestock and the remainder from secondary activities. The sector's total factor productivity has been climbing over time and in 2021 is 8.5% higher than 2010 levels[126]. Other reports[127] are available studying the financial needs in the agriculture and agri-food sectors in EU Member States and the planning and programming of the use of financial instruments in their CAP Strategic Plans.

However, due to the data limitations mentioned above, the Commission itself is unfortunately not in a position to assess the quantified impacts on competitiveness of small and medium-sized farms specifically of the identified administrative burden and costs associated with the SUR proposal, as requested in the Council Decision. Therefore, only a general assessment can be made of the impacts the outlined administrative burden costs could have on the income, profitability and competitiveness of small and medium-sized farms, also considering Member State specific variation in farm sizes and types, crops grown, and pesticides used etc. The cost would also be more difficult to bear for most small and medium-sized farms. The Commission nevertheless recognises that, based inter alia on public feedback received, administrative burden for farmers (including small and medium-sized farms), other professional pesticide users and Member State competent authorities linked to the SUR proposal represents a major concern for stakeholders, including administrative burden and costs for Member State competent authorities (for example linked to development and revision of national action plans, approving IPM crop-specific rules and introducing other record-keeping, monitoring and reporting systems). It should be noted, however, that the Council Decision request on administrative burden was linked only to small and medium-sized farms rather than the potential administrative burden and costs for other professional pesticide users and Member State competent authorities.

The Commission non-paper on sensitive areas[128] of November 2022 states that constructive discussions with Member States should continue on key issues covered by the SUR proposal, such as administrative burden, for which appropriate solutions can be found. Many potential options

[123] Regulation (EC) No 138/2004 of the European Parliament and of the Council of 5 December 2003 on the economic accounts for agriculture in the Community (OJ L 33, 5.2.2004).
[124] European farming (copa-cogeca.eu)
[125] Statistics | Eurostat (europa.eu)
[126] DG AGRI calculations based on Eurostat Economic Accounts of Agriculture Productivity (europa.eu) European Commission | Agri-food data portal | Productivity - Infopage (europa.eu)
[127] fi-compass Study on financial needs in the agriculture and agri-food sectors in 24 EU Member States | fi-compass
[128] pesticides_sud_sur-non-paper_en.pdf (europa.eu)

and solutions could be considered by the co-legislators to reduce or mitigate potential administrative burden and costs, including for small and medium-sized farms which were the specific focus of the Council Decision in this respect. Specific exemptions or thresholds for small and medium-sized farms for some of the SUR proposal provisions, including extra IPM record-keeping or compulsory independent annual advice, could be considered, recognising that small farms in particular would be expected to comprise a relatively small proportion of overall EU agricultural production. By extension it could be assumed that such small farms might represent a relatively small proportion of overall EU agricultural pesticide use and associated health and environmental risks accordingly. Taking IPM record-keeping as an example, Member States such as Belgium and the Netherlands have developed checklists and monitoring dashboards respectively which could offer the potential to reduce the administrative burden and costs to individual farmers and other professional pesticide users, including small and medium-sized farmers as mentioned in the Council Decision. Thresholds or exemptions for obtaining compulsory advice or reducing the level of detail or frequency of such advice or reducing some of the proposed details on PAE registration could also be considered by the co-legislators as a potential means of reducing any undesired extra administrative burden or costs on small and medium-sized farmers, while still ensuring that the overall goals of the SUR proposal to reduce the use and risk of pesticides to protect health and the environment would be achieved in practice.

Supporting tables

TABLE 13a. FADN-survey based costs of crop protection materials, €/farm annually (SE300), by types of farms (TF8 groups) in EU27 Member States

The results are calculated as averages for years 2018-2020.	**Annual average for FADN survey**	(1) Fieldcrops	(2) Horticulture	(3) Wine	(4) Other permanent crops	(5) Milk	(6) Other grazing livestock	(7) Granivores	(8) Mixed
BE	**8 624**	12 877	12 774		33 296	4 360	2 887	4 985	10 949
BG	**4 309**	9 584	1 498	9 041	1 889	237	65	1 095	654
CZ	**19 370**	26 648	2 222	3 795	10 008	18 310	784	3 618	35 091
DK	**11 111**	13 101	20 375		3 052	7 416	1 214	21 713	9 765
DE	**8 793**	17 046	6 111	5 182	11 784	3 187	1 914	8 718	13 271
EE	**4 522**	7 316	1 231		69	5 583	44	2 350	4 960
IE	**917**	14 098				543	165	0	5 309
EL	**990**	1 526	3 707	1 453	843		160	74	295
ES	**3 314**	3 787	10 111	2 739	4 048	974	395	1 378	1 382
FR	**9 805**	18 483	4 793	9 577	10 666	4 443	1 751	4 821	10 678
HR	**1 188**	2 506	1 308	2 844	1 322	674	287	573	427
IT	**2 222**	2 672	4 396	2 884	2 024	1 412	322	3 137	1 388
CY	**1 020**	1 781	2 413	803	723		207		215
LV	**2 863**	6 915				276	38		1 054
LT	**2 089**	5 015	1 794		436	251	59	2 523	1 053
LU	**4 789**	8 184		7 501		4 329	2 925		8 270
HU	**3 570**	4 710	2 422	3 040	3 553	3 692	415	1 822	2 298
MT	**612**	520	949			255	56	95	386
NL	**10 499**	24 601	26 725		19 767	1 906	683	1 964	8 893
AT	**1 740**	4 149		3 385	5 735	292	292	2 684	2 432
PL	**1 199**	1 724	875		1 873	428	177	1 743	772
PT	**1 356**	2 948	1 792	2 274	1 802	1 051	186	58	484
RO	**913**	2 946	436	6 013	1 323	202	217	652	282
SI	**594**	952		1 667	1 342	383	100	1 378	451
SK	**35 289**	43 413				26 218	1 954		69 266
FI	**2 020**	2 230	6 730			828	631	5 352	2 792
SE	**4 291**	8 786	8 912			1 568	619	7 780	6 808
EU27	**3 034**	5 022	5 562	4 336	2 444	1 438	483	3 838	2 154

TABLE 13b. FADN-survey based costs of crop protection materials, €/ha annually (SE300/SE025), by types of farms (TF8 groups) in EU27 Member States

The results are calculated as averages for years 2018-2020.	**Annual average for FADN survey**	(1) Fieldcrops	(2) Horticulture	(3) Wine	(4) Other permanent crops	(5) Milk	(6) Other grazing livestock	(7) Granivores	(8) Mixed
BE	**164**	220	1 019		1 459	71	48	205	172
BG	**63**	67	498	256	165	11	3	51	38
CZ	**93**	130	429	329	358	56	6	145	93
DK	**95**	110	626		100	42	27	114	90
DE	**94**	134	681	378	360	40	28	115	92
EE	**33**	46	156		3	23	1	86	39
IE	**19**	159				9	4	0	80
EL	**105**	110	914	248	158		10	48	33
ES	**71**	59	1 294	107	172	27	5	48	14
FR	**110**	158	477	393	368	45	16	100	88
HR	**80**	111	393	503	253	35	12	68	51
IT	**104**	102	818	325	208	40	7	120	51
CY	**97**	81	519	175	190		14		119
LV	**43**	74				5	1		22
LT	**44**	68	127		14	8	2	64	28
LU	**55**	116		895		41	33		91
HU	**80**	80	301	290	297	52	7	102	65
MT	**235**	155	384			69	25	120	146
NL	**264**	420	2 008		1 399	32	28	196	245
AT	**52**	79		179	465	11	9	82	63
PL	**61**	76	163		209	19	10	66	44
PT	**58**	154	470	217	136	56	4	10	20
RO	**52**	60	255	335	234	25	17	48	45
SI	**56**	105		294	299	21	9	76	48
SK	**79**	114				35	5		79
FI	**30**	37	474			11	7	53	31
SE	**41**	75	2 011			10	8	73	50
EU27	**82**	100	832	277	200	32	11	96	67

TABLE 14a. FADN-survey based costs of crop protection materials, €/farm annually (SE300), by classes of economic size of farms (classes of Standard Output) for EU27 Member States

The results are calculated as averages for years 2018-2020.	Annual average for FADN survey	(3) 4 000 - < 8 000 EUR	(4) 8 000 - < 15 000 EUR	(5) 15 000 - < 25 000 EUR	(6) 25 000 - < 50 000 EUR	(7) 50 000 - < 100 000 EUR	(8) 100 000 - < 250 000 EUR	(9) 250 000 - < 500 000 EUR	(10) 500 000 - < 750 000 EUR	(11) 750 000 - < 1 000 000 EUR	(12) 1 000 000 - < 1 500 000 EUR	(13) 1 500 000 - < 3 000 000 EUR	(14) >= 3 000 000 EUR
BE	**8 624**					4 651	6 055	10 189	18 394	19 362	26 523	22 620	
BG	**4 309**	196	370	622	1 285	3 131	9 768	27 772	46 920	73 282	106 266	156 075	241 471
CZ	**19 370**		298	799	1 504	4 781	10 789	23 528	48 197	66 996	97 183	147 570	272 966
DK	**11 111**			718	1 874	3 349	9 814	18 354	19 173	20 402	24 763	36 759	61 954
DE	**8 793**				1 588	2 875	5 694	11 181	19 052	25 229	44 154	76 404	175 490
EE	**4 522**	35	88	180	1 003	2 851	9 742	19 098	29 473		48 011	78 564	
IE	**917**		71	153	425	1 321	2 021	4 807					
EL	**990**	317	642	1 107	1 782	3 628	5 367						
ES	**3 314**		1 110	1 334	2 274	3 504	5 971	12 074	12 810	17 223	25 305	33 463	57 352
FR	**9 805**			1 059	2 046	3 762	9 456	18 139	26 324	29 223	29 049	37 820	
HR	**1 188**	360	621	913	1 768	4 060	8 960	9 023					
IT	**2 222**		454	749	1 290	2 427	4 700	9 783	13 926	16 265	17 629	27 015	16 655
CY	**1 020**	361	507	908	917	1 936	4 946						
LV	**2 863**	68	126	341	794	3 021	10 349	33 372	68 771				
LT	**2 089**	76	214	493	1 565	4 308	13 580	35 945	72 610				
LU	**4 789**				1 442	3 134	3 923	5 671	9 821				
HU	**3 570**	322	625	1 332	2 361	5 052	11 858	24 047	44 648	76 142	103 009	101 058	191 397
MT	**612**	183	294	732	1 348	3 329	668	348	1 788				
NL	**10 499**				1 288	3 555	6 846	7 401	9 694	14 302	16 205	37 531	123 576
AT	**1 740**			344	687	1 469	3 991	8 832					
PL	**1 199**	184	382	662	1 276	2 428	5 980	15 934	26 857	43 068	47 886	93 386	
PT	**1 356**	317	490	778	1 584	2 630	4 835	11 077					
RO	**913**	207	400	634	1 486	3 589	12 432	29 881	52 377	72 494	99 976	135 363	
SI	**594**	244	271	457	662	1 573	3 975						
SK	**35 289**				2 642	5 231	14 355	32 092	66 835	76 514	119 732	179 025	
FI	**2 020**		461	792	2 091	2 006	2 896	4 397	7 765				
SE	**4 291**			454	1 278	2 451	5 241	10 251	10 493	21 554	21 138	28 205	
EU27	**3 034**	224	510	841	1 526	3 024	6 798	13 748	20 353	26 127	37 055	56 470	111 759

TABLE 14b. FADN-survey based costs of crop protection materials, €/ha annually (SE300/SE025), by classes of economic size of farms (classes of Standard Output) for EU27 Member States

The results are calculated as averages for years 2018-2020.	Annual average for FADN survey	(3) 4 000 - < 8 000 EUR	(4) 8 000 - < 15 000 EUR	(5) 15 000 - < 25 000 EUR	(6) 25 000 - < 50 000 EUR	(7) 50 000 - < 100 000 EUR	(8) 100 000 - < 250 000 EUR	(9) 250 000 - < 500 000 EUR	(10) 500 000 - < 750 000 EUR	(11) 750 000 - < 1 000 000 EUR	(12) 1 000 000 - < 1 500 000 EUR	(13) 1 500 000 - < 3 000 000 EUR	(14) >= 3 000 000 EUR
BE	164					143	123	152	211	247	360	571	
BG	63	46	37	33	39	43	57	66	67	72	77	75	72
CZ	93		18	34	34	64	74	65	99	102	101	110	119
DK	95			43	65	58	87	102	95	88	96	112	153
DE	94				53	67	83	101	113	115	125	107	100
EE	33	2	4	5	13	21	34	37	44		47	52	
IE	19		3	5	9	20	27	43					
EL	105	75	104	118	103	107	130						
ES	71		66	58	62	57	57	105	122	129	126	291	603
FR	110			139	54	61	99	134	177	205	271	277	
HR	80	69	75	62	80	82	88	64					
IT	104		66	75	83	92	100	151	141	185	193	176	160
CY	97	132	128	123	69	72	130						
LV	43	4	5	10	13	26	45	79	94				
LT	44	6	8	13	26	40	65	87	111				
LU	55				46	74	56	47	58				
HU	80	51	55	60	58	62	76	83	93	111	160	123	116
MT	235	93	137	257	327	657	214	110	762				
NL	264				88	188	220	166	158	230	281	737	2 159
AT	52			19	28	41	78	110					
PL	61	24	36	43	55	63	84	105	126	101	126	138	
PT	58	49	45	50	53	56	49	136					
RO	52	47	47	39	42	43	55	60	61	61	60	70	
SI	56	48	33	44	43	67	114						
SK	79				39	42	59	61	82	76	94	91	
FI	30		19	19	33	26	28	35	52				
SE	41			14	26	32	38	52	39	67	59	56	
EU27	82	39	46	51	55	61	81	109	121	122	123	128	135

Table 15. Average number of persons working on farms (including managers and family members) and share of farms by their annual theoretical turnover (in EUR)[129]

	Average number of persons working on farms			**Share of farms by their annual theoretical turnover**		
	<8000	**>8000 - to <250.000**	**>250.000**	**<8000**	**>8000 - to <250.000**	**>250.000**
BE	1.46	1.65	2.61	6.29%	63.89%	29.82%
BG	1.91	2.65	12.06	80.81%	17.68%	1.51%
CZ	1.94	2.65	26.02	31.50%	57.68%	10.86%
DK	1.30	1.51	4.27	11.50%	66.56%	21.91%
DE	1.51	2.00	4.20	10.51%	70.38%	19.11%
EE	1.75	2.18	13.91	65.99%	30.42%	3.47%
IE	1.69	2.00	2.89	31.67%	65.27%	3.06%
EL	1.62	2.01	5.15	67.70%	32.15%	0.15%
ES	1.90	1.96	4.64	52.89%	44.42%	2.69%
FR	1.33	1.72	3.16	18.87%	64.92%	16.20%
HR	2.18	2.68	9.86	69.14%	30.28%	0.57%
IT	1.48	1.96	4.53	50.57%	46.65%	2.78%
CY	1.96	2.43	5.85	81.22%	17.64%	1.17%
LV	1.99	2.88	14.65	76.85%	22.04%	1.12%
LT	1.44	1.94	22.81	75.94%	23.42%	0.65%
LU	1.50	2.20	3.25	8.21%	62.56%	29.23%
HU	1.64	2.37	19.24	83.25%	15.96%	0.79%
MT	1.53	2.23	4.00	84.43%	15.04%	0.64%
NL	2.03	2.27	4.04	4.17%	48.24%	47.59%
AT	1.90	2.59	4.95	31.31%	66.73%	1.97%
PL	1.94	2.54	7.94	64.79%	34.55%	0.66%
PT	2.10	2.67	9.05	72.84%	25.96%	1.20%

[129] Statistics | Eurostat (europa.eu)

RO	1.72	2.46	11.02	94.57%	5.32%	0.11%
SI	2.57	3.09	8.52	58.83%	40.83%	0.36%
SK	1.79	2.33	24.08	68.28%	26.50%	5.18%
FI	1.85	2.23	4.15	23.60%	70.79%	5.61%
SE	1.61	2.10	4.09	39.10%	52.91%	7.98%
EU27	1.75	2.15	4.92	68.33%	28.99%	2.68%

Table 16: Share of farms in the different economic size classes[130]

Share of farms in the different economic size classes			
	< 8000 €	**>8000 - < 250,000€**	**> 250,000€**
EU - 27 countries (from 2020)	65.59%	31.16%	3.25%
Belgium	6.25%	63.61%	30.17%
Bulgaria	67.27%	30.34%	2.40%
Czechia	38.29%	51.54%	10.10%
Denmark	30.49%	50.58%	18.90%
Germany	15.80%	65.26%	18.93%
Estonia	53.56%	40.99%	5.28%
Ireland	29.77%	65.96%	4.29%
Greece	63.25%	36.43%	0.31%
Spain	49.12%	47.46%	3.42%
France	14.21%	66.10%	19.69%
Croatia	73.05%	26.54%	0.42%
Italy	36.72%	59.61%	3.67%
Cyprus	79.24%	19.00%	1.73%
Latvia	77.82%	20.88%	1.30%
Lithuania	75.03%	24.04%	0.92%
Luxembourg	13.83%	60.11%	25.53%
Hungary	67.94%	30.26%	1.80%
Malta	81.57%	17.52%	0.78%
Netherlands	5.98%	44.97%	49.07%
Austria	24.52%	72.48%	3.01%
Poland	63.91%	35.19%	0.90%
Portugal	71.87%	26.60%	1.53%

[130] Statistics | Eurostat (europa.eu)

Romania	93.67%	6.18%	0.15%
Slovenia	65.09%	34.52%	0.41%
Slovakia	58.28%	34.69%	7.03%
Finland	27.31%	66.27%	6.44%
Sweden	38.05%	53.24%	8.73%

Table 17: Share of agricultural area in the different economic size classes[131]

Share of agricultural area in the different economic size classes			
	< 8000 €	**>8000 - < 250,000€**	**> 250,000€**
EU - 27 countries (from 2020)	9.97%	55.97%	34.06%
Belgium	0.58%	46.96%	52.46%
Bulgaria	5.38%	38.85%	55.77%
Czechia	2.08%	25.39%	72.53%
Denmark	2.61%	31.37%	66.01%
Germany (until 1990 former territory of the FRG)	2.00%	40.24%	57.76%
Estonia	7.03%	44.34%	48.63%
Ireland	10.91%	76.15%	12.95%
Greece	15.55%	55.44%	29.01%
Spain	8.30%	71.13%	20.57%
France	2.53%	58.97%	38.50%
Croatia	17.31%	51.84%	30.85%
Italy	7.21%	65.84%	26.95%
Cyprus	26.14%	53.65%	20.20%
Latvia	16.86%	48.41%	34.72%
Lithuania	16.71%	56.71%	26.58%
Luxembourg	0.75%	44.20%	55.05%
Hungary	8.06%	51.97%	39.97%
Malta	60.92%	36.94%	2.14%
Netherlands	0.54%	23.96%	75.50%
Austria	5.53%	84.79%	9.68%

[131] Statistics | Eurostat (europa.eu)

Poland	21.32%	64.12%	14.56%
Portugal	15.28%	58.00%	26.72%
Romania	30.26%	40.79%	28.95%
Slovenia	27.51%	64.91%	7.58%
Slovakia	3.14%	22.10%	74.76%
Finland	6.09%	75.35%	18.55%
Sweden	5.61%	50.70%	43.69%

Table 18: Share of farms in the different area size classes[132]

Share of farms in the different area size classes	Zero ha	>0 - < 5 ha	>5 - < 50 ha	> 50 ha
EU - 27 countries (from 2020)	1.39%	62.39%	28.74%	7.47%
Belgium	1.94%	11.58%	60.06%	26.42%
Bulgaria	4.11%	59.91%	25.90%	10.07%
Czechia	1.63%	23.63%	46.97%	27.78%
Denmark	2.70%	16.02%	50.39%	30.90%
Germany	1.49%	6.68%	60.28%	31.54%
Estonia	2.11%	8.27%	63.41%	26.12%
Ireland	-	5.66%	74.63%	19.71%
Greece	1.02%	73.02%	24.86%	1.10%
Spain	0.87%	50.68%	36.83%	11.62%
France	1.14%	18.50%	34.40%	45.96%
Croatia	2.08%	68.53%	26.57%	2.83%
Italy	1.10%	63.00%	31.42%	4.48%
Cyprus	1.15%	86.37%	11.19%	1.35%
Latvia	2.49%	44.46%	43.56%	9.48%
Lithuania	1.28%	48.89%	41.35%	8.49%
Luxembourg	2.66%	13.83%	31.38%	52.66%
Hungary	7.87%	57.02%	27.26%	7.85%
Malta	3.79%	92.81%	3.40%	0.00%
Netherlands	2.58%	17.36%	56.25%	23.82%
Austria	0.49%	20.32%	68.23%	10.98%
Poland	0.32%	51.97%	44.60%	3.11%
Portugal	1.39%	72.00%	22.26%	4.35%
Romania	1.58%	88.74%	8.74%	0.94%

[132] Statistics | Eurostat (europa.eu)

Slovenia	1.19%	60.76%	37.13%	0.95%
Slovakia	8.46%	31.48%	42.23%	17.88%
Finland	0.55%	2.52%	63.64%	33.31%
Sweden	0.88%	9.87%	64.45%	24.83%

Table 19: Share of utilised area in the different area size classes[133]

	< 5 ha	5 -< 50 ha	> 50 ha
EU - 27 countries (from 2020)	5.78%	26.07%	68.15%
Belgium	0.86%	35.00%	64.14%
Bulgaria	2.51%	13.67%	83.83%
Czechia	0.33%	7.10%	92.58%
Denmark	0.63%	12.62%	86.75%
Germany	0.22%	18.93%	80.85%
Estonia	0.29%	12.14%	87.57%
Ireland	0.48%	44.80%	54.72%
Greece	16.87%	43.50%	39.64%
Spain	3.80%	23.49%	72.71%
France	0.54%	10.80%	88.66%
Croatia	12.55%	32.76%	54.69%
Italy	10.28%	42.28%	47.44%
Cyprus	25.99%	38.07%	35.94%
Latvia	3.52%	22.68%	73.80%
Lithuania	5.39%	26.47%	68.14%
Luxembourg	0.42%	9.59%	90.00%
Hungary	3.88%	19.76%	76.36%
Malta	78.78%	20.00%	0.00%
Netherlands	1.23%	36.53%	62.24%
Austria	2.32%	57.83%	39.85%
Poland	11.70%	52.98%	35.32%
Portugal	9.22%	22.54%	68.24%
Romania	22.85%	23.17%	53.98%
Slovenia	19.95%	65.10%	14.95%

[133] Statistics | Eurostat (europa.eu)

Slovakia	0.71%	6.87%	92.43%
Finland	0.11%	27.94%	71.95%
Sweden	0.71%	20.96%	78.34%

Chapter 3 – Alternatives to chemical pesticides

Contents

Summary

This chapter will address part of Article 1(1) point (e), of Council Decision (EU) 2022/2572[134], which requests that the Commission address the aspect of the availability of alternatives to plant protection products. The second part of this point on the potential increased risk of introduction and spread of harmful organisms in the EU is dealt with under Chapter 4 (sensitive areas) of this study.

The evaluation and impact assessment acknowledge the need for alternatives to chemical pesticides and that more research and policy measures are needed to increase the availability of alternatives to support the transition to more sustainable practices.

Section 4 of Chapter 1 (economic issues) nonetheless highlights how existing technologies already permit targeted, and thus reduced, applications of pesticides, or provide alternatives to pesticides altogether. For example, improvements in decision support systems already reduce pesticide needs by over 50 %, precision farming tools make it possible to reduce by up to 96 % in certain crops. Moreover, it concludes that resistant plant varieties, when included in a system-wide rethinking of crop protection, permit significant reductions of pesticides, and new breeding techniques could increase the availability of such varieties. In general, it recognises that a successful transition must build on the diversity of knowledge on complementary strategies for crop protection, which is overarchingly formulated in the IPM principles.

This chapter describes a number of ongoing and future measures which are being undertaken in parallel with the SUR proposal that will help with facilitating and accelerating market access for low-risk pesticides through easier approval systems, simplified data requirements and risk assessment and capacity building in Member States. Concrete additional measures which can immediately be taken by the different players in the approval process for low-risk active substances and pesticides are listed at the end of this chapter, as are the provisions in the existing SUR proposal that will also facilitate this transition. The Commission's research, dissemination and training projects on biological control, low pesticide input management systems such as IPM, agroecology and organic farming, as well as traditional and new plant breeding technologies, will help farmers and other pesticide users to engage in more sustainable agriculture with reduced chemical pesticide use, thus also reducing the exposure of workers to hazardous substances.[135]

[134] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).
[135] See Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work

1. Ongoing measures

(a) Facilitating market access for low-risk pesticides

The current legislation on the placing of plant protection products on the market (Regulation (EC) No 1107/2009 of the European Parliament and of the Council[136]) already provides incentives to develop low-risk active substances, with both an easier approval system and a longer initial approval period. Four **Implementing Regulations** (Commission Regulations 2022/1438, 2022/1439, 2022/1440 and 2022/1441[137]) in force since November 2022 further simplify data requirements and risk assessment principles for living micro-organisms such as bacteria, fungi and viruses used in pesticides, which cover most current biological control approvals. They are expected to ease the administrative burden for submission of dossiers, reduce costs for applicants and Member States, and accelerate the processing of approval and authorisation requests.

Already today ca. 170 (37%) out of the total 453 EU-approved active and basic substances are 'natural means of biological origin or substances identical to them' and are therefore not considered as 'chemical' for use reduction purposes under the SUR pesticide reduction targets. As these active substances are already approved, Member States could swiftly authorise products containing them to a much larger extent than they currently do, to increase the range of uses.

It is also worth noting that new biological control solutions will be coming to the market: 65 applications for first time approval of active substances are currently under evaluation (ca. 30 fall into the category of biological control as defined under the SUR proposal). Depending on progress with the evaluations by Member States and the European Food Safety Authority (EFSA), these could be approved in the course of the coming months or years.

Furthermore, according to information received from 26 companies[138] of the International Biocontrol Manufacturers Association (IBMA), new applications for approval of 79 new biological control active substances (as defined under the SUR proposal) and 54 extensions of uses of existing active substances are expected before 2028. These will have significant potential to replace chemical pesticides in a range of crops, including in field crops such as cereals and oilseed. According to the crops/pests targeted by these innovations, the size of the agricultural surfaces that

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[136] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).

[137] Commission Regulation (EU) 2022/1438 of 31 August 2022 amending Annex II to Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards specific criteria for the approval of active substances that are micro-organisms (OJ L 227, 1.9.2022, p. 2); Commission Regulation (EU) 2022/1439 of 31 August 2022 amending Regulation (EU) No 283/2013 as regards the information to be submitted for active substances and the specific data requirements for micro-organisms (OJ L 227, 1.9.2022, p. 8); Commission Regulation (EU) 2022/1440 of 31 August 2022 amending Regulation (EU) No 284/2013 as regards the information to be submitted for plant protection products and the specific data requirements for plant protection products containing micro-organisms (OJ L 227, 1.9.2022, p. 38); Commission Regulation (EU) 2022/1441 of 31 August 2022 amending Regulation (EU) No 546/2011 as regards specific uniform principles for evaluation and authorisation of plant protection products containing micro-organisms (OJ L 227, 1.9.2022, p. 70).

[138] 26 companies representing 15% of the 160 companies actively developing biocontrol substances

could potentially be treated would be around 30 million ha (ca. 20% of the total), out of which 23 million ha would be used for arable crops.

In addition to changing the regulatory framework further steps are being taken to facilitate the approval process for micro-organisms and products containing them:

1. **Simplification of dossier-preparation by applicants**. Two communications have been endorsed by the Standing Committee on Plants, Animals, Food and Feed on 22-23 March and several explanatory notes are expected to be endorsed before the end of 2023. These documents are intended to facilitate the dossier-preparation in line with the implementing Regulations on micro-organisms (Regulations 2022/1438, 2022/1439, 2022/1440 and 2022/1441) mentioned above.

2. **Capacity building for Member States**. As part of the Commission '*Better Training for Safer Food'* (BTSF) initiative[139], training opportunities are available to Member State experts to build expertise in conducting risk assessments of micro-organisms used as pesticides (8 sessions with 152 participants so far) and further training under this initiative is foreseen after 2024. In addition, the Commission has also launched a call for proposals under the single market programme for **financial grants** to Member States (EUR 10 million over 5 years) to boost their expertise and capacity for conducting assessments of active substances and pesticides – with particular emphasis on micro-organisms in order to reduce delays in the access to the market of alternatives to chemical pesticides.

(b) Development and dissemination of sustainable agricultural practices such as organic farming, biological control and IPM

1. **Support to Organic Farming.** The Commission's Farm to Fork Strategy sets a target of 'at least 25% of the EU's agricultural land under organic farming' to be achieved by 2030. As demonstrated in section 2.5 of Chapter 1 (economic issues), this significant increase in the area under organic farming will significantly contribute to achieving the SUR pesticide reduction targets and will offer alternatives to the use of chemical pesticides and a framework of financial support under the CAP. In April 2021, the Commission put forward an Action Plan on Organic Farming, which the Commission is implementing to help the organics sector reach its full potential. Moreover, under the CAP Strategic Plans, Member States have included support for the conversion and maintenance of organic farming.

2. **Development and dissemination of IPM practices.** IPM is seen as one of the cornerstones of the SUR proposal and one of the key measures to contribute to the reduction in pesticide use and risk. IPM requires farmers to have a range of tools available, and be informed of these, to facilitate making decisions that will ensure chemical pesticides are only used as a last resort. The European Commission has recently published **a** database **presenting an overview of the IPM methods currently available, including the 'crop-specific guidelines' developed by Member States in the implementation of the Sustainable Use of Pesticides Directive[140], accompanied by a study assessing their effectiveness and prospects for their further uptake.** This overview of practices, established following a two year project Pilot Project 'IPM

[139] BTSF ACADEMY online training platform: BTSF ACADEMY (europa.eu)

[140] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

Toolbox for farmers'[141], shows that there is a great variety in the uptake and implementation options for IPM across EU countries. This toolbox, with its database containing the available IPM methods and practices, intends to inspire national authorities when developing crop-specific rules adapted to local/regional agroclimatic conditions, and to inspire farm advisors and professional users to implement them. The database, hosted on the JRC's Data-Modelling platform of resource economics, will be updated with additional examples on a regular basis.

3. **Development of IPM crop-specific rules**. The Commission intends launching a project under the LIFE programme to support Member States in developing crop-specific rules which are proposed to be required by the SUR proposal. The call for proposals was published on 18 April 2023, envisaging the project start in early 2024. The project will develop concrete recommendations for plant protection that are specific for major arable and permanent crops as well as grassland, differentiated for agro-climatic conditions, fully in line with IPM principles, and coherent with the SUR pesticide reduction targets. It will also develop recommendations for setting up efficient and cost-effective schemes to support practices, which minimise the use and risk of pesticides beyond the obligatory baseline requirements of crop-specific rules. These proposals should be in particular suitable for support under the CAP. The Horizon Europe project SUPPORT will also contribute to the development of an inventory of IPM tools and co-create strategies to apply IPM, working together with the entire agrifood-chain.
4. **IPM training**. Several specific training sessions on IPM (20 sessions with 545 participants) under the BTSF initiative have been organised since 2018 and will be running until the end of 2023. (An extension beyond 2023 is currently being considered). This training programme, targeted at national officials and agricultural advisors, helps improve IPM implementation at farm level and assists controls by competent authorities. In addition, BTSF training on the testing of pesticide application equipment has been running since 2019 and will be ongoing until 2025. So far, 5 sessions were organised with a total of 96 participants attending. BTSF training is built on the cascade principle to train the trainers. Participants commit to disseminating the knowledge gained as part of their engagement in the programme. This results in a substantially larger number of trained persons than the headline figures.
5. **Dissemination and networking of sustainable practices** is of utmost importance to help farmers, advisors and other stakeholders in the transition towards a greater uptake of non-chemical plant protection methods. The Horizon 2020 project IPM Works has set an EU-wide network of farmers to demonstrate and promote the benefits of IPM practices. Moreover, through EIP-AGRI strand of the EU CAP Network (previously EIP-AGRI Network), the Commission provides support and promotes, through the organisation of workshop, seminars and focus groups, the exchange and dissemination of best practices among Member States and other stakeholders. Several EIP-AGRI networking activities were organised over the past years helping farmers to produce with a reduced used of chemical pesticides. In this regard, a special newsletter focusing on pesticide reduction was issued in September 2022[142].

[141] Using less chemical pesticides: European Commission publishes toolbox of good practices (europa.eu)
[142] Newsletter 106, **EN FR DE SK**

The following are some examples of EIP-AGRI focus groups whose activities were summarised in reports containing several good practices and recommendations to facilitate the transition towards a reduced use of pesticides[143]:

- Integrated Pest Management (IPM) - Focus on Brassica species. This group focused on winter oilseed rape and the three most important Brassica vegetables, cauliflower, broccoli and white cabbage. In its final report (January 2016), it was concluded that although effective non-pesticidal approaches were still limited in number for these species, and IPM strategies such as biological control products, natural enemies of pests, and general pest resistance were deemed to need further exploration, the use of proper preventive IPM measures could contribute to better management of problems in Oilseed rape and Brassica vegetables. Efforts were suggested to focus on a few growers which would be leaders in the IPM strategy implementation. Their success would push other growers to follow their example.
- Non-chemical weed management in arable cropping systems: the Focus Group, in its final report (March 2020), identified various good practices in relation to redesigning the cropping system, through a proper use of crop rotation and cover crops, including intercropping, crop sowing patterns, sowing time adjustments and fertilisation and a choice of weed-suppressive and tolerant varieties of crops. This is recommended as using the competitiveness of a crop either for being weed-suppressive or weed-tolerant is a relevant way to reduce the need for more invasive types of weed management.
- Optimising profitability of crop production through Ecological Focus Areas. In its report (March 2016) this Focus Group studied how landscape features contribute to the profitability of arable crop production. In the report landscape features were considered to comprise the following: i) 'field margins', the spontaneously established strips of herbaceous plants at the edge of fields; ii) 'hedgerows', composed of one or two rows of planted or naturally established shrubs and/or trees; and iii) 'grassy or flower strips', intentionally sown.
- Organic farming – Optimising arable yields. This group analysed the issue of yield gaps in organic farming and in its final report (May 2014) included several proposals for further discussions in operational groups, recommendations for further research and practical solutions which have already implemented in some areas of Europe. The latter include, among others: farming systems co-design; information and decision support systems; how to increase soil microbial activity and biodiversity by farming techniques; fine-tuning of composting techniques, structuring of joint purchase and use of machinery; selection of locally appropriate robust varieties; development of innovative tillage techniques; fostering the use of companion planting and cover crops.
- IPM practices for soil-borne diseases suppression in vegetables and arable crops. From November 2014 until September 2015, the Group evaluated the current state of the art on soil-borne diseases and brought together existing knowledge on innovative techniques to control soil-borne diseases caused by fungi and nematodes. In its final report (October 2015) it was concluded that the absence of an integrated approach to soil health and soil quality in general is the main cause of problems regarding soil-borne diseases. A lack of awareness and knowledge along the production chain, resulting in a lack of knowledge-

[143] A more comprehensive list of activities can be found on a dedicated site.

based planning, monitoring and a lack of preventive measures, leads to a reactive approach. The guiding principle should be to enhance soil health on a constant basis rather than a reactive approach where incidents are only managed when a soil disease develops. IPM of soil-borne diseases is knowledge-intensive, so effective knowledge exchange is crucial, and, in this respect, it is important to communicate about 'permanent success stories'.

- Sustainable ways to reduce the use of pesticides in pome and stone fruit production | EIP-AGRI (europa.eu). In its final report (September 2022) this Focus Group evaluated various ways to reduce pesticides in pome and stone fruits, for example: substitute synthetic chemicals by alternative practices (biological control agents, natural products, pheromones, physical barriers, mechanical technics, cultural methods), improve plant protection by using decision support tools and precision agriculture systems, redesign production systems based on biodiversity with hedgerows, companion plants and on favouring the plant's defences by genetics and cultural practices. Overall, the main conclusions were that there is not one solution, but a range of solutions to limit the use of pesticides. On a case-by-case basis, the solution will come from applying several tools/strategies simultaneously in a complementary way, depending on the crop species, the pest and disease pressure, its environment (type of soil, climate condition, etc.), the size and economic level of the farm, etc. Basic and applied research was considered still needed to find new and innovative measures to protect orchards. Knowledge and support were considered necessary for the farmers to engage in the transition towards new practices and to face more complex production systems.
- As part of this dissemination strategy, the EU CAP Network workshop 'Innovative arable crop protection – using pesticides sustainably', which took place from 19 to 21 April 2023 in Amsterdam, focused on exchanging knowledge and sharing innovative, inspirational practices that support farmers, advisors and other stakeholders to ensure a greater uptake of non-chemical plant protection methods in arable crops by using holistic economically and ecologically-sound sustainable approaches.

(c) Research, innovation and knowledge exchange

Priority is given to research measures supporting the Green Deal objectives. Specifically, the EU has supported R&I and knowledge exchange in the area of plant health and plant protection through various instruments and these are summarised as follows:

1. **Horizon 2020**[144] and **Horizon Europe**[145]: The EU R&I funding framework programmes, Horizon 2020 and Horizon Europe, support measures to develop a wide range of tools for prevention, early detection, monitoring, control and management of plant pests and diseases, along with promoting breeding of plant varieties with improved characteristics like pest resistance, and crop management strategies. It also financed a project focused on organic farming: RELACS (replacements of contentious inputs in organic farming systems) and Organic-PLUS, which have achieved important results in relation to reducing and phasing-out the use of some of the most contentious pesticides still used in organic farming. Horizon 2020

[144] 2014-2020 Horizon 2020 (europa.eu)
[145] 2021-2027 Horizon Europe (europa.eu)

has financed 37 projects with + EUR 189 million to protect plant health and promote IPM[146], including by promoting sustainable farming practices such as agro-ecology and organic farming. Over EUR 60 million were dedicated to plant health and plant protection in the first two years of Horizon Europe to finance 10 projects. Several projects implement the 'multi-actor approach' to develop demand-driven solutions which are more ready to be applied in practice, accelerating the transition and reaching end-users. Innovative solutions and practical knowledge are also made available to advisors and farmers through Thematic Networks[147] funded by EU R&I programmes. A non-exhaustive list of financed R&I projects is included in Annex 1. Moreover, a future Horizon Europe partnership on agroecology is expected to catalyse efforts that will underpin the agroecology transition in Europe. The partnership would constitute a key instrument to foster the implementation of agroecological practices for plant health and to reduce the use of chemical pesticides.

2. **European Innovation Partnership for Agricultural Productivity and Sustainability** (EIP-AGRI): Innovation and knowledge exchange are supported through the EIP-AGRI Operational Groups funded under the common agricultural policy. EIP-AGRI Operational Groups are project-based and support the development of innovations seeking solutions to a certain (practical) problem by groups of relevant actors in a bottom-up manner. From over 2,788 Operational Groups, 475[148] are working on finding solutions for the sustainable use of pesticides. Examples of EIP-AGRI Operational Groups are accessible on the EU CAP Network website and found at the following links:

   - a vineyard app for plant protection; the project ('APPVID') ran between 2016 and 2018 in Spain, bringing together different types of organisations as partners, representing research and practice. In the first phase of the project, meteorological stations were installed on 9 experimental vineyard plots. In the second phase, disease data for mildew, powdery mildew and botrytis diseases were collected. In parallel, the different components for the mobile application were developed. Finally, the mobile application was developed and made available.

   - weed control with non-chemical alternatives; this Operational Group ('HortInf'), is trying to find non-chemical alternatives to conventional weed management that could be used by Portuguese farmers. It is one of 23 Operational Groups working on weed management.

   - certification of pesticide residue free fruit & vegetables: 'AGroTrend', the Polish operational Group is developing a zero-residue certification system providing more detailed information to the consumer about the quality of the product they are buying while encouraging further uptake of farming techniques to protect the environment.

   - alternatives for stone fruit, berries and table grapes: this Spanish Operational Group 'FruitCare' was created in 2020 and is aimed at establishing pesticide substitution programmes for fruit producers. The study considered the socio-economic impact of the strategies, allowing them to determine the real consequences of the suppression of active substances, as well as the suitability of the alternative strategies proposed, in each crop. Based on the outcomes of the project, the partners have designed and created

[146] Plant Health factsheet factsheet-agriresearch-plant-health_en_0.pdf (europa.eu)
[147] Examples of relevant Thematic Networks: Innoseta, Oper8, SmartProtect.
[148] Data at 04.04.2023.

'Dissemination cards' for each of the pesticides illustrating which alternative processes or methods can be used instead of the pesticide.

- controlling wireworms in potato production. This Austrian Operational Group has been carrying out trials to find alternative control measures for wireworm control in potatoes without using synthetic pesticides. The results seem encouraging as a reduction in the wireworm population can be achieved through the use of site-specific, multi-annual strategies using a combination of various measures. For example, through the use of attractive plants, wireworms gather in specific areas of the field, and they can be dealt with in a targeted manner. The project has contributed to the development of forecast models to support the decision-making for the application of the different measures to control wireworm damage. These models have been widely shared amongst farmers and farm advisors in Austria.

3. **Digital Europe programme:** Specific financial support for new technologies and precision farming tools is also part of the Digital Europe Programme which is a new EU funding programme focused on bringing digital technology to businesses, citizens and public administrations. The Digital Europe Programme is implemented by means of multiannual work programmes in 2023-2024, with a total budget of EUR 909,5 million. Measures under the Work programme 2023-2024 will boost the number of education and training opportunities for 'users of advanced digital technologies', such as farm advisors exploiting the potential of precision farming technologies or software experts with specific automotive expertise.

2. Possible additional measures for accelerating access to the market of new biological control solutions

Looking forward to the need for additional measures to achieve the SUR pesticide reduction targets, consideration needs to be given to the fact that authorisation and approval requires measures by a number of players. The following summary suggests measures that need to be taken by each of these to accelerate bringing alternatives to the market:

(a) By applicants:

- Actively seek pre-submission meetings with Member States when preparing application dossiers to agree on the appropriate content (considering all possibilities for adaptation of data requirements) and agree on submission schedules
- Prepare high-quality dossiers with the content agreed with Member States in pre-submission meetings and submit at the foreseen points in time
- Once an active substance is approved, submit applications for product authorisation in all or the maximum number of Member States covering all relevant crops to increase availability

(b) By Member States:

- As mentioned under point Ia, Member States could authorise more pesticides containing 'natural means of biological origin or substances identical to them' already approved at EU level and for a wider range of uses than they currently do.

- Increase capacity in human resources (number of staff and expertise) to assess applications for biological control solutions so that more Member States than today can act as rapporteur Member States for approval or as reference Member State for zonal authorisation of products. This would then mean that approvals would be spread across more Member States and would reduce difficulties caused by only one or two Member States conducting the assessment.
- Further exploit the existing provision under Regulation (EC) No 1107/2009 of the European Parliament and of the Council[149] for mutual recognition of authorisations granted by neighbouring countries (as is done for example by Ireland and Luxembourg) and/or of authorisations granted by any other Member State in the respective zone for biological control products.
- Further use provisions under Art 40(2) of Regulation (EC) No 1107/2009 to recognise authorisations from other Member States on application of third parties (such as farmers associations) or by authorities/public bodies
- Reduce fees for certain products to increase attractiveness for applications for authorisation – in particular for biological control products.
- Fully exploit the possibilities under Article 51 of Regulation (EC) No 1107/2009 to extend authorisations granted for major crops to minor crops on their own initiative.
- Agree to pre-submission meeting requests from applicants – and involve EFSA to avoid discrepancies later on. Examine all possibilities for adaptation of data requirements as foreseen in point 1.5 of the introduction to the Annexes to Commission Regulations (EU) No 283/2013[150] and 284/2013[151], respectively.
- Systematically prioritise applications for approval/authorisation of biological control solutions and deliver draft assessment reports (for approval) in 6 months instead of 1 year as foreseen in Article 11(1) of Regulation (EC) No 1107/2009 and within 120 days for product authorisations. The establishment of separate approval streams is one example of a practice that can be adopted by Member States to assist in this.
- Provide incentives for submission of applications for authorisation of biological solutions (e.g. lower fees – or payment of fees in instalments, fast decisions on applications for mutual recognition of products already authorised by another Member State).

(c) By EFSA:

- Increase expertise to assess applications for biological control solutions.

[149] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).
[150] Commission Regulation (EU) No 283/2013 of 1 March 2013 setting out the data requirements for active substances, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market (OJ L 93, 3.4.2013, p. 1).
[151] Commission Regulation (EU) No 284/2013 of 1 March 2013 setting out the data requirements for plant protection products, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market (OJ L 93, 3.4.2013, p. 85).

- Participate in pre-submission meetings between Member States and applicants on dossier composition to identify data gaps at an early stage rather than them being discovered after delivery of the draft assessment reports.

(d) By the Commission:

- Continue providing capacity building for Member States (if so desired by them) through the BTSF initiative to build expertise in conducting risk assessments for biological control solutions.
- Consider simplifying data requirements and assessment methodologies for more biological control substance categories. Similarly to what has been done on micro-organisms, consideration could be given as to whether it might be appropriate to make targeted changes to Regulations (EU) 283/2013 and 284/2013 (data requirements) and Commission Regulation (EU) 547/2011[152] (uniform principles) to simplify and speed up the system of approvals for semiochemicals (pheromones), plant extracts or other biological control active substances (such as peptides/proteins). This would benefit the swifter access of such biological control products to the market following fit-for-purpose risk assessment while keeping the level of protection of human health and the environment high. Any such potential changes, if found necessary, could be based on the experience gained with the application of the existing guidance documents and/or the experience gained by rapporteur Member States having conducted assessments.
- Set up a meeting with smaller Member States, who cite problems with the availability of (biological control) pesticides, to explain how the existing provisions in Regulation (EC) No 1107/2009 can be better utilised for mutual recognition of authorisations granted by other Member States and sharing best practices from Member States with positive experience.

(e) By the European Parliament and the Council:

In the context of the inter-institutional negotiations of the SUR proposal the Council and the European Parliament could consider potentially making targeted changes to Regulation (EC) No 1107/2009, in order to:

- **Set shorter timelines** for Member States in Article 11(1) of Regulation (EC) No 1107/2009 to deliver draft assessment reports for new biological control active substances (e.g. 6 months), which would reduce the time to market for new biological control active substances and products containing them.
- **Allow provisional authorisations for biological control products** as was foreseen in Article 30 of Regulation (EC) No 1107/2009 until 2016: if the Rapporteur Member State establishes that a new biological control active substance meets the approval criteria, all Member States could grant provisional authorisations for products containing it until the approval process is completed and regular authorisations granted, which would mean that biological control products could be placed on the market and used significantly faster and well before a regular authorisations would be granted.

[152] Commission Regulation (EU) No 547/2011 of 8 June 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards labelling requirements for plant protection products (OJ L 155, 11.6.2011, p. 176).

- **Unlimited approvals for biological control active substances**. Approvals of biological control active substances could be made unlimited in time by modifying Article 5, as is already the case for basic substances. This would immediately free resources in companies to invest in the development of new active substances, and in Member State authorities for the evaluation of new applications.

3. Further measures for developing alternatives to chemical pesticides

(a) Facilitating new plant varieties:

Plant breeding and the availability of suitable varieties with traits of resistance to certain pests is one of the tools that enables decisions to be made in applying IPM that reduce later the need for pesticide application. There are two possible measures to support this:

- **Plant Breeding.** The Commission is revising the legislation on plant and forest reproductive material, with the aim of modernising it and better aligning it with the goals of the European Green Deal and the Farm to Fork Strategy, ensuring a sustainable agri-food production. A proposal on plant and forest reproductive material is expected to be adopted in July 2023 and it intends, among other aims, to introduce sustainability criteria in the variety registration for plant reproductive material and approval of basic material (forest reproductive material) and to simplify procedures, harmonise the official controls, and improve coherence with the plant health and the organic regulations (Regulation (EU) 2016/2031 of the European Parliament and of the Council[153] and Regulation (EU) 2018/848 of the European Parliament and of the Council[154]).
- **New Genomic Techniques.** New Genomic Techniques (NGT) appear to have the potential to reduce the development time and costs of new varieties and to enable the introduction of multiple resistance genes, which, as a result, can lead to a reduction in the use of pesticides (in particular, insect resistance). Nonetheless, established methods for genetic modification of plant varieties have also introduced traits that can be associated with increased pesticide use (in particular herbicide tolerance). Therefore, NGT could represent a valid alternative to chemical pesticides only provided that future breeding goals are consistently directed towards a reduced pesticide use. The Commission plans to bring forward a legal proposal for plants obtained by certain NGTs during 2023, based on the outcome of the impact assessment and considering the views of all stakeholders including conventional and organic farmers.

(b) Research and innovation:

1. **Horizon Europe.** Under its work programme 2023-2024, Horizon Europe provides several funding opportunities for the development of alternatives, including breeding, farming and

[153] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC (OJ L 317 23.11.2016, p. 4).
[154] Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007 (OJ L 150, 14.6.2018, p. 1).

management practices, supporting the transition to sustainable and biodiversity-friendly farming systems. The following topics for proposals are of particular relevance and selected projects will start indicatively from the fourth quarter of 2023, will last between three to five years, and are expected to deliver throughout their lifetime:

- Innovations in plant protection: alternatives to reduce the use of pesticides focusing on candidates for substitution (EC indicative budget EUR 10 million) Projects are expected to contribute to i) increased availability of widely accessible and cost-efficient alternatives for prevention and (bio)control of plant pests with improved environmental performance (e.g. reduced effects on non-target organisms, natural resources, humans and the environment); ii) reduced reliance on more hazardous pesticides and favouring low-risk plant protection solutions, to sustain crop productivity and food security while contributing to sustainable agriculture and/or forestry; and iii) minimized pesticides impact on human and animal health, terrestrial and aquatic ecosystems, drinking water, soils and the food chain.

- Developing EU advisory networks to reduce the use of pesticides (EC indicative budget EUR 4 million) The project will connect advisors possessing a broad and extensive network of farmers across all EU Member States in an EU advisory network dedicated to pesticide use and risk reduction, including farming techniques which support pesticide use and risk reduction, with a view to sharing experiences on how to best tackle the issues, building on the outcomes of the EIP-AGRI Focus Groups and Workshops as well as the Horizon 2020 Thematic networks related to pesticide use and risks reduction;

- Biodiversity friendly practices in agriculture – breeding for Integrated Pest Management (IPM) (EC indicative budget EUR 10 million) aims to boost the development of plant varieties with tolerance of, or resistance to, relevant pests and diseases, with the goal of reducing reliance on chemical pesticides.

- Improving yields in organic cropping systems (EC indicative budget EUR 8 million) aims to foster the networking and the exchange of existing knowledge on how to improve yields of crops grown under organic conditions.

- Increasing the availability and use of non-contentious inputs in organic farming (EC indicative budget EUR 12 million) aims to develop, test and put in the place alternative products and solutions for harmful active substances such as copper fungicides in use in organic crop production.

In addition, under Horizon Europe, a co-funded partnership with EU Member States on Agroecology is expected to be tentatively launched in 2024 for an estimated total indicative budget of EUR 300 million. The overall aim of the partnership would be to enhance the knowledge base and deliver solutions and tools that will underpin the agroecology transition in Europe. The partnership will tap into the potential of agroecology to reduce and phase out the use of pesticides and mineral fertilisers and close nutrient cycles, while preserving natural resources.

4. Measures described in the SUR proposal:

It should be noted that various aspects of the existing SUR proposal are designed to incentivize, support and encourage the bringing to the market of alternatives, and to facilitate their availability to the professional user. In addition, various measures are suggested for the co-legislators to discuss and consider in the SUR proposal that would further accelerate this process. For the first time the SUR proposal provides a definition of biological control (Article 3, point 23 of the SUR proposal). This is a broad and inclusive definition and is designed to provide clarity on what is biological control and to allow inclusion of a broad range of substances, some of which are relatively new to the market (such as peptides). This is of further importance because the Articles that follow Article 3 deal with SUR pesticide reduction targets for reduction in chemical pesticides and thus any biological control substances are not included in the SUR pesticide reduction targets.

- Article 4 SUR EU pesticide reduction targets and Article 5 SUR national pesticide reduction targets. The establishment of legally binding SUR pesticide reduction targets for 2030 is intended to incentivise the transition from more hazardous pesticides to low-risk pesticides. Setting the target for only chemical pesticide reduction is intended to result in biological control being prioritised.

- Article 8 National Action Plans transfer these SUR national pesticide reduction targets to relevant Member State specific action. Article 8 specifies that the plans should contain information on Member State measures for encouraging the use of non-chemical methods, and measures to support innovation and development in this area. Article 9 further requires the setting of national indicative pesticide reduction targets which include a target for increasing the non-chemical methods for the main crops and pests specific to the Member State situation in its efforts to achieve the SUR pesticide reduction targets under Article 5, and for a national indicative target for increasing the percentage of overall sales of pesticides that are not chemical pesticides.

Chapter IV covers provisions for IPM and enforces the principle of a hierarchy of measures with Chemical Interventions as a last resort.

The system of independent advice on IPM (Article 26) and information at the point of sale (Art 24) additionally provide a framework for relevant information to be made available to the professional user to assist in making decisions on the use of biological control or alternative control methods.

5. Conclusion

The provision of alternatives and making them public and well-known by all actors, in first row farmers and advisors, is key to providing an array of tools to facilitate decision-making in the framework of applying IPM. Several measures to increase the knowledge and spreading of holistic IPM principles and relevant tools are already in progress, strongly supported by research and innovation, together with legislative initiatives aimed at increasing the number of low-risk and biological control substances available on the market in the medium term. The bringing of new products to the market requires legislative measures to be taken by the Commission, but also by industry and Member States in submitting and approving pesticides within the regulatory timelines. The Commission has a number of measures underway that establish a legal framework for accelerated approvals of low-risk and biological control substances and is taking steps to extend this. The SUR proposal is designed to increase the availability of these by encouraging biological controls and establishing SUR pesticide reduction targets, and the co-legislator could consider going further by changing some of the requirements of Regulation (EC) No 1107/2009 of the European Parliament and of the Council[155]. With this framework and if appropriate measures are taken by industry, by Member State authorities and by the Commission, it currently appears that sufficient tools will be available within the timeframe of the 2030 SUR pesticide reduction targets to achieve the required reduction in chemical pesticide use and risk without unacceptable implications on food security or food affordability.

[155] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).

ANNEX 1.

EU funded R&I activities for healthy crops with a reduced use of chemical pesticides[156]

IPM and alternative solutions to reduce the use of chemical pesticides, including agroecological approaches	**IPM DECISIONS** creates an online platform that is easy to use to monitor and manage pests supporting Integrated Pest Management. This project will give farmers and advisers access to an extensive range of existing Decision Support Systems adapted to regional conditions. **IPM Works** with 31 partners has set up an EU-wide network of farmers to promote cost-effective IPM strategies. The project aims to demonstrate to other farmers that holistic IPM 'works' and allows reductions in the reliance on pesticides with better pest control, reduced costs and enhanced profitability. **SuperPests** seeks innovative tools to control the most difficult-to-manage pests. **OPTIMA** developed an optimised IPM to precisely detect and control plant diseases in perennial crops and open-field vegetables. **NOVATERRA** investigates novel ways to reduce the use of pesticides in grapevines and olives. Alternatives to chemical pesticides are being developed by the projects **WELASER**, **BIOSCHAMP**, **NOVLGRAIN**, and **VIROPLANT**. **PESTNU** deploys solutions and innovations like robotic traps, mobile robots for pesticide monitoring and 3D spot spraying to reduce the use of pesticides and fertilisers. **SoildiverAgro** develops and deploys management practices that enhance soil biodiversity reducing the use of external inputs, like pesticides. **IWMPRAISE** developed and optimised novel alternative weed control methods and created a 'toolbox' of validated IWM methods and made results available to end users. Three additional upcoming Horizon Europe projects - **Conserwa, Agrosus** and **Good** - will continue to investigate the potential of agroecological practices for sustainable weed management and support the transition to agroecological weed management in diverse farming systems in the EU. **SUPPORT** aims to support the uptake of IPM and low-risk pesticide use. **RELACS** and **Organic-PLUS** have investigated and developed alternatives to the use of contentious inputs in organic farming systems.
Plant Pests	Several projects tackle pest-crop-specific challenges: • The projects **PONTE**, **XF ACTORS**, **PRE-HLB**, **FF-IPM, IPM-Popillia, REACT, PURPEST** and **BeXyl** provide tools for prevention,

[156] Non-exhaustive list of Horizon 2020 Societal Challenge 2 and Horizon Europe Cluster 6 projects.

	monitoring, control and management of pests and diseases affecting important crops in Europe. • **RUSTWATCH** established a stakeholder driven early-warning system to improve preparedness and resilience to emerging rust diseases on wheat. • **MUSA** developed sustainable alternatives for protecting banana crops. • **EMPHASIS** addressed native and alien pest threats for a range of both natural ecosystems and farming systems. • **HOMED** developed practical solutions for managing emerging native and non-native pests and pathogens (PnPs) threatening European forests. Early diagnosis and rapid response are crucial to reduce the risk of entry and spread of plant pests and, ultimately their impacts. **VALITEST** worked on the validation of diagnostic tests to support plant health.
Knowledge, Training and Advising	**INNOSETA** established a thematic network on spraying equipment, training and advising to close the gap between the available new high-end crop protection solutions and European farmers. **WINETWORK** built a network for the exchange and transfer of innovative knowledge between European wine-growing regions to control and fight against diseases that jeopardise the future production potential of the EU. **SmartProtect** creates an e-platform to gather, share, manage and distribute knowledge on IPM for vegetable production in open fields and greenhouses. **Oper8** aims to co-create, showcase and evaluate non-chemical weed control.
Risk assessment and One Health approach	The **SPRINT** project aims to develop a Global Health Risk Assessment Toolbox to assess the impacts of pesticides on environment and human health and propose several transition pathways. **RATION** aims to develop a novel risk assessment scheme, supported by the necessary guidance on methods and tools, tailored to the specific characteristics of established and emerging low-risk pesticides solutions.

Chapter 4 – Sensitive areas

Contents

Summary

In Article 1(1)(f) of Council Decision (EU) 2022/2572[157] ('the Council Decision'), the Council requested the Commission to provide a quantification of the impact of banning the use of plant protection products in sensitive areas as defined in Article 3(16) of the proposal for a sustainable use of plant protection products regulation[158] ('SUR proposal'), especially in areas used by the general public and in human settlements (public and urban areas). This additional input focuses on the impacts of sensitive areas in line with the more limited territorial coverage arising from possible options for the co-legislators to consider that were included in the Commission non-paper on sensitive areas that was submitted to the European Parliament and to the Council on 15 November 2022. [159] This non-paper includes a possible option for the co-legislators of allowing use of biological control and low-risk pesticides in all sensitive areas, and allowing all but more hazardous pesticides in agriculture within ecologically sensitive areas, including all pesticides authorised for use in organic farming.

The impacts of pesticide restrictions in sensitive areas are assessed against a baseline of the current Sustainable Use Directive[160], characterised by varied levels of implementation and a wide variety of approaches, both between Member States and even between regions or cities within some Member States.

The primary purpose of proposing restrictions on the use of pesticides in sensitive areas is to protect human health and the environment. Public and urban areas are protected primarily because of the higher risk of human exposure. Areas protected under environmental legislation for habitats or water protection reasons are prioritised because of their ecological importance.

As noted in section 2.1 of Chapter 1 (economic issues) of this document, pesticide use restrictions in urban and public areas have no impact on agricultural production. A transition towards pesticide-free management may require a change in visual aesthetics in urban areas in particular, and to the overall approach to weed management. This can be done without affecting the overall budget balance but with positive effects on the environment. There are particular challenges (especially in cemeteries and sports grounds), but many technical solutions are available to substantially reduce the use and risk of pesticides in such areas without any negative economic impacts.

Concerning agricultural areas Good Agricultural and Environmental Condition standard 8 will limit the use of pesticides in non-productive areas independently of the SUR. The SUR proposal also proposes an additional requirement to use only low-risk pesticides or biological control in a 3-metre buffer zone, which could contribute to that biodiversity function. In practice, the buffer zone will mostly be required for farms with more than 10 hectares of arable land where the limitation on pesticide use due to the buffer zone will be less relative to the overall size than it would be for a smaller farm.

[157] Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).
[158] Proposal for a regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 (2022/0196 (COD)).
[159] pesticides_sud_sur-non-paper_en.pdf (europa.eu).
[160] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

Allowing only biological control and low-risk pesticides in urban areas covered by watercourses or water features, recreational/ bathing water and areas designated for the protection of economically significant aquatic species is expected to have a negligible impact on agriculture. Given the environmental importance of surface water and the negative medium-term outlook for water quality, it appears prudent to introduce such a restriction.

The Commission non-paper on sensitive areas includes various options for the protection of drinking water resources. In addition to the aims of protecting human health and the good status of water bodies, there is also a high economic cost (borne by the consumer) that arises from the need to treat water polluted by pesticides. There are therefore strong economic reasons to address contamination at source, in line with the prevention-at-source principle.

The inclusion of Natura 2000 and areas protected under national legislation and areas reported to the nationally designated protected areas inventory (Common Database on Designated Areas (CDDA)) will help to protect rare and threatened species and rare natural and semi-natural habitat types and to maintain, enhance, or restore the integrity, connectivity and resilience of all ecosystems.

The likely extent of areas for the protection of pollinators threatened with extinction is briefly addressed in this study.

In Article 1(1)(e) of the Council Decision, the Council requested the Commission to address the availability of alternatives to plant protection products (which is discussed in detail in Chapter 3 (alternatives to chemical pesticides) of this study) and the potential increased risk of introduction and spread of harmful organisms in the EU due to the limited availability of alternative means of mitigating that risk. This chapter briefly addresses the second part of that question.

In Article 1(1)(g) of the Council Decision, the Council requested the Commission to provide a quantification of the impacts of the proposed restriction concerning the use of plant protection products on forest stands and forest dependent biodiversity. The Commission does not possess data at EU level on pesticide use in forest stands, though research shows that such use is much more limited compared with use in agriculture. As pesticide restrictions in forest stands are part of wider restrictions on pesticide use in sensitive areas, the Commission has chosen to address forest stands in this chapter.

In conclusion, the protection of sensitive areas is very important for human health and biodiversity. As strong reliance on chemical control results in the development of pests' resistance, nature restoration measures can also assist with pest control. It is possible to successfully implement pesticide restrictions, in particular in urban and public areas and other areas not in agricultural use, without increasing the overall costs. An EU-wide harmonised approach would also facilitate knowledge-sharing networks between municipalities and communication to the public as well as simplifying administration for national authorities. The impact on agriculture will be minimized and, in some cases, short- or medium-term, as well as long-term, economic benefits can even be expected.

Impacts of pesticide restrictions in sensitive areas

1. Introduction

The Council has requested that the Commission provide a quantification of the impact of banning the use of plant protection products in the sensitive areas as defined in Article 3(16) of the SUR proposal, especially in areas used by the general public and in human settlements.[162]

The Commission understands the concerns of the co-legislators that a total ban on the use of all pesticides in sensitive areas as set out in Article 3(16) of the SUR proposal could have an impact on some types of agriculture. Since the adoption of the SUR proposal, the co-legislators and stakeholders have highlighted that agriculture can be part of the solution that contributes to meeting biodiversity objectives, and in some cases the sensitive organisms to be protected are dependent on the maintenance of the agricultural habitat or crop.

The Commission has listened to these concerns and for this reason, transmitted a Commission non-paper on sensitive areas to the Council and the European Parliament on 15 November 2022. This outlines possible options for the co-legislators to consider in relation to the SUR proposal and takes account of key concerns in relation to sensitive areas.

The impact assessment already explored the impacts of provisions on sensitive areas as set out in the SUR proposal. A further detailed assessment of the SUR proposal beyond what was already set out in the impact assessment would therefore serve no purpose. The Commission non-paper on sensitive areas now includes the option of creating a clear distinction between non-agricultural, including urban, sensitive areas and agriculture in ecological sensitive areas. In the latter it is proposed to allow use of all but the more hazardous pesticides, and allow pesticides used in organic agriculture. Because of the scope of the Council request this additional input focusses on public and urban areas.

The Council has requested that the Commission assess the potential increased risk of introduction and spread of harmful organisms and include a quantification of the impacts of the proposed restriction concerning the use of plant protection products on forest stands and forest dependent biodiversity.[163] The SUR proposal does not have any provisions dealing specifically with pesticide use in forest stands. However, many forest sites are included in the sensitive area definition as they are open to the public or are found in ecologically sensitive areas.[164] Some input on forest stands is therefore provided in this chapter.

[162] See Article 1(1)(f) of Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).

[163] See Article 1(1)(g) of Council Decision (EU) 2022/2572 of 19 December 2022 requesting the Commission to submit to Council a study complementing the impact assessment of the proposal for a Regulation of the European Parliament and of the Council on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115 and to propose follow-up actions, if appropriate in view of the outcomes of the study (OJ L 331, 27.12.2022, p. 6).

[164] Under the Commission non-paper on sensitive areas, these would be Natura 2000 and CDDA areas, areas designated for the protection of economically significant aquatic species and 'catchment areas for abstraction points', to be designated by Member States by 2027 under Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (recast) (OJ L 435, 23.12.2020, p. 1). See pesticides_sud_sur-non-paper_en.pdf (europa.eu). See also further section 3.2 of this chapter below.

2. Sensitive areas under the Commission non-paper on sensitive areas

The Commission non-paper on sensitive areas outlines options for the co-legislators to consider that greatly reduce the impact of pesticide restrictions in sensitive areas on agriculture. It would limit the total area covered by the definition so that the co-legislators could focus on those areas deemed most relevant to pesticide use restrictions. To alleviate the burden on agriculture in protected areas, all but the more hazardous pesticides could be allowed in conventional agriculture in areas protected under Directive 2009/147/EC of the European Parliament and of the Council and Council Directive 92/43/EEC[165] (the Birds and Habitats Directives) (Natura 2000) or reported to the CDDA, excluding also emergency authorisations for products containing non-approved active substances. To support organic agriculture in protected areas, all pesticides used in organics could be allowed. In line with the aim of promoting the use of pesticides with good risk profiles (safer for farmers, the environment, pesticide users and citizens), the Commission non-paper on sensitive areas provides an option for the co-legislators to consider allowing biological control and low-risk pesticides in all sensitive areas. Finally, the scope of derogations could be widened.

The Commission non-paper on sensitive areas also maintains a high level of ambition in relation to the protection of human health and the environment.

3. Impacts of pesticide restrictions in sensitive areas under the options included in the Commission non-paper on sensitive areas

3.1 Areas used by the general public/vulnerable groups/human settlements

3.1.1 Protection aim:

The Commission non-paper on sensitive areas identifies for the co-legislators a possible option that only low-risk pesticides or biological control would be permitted in these areas and within a 3-metre buffer zone surrounding them. Public and urban areas and areas used by vulnerable groups are primarily included with the aim of protecting public health.[166] Analysis of academic and scientific literature points to similar and recurring conclusions on the risks and possible impacts and strongly presumed links for several exposure-disease combinations.[167] There is a high standard of protection of human health in approvals of active substances used in pesticides in the EU. An active substance must be shown not to have 'any harmful effects' on human health, including that of vulnerable groups, or animal health, taking into account known

[165] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ L 20, 26.1.2010, p. 7); Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p. 7).
[166] The Commission non-paper on sensitive areas includes a possible option for the co-legislators to consider excluding the agricultural element of discontinuous urban fabric from the definition of urban areas ('human settlements') and to have a closed definition of 'vulnerable groups' as limited to pregnant and nursing women, the unborn, infants, children and the elderly. See pesticides_sud_sur-non-paper_en.pdf (europa.eu).
[167] Commission Staff Working Document - 2022-170_part-1 (europa.eu).

cumulative and synergistic effects where accepted scientific methods to assess such effects are available.[168]

However, although the assessment of effects on human health is a stringent one, it is based on a system of assessing each active substance individually. Furthermore, the methodology of assessment is dependent on the availability of accepted scientific methods to assess synergistic or ‘cocktail’ effects, which are not available. There is a concern about the effects of simultaneous exposure to two or more chemical substances, which occurs in real-life conditions and may have synergistic effects (Nicolopoulou-Stamati et al., 2016). Since the Commission does not have access to data on pesticide use, these real combinations are not known and hence cannot be properly assessed and regulated, which further justifies pesticide restrictions in public and urban areas and areas used by vulnerable groups. The current limits on allowed maximum pesticide residues on food are set for single substances and the current measures to protect human health do not adequately address potential for mixture effects. EFSA has concluded that cumulative dietary exposure is, with various degrees of uncertainty, below the threshold that triggers regulatory action for all population groups.[169]

Pesticide residues have also been detected in human breast milk samples, and there are concerns about prenatal exposure and health effects in children (Nicolopoulou-Stamati et al., 2016). However, in its latest report on maximum residue levels, EFSA concluded that dietary exposure to pesticides for which health-based guidance values were available is unlikely to pose a risk to EU consumer health. In the rare cases where dietary exposure for a specific pesticide/product combination was calculated to exceed the health-based guidance value, and for those pesticides for which no health-based guidance value could be established, the competent authorities took appropriate and proportionate corrective measures to address potential risks to consumers.[170]

Most epidemiological studies point to statistical associations between pesticide exposure and health impacts. However, so far regulatory risk assessment approaches, including some on mixtures, point to low risk. This is a significant scientific challenge which makes it difficult to conclude on the causality of observed links (or statistical associations) and the potentially differing conclusions of risk assessment methodologies and epidemiological studies. However, if confirmed as causal relationships, the observed links carry major societal and health costs which support the case for reducing exposure and risk. It has been shown that combinations of chemicals present at even low levels may contribute to the overall risk of adverse health effects such as cancer and reproductive toxicity and most epidemiological studies point to several statistically significant associations or presumed links.[171]

Another benefit of restrictions in urban or public areas is to reduce risks to human health associated with incorrect use. For example, the German Federal Environment Agency (UBA) has advocated for a complete ban on herbicides in gardens and allotments, given the repeated occurrence of inputs of herbicides into public sewers and wastewater treatment system, in many cases likely due to inappropriate application by private users (Frische et al., 2018).

In addition to the benefits for human health of restricting pesticide use in urban and public areas, there are benefits for biodiversity. Pesticides are among the pollutants that contribute to

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[168] See Article 4(2) of Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).
[169] Commission Staff Working Document - 2022-170_part-1 (europa.eu).
[170] The 2020 European Union report on pesticide residues in food | EFSA (europa.eu)
[171] Commission Staff Working Document - 2022-170_part-1 (europa.eu).

environmental degradation and ecosystem service losses and pesticide use is listed as among the key drivers for pollinator decline.[172] As was noted in a keynote address to the European Parliament, urban spaces can be turned into a network of insect reserves, making a positive contribution to biodiversity.[173] Many urban green spaces and parks include old-growth trees and other habitat elements that have become rare in more intensively used landscapes, which makes these areas important for the protection of certain groups of organisms, such as saproxylic insects[174].

3.1.2: Available data

The Commission possesses data on the total territory in each Member State to be categorised as 'human settlements' as defined in Article 3(16)(c) of the SUR proposal.[175] This is defined by reference to the CORINE (Coordination of information on the Environment) system maintained by the European Environment Agency (EEA) Land Cover Level 1 classification (Artificial Surfaces) and covers 1.1 and 1.4 of that classification system, which encompasses:

1.1.1 Continuous urban fabric

1.1.2 Discontinuous urban fabric

1.4.1 Green urban areas

1.4.2 Sport and leisure facilities

Annex 2 provides the total territory (rounded to the nearest percentage) affected in each Member State.[176] The category of discontinuous urban fabric includes private gardens, which will therefore also be covered in the following subsections. The Commission non-paper on sensitive areas includes the option of removing agricultural parts of 'discontinuous urban fabric' (which are described in CORINE as 'complex cultivation patterns') from the sensitive area definition.

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[172] For further details, please see section 3.1 of Chapter 1 (economic issues) of this study and section 3.6.1 of this chapter.

[173] European Parliament Webstreaming page (europa.eu) and Bumblebee Ecology Dr Dave Goulson Conservation, population genetics, ecology, behaviour, impacts as exotic aliens (pesticide-free-towns.info) . See also a presentation given at a 2022 conference organised by the 'Pesticide Free municipalities' initiative Microsoft PowerPoint - 20221110_Kuemmerlen_Insektenschutz_Kommunen.pptx [SchreibgeschÃ¼tzt] (umweltbundesamt.de)

[174] Old park trees as habitat for saproxylic beetle species | SpringerLink

[175] This has been calculated using the official CORINE Land Cover dataset and the Eurostat GISCO database for Member States boundaries (Countries 2020, scale 1:1). The percentages on the total Member States area were calculated using the Eurostat dataset for Member States boundaries available on the GISCO website (Countries 2020, scale 1:1 Million - https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/countries). However, the Commission does not have specific data on the territories covered by areas used by the general public or vulnerable groups outside urban areas.

[176] Table 20A in Annex 2 provides the total territory (rounded to the nearest percentage) affected in each Member State. Table 20B in Annex 2 provides a breakdown of the affected territories for continuous and discontinuous urban fabric. Table 20C in Annex 2 provides a breakdown of the affected territories for green urban areas and sports and leisure facilities. It should be noted that in this and all tables, the 3-metre buffer zone is not included in the calculations.

3.1.3 Examples of Member State, regional and municipal initiatives to restrict pesticides in urban and public areas

In addition to legislation providing for general conditions of use in pesticide authorisations, many Member States, regions and cities have provided for restrictions on pesticide use in urban and public areas specifically.[177] Pesticides are restricted in public areas, including parks, sports grounds, cemeteries and urban green spaces, as well as in private gardens and sports clubs. There are also restrictions in areas used by vulnerable groups such as healthcare facilities, schools and childcare facilities. Restrictions to permit only low-risk pesticides in public areas exist in some Member States. Limited exemptions are also provided for, mainly concerning control of harmful organisms or alien invasive species, in line with the derogation in the SUR proposal.

Many Member States have extensive experience of successful pesticide-free management of urban areas. For example, in Germany, through a network of 'Pesticide Free municipalities' (*Pestizidfreie Kommunen*)[178], more than 550 German municipalities and local communities have committed themselves to avoiding the use of chemical pesticides either completely or as far as possible. Cities such as Münster and Saarbrücken have practiced pesticide-free management for twenty years.[179] By the end of 2015, 40% of Luxembourgish municipalities had voluntarily renounced chemical pesticides and many others had seen a significant reduction, which resulted in national legislation making almost the entire public space in Luxembourg pesticide-free.[180] Authorities in the Netherlands have also concluded that in general, the quality level for weed control sought by site managers can be achieved thorough non-chemical methods. The application of non-chemical methods to paved and unhardened surfaces was seen as technically feasible, subject to a few exceptions. [181]

Tallinn has adopted a city strategy – Tallinn 2035 Development Strategy – in which the municipal authorities consider all green areas in terms of planning, designing, construction and importantly, maintenance. Incorporation of integrated plant protection considerations into each of these phases is considered absolutely necessary to achieve the goals of the strategy. Since 2022, it has been a condition in all new tenders for the maintenance of green areas by private companies that no pesticides should be used on public land in the city apart from in exceptional cases. The maintenance procurement approach recommends alternative weed control techniques and detailed records and supervision of exceptional use of pesticides. There are other city initiatives such as publicity campaigns encouraging private garden owners to use IPM, guidance documents on maintenance of these spaces and incentives for pesticide-free gardens and kitchen gardens on publicly owned urban land.

In Paris, first reflections about chemical pesticides started in 1990 by stopping the use of the most toxic and dangerous products (such as atrazine) and starting using insect larvae to control harmful insects in greenhouses. Differentiated management began in urban parks and gardens in the 2000s. Since 2009, gardens (454 ha) are managed without any chemical pesticides. In

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[177] See Annex 3 for further details. In addition to specific references, a lot of the information in this section and in Annex 3 comes from Member State responses to a Commission request to the Council Working Party for information on restrictions on the use of pesticides in public and urban areas and contacts with staff in municipal authorities.

[178] Pestizidfreie Kommunen: Es tut sich was – BUND e.V.

[179] Broschüre "Pestizidfreie Kommunen" (bund.net)

[180] merkblätter_kampagne_ouni_pestiziden_einführung__unternehmen_.pdf (ounipestiziden.lu)

[181] See explanatory memorandum accompanying the Decree of 9 March, https://zoek.officielebekendmakingen.nl/stb-2016-112.html.

addition, 422 hectares of Parisian cemeteries (inside and outside Paris territory) have been managed without any chemical pesticides since 2015. Over 90% of green spaces have the EcoJardin label, which goes beyond national legislation (which permits low-risk pesticides, biological control and products used in organic farming) and bans all products classified as hazardous to human health or the environment. Urban agriculture is encouraged through the Parisculteurs scheme and there is a 'Green fingers' scheme for eco-friendly community gardens.

There are certain current and emerging phytosanitary challenges in Paris. For example, there are some limited biological treatments for the box-tree moth in Paris, which is an invasive alien species. The strategy is to allow restricted treatments on box-tree moth of heritage interest (for example plant sculptures) in sites that can be closed to the public at night with an EcoJardin compatible biological solution (*Bacillus thurengiensis*) and close the area to the public for 12 hours after treatment. For other types of box-trees or box-trees in other types of sites, the solution is to replace the plants gradually with other plants or landscaping solutions (such as a metallic barrier or wooden edges).

The Swedish city of Malmö has had a restrictive stance on pesticides for approximately 20 years. In effect, use of pesticides is prohibited (with limited exceptions) in places such as school and kindergarten playgrounds, parks, gardens and public recreational areas, land for residential buildings, private gardens and a plethora of other areas, and permission is required before using pesticides for professional use on areas such as gravel and highly permeable surfaces. While public areas such as parks and cemeteries are considered pesticide-free, permission can be granted to use pesticides in these areas where certain invasive and alien species occur. The city's pesticide-free policies are linked to other initiatives to improve biodiversity such as reduced cutting of roadside grass, planting mixed seeds and allowing higher grasses on roundabouts.

3.1.4: Impacts of pesticide use restrictions in urban and public areas

The impacts of pesticide use restrictions in urban and public areas are explored in more detail in Annex 5. This subsection provides an overview of the main issues. As a preliminary point, it should be noted that the 3-metre buffer zone applying to urban and public areas is included to provide additional protection for public health in urban areas through minimizing the risks from simultaneous exposure or incorrect applications explored above.[182] It is estimated that the impact of this restriction on agriculture is likely to be minimal and it will benefit human health and biodiversity as well as having a positive impact on tourism, environmental education, recreation or general well-being.[183] For example, a recent study estimating the amount of agricultural land close to residential buildings in France estimated that only 0.2% of crops are within 10 metres of residential buildings and about half of those crops are not treated with pesticides (e.g. grasslands and pastures) (Guilpart et al., 2022).

[182] See section 3.1.1 of this chapter.
[183] See section 3.1.4.3 of this chapter.

3.1.4.1: Costs and tools for the transition

The experience in many Member States (for example in France, Germany, Luxembourg and the Netherlands) is that implementation of differentiated management and a change in citizens' aesthetic expectations can help make pesticide-free management of municipalities possible from a cost perspective.[184]

Research in France has shown that a transition to zero pesticides is not a matter of pure technical substitution which would lead to an increase in management costs. Instead, there is a need for an overall change in space management and a daily optimisation of resources under budgetary constraints.[185] A transition usually leads to a temporary increase in costs while managers change their maintenance objectives through mulching, landscape adjustments and above all, acceptance of spontaneous flora.[186]

Similarly, a cost study by the Dutch Ministry of Infrastructure and the Environment found that higher costs do not automatically mean higher maintenance budgets. While there are municipalities that gradually increase the budget for weed control, there are also municipalities that 'shift within the budget' or accept a slightly lower level of quality. Chemical-free weed control has been assessed as about four times more expensive, with a slightly decreasing trend, but as the total budget for public space management in Dutch municipalities was found to be in the region of 0.3% to 3.6%, budgetary adjustments were feasible.[187]

The decision not to use pesticides in public procurement contracts in Tallinn, which is linked to the green transformation goal in the Tallinn 2035 Development Strategy is a new initiative and so it is still too early to assess the real impacts on budgetary costs. Adding to the difficulty in assessing the financial impacts, there was also a change in the way in which the authorities request the maintenance to be carried out, switching from a quantitative method (e.g., cut grass 5 times) to a more qualitative method (e.g., keep grass to X cm). Actual figures should become available after a few years of operation.[188].

Experience gained from 'Pesticide Free municipalities' in Germany shows that a number of tools can help, including choice of design and construction materials in paved areas, soil cover to suppress the growth of unwanted plants and differentiated management.[189] UBA reports that urban pesticide restrictions can best be implemented with an overall sustainability concept. Once initial difficulties have been overcome, such as the proper conservation of green areas (financial hurdles: acquisition of suitable equipment; management plan: mowing and flowering; acceptance by citizens of the measures), pesticide-free policies bring many benefits. Information events are also important for networking between the municipalities and are a quick and effective way of sharing knowledge.

Knowledge-sharing between municipalities has been identified as an important tool in many Member States and existing networks such as the European Green Cities Network and the

[184] For further details, see Annex 5, section 1 of this chapter.
[185] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[186] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr); Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr).
[187] Inventarisatie onkruidbestrijding op verhardingen, Microsoft Word - R001-1214386JGC-rlk-V03-NL (officielebekendmakingen.nl).
[188] See Regulation on the requirements for maintenance of green spaces in Tallinn, enacted on the basis of Section 30(1)(3) of the Local Government Organisation Act, paragraph 16.
[189] Broschüre "Pestizidfreie Kommunen" (bund.net)

European Pesticide Free Towns Network bring many benefits. There will be a much stronger framework for such knowledge sharing and support with an EU-wide harmonised approach.

French research on pesticide-free practices in municipalities also demonstrates the multitude of available tools, such as city charters, eco-management labels and management plans for differentiated management, weed control or site redevelopment. Other useful tools include participatory governance, experience-sharing, financial aid for the purchase of equipment, training, communication with users and awareness-raising measures on nature in cities. Public communication and engagement are also very important, for example through participatory workshops, information posters or public consultation.[190]. The increased number of tools now available make it easier for managers to have a shorter transition.[191]

In relation to public engagement, research has shown that citizens have a strong preference for a natural visual appearance, which suggests that the costly control of the vegetation is not always desirable. It also found that fauna abundance and the improvement in the recreational opportunities available in urban green spaces are valued by a large majority of respondents. Overall, the transition is more likely to be accepted by making sure that recreational opportunities are not restricted and workers' conditions do not deteriorate (Lefebvre, Maslianskaia-Pautrel, et al., 2022).

Again, an EU-wide harmonised approach will help facilitate clear messages to the public on pesticide-free policies. Finally, pesticide restrictions in urban areas will be a lot easier to administer when they are more harmonised. This will reduce the complexity for national administrations by reducing the variations between municipalities.

3.1.4.2 Specific challenges: cemeteries and sports grounds:

The transition to zero pesticide use is easier to make in public parks and gardens than it is in cemeteries and sports grounds. There can be specific cultural challenges in cemeteries (for example in France and Belgium) as families can view toleration of spontaneous flora as disrespectful and a failure on the part of the municipality to maintain the cemetery. Greater acceptance can be facilitated through measures such as keeping spontaneous flora to an acceptable height or mixing spontaneous flora with horticultural plants.[192] In Italy, the City of Venezia banned the use of synthetic pesticides in cemeteries in 2023, but is keeping its policy under review due to increased costs from challenges such as in relation to limiting spontaneous grass in gravel fields.[193] Despite these challenges, pesticide restrictions in cemeteries exist in many Member States, such as Belgium, Denmark, France, Germany, Luxembourg, Sweden and The Netherlands.[194] While other Member States may not have explicit prohibitions in place, the actual use is considered negligible such as in the Estonian capital city, Tallinn. Pesticide use in cemeteries in Malmö is only permitted in case of occurrence of invasive weed species such as Japanese knotweed or Giant hogweed, as these species can cause structural damage to headstones etc.

[190] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr); and Plante & Cité, Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr).
[191] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[192] See Annex 5, section 2 of this chapter for further details.
[193] Citta' di Venezia, Allegato a Relazione Istruttoria – Nuova Proposta di Adeguamento Degli Standard Previsti per la Gestione del Verde Cimiteriale Da Parte di Veritas S.P.A.
[194] See Annex 3, section 1 of this chapter for further details.

Sports grounds also pose technical and aesthetic challenges linked to the maintenance requirements of clubs. These are greater in the case of sports fields for high-level competitions, racetracks and golf courses. Nevertheless, Member States such as Belgium, France, Germany, Portugal, Slovenia, Spain, Sweden and The Netherlands have pesticide restrictions in sports grounds. Many strategies support this, such as the use of design and maintenance tools, close surveillance of relevant symptoms and pests, monitoring tools such as checklists, support and training for maintenance teams and tailored and motivational communication to raise awareness among users.[195]

Support for municipalities is important, including general information, exchange of good practice, knowledge sharing and a roadmap for environmentally friendly work. In the Netherlands, three quarters of the municipalities surveyed expressed a need for such supports. In response to that, an Integrated Sports Management Manual was published in the Netherlands in 2023 within the framework of a Sports Sustainability Roadmap. In the longer term, developments in precision agriculture will facilitate a preventive and ultimately cost-effective approach.[196]

In Tallinn, pesticide use on the sports grounds included in the city's maintenance contracts is prohibited. This can be challenging in some situations, but there is a focus on making the transition and developing new maintenance strategies, such as mechanical weeding and regular maintenance to prevent the spread of weeds.

The use of pesticides in sports grounds in Malmö is generally prohibited but on occasion, if a situation develops which requires intervention using chemical pesticides, a permit can be sought from the Environmental Department, which will determine if the pesticide can be applied, or not.

In conclusion, while certain areas are more challenging in relation to implementation of pesticide-free policies, there are many tools available to support municipalities. Changes in design and aesthetic expectations allow a transition and need to be facilitated by knowledge sharing and exchange of good practice among staff and managers as well as effective communication to the public in relation to the approach taken and the reasons for it.

3.1.4.3 Environmental, public health and other benefits of pesticide use restrictions in urban and public areas

As noted in section 3.1.1 of this chapter, public and urban areas and areas used by vulnerable groups are included with the aim of protecting public health given concerns about the effects of simultaneous exposure to combinations of pesticides and risks from incorrect application of pesticides. It is therefore appropriate to restrict the use of pesticides in areas where there is a greater risk of human exposure.

There are also clear environmental benefits to restricting pesticide use in urban and public areas given the effects of pesticides on environmental degradation and pollinator decline.[197] For example, on a Commission field trip to Paris to understand its pesticide-free policy, it was noted that there is an abundance of bees in Paris due to the approach taken in the city and that there are more fish in the river Seine (an increase from 3 species in the 1980s to 32 species

[195] See Annex 5, section 2 of this chapter for further details.
[196] See Annex 5, section 2 of this chapter for further details.
[197] See section 3.1.1 of this chapter.

currently) due to environmental policies in the city. Another positive side-effect of restrictions was that it inspired more research and experimentation to find new solutions in horticulture, bringing educational as well as environmental benefits. The French organisation Plante & Cité also confirmed that French pesticide policies have helped to incentivise the biological control industry to bring more products to the market in France. During the visit to Paris, municipal officials also stated that a positive side-effect of restrictions was that it inspired more research and experimentation to find new solutions in horticulture, bringing educational as well as environmental benefits.

An analysis carried out in the Netherlands on behalf of the Ministry of Infrastructure and Water Management in 2018 of measurement data of pesticides in surface water to understand the effectiveness of the ban on professional pesticide use outside agriculture found that a decrease in glyphosate concentrations and standard exceedances compared with other groups of monitoring points is demonstrable at drinking water intake points and that there was a plausible link to the prohibition.[198] In 2018, the Central Statistics Office in the Netherlands reported that Dutch public authorities were using about 82% less pesticides than 5 years earlier. Most of the pesticides used (69%) were used to keep railway tracks and marshalling yards free of weeds.[199]

Finally, some wider benefits have been noted. UBA informed the Commission that pesticide-free communities in Germany report clear effects from their policies that have a positive impact on tourism, environmental education, recreation or general well-being. They also report more tolerance of spontaneous flora, increased greening and biodiversity in the settlement areas and a greater recognition of the value and importance of urban nature. Research carried out in France in 2017, when a pesticide ban in all urban green spaces was implemented, found that citizens have a strong preference for a natural visual appearance, which suggests that the costly control of the vegetation is not always desirable. It also found that fauna abundance and the improvement in the recreational opportunities available in urban green spaces are valued by a large majority of respondents (Lefebvre, Maslianskaia-Pautrel, et al., 2022).

3.1.5 Conclusion

As is evident from the overview of initiatives in this section, it is possible to successfully implement pesticide restrictions in urban and public areas. Many such initiatives have been in place for several years and include restrictions similar to those identified in the Commission non-paper on sensitive areas (permission to use only low-risk pesticides and biological control) as well as more stringent restrictions (zero pesticide approach, with limited derogations).

Even in the case of restrictions that are more stringent it is possible to implement them without increasing the overall costs of managing green spaces through adjusting maintenance objectives and employing a differentiated management approach. Certain areas, such as cemeteries and sports grounds, have particular technical, aesthetic or cultural challenges but pesticide restrictions have been successfully implemented in those areas also. It is also evident that it is possible to make a quick transition and that this has become easier due to the number of tools now available and the possibility of drawing from experiences of other municipalities

[198] Addendum bij Effecten van het gebruiksverbod gewasbeschermingsmiddelen buiten de landbouw op oppervlaktewater (overheid.nl).
[199] Gebruik bestrijdingsmiddelen overheden fors gedaald (cbs.nl); Bestrijdingsmiddelengebruik door de overheid, 1992-2018 | Compendium voor de Leefomgeving (clo.nl).

in relation to issues such as alternative weed control or public communication and engagement.[200]

A change in aesthetic objectives and greater acceptance of spontaneous flora are key to allowing a transition to be made in a cost-neutral manner. Furthermore, there is evidence from France that rather than this being a trade-off, citizens have a strong preference for a natural visual appearance and greatly value fauna abundance and the improvement in recreational opportunities in urban green spaces from such an approach.[201] Such preferences may also pertain in other Member States. Even if there is a more challenging trade-off between cultural or aesthetic values on the one hand and the protection of human health and the environment on the other in some Member States, tools such as differentiated management and public information campaigns can help to ease the transition.

Given that pesticide restrictions in urban and public areas do not impact on agriculture, there is less of a need to balance the benefits for biodiversity against disadvantages in relation to food production.[202] This point was also noted by many Member States in Council and is reflected in the Commission non-paper on sensitive areas. Similarly, UBA notes that the use of pesticides in public areas 'cannot be justified with any existential necessity'[203]. In contrast to farming, UBA argues that the economic benefits are usually negligible. Giving preference to non-chemical alternatives in these cases is, therefore, both practicable and reasonable (Frische et al., 2018).

There is a need to harmonise controls both from the point of view of equality between European citizens and because the threat to biodiversity and ecosystems linked to the use of pesticides crosses boundaries and necessitates a strong and EU-level action.[204] An EU-wide harmonised approach would also facilitate knowledge-sharing networks between municipalities and communication to the public as well as simplifying administration for national authorities.

3.2 Forest stands

3.2.1 Protection aim:

As noted in the introduction, the SUR proposal does not have any provisions dealing specifically with pesticide use in forest stands. However, the vast majority of forest stands across the EU are open to the general public and are therefore included in the sensitive area definition. Forests are also found in ecologically sensitive areas. Given that the SUR proposal does not address forests specifically, there is no distinction drawn between commercial forests and other forests that are rich in biodiversity.

Forests and other wooded land cover over 43.5 % of the EU's land space.[205] Their rich biodiversity and unique natural system are home and habitat for most species found on land around the world. Forests are a place to connect with nature, thus helping us to strengthen our

[200] See section 3.1.4 of this chapter.
[201] *Ibid*.
[202] On this issue, see also the discussion in section 2.1 of Chapter 1 (economic issues) of this study.
[203] Towards sustainable plant protection | Umweltbundesamt.
[204] See further *Commission Staff Working Document, Subsidiarity Grid accompanying the document Proposal for a Regulation of the European Parliament and of the Council for a Regulation on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115*.
[205] EUR-Lex - 52021DC0572 - EN - EUR-Lex (europa.eu).

physical and mental health, and are central to preserving lively and prosperous rural areas. Forests play a crucial role in reducing greenhouse gas emissions and have a hugely important role in our economy and society, creating jobs and providing food, medicines, materials and clean water. Forests are a natural ally in adapting to and fighting against climate change and will play a vital role in making Europe the first climate neutral continent by 2050. Protecting forest ecosystems also lessens the risk of zoonotic diseases and global pandemics.[206]

Despite this imperative, European forests are under increasing strain – partly because of natural processes but also because of increased human activity and pressures. While forest area has become bigger in the last decades thanks to natural processes, afforestation, sustainable management and active restoration, and while this has resulted in several trends moving upwards, forest conservation status should be considerably improved, including in the 27% of the EU forest area that is protected and should be the healthiest.[207]

Among many measures the Commission is taking to ensure sustainable forest management under the New EU Forest Strategy for 2030, the Commission, working with the Member States, will monitor the situation of tree health in the EU, including the impact of invasive alien species, diseases and pests such as bark beetles, and encourage the necessary preventive action for early detection and eradication. These include pest management strategies to identify areas most at risk, exchange of best practices, and support and cooperation on phytosanitary controls, as well as the development of innovative and sustainable plant protection tools in respect of ecological principles favourable to biodiversity.[208]

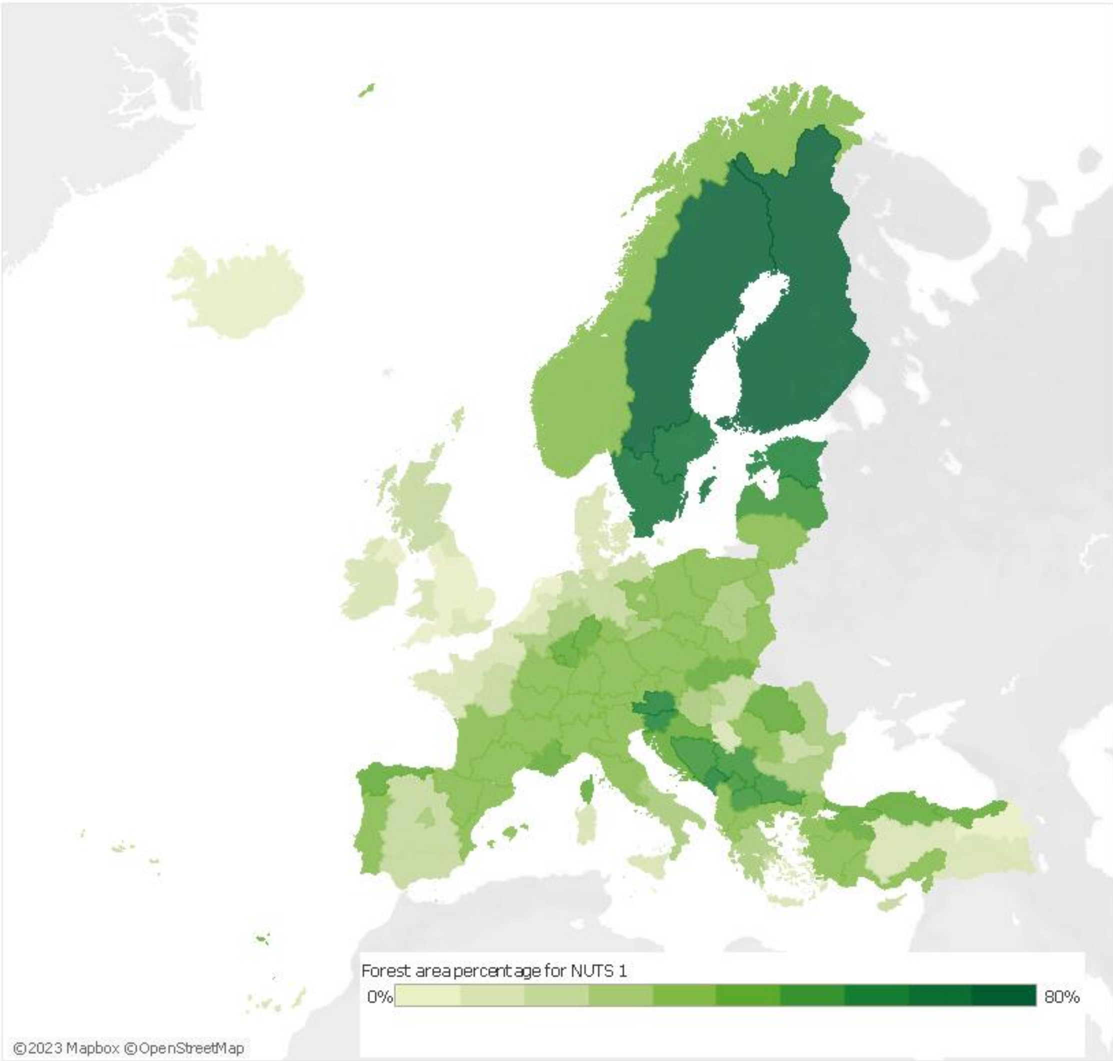
3.2.2 Available data:

The Commission does not have EU-level data submitted by Member States on the level of pesticide use in forest stands, although research indicates it is very low compared with agriculture. Across EU Member States, pesticide use in forestry is usually less than one percent of agriculture on an annual basis (McCarthy et al., 2011). Forest coverage is highly variable across Member States. The following chart shows an overview of forest area coverage across the EU:

[206] EUR-Lex - 52021DC0572 - EN - EUR-Lex (europa.eu).

[207] EUR-Lex - 52021DC0572 - EN - EUR-Lex (europa.eu). Forest habitats listed in Annex I of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p. 7) (the Habitats Directive) cover about 27% of all forested area in the EU.

[208] EUR-Lex - 52021DC0572 - EN - EUR-Lex (europa.eu).



The Commission asked Member States to provide data on pesticide use in forests.[209] Member States generally do not have detailed statistics on pesticide use in forests but provided information on the restrictions that are on place.

As noted above, forests and other wooded land cover over 43.5 % of the EU's land space.[210] The range of forest cover is substantial, with some Member States such as Finland, Sweden and Slovenia having over 60% forest cover, while Member States such as Cyprus, Denmark and Ireland have less than 20% forest cover and Malta has about 1%. A large cohort of Member States have forest cover of between 30-40%.

While the majority of Member States do not currently have comprehensive statistics on pesticide use in forestry scenarios, it is generally considered that pesticide use in forestry situations accounts for quite a small proportion of overall pesticide use. Nonetheless, while in an overall context the pesticide use is not considered significant, it is still considered quite important in most Member States. Some Member States do not have pesticides specifically

[209] Request for contributions in WK 4195/2023 REV 1. See Annex 4 for further details on the responses.
[210] See section 3.2.1 of this chapter.

authorised for use in forestry and others do not allow pesticide use at all in forest plantations and the majority allow pesticide use in such areas but only in exceptional circumstances.

In the Member States that actually use pesticides in forest stands, it tends to be concentrated in the establishment phase of the forest stand or in commercial growing of for example Christmas trees. In some Member States during the one- to two-year establishment period, some use of pesticides is considered necessary to ensure that newly planted areas can establish in a viable way and become resilient and stable stands. In other Member States pesticide treatment of stumps after harvesting is considered necessary to protect the next forest plantation, either with chemical substances or biological control. In addition, a small number of Member States experience pest outbreaks in mature forests where treatment is deemed necessary to save the affected stand but also to protect the surrounding forest plantations.

In summary, there is no routine annual application of pesticides to forestry plantations, some Member States manage their forests effectively without chemical pesticide use, and overall pesticide use is very low. Where pesticide treatments are applied to forest plantations, Member States are using both biological and/or chemical pesticides depending on the pest encountered. Newly established plantations may receive pesticide applications in the establishment period of 1-2 years, but generally do not receive further treatment for the life of the plantation (40-60 years for faster maturing species). Very occasionally, pest outbreaks require the treatment of more mature forest plantations. Treatment of the more mature plantations is sometime carried out by aerial application under derogation (Article 9 of the Sustainable Use of Pesticides Directive[211]).

A brief summary of submissions Member States have made is available in Annex 4.

3.2.3 Analysis:

The SUR proposal includes a possibility to derogate from restrictions on pesticide use in sensitive areas in cases where there is a proven serious and exceptional risk of the spread of quarantine pests or invasive alien species and no technically feasible lower risk alternative control technique.[212] Furthermore, as is explained in more detail below in section 3.8, a possible option for the co-legislators to consider would be to include a more general derogation to allow the use of specified pesticides within demarcated areas without the need for individual applications. The Commission believes that these derogation possibilities, coupled with the possibility of using low-risk pesticides or biological control, more than suffice to ensure the protection of forest stands and forest-dependent biodiversity. Indeed, forest stands survived for millennia in the absence of pesticides and will normally regenerate in an area affected by an outbreak (Zeppenfeld et al., 2015). However, it is acknowledged that in some circumstances pesticide use may be necessary, especially during the establishment of a new plantation and in cultivation of Christmas trees or in the production of pest free planting material in forest nurseries. A clarification that forest nurseries and specific cultivation of stands for Christmas tree use could be classified as agriculture would be one way to address this issue. It would allow a greater range of pesticides to be used where such private forest nurseries or Christmas tree stands were located in ecologically sensitive areas. Furthermore, it should be noted that where Member States wish to establish a new plantation, the area of sapling trees can be

[211] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).
[212] Article 18(3) of the SUR proposal.

demarcated from public access and thus excluded from the 'sensitive area' definition under the SUR proposal.

While precise economic impacts of limiting pesticides to low-risk and biological control, as well as those needed to control quarantine pests or invasive alien species, cannot be provided in the absence of pesticide use data at EU or Member State level, it is clear that many Member States successfully implement pesticide use bans or significant restrictions in forest stands.

3.3 Non-productive areas under GAEC 8

3.3.1 Protection aim:

The Commission non-paper on sensitive areas refers to a possible option for the co-legislators to consider allowing only low-risk pesticides or biological control in the areas covered by GAEC 8 and within a 3-metre buffer zone surrounding GAEC 8 areas and elements. The GAEC standards under the CAP aim to contribute, among other things, to the protection and quality of soil and water, and the protection and quality of biodiversity. GAEC 8 aims to improve on-farm biodiversity amongst other aims through a requirement to devote a minimum share of arable land to non-productive features or areas. The main objective of this obligation is the maintenance of non-productive features and areas to protect and improve farmland biodiversity, including birds and pollinators.[213]

The Commission non-paper on sensitive areas refers to a possible option for the co-legislators to consider allowing only low-risk pesticides or biological control in the areas covered by GAEC 8 and within a 3-metre buffer zone surrounding GAEC 8 areas and elements.

A minimum buffer zone for all sensitive areas is envisaged as a matter of prudence, given the ecological and human health importance of the sensitive areas. This restriction will mainly affect the 3-metre buffer zone as many of these areas and features should not be treated with pesticides anyway and such treatment is even prohibited by some Member States. Thus, the protection aim for GAEC 8 areas really relates primarily to the buffer zone rather than the non-productive areas themselves. Regulation (EC) No 1107/2009 of the European Parliament and of the Council can provide for much greater buffer zones as part of the authorisation process for the relevant pesticide.[214] Such buffer zones would be specific to a certain pesticide use and the acceptable risk mitigation measures.

3.3.2 Available data:

GAEC 8 provides for a requirement to devote a minimum share of arable land to non-productive features or areas. Member States can provide different options to farmers for how to comply with this requirement, in particular it can be fulfilled by devoting 4% of arable land

[213] See Ares(2021)7125284 - Working document Conditionality : fact sheets GAEC (Annex III of Regulation (EU) No 2021/2115), November 2021, Expert group direct payments.
[214] See Articles 4(3)(e)(i), 6 and 31(4)(a) of Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).

to non-productive aeras and features[215]. There is an obligation to report on the number of hectares that will be subject to this obligation.[216] This reporting will only start in 2025[217] and therefore the Commission does not yet possess data on the extent of non-productive areas covered in each Member States. Depending on the Member State definition, non-productive areas and features can include:

- *land lying fallow, especially the most valuable land lying fallow with natural or planted green cover (e.g. melliferous plants, wildflowers etc.)*
- *woody features such as hedgerows, individual or groups of trees, rows of trees*
- *field margins, field patches ('islands of biodiversity'), buffer strips, ditches, streams, small ponds, small wetlands, stonewalls, cairns, terraces, cultural features, and other*[218]

The term 'non-productive' means that cultivated areas are excluded, reducing the likelihood of pesticides being applied in these areas. The obligation to focus on 'non-productive areas and features' leads to higher biodiversity benefits compared with the current EFA elements.

As many of these areas and features should in any case not be treated with pesticides, irrespective of the pesticide restriction on sensitive areas, the inclusion of such non-productive areas in the SUR proposal 'sensitive area' definition has a very minimal additional impact on food production, while being of significant relevance for the protection of human health and biodiversity. The requirement mainly aims at using only low-risk pesticides or biological control in the 3-metre buffer zone around the non-productive area to increase the protection of human health and biodiversity.

[215] See the description of GAEC 8 in Annex III to Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013.

[216] Annex IV of Commission Implementing Regulation (EU) 2022/1475 of 6 September 2022 laying down detailed rules for implementation of Regulation (EU) 2021/2115 of the European Parliament and of the Council as regards the evaluation of the CAP Strategic Plans and the provision of information for monitoring and evaluation.

[217] See Article 15 of Commission Implementing Regulation (EU) 2022/1475 of 6 September 2022 laying down detailed rules for implementation of Regulation (EU) 2021/2115 of the European Parliament and of the Council as regards the evaluation of the CAP Strategic Plans and the provision of information for monitoring and evaluation (OJ L 232, 7.9.2022, p. 8).

[218] This is not included in Regulation (EU) 2021/2115 but rather builds on the previous CAP legislation. Member States have to fill in a form (in the SFC IT tool) which provides a structure for the Strategic Plans. These categories are already included in the tool, and Member States tick the corresponding boxes. They may also add additional features. So, Member States are given free choice about the type of landscape features that can be counted. However, this is set out in the CAP Strategic Plan and is therefore also subject to approval. See section 3.1 of Annex I of Commission Implementing Regulation (EU) 2021/2289 of 21 December 2021 laying down rules for the application of Regulation (EU) 2021/2115 of the European Parliament and of the Council on the presentation of the content of the CAP Strategic Plans and on the electronic system for the secure exchange of information (OJ L 458, 22.12.2021, p. 463).

3.3.3 Analysis

The three-meter ‘buffer zone’ would increase the total area on which pesticide use would be restricted. Under Regulation (EU) 2021/2115 of the European Parliament and of the Council[219] (the CAP Strategic Plans Regulation), Member States may exempt farmers with up to 10 hectares of arable land from the obligation to have non-productive areas and features under GAEC 8. Therefore, as the 3-meter buffer zone mainly applies in larger farms the increase of the non-productive area due to the buffer zone will be less relative to the overall size of the farm than it would be for a smaller farm.

A three-meter buffer zone is proposed in order to help to reduce the risk of spray drift of pesticides or of contact of wild fauna with pesticides when these animals temporarily leave the protected area. It could also help prevent the accumulation and spread of pesticides in the soil in the non-productive areas and features under GAEC 8 as pesticide accumulation in soil can contaminate surrounding soil and flora (Mishra et al., 2012; Sharma et al., 2020). This could contribute to the biodiversity function of these non-productive areas. The main objective of GAEC 8 is maintenance of non-productive features and areas to improve the on-farm biodiversity. Landscape features also provide a number of important environmental benefits for soils, water quality and climate change with a major role in the supply of ecosystem services such as natural pest control and soil erosion prevention. These elements also provide broader connectivity corridors and contribute to building ’green infrastructure’ in agricultural areas.[220] The 3-metre buffer zone will help increase the value and quality of the connectivity corridors and will contribute to healthy and resilience soils, again with positive effects for natural pest control and avoidance of soil erosion.

Agricultural production would still be permitted in the buffer zone, unlike in the non-productive areas under GAEC 8. Under the possible options for the co-legislators to consider that are included in the Commission non-paper on sensitive areas, production in the buffer zones would only be constrained by the requirement to use only low-risk pesticides or biological control (or not spraying if the farmer so decides). This is likely not to lead to significant yield losses since the rest of the parcel will be managed without restriction, yields along field margins are in any case usually lower compared with yields in the field interior, and the overall pressure of pests and diseases will remain under the farmer’s control and may even be reduced due to improved natural pest control by providing better protected habitats for natural predators of pests. Eco-schemes or agri-environment-climate schemes could be put in place to support farmers extending the treatment of buffer strips with low-risk pesticides or biological control, or without treatment, to the rest of the parcel.

[219] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013 (OJ L 435, 6.12.2021, p. 1).

[220] See Ares(2021)7125284 - Working document Conditionality : fact sheets GAEC (Annex III of Regulation (EU) No 2021/2115), November 2021, Expert group direct payments, p. 18.

3.4 Urban areas covered by watercourse or water feature, recreational/ bathing water and areas designated for the protection of economically significant aquatic species

3.4.1 Protection Aim:

The Commission non-paper on sensitive areas mentions a possible option for the co-legislators to consider allowing only low-risk pesticides or biological control on these water bodies and within 3-metre buffer zone surrounding them.[221] The aim of protection of these waters is the protection of human health and of the aquatic environment.[222] Directive 2000/60/EC of the European Parliament and of the Council[223] (the Water Framework Directive) and Directive 2006/118/EC of the European Parliament and of the Council[224] (the Groundwater Directive) both set out rules to halt deterioration in the status of EU water bodies and achieve good status for Europe's rivers, lakes and groundwater.[225]

In line with this, Article 6 and Annex IV of the Water Framework Directive oblige Member States to designate protected areas, which should be included in (national) registers of protected areas. These protected areas are included in the SUR proposal 'sensitive area' definition and include areas designated for the protection of economically significant aquatic species and bodies of water designated as recreational waters, including areas designated as bathing waters under Council Directive 76/160/EEC.[226] In addition, the SUR proposal proposes to protect urban areas covered by a watercourse or water feature. These waters correspond to 'surface waters' under the Water Framework Directive and are proposed to be given additional protection because they are found in urban areas.[227]

The protection of surface water is important as it is particularly at risk from the use of pesticides and the area of surface waters that are at risk due to the use of pesticides is continuously increasing. As has been explained by UBA:

> 'This particularly applies to small water bodies in vicinity of agricultural areas. They represent the major part of total flow length and are of particular importance for the

[221] The Commission non-paper on sensitive areas cites an option for the co-legislators to consider of excluding nutrient-sensitive areas, including areas designated as vulnerable zones, and areas designated as sensitive for urban waste-water treatment protected under the Water Framework Directive in order to focus on the areas most relevant for pesticide use restrictions. See pesticides_sud_sur-non-paper_en.pdf (europa.eu).

[222] See recitals 23 and 24 and Article 19 of the SUR proposal. Article 19 of the SUR proposal also prohibits the use of pesticides on all surface waters and within three metres of such waters. The reason for inclusion of certain surface water bodies also under Article 18 is that the Water Framework Directive has two systems for designating water bodies. Under one of those systems, water bodies under a certain size don't need to be designated, so there was a need to capture those smaller water bodies in the 'sensitive area' definition also. In addition, areas designated for the protection of economically significant aquatic species are wider than the water bodies themselves.

[223] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1).

[224] 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 (OJ L 372, 27.12.2006, p. 19).

[225] For further details, see Water Framework Directive (europa.eu) and Article 1 and Annex IV of Directive 2000/60/EC.

[226] Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water (OJ L 31, 5.2.1976, p. 1). See Article 3(16)(f)(i) of the SUR proposal, which refers to any protected area under the Water Framework Directive, Annex IV of which includes such areas and bodies of water as protected areas.

[227] For further details on the protection aim in relation to protecting urban areas, see section 3.1.1 of this chapter.

> natural balance. Pesticides enter natural water bodies mainly intermittently in a dissolved or by a sediment-bound form from adjacent fields through surface runoff after rain events […]. According to estimations by Röttele (2013), 35 % of pesticides enter water bodies diffusely via surface runoff and only 5% via drift. A recently published Germany-wide study […] shows that the concentrations of pesticides are beyond ecologically acceptable thresholds in more than 80 % of the small water bodies within agricultural landscapes after rain events [in Germany]. Similarly, more than 80 % of the investigated water bodies show a reduced proportion of sensitive aquatic organisms such as dragonflies and caddisflies. Thus, pesticides are a crucial stress factor for insects in small water bodies in agricultural landscapes.'[228]

The EEA has reported that Europe is not on track to meet policy objectives on water quality. It predicted a 'red light' warning in its outlook to 2030 based on continuing progress to restrict pesticide use. Regulatory monitoring for European surface water between 2007 and 2017 records exceedances of quality standards of 5–15% by herbicides, 3–8% by insecticides, and negligible exceedances for fungicides. Whereas for groundwater, the exceedances of quality standards were about 7% for herbicides and below 1% for insecticides, whilst also being negligible for fungicides.[229] Aquatic biodiversity is a vital resource and there is an important feedback loop between terrestrial and aquatic ecosystems. Many terrestrial species that directly improve food production also rely on riparian zones (uncropped areas around water bodies).[230]

The EEA database on pesticides in groundwater and on surface waters shows the following important statistics:

1) between **4 and 11% of ground waters** are above the limit value~~s~~ of the Groundwater Directive (**threshold value i.e. 0,1 µg/l** for each individual pesticide);

2) Between **10 to 25% of the surface waters** are above standards laid down in Directive 2008/105/EC of the European Parliament and of the Council[231] (the Environmental Quality Standards Directive) and, in the absence of those, national regulatory standards.[232]

Some pesticides can remain in the environment for years and accumulate in soils and water. Since many synthetic pesticides degrade slowly in the environment, they can lead to contamination of groundwater. These are also responsible for polluting nearby water bodies via rainwater and pesticide run-off (Sharma et al., 2020). Studies have shown that pesticide residues are found in surface water and groundwater. Contamination of water by pesticides is widespread (Aktar et al., 2009).

The protection of economically significant aquatic species, including freshwater fish and shellfish, was included among the areas protected under the Water Framework Directive in order to protect the aquatic environment and for economic reasons. Pesticides can adversely affect non-target organisms, including fish. A 2000-2019 literature review identified several

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[228] See Towards sustainable plant protection | Umweltbundesamt .

[229] pesticides_sud_eval_2022_ia_report.pdf (europa.eu).

[230] pesticides_sud_eval_2022_ia_report.pdf (europa.eu).

[231] Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council (OJ L 348, 24.12.2008, p. 84).

[232] https://www.eea.europa.eu/data-and-maps/figures/percentage-of-reported-monitoring-sites-2/

blood cell and biochemical effects of various herbicides, insecticides, and fungicides in fish. It also noted an adverse effect of pesticides on the immune systems of fish and possible immunosuppression. Pathophysiological changes in fish induced by pesticides depend on many factors, such as active compound and its concentration, exposure duration, fish species, and environmental conditions (Bojarski & Witeska, 2020).

A recent study of concentrations and toxicities of 148 pesticide active substances across the EU estimates that individual substances are generally below no observed effect concentrations (NOEC) for aquatic organisms. However, the cumulative mixture toxicity (calculated by adding individual active substance concentrations divided by the respective NOEC) can exceed 0.1 toxic units for more than 27% of the length of the EU's stream network, and 1 toxic unit for more than 4%. This suggests a relatively widespread risk due to pesticide pollution (Pistocchi et al., 2023).

Pesticide use restrictions for recreational and bathing water and urban areas covered by a watercourse or water feature are primarily aimed at protecting human health but also serves to protect the aquatic environment. Reducing pesticide use, in particular of key insecticides and herbicides, is found to reduce risks to aquatic ecosystems, such as freshwater or marine water ecosystems, and species which are particularly vulnerable to toxic chemicals.[233] Studies have shown that insecticides may be responsible for more than half, and herbicides for more than one-quarter, of acute risks to aquatic life in the EU (Wolfram et al., 2021).

3.4.2 Available data:

Member States are obliged to include identification and mapping of protected areas in their River Basin Management Plans.[234] Table 21 in Annex 2 shows the data the Commission has in relation to areas designated for the protection of economically significant aquatic species and bodies of water designated as recreational waters. Data on bathing water is in the form of points and most of the data on economically significant aquatic species (provided by nine Member States) is in the form of lines representing length in kilometres rather than total area affected so cannot be converted to a percentage of total territory. In the case of the four Member States that have provided data in the form of the percentage of total territory affected by protection of economically significant aquatic species, the territory affected (rounded to the nearest percentage) is 0% or 1%.

Table 22 provides the total territory affected by 'urban area covered by a watercourse or water feature' in each Member State (rounded up to the nearest percentage). The terms 'watercourse or water feature' refer to 'surface water' as defined under the Water Framework Directive. Rounded to the nearest percentage, it affects 0% of total territory in 22 Member States, 1% in

[233] Commission Staff Working Document - 2022-170_part-1 (europa.eu); pesticides_sud_eval_2022_ia_report.pdf (europa.eu).

[234] Under point 3 of Annex VII of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1), River Basin Management Plans must include 'identification and mapping of protected areas as required by Article 6 and Annex IV'.

2 Member States and 2% in 2 Member States. The Member State most affected is the Netherlands, with 7% of its territory affected.[235]

On 27 March 2023, the Commission received representations from the Dutch Organisation for Greenhouse Horticulture (Glastuinbouw Nederland) that the buffer zone of three metres is problematic as some greenhouses in the Netherlands are closer than three metres to surface water. The co-legislators might wish to consider providing for an exemption in relation to certain types of greenhouses that provide a close to zero risk of pesticide run off.

3.4.3 Analysis

The protection of bathing water points and of urban areas covered by a watercourse or water feature covers surface water and a 3-metre buffer zone around it. While there may be some overlap between agricultural areas and the 3-metre buffer zone (for example in the case of a large lake that is designated as a bathing water point), this should have a limited impact. Bathing water points and urban areas covered by a watercourse or water feature will often not coincide with agriculture[236] and data on the latter shows a very low percentage of coverage in most Member States. Even where they do coincide with agriculture, pesticide restrictions will be limited to the 3-metre buffer zones. This is in line with the GAEC 4 standard, which provides that as a general rule, buffer strips along water courses shall respect a minimum width of 3 meters.

Areas designated for the protection of economically significant aquatic species might in theory have a greater impact on agriculture since a Member State might choose to designate much larger areas than the water bodies themselves. The Commission only possesses data from nine Member States in relation to these areas and five of those are in the form of number of lines and overall length of lines, from which it is not possible to gauge the percentage of total Member States territory affected. In the case of the 4 Member States that have provided data on the percentage of territory affected by the designation of these areas, the territory affected, rounded to the nearest whole percentage, amounts to 0% or 1% of the total Member State territory.[237] If this type of coverage is replicated in other Member States, the likely impact on agriculture would be also minimal.

Member States that have identified and mapped the protected areas in relation to economically significant aquatic species in the form of numbers of lines and length of lines may wish to verify the percentage of territory that may be affected by this designation. Member States that have not yet carried out an identification or mapping of such protected areas in line with their obligations under the Water Framework Directive, or that have designated them in the past but wish to amend that designation in updated River Basin Management Plans, might wish to take

[235] The percentages on the total Member States area were calculated using the Eurostat dataset for Member States boundaries available on the GISCO website (Countries 2020, scale 1:1 Million - https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/countries).

[236] The Commission non-paper on sensitive areas identifies a possible option for the co-legislators to consider of removing the agricultural element from the 'discontinuous urban fabric' part of human settlements. See pesticides_sud_sur-non-paper_en.pdf (europa.eu). However, this does not necessarily apply to urban areas covered by a watercourse or water feature, where the term 'urban' can be taken to mean 'local administrative units' (LAU) classified as 'cities' and 'towns and suburbs', according to the Degree of Urbanization (Eurostat, 2018). Therefore there might be some limited overlap between urban areas covered by a watercourse or water feature and agriculture.

[237] See Table 2 in Annex 2.

into account possible pesticide use restrictions that might arise from options presented for the co-legislators to consider in the Commission non-paper on sensitive areas and potential impacts on agriculture, as well as the need to ensure adequate protection of economically significant aquatic species.

In addition, the protection of surface water is of great environmental importance. As noted above, there is evidence that concentrations of pesticides are beyond ecologically acceptable thresholds in between 10% and 25% of surface water bodies and the European Environmental Agency has predicted a 'red light' warning in its outlook to 2030 based on continuing progress to restrict pesticide use.[238] Given the high level of concern in relation to water quality in the medium term and the relatively minor likely impact on agriculture of protecting these areas, it appears prudent to restrict the use of pesticides in these areas to biological control and low-risk pesticides.

Finally, it should be noted that the minimal 3-metre buffer zone proposed under the SUR proposal would help address the issues of point source contamination and drift or surface run-off from use of pesticides in close proximity to water (under three metres) but would not address drift or surface run-off issues from pesticides requiring greater buffer zone distances. However, as noted above, Regulation (EC) No 1107/2009 of the European Parliament and of the Council[239] can provide for much greater buffer zones as part of the authorisation process for the relevant pesticide to avoid contamination of surface water from drift or surface run-off.[240]

3.5 Drinking water protection areas

3.5.1 Protection aim

The Commission non-paper on sensitive areas includes an option for the co-legislators to consider that only low-risk pesticides or biological control would be permitted in these areas and within a 3-metre buffer zone surrounding them. The Water Framework Directive[241] and the Groundwater Directive[242] contain provisions for extra protection of surface- and groundwater bodies used for the abstraction of drinking water. Those are aimed at avoiding a deterioration of quality and at reducing the level of purification treatment required for the production of drinking water. In addition to the general need to protect surface water and aquatic life as set out in section 3.4, there is a specific need to protect drinking water, which can be sourced from groundwater and freshwater surface bodies. Persistent and bioaccumulative substances can be found decades after their ban or end of use. Some substances and many metabolites can last for

[238] For further details, see section 3.4.1 of this chapter.
[239] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (*OJ L 309, 24.11.2009, p. 1).*
[240] See section 3.3.1 of this chapter.
[241] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1).
[242] 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 (OJ L 372, 27.12.2006, p. 19).

decades in some large water tables because there is no degradation below the surface of the ground.[243]

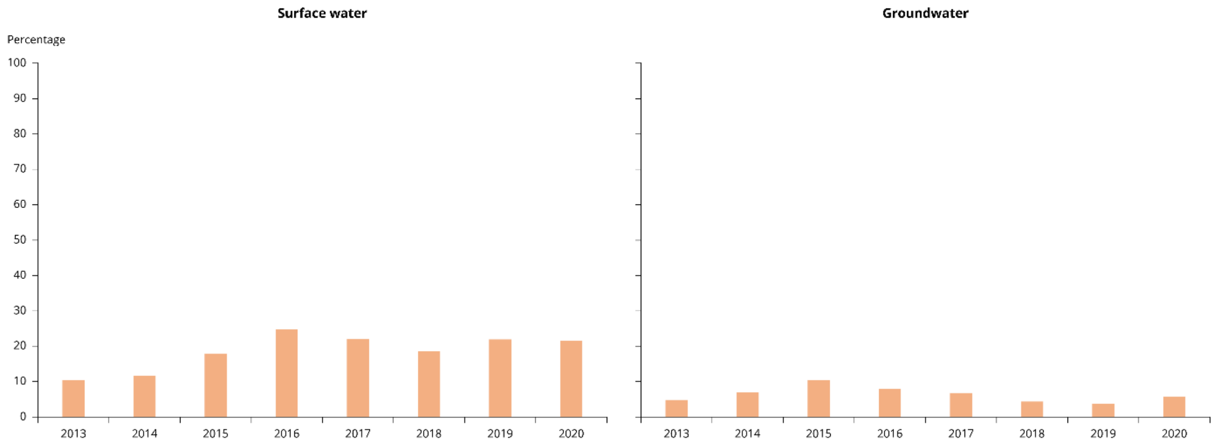
Moreover, there is a high economic cost to the current widespread presence of pesticides and their metabolites in drinking water resources. Many water suppliers must take costly measures to comply with the parametric values of Directive (EU) 2020/2184 of the European Parliament and of the Council[244] (the Drinking Water Directive). These costs are passed on to the water consumer.

Water industry case studies refer to examples of additional activated carbon filtration and ozonation due to pesticides in drinking water resources costing a water processing company EUR 50 M in the period 2018-2020. Another case study examined the case of a UK water operator which found the pesticide metaldehyde in its treated drinking water and failed to meet the limit value for the indicated pesticide threshold under the Drinking Water Directive. Treating the water for metaldehyde would have cost €612.4M, entailing a 21% increase in consumer water bills. As an alternative to treating the water, the company used financial incentives to address the cost barriers to farmers to use an alternative to metaldehyde. This alternative cost €16.6M, 3% of the alternative cost of treating the water. A recent paper claims that various infrastructural, institutional and behavioural ‘pesticide lock-ins’ hamper more effective measures being taken in this area.[245]

The European Federation of National Associations of Water Services (Eureau), has estimated that it could cost several hundred million euro throughout the EU each year to test and clean water from pesticides to achieve concentrations below the maximum residue levels. Despite this, there is currently little transparency on how much is spent or even how many samples are analysed each year in the EU by government authorities and private companies. By way of examples, they note that the most tested pesticide, atrazine, which was banned in the EU since 2004, would cost over €25 million per year, that one large private water supplier in Lower Saxony (Germany) spends about €0.8 million a year and there are tens of thousands of water suppliers in the EU. In France, a total of €360 million is spent every year on the removal of pesticides from drinking water, and consumers spend €137 million per year on bottled water to avoid drinking tap water with pesticide residues.[246]

[243] Eureau, the European Federation of National Associations of Water Services, *Sustainable Use of PPP Regulation Additional EurEau Input on PPP and Drinking Water Resources*, October 2022.
[244] Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (OJ L 435, 23.12.2020, p. 1).
[245] Commission Staff Working Document - 2022-170_part-1 (europa.eu).
[246] Eureau, the European Federation of National Associations of Water Services, *Sustainable Use of PPP Regulation Additional EurEau Input on PPP and Drinking Water Resources*, October 2022.

Figure 8 shows the percentage of reported monitoring sites with pesticides exceeding thresholds in a) surface waters and b) groundwater in Europe, weighted by country area (courtesy of the EEA)[247]



In France, the percentage of the population that was exposed to pesticides that exceeded the limits under the Drinking Water Directive increased from 2,6% (2020) to 6,6% (2021) as regards occasional exceedances and from 3,3% (2020) to 10,8% (2021) as regards recurrent exceedances.[248] In Denmark, it is estimated that the proportion of Danish households potentially exposed at least once to pesticides above the maximum allowed concentration under the Drinking Water Directive was 19% for 2002-2019 and 11% for 2015-2019 (Voutchkova et al., 2021).

In the Czech Republic, of nearly 200 pesticides monitored in 2017, more than 80% were detected at least once at levels above the limits of quantification. It can therefore be assumed that hundreds of pesticides can be present in drinking water, even if only rarely. Based on the routine monitoring data, 96% of findings were below the limit of quantification. A recent study suggests this can be considered over-monitoring as a result of non-targeted monitoring. Public feedback suggested the situation had undermined consumer confidence in drinking water quality (Kotal et al., 2021).

In the Netherlands, a prohibition of professional use of pesticides outside agriculture (with limited exceptions) was justified in the explanatory memorandum accompanying the legislation by reference to reports of the Environmental Planning Bureau showing that banning specific active substances, sustainable weed management measures and legal obligations to minimise pesticides had had limited positive impact on the quality of the aquatic environment and that pesticide use restrictions were therefore necessary.[249]

From both the economic and health perspective, the solution is not to provide most water treatment plants with pesticide removal technologies as it does not address the cause of the problem, it contradicts the polluter-pays principle, and moreover, the existing technologies are not equally effective against all pesticides or may have negative side effects. It is necessary to

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[247] Percentage of reported monitoring sites with pesticides exceeding thresholds in a) surface waters and b) groundwater in Europe, weighted by country area — European Environment Agency (europa.eu)

[248] 2021_bilan_pesticides.pdf (sante.gouv.fr) .

[249] See explanatory memorandum accompanying the Decree of 9 March, https://zoek.officielebekendmakingen.nl/stb-2016-112.htmlSee explanatory memorandum accompanying the Decree of 9 March Staatsblad 2016, 112 | Overheid.nl > Officiële bekendmakingen (officielebekendmakingen.nl) .

adopt effective regulation, direct or indirect, over the use of the most problematic pesticides in the environment in regard to their impact on water sources.

In conclusion, additional treatment appears to be needed for drinking water. This clearly demonstrates the need for pesticide restrictions in water catchment areas, in line with the requirement for preventive measures under Article 8 of the Drinking Water Directive and Article 8 of the Water Framework Directive.

3.5.2 Available data:

The SUR proposal 'sensitive area' definition includes areas designated for the abstraction of water intended for human consumption.[250] The Commission only possesses data in relation to the percentage of territory affected in nine Member States – most Member States do not disclose the data for reasons of confidentiality. In some cases, areas currently designated for abstraction of drinking water under the Water Framework Directive cover up to a 100% of a Member State's territory. However, as explained below, under the recast Drinking Water Directive, Member States are required to define catchment areas for the protection of drinking water abstraction points. This exercise will allow the Member States to designate areas to be protected from pesticides more precisely.

3.5.3 Analysis

Given that in some cases, Member States have designated 100% of their territory as areas designated for abstraction of drinking water under the Water Framework Directive, pesticide use restrictions on such a large extent of territory would have a severe economic impact on agriculture. On that basis, the Commission non-paper on sensitive areas notes the following possible options in relation to drinking water[251]:

1) restricting pesticide use in '"catchment areas for abstraction points of water intended for human consumption' as referred to in Article 8 of the recast Drinking Water Directive that will be identified by 2027[252] rather than in areas designated for the abstraction of drinking water under Article 7 of the Water Framework Directive. Exemptions could be permitted under specific technical conditions[253];
2) Member States could delineate specific sub-sections of the catchment area for abstraction points after carrying out a risk assessment of the catchment area for abstraction points under the Drinking Water Directive and could identify the relevant areas where risk monitoring demonstrates that a particular risk warrants a restriction on use of pesticides;

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[250] Article 3(16)(f)(i) of the SUR proposal, which refers to any protected area under the Water Framework Directive, Annex IV of which includes such areas as protected areas.
[251] See pesticides_sud_sur-non-paper_en.pdf (europa.eu) .
[252] Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption.
[253] Exemptions could be permitted where (i) the use of pesticides and their metabolites is not identified as a risk to human health under the risk assessment of the catchment areas for abstraction points; (ii) the results of the monitoring do not exceed 50 % of the parametric value set out for the parameters 'pesticides' and 'pesticides total', including the results of the monitoring of relevant metabolites of pesticides; and (iii) the concentration of each non-relevant metabolite of pesticide does not exceed 1 μg/l in the raw water.

3) Deletion of the reference to protection of drinking water under the SUR proposal on the basis that it is adequately covered by the Drinking Water Directive and Regulation (EC) No 1107/2009 of the European Parliament and of the Council[254].

Under Option 1, Member States would have control over the extent of designated territory and would designate that territory in the knowledge that the area would be subject to pesticide use restrictions. Such pesticide use restrictions would permit biological control and low-risk pesticides in the overall catchment area for abstraction points. There would also be the possibility to provide for specific exemptions, as outlined in the Commission non-paper on sensitive areas, where certain technical conditions are met.

The advantage of this option is that it would provide for an approach whereby all parts of catchment areas for abstraction points would be treated in a consistent manner. The clear technical conditions described above would be set in the catchment areas, which would be the same across all Member States, thus introducing more harmonisation.

In addition, there would be a requirement to prove that there are no risks to human health before pesticides other than low-risk pesticides or biological control could be used in such areas. Thus, sufficient proof would be required before such pesticides could be used. Furthermore, the technical conditions for exceptions would be tailored in an objective manner to national and even local situations enabling the competent authorities to take targeted measures. It appears that only a few pesticides may account for most of the risk to aquatic life and these pesticides would thus be avoided (van Eerdt et al., 2014; van Klink et al., 2020).[255]

The occurrence of pesticides and their metabolites can vary a lot from Member State to Member State and even within the regions of a Member State. While the risk to human health from drinking water consumption is addressed by limit values defined in the Drinking Water Directive, a (local) risk assessment of the catchment area is a good tool to identify the local human health risks due to how specific pesticides are being used in the relevant area. In option 1, pesticides can be used provided they are not identified as a risk to human health. Under the recast Drinking Water Directive, as a part of the risk assessment, Member States shall ensure that appropriate monitoring is carried out in the catchment areas. The use of these monitoring data (measuring what pesticides/metabolites are actually present in the water sources) in the assessment of the risk they could pose to the quality of water intended for human consumption, and in particular ensuring that the results of the monitoring do not exceed 50 % of the parametric value[256], is an advantage of option 1 with a view to protecting human health.

Under Option 2, Member States could delineate specific sub-sections of the catchment area for abstraction points after carrying out a risk assessment under the Drinking Water Directive.[257] Member States could identify the relevant areas where risk monitoring demonstrates that a particular risk warrants a restriction on the use of pesticides.

An advantage of Option 2 is that it would allow Member States to apply stricter pesticide use restrictions in the areas where they determine there is a greater risk of pollution of surface

[254] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (*OJ L 309, 24.11.2009, p. 1).*

[255] See also IEEP_PANUK2016_RSPB_pesticides_report.pdf.

[256] See point (ii) of footnote 253 above.

[257] Articles 7 and 8 of Directive 2021/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (OJ L 435, 23.12.2020, p. 1).

waters or of groundwater. They would have greater flexibility to pinpoint the precise areas where the greatest risk exists. In addition, there would be less administrative burden for competent authorities in relation to assessing whether the exceptions under Option 1 apply.

A possible disadvantage of Option 2 is that pesticide use restrictions could only apply after specific problems had been identified. The Commission has received representations from the Eureau, that risk assessments will document pollution that has already occurred with no power to enforce source control measures. They argue that this is even more problematic, as it can take up to 10 years for pesticides and their metabolites to arrive in groundwater bodies.[258] As against this, it should be noted that monitoring under the Drinking Water Directive will immediately show where past use of pesticides in the last decade or longer have created the most problems. The properties of soil do not normally change quickly so this should give an accurate picture of where the greatest risks of run-off area. However, it is also true that once problems have been identified and pesticide use restricted in a given area, it may take many years for the soil and water to recover.

Under Option 3, Member States might consider sufficient for the purposes of pesticide use restrictions the obligations under the Drinking Water Directive to define risk management measures. The references in the Drinking Water Directive to ‘preventive measures’ and ‘mitigation measures’ could be interpreted to include such pesticide use restrictions.[259]

A disadvantage of this approach is that it may not lead to adequate protection as there would be no additional protection for drinking water provided by the SUR proposal. In practice, Member States have difficulties to reach the limit values of the Drinking Water Directive for pesticides. Under Option 3, there would be no explicit obligation to provide for pesticide use restrictions and no scope to provide parameters for a more harmonised approach.

Protection of drinking water from pesticides is important for human health and for protecting the good status of water bodies given that persistent and bio-accumulative substances can be found decades after their ban or end of use. There is also a high economic cost that arises from the need to treat water polluted by pesticides. Water suppliers have to take costly measures, with the cost being passed on to the consumer. The cost of treating drinking water has been estimated at several hundred million euro throughout the EU. This suggests a need for proportionate action to reduce contamination at source.

3.6 Other ecologically sensitive areas: Natura 2000 and CDDA

3.6.1 Protection aim

The aim of protecting Natura 2000 and CDDA areas is the preservation of biodiversity. Natura 2000 is a network of core reproductive and resting sites for rare and threatened species. Natura 2000 also protects a wide range of natural and semi-natural habitat types, including grasslands, wetlands, dunes, heathlands, forests, lakes and rivers. Its aim is to ensure the long-term survival

[258] Eureau letter to Commissioner Kyriakides, 15 December 2022.

[259] See Article 8 of Directive 2021/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (OJ L 435, 23.12.2020, p. 1).

of Europe's most valuable and threatened species and habitats, listed under the Birds and Habitats Directives.[260]

The Natura 2000 network is complemented by protected areas for nature conservation at national and regional level, which are reported by Member States to the CDDA, the official source of protected area information for the World Database of Protected Areas (WDPA).[261] Jointly, all protected areas make up a network required for nature protection, and for reaching the targets of the Kunming-Montreal Global Biodiversity Framework,[262] in particular to maintain, enhance, or restore the integrity, connectivity and resilience of all ecosystems.

The Commission non-paper on sensitive areas identifies for the co-legislators a possible option that outside agriculture, only low-risk pesticides or biological control would be permitted in these areas and within a 3-metre buffer zone surrounding them. In agriculture within these areas, Member States may envisage allowing the use of biological control, low-risk and other approved substances as well as all pesticides allowed in organic agriculture while not allowing the use of emergency authorisations of pesticides containing non-approved substances or the use of more hazardous pesticides that are not used in organic agriculture.[263]

There is ample scientific evidence for negative impacts of current pesticide use on biodiversity.[264] While the task and function of protected areas is to protect rare and endangered species and their communities from harmful influences outside the protected areas, many scientific studies show a rapid decline of species even in protected areas. At the same time, populations of valuable species in protected areas are often in an unfavourable conservation status and thus highly vulnerable to additional anthropogenic stress.[265] Insect decline is a global phenomenon (Goulson, 2019; Wagner et al., 2021; Zattara & Aizen, 2021) and pesticide use is listed among the key drivers for pollinator decline, even inside protected areas (Hallmann et al., 2017; IPBES, 2016). In some EU Member States, pesticide application on agricultural land is frequent within Natura 2000 areas, which is expected to impact the environment not only on the applied farmland, but also on adjacent natural habitats. There is evidence that pesticide use on farmland negatively affects biodiversity in neighbouring conservation areas (Köthe et al., 2023). While isolation distances vary greatly, for certain insecticides, isolation distances of several hundred meters are required to prevent unacceptable impacts on non-target arthropods (*EFSA Statement on Risk Mitigation Measures on Cypermethrin*, 2019). There are no reports that such isolation distances are systematically applied, which means that negative impacts on the fauna in nature reserves are likely to be significant in terms of driving the invertebrate declines in Natura 2000 sites and other protected areas in the EU.

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[260] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (*OJ L 20, 26.1.2010, p. 7*); Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (*OJ L 206, 22.7.1992, p. 7*). For further details, see Natura 2000 - Environment - European Commission (europa.eu)

[261] For further details, see Nationally designated areas (CDDA) — European Environment Agency (europa.eu)

[262] The Kunming-Montreal Global Biodiversity Framework was agreed at the 15th meeting of the Conference of Parties to the UN Convention on Biological Diversity in 2022. COP15: Final text of Kunming-Montreal Global Biodiversity Framework | Convention on Biological Diversity (cbd.int)

[263] In addition, the Commission non-paper on sensitive areas cites a possible option for the co-legislators to consider of explicitly removing roads, railways, ports and airports from all parts of the sensitive area definition. See pesticides_sud_sur-non-paper_en.pdf (europa.eu). Such areas are explicitly excluded from human settlements but are not explicitly excluded from Natura 2000 and CDDA areas under the SUR proposal.

[264] See for example EEA briefing: How pesticides impact human health and ecosystems in Europe | Knowledge for policy (europa.eu).

[265] See Towards sustainable plant protection | Umweltbundesamt .

3.6.2 Available data

Natura 2000 areas

Table 23A in Annex 2 provides data on the percentage of territory in Natura 2000 areas in each Member State. This shows that between 9 and 39% of total Member States territory is in Natura 2000. Table 23B in Annex 2 provides data on the percentage of arable land, permanent crops[266], pastures and heterogeneous agriculture[267] affected. Of arable land, which is the most economically significant, between 1% and 25% of arable land is affected.

Nationally designated protected areas inventory (CDDA):

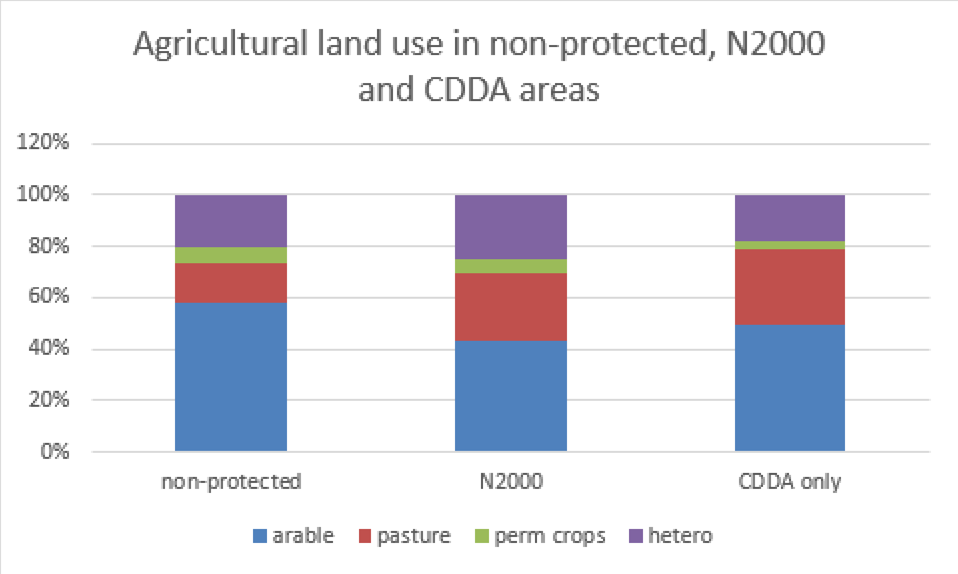
The Commission also possesses data on territories in each Member States affected by the CDDA. Table 24A in Annex 2 provides data on the percentage of territory in CDDA areas in each Member State. This shows that between 1% and 60% of Member State national territory is affected. Table 24B in Annex 2 provides details of the percentage of arable land, permanent crops, pastures and heterogeneous agriculture affected. Of arable land, which is the most economically significant, between 1% and 56% is affected.

While this data is still useful information in understanding the effects of inclusion of the CDDA, it is less directly relevant than the data on Natura 2000, given that the Commission non-paper on sensitive areas describes various options for the co-legislators to consider for limiting or removing the CDDA areas that would be relevant to pesticide use restrictions.

Another point of relevance is that the proportion of land that is arable, and consequently more economically productive, is lower in Natura 2000 and CDDA areas than in areas that are not under protection, as the following graph shows:

[266] Permanent crops are all fruit trees, all citrus fruit trees, all nut trees, all berry plantations, all vineyards, all olive trees and all other permanent crops used for human consumption (e.g. tea) and for other purposes (e.g. Christmas trees). For further information, see [Glossary:Permanent crops - Statistics Explained (europa.eu)](https://ec.europa.eu).

[267] The phrase 'heterogeneous agricultural areas' refers to areas of annual crops associated with permanent crops on the same parcel, annual crops cultivated under forest trees, areas of annual crops, meadows and/or permanent crops which are juxtaposed, landscapes in which crops and pastures are intimately mixed with natural vegetation or natural areas. See Home :: Corine Land Cover classes (copernicus.eu).



Data:

	non-protected	N2000	CDDA only
Arable	58%	43%	49%
Pasture	15%	27%	29%
perm crops	7%	5%	3%
Hetero	20%	25%	18%

('N2000' includes 'N2000 only' and 'CDDA land that is also categorised as N2000'.)

3.6.3 Promotion of agriculture in Natura 2000 and CDDA areas

The application of pesticides on agricultural land within areas designated for nature protection obviously limits the value of this land for biodiversity conservation, and this also affects adjacent non-agricultural land in these protected areas (see review of pesticide impact in section 3.6.1 of this chapter). Nevertheless, since the adoption of the SUR proposal, a number of concerns have been raised by the co-legislators and by stakeholders as regards the continuation of agricultural use in areas protected for habitats and biodiversity in Natura 2000 and CDDA. Several argued that agriculture is part of the management policy that contributes to the meeting of biodiversity objectives, and in some cases the sensitive organisms to be protected are dependent on the maintenance of the agricultural habitat or crop. Feedback further suggested that significant agricultural areas would be affected and showed a preference for prohibiting only the more hazardous pesticides in such areas. Some Member States, including Germany, Austria and Slovenia indicated they had prioritised and promoted organic farming in these areas.

At the same time, there is a balance to be struck between the immediate and longer-term needs of agriculture. The OECD has highlighted the need to 'weigh the risk that measures may be difficult to rescind and may provide limited or marginal assistance with the current pressures, while carrying important longer term environmental costs, in particular for biodiversity'.[268] It is also important to weigh the benefits of food production against externalised costs of agriculture. For example, a recent study from November 2022 in France found that the social costs attributable to synthetic pesticide use in France amounted to EUR 372 million, more than 10% of the annual budget in 2017 of the French Ministry of Agriculture and Food (Alliot et al., 2022). Thus, the Commission has tried to strike a balance by identifying for the co-legislators a possible option that more hazardous pesticides would be prohibited in agriculture in Natura 2000 and CDDA areas.

The Commission non-paper on sensitive areas envisages allowing the use of biological control, low-risk and other approved substances as well as all pesticides allowed in organic agriculture while not allowing the use of emergency authorisations of pesticides containing non-approved substances[269] or the use of more hazardous pesticides that are not used in organic agriculture. Prohibition of both these classes of substances in agriculture in Natura 2000 and CDDA areas would therefore remove those pesticides considered to be most damaging to biodiversity in the longer term. It is considered that this approach, coupled with a more effective application of the IPM provisions as set out in the SUR proposal, could still lead to a more progressive move to chemical pesticides as a last resort. This approach could also better consider the current availability of effective alternatives for agricultural needs. However, under this approach, protected areas will continue to be exposed to a range of pesticides, which may have an impact on biodiversity within these areas.[270]

Copper compounds are the only 'more hazardous' pesticides that are authorised for use in organic agriculture (while being also widely used in conventional agriculture). Research initiatives supported by Horizon Europe are ongoing and have already yielded substantial reductions in the level of copper use by using expert systems to rely on climate and humidity to predict when copper is not needed, by developing resistant cultivars and by developing biological controls. In addition, the quantity of copper permitted in both conventional and organic farming has been reduced to 28kg per hectare over a seven-year period.[271]

[268] Agricultural Policy Monitoring and Evaluation 2022 : Reforming Agricultural Policies for Climate Change Mitigation | Agricultural Policy Monitoring and Evaluation | OECD iLibrary (oecd-ilibrary.org).

[269] Emergency authorisations of pesticides containing approved and non-approved active substances are provided for under Article 53 of Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1). These substances have the highest hazard weighting within the existing Sustainable Use of Pesticides Directive harmonised risk indicator 1 as they have either lost approval due to their hazard properties or no application has been submitted for approval or renewal of approval, which means that their effects on the environment have not been assessed under the latest environmental risk assessment methodology as having no unacceptable effect on the environment. In 2019-2021, the average percentage of emergency authorisations of non-approved active substances accounted for 18% of the relevant emergency authorisations. This is based on COM analysis of the emergency authorisations notified to it, counting any emergency authorisation of use of an active substance that was non-approved at the time the authorisation was granted.

[270] See section 3.1. of Chapter 1 (economic issues) of this study.

[271] Member States should supervise the use of copper in organic farming during annual inspections for certification of organic farming and in related sampling in order to ensure that its use is minimised in line with emerging research and reduction techniques.

3.6.4 Options in relation to the CDDA

The CDDA accounts for around the same amount of territory across the EU as Natura 2000 areas. It also includes a great deal of agriculture and a higher share of arable land (which is of most economic significance for agriculture) than Natura 2000 areas. As with drinking water protection and Natura 2000 areas, the consequence under the options set out in the Commission non-paper on sensitive areas of including certain CDDA areas within ‘sensitive areas’ would be to allow only low-risk pesticides or biological control in non-agricultural parts of those areas. This would be of benefit to the protection of biodiversity in ways that are not sufficiently covered by Natura 2000 alone.

The EU and all of its Member States adopted the Kunming-Montreal Global Biodiversity Framework[272], which sets out a target to ensure by 2030 at least 30 per cent of terrestrial areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures.

The EU Biodiversity Strategy for 2030 sets out a commitment to legally protect a minimum of 30 % of the land (including inland waters), and 30 % of the sea in the EU, of which at least one third should be under strict protection, including all remaining primary and old-growth forests.[273] The Natura 2000 network in its present form alone will not suffice to meet this goal as it covers only 18% of the EU land area.[274] In line with other ecologically sensitive areas, a different balance would be struck in agricultural parts of the CDDA in order also to permit the continuation of agriculture in such areas, as outlined above in section 3.6.3 of this chapter.

Several Member States have reported areas to the CDDA database that are not primarily protected for biodiversity conservation, for example areas of cultural value. These areas are reported by Member States and the classification criteria are not harmonised at EU level. On that basis, the Commission non-paper on sensitive areas provides options for the co-legislators to consider to limit the extent of CDDA territory affected. The Commission non-paper on sensitive areas sets out the following options in relation to the CDDA:

1. Member States might remove areas not directly relevant for biodiversity from the CDDA designation, modifying their CDDA notification on that basis.

2. To make SUR-related reporting a specific reporting field in future CDDA reporting (which is done annually). This would mean that Member States would then be responsible for designating areas relevant for SUR purposes under the CDDA (e.g. areas considered by the Member State as more vulnerable to pesticide use). Those areas that are designated as relevant for SUR purposes would be subject to a restriction on pesticide use (using only low-risk pesticides or biological control, or a greater range of pesticides in agriculture within those areas – see section 3.6.3 of this chapter). Member States would have more flexibility within their existing reporting, but subject to criteria relevant for designating SUR relevant areas for the protection of biodiversity that are not separately covered by the Birds and Habitats Directives.

[272] COP15: Final text of Kunming-Montreal Global Biodiversity Framework | Convention on Biological Diversity (cbd.int)
[273] Biodiversity strategy for 2030 (europa.eu).
[274] Workbook: Protected_Area_with_CLS18 (europa.eu)

3. Exclusion of the CDDA from the sensitive area definition.

The advantage of Option 1 is that it would ensure the widest area of protection of biodiversity through pesticide use restrictions. At the same time, it would avoid restrictions in areas where there is no particular biodiversity-related reason for restriction (such as areas of cultural value). If Member States removed irrelevant areas, Option 1 could provide a wider protection of biodiversity in a harmonised manner.

The advantage of Option 2 is that it would allow Member States a greater degree of control in specifying the areas of the CDDA of most relevance to the SUR proposal pesticide restrictions. Areas that are protected both by the CDDA and by Natura 2000 would have the Natura 2000 default of biological control and low-risk pesticides, with a greater range permitted in agriculture.[275]

The advantage of Option 3 is that it would involve less administrative burden for Member States. The disadvantage is that it would remove from protection certain areas necessary for the protection of biodiversity. As noted above[276], the Natura 2000 network in its present form alone will not suffice to meet this goal as it covers only 18% of the EU land area. Thus, this option would fall behind the requirements to effectively implement the aspirational commitments set out in the EU Biodiversity Strategy and the legally binding commitment adopted by the EU and its Member States under the Kunming-Montreal Global Biodiversity Framework to ensure that a minimum share of 30% of the land area is protected for biodiversity.

3.6.5 Conclusion

Placing stricter restrictions on pesticide use in sensitive areas will allow the overall SUR pesticide reduction targets to be met in a way that maximizes the environmental benefits. A ban on all but low-risk pesticides and biological control will help to protect essential habitats and biodiversity. Permitting the use of a greater range of pesticides in agriculture in those areas will promote agriculture in those areas while also preventing the use of the more hazardous pesticides. In CDDA areas a balance needs to be struck between striving to promote further biodiversity in areas not covered by the Birds and Habitats Directives, whilst not imposing unnecessary restrictions on CDDA areas not relevant to biodiversity protection.

3.7 Areas that sustain European red listed pollinators threatened with extinction

The Commission non-paper on sensitive areas states that the Commission considers the protection of pollinators threatened with extinction as a priority issue. It also states that Member States should consider how pesticide use may negatively affect pollinators in the discussions on the Nature Restoration Law proposal[277]. As regards protection for pollinators under the SUR

[275] See further section 3.6.3 of this chapter above.
[276] See above the third paragraph of this section 3.6.4 of this chapter.
[277] Proposal for a regulation of the European Parliament and of the Council on nature restoration (2022/0195(COD)).

proposal sensitive areas, the co-legislators have raised concerns that the areas to be designated in future under the Natural Restoration Law are not yet known.

The protection of pollinators is essential to biodiversity and food security and has multiple economic benefits. Pollinators are required for at least 35 percent of global human food supply and provide vital ecosystem services to crops and wild plants. Over half of global GDP depends on nature and services provided by pollination. At EU-level, the pollination services provided by bees alone has been estimated to account for 8 to 20 % of the total yield value of pollination dependent crops or 10 billion euro – while this figure does not quantify most of the essential benefits that pollinators provide, such as their contribution to nutrition security and health, or to maintaining ecosystem health and resilience by pollinating wild plants. A diverse community of pollinators, including wild species, generally provides more effective and stable crop pollination than any single species. It is well-established that pesticides contribute to the decline of pollinators.[278]

As is explained in the technical clarifications provided in Annex 6, areas sustaining persistent populations of pollinators threatened with extinction are likely to be small and to not coincide with agriculture, particularly intensive agriculture. Threatened pollinators have very specific habitat requirements to meet essential needs (such as specific host plants, or nesting structures), which are not found in intensively managed farmland. Furthermore, most wild pollinator species move across rather limited ranges. Annex 6 also includes maps showing georeferenced data of recorded sightings of threatened bee species compared with sightings of a common wild bee species. While many exact locations of areas sustaining pollinators threatened by extinction are not yet known, the pollinator monitoring that will take place under Article 8 of the Nature Restoration Law proposal is expected to help in identifying these areas.

3.8 Potential increased risk of introduction and spread of harmful organisms

Article 1(1)(e) of the Council Decision requested the Commission to address the availability of alternatives to plant protection products and the potential increased risk of introduction and spread of harmful organisms in the EU due to the limited availability of alternative means of mitigating that risk. The issue of the availability of alternatives has already been discussed in detail in Chapter 3 (alternatives to chemical pesticides) of this study. This subsection briefly addresses the second part of the question – the potential increased risk of introduction and spread of harmful organisms in the EU due to the limited availability of alternative means of mitigating that risk.

3.8.1 Risk of the introduction and spread of harmful organisms

In principle, the limited availability of alternatives does not influence the introduction of harmful organisms into the EU but is of relevance in relation to the potential increased risk of spread of harmful organisms. Since the green revolution, the agricultural system has moved to an approach to manage pests based on the use of chemical pesticides. The standardization of farming systems with less biodiversity at farm level (monocropping, few rotations, etc.) and landscape level (larger plots, removal of hedges, etc.) increases the risk of pests, leads to the

[278] For further details, see section 3.3 of Chapter 1 (economic issues) of this study.

development of pests' resistance to chemicals and finally is leading to a constant increase in pesticides use, often described as the pesticide treadmill (Hedlund et al. 2020).[279]

As is noted in section 4.4 of Chapter 1 (economic issues) of this study, it has long been recognized that the landscape configuration and composition is closely related to pest spread and therefore also the impact (Bonato et al., 2023; Epanchin-Niell et al., 2010, 2012; Topping et al., 2015). The strong reliance on chemical control, through selective pressure, results in the development of pests' resistance to the applied chemicals, which may lead to an increase in pesticides use or a shift to different active ingredients with the associated mixture effects on the environment (Tang & Maggi, 2021).[280]

While the severity of the impacts is expected to increase, also the availability of alternative solutions to widespread chemical pesticides is also expected to widen.[281] As is described in detail in Chapter 3 (alternatives to chemical pesticides) of this study, a wide of array of Commission policies, including the SUR proposal, are aimed at increasing the availability of alternatives to chemical pesticides. This will help to address the contribution of pesticide dependency and biodiversity loss to increased spread of pests within the EU.

Over 11 000 invasive species have already spread into Europe with the average annual rate of establishment progressively increasing over the last century (Hulme et al., 2009). Estimates by the Commission suggest that these species already cost taxpayers 12.5 billion euro annually. Considering that for almost 90 percent of invasive species information on impact in Europe is missing, this arguably represents a rather conservative estimate (Vilà et al., 2010).[282]

For Europe, the maximum potential impact of 28 EU quarantine pests in terms of the maximum production lost has been quantified. The cumulative impact of these pests only may reach over EUR 25 billion for annual crops, representing around 20% of the total EU production value. There are also non-economic impacts such as reduced food availability (a maximum of 3% of total caloric intake) or impact on trees in streets and city parks.[283]

3.8.2 Impact of the SUR proposal

While the causes of the risk of increased introduction and spread of harmful organisms are much wider than the limited availability of alternatives to chemical pesticides and biodiversity loss, the SUR proposal will help to address these issues. The SUR proposal includes SUR pesticide reduction targets for decreasing the use and risk of chemical pesticides, measures to promote low-risk and biological control in national action plans and measures to strengthen the implementation of IPM. These will contribute to addressing the risk of spread of harmful organisms in ways that avoid a vicious circle through the 'pesticide treadmill' mentioned in section 3.8.1 of this chapter.

The Farm to Fork Strategy[284] aims to increase the availability of alternatives to sustain the toolbox to control harmful organisms as is set out in Chapter 3 (alternatives to chemical

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[279] See also section 4.4 of Chapter 1 (economic issues) of this study and Analysis of main drivers on food security (europa.eu).
[280] See section 4.4 of Chapter 1 (economic issues) of this study.
[281] Analysis of main drivers on food security (europa.eu).
[282] Analysis of main drivers on food security (europa.eu).
[283] Analysis of main drivers on food security (europa.eu) .
[284] Farm to Fork Strategy (europa.eu).

pesticides) of this study. As has also been explained in Chapter 1 (economic issues) of this study, the SUR pesticide reduction targets are designed to provide for flexibility in how they are achieved and permit adequate pest control where needed as a last resort.

Ports, airports and industrial areas are excluded from the SUR proposal sensitive area definition (types of 'artificial surfaces' under 'human settlements') specifically because of industrial treatments including post-harvest pesticide treatment that removes pests in fruits/ grain that is being imported or indeed exported. The Commission non-paper on sensitive areas also clarifies that ports and airports should be excluded from all parts of the definition.

It is clear that there are biological control solutions, coupled with other strategies, for treating certain harmful organisms, such as the box-tree moth in Paris.[285] Where this is not possible, the SUR proposal includes a possibility to derogate from the restrictions on the use of pesticides in sensitive areas where there is a proven serious and exceptional risk of the spread of quarantine pests or invasive alien species and no technically feasible lower risk alternative control technique. Under the Commission non-paper on sensitive areas, a possible option is suggested for the co-legislators to consider of allowing the period of each derogation to last for a full growing season or for 120 days, whichever is the longer. In addition, the co-legislators could allow the possibility to apply for a derogation in relation to pests for which an application for classification as quarantine pests or invasive alien species is pending decision. If an application for classification as quarantine pests or invasive alien species were to fail, the derogation would lapse automatically.

One issue that has been raised by the co-legislators is the compatibility of the SUR proposal with obligations under Regulation (EU) 2016/2031 of the European Parliament and of the Council[286] ('Plant Health Law') to act promptly to eradicate or contain certain prescribed pests in specifically designated areas.[287] The concern is that the SUR proposal derogations for these purposes would be too slow to facilitate this process and furthermore each derogation would have to be applied for to authorities by each individual farmer, which could create a huge administrative burden.

The Commission is fully aware of the issue and has been examining at technical level how best to resolve it. One possible option for the co-legislators to consider would be to allow the use of specified pesticides within demarcated areas without individual applications by farmers in order to reduce the administrative burden of the derogation procedure. The co-legislators might potentially consider providing for a second derogation possibility in cases where a demarcated area is established for eradication or containment in accordance with Article 18(1) or Article 28(2) of the Plant Health Law. In such cases, a competent authority under the Plant Health Law might issue a general derogation permitting professional users to apply pesticides for the purposes of the eradication or containment of any relevant EU quarantine pests, protected zone quarantine pests or pests that are not included in the list of EU quarantine pests but that the Commission considers may fulfil the conditions for inclusion in that list or their vectors within

[285] See section 3.1.3 of this chapter.

[286] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC (OJ L 317 23.11.2016, p. 4).

[287] See Articles 18(1) and 28(2) and Annex II of Regulation (EU) 2016/2031 of the European Parliament and of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC (OJ L 317 23.11.2016, p. 4).

the demarcated area for the duration of the demarcation without the need to apply for an individual permit.

This would resolve any possible differences between the SUR proposal and the Plant Health Law.

3.8.3 Conclusion

In addition to related policies under the Farm to Fork Strategy, the SUR proposal will help to address biodiversity loss and the limited availability of alternatives to chemical pesticides, both of which are among the causes of the risk of increased introduction and spread of harmful organisms.

Ports, airports and industrial areas are excluded from the SUR proposal sensitive area definition specifically because of industrial treatments including post-harvest pesticide treatment that removes pests in fruits/ grain that is being imported or indeed exported. Where low-risk or biological control solutions are not possible in sensitive areas, the SUR proposal includes a possibility to derogate from sensitive area restrictions in order to tackle the risk of the spread of quarantine pests or invasive alien species. This might be further expanded to permit general derogations in cases where a demarcated area is established for eradication or containment under the Plant Health Law, which would resolve any possible differences between the SUR proposal and the Plant Health Law.

ANNEX 2: DATA ON SENSITIVE AREA COVERAGE IN MEMBER STATES

It should be noted that in all tables, the 3-metre buffer zone is not included in the calculations

Table 20a: human settlements

Member State	% of Member State area as human settlements
Austria	5
Belgium	18
Bulgaria	4
Croatia	3
Cyprus	7
Czechia	5
Denmark	7
Estonia	1
Finland	1
France	4
Germany	7
Greece	2
Hungary	5
Ireland	2
Italy	4
Latvia	1
Lithuania	3
Luxembourg	8
Malta	24
Netherlands	11
Poland	5
Portugal	3
Romania	5
Slovakia	5
Slovenia	3
Spain	2
Sweden	1

Table 20b: Continuous and discontinuous urban fabric

Member State	% of Member State area as continuous urban fabric	% of Member State area as discontinuous urban fabric
Austria	0	5
Belgium	0	17
Bulgaria	0	3
Croatia	0	3
Cyprus	0	6
Czechia	0	5
Denmark	0	5
Estonia	0	1
Finland	0	1
France	0	4
Germany	0	7
Greece	0	2
Hungary	0	5
Ireland	0	2
Italy	1	3
Latvia	0	1
Lithuania	0	2
Luxembourg	0	8
Malta	1	21
Netherlands	0	9
Poland	0	5
Portugal	0	2
Romania	0	5
Slovakia	0	5
Slovenia	0	2
Spain	0	1
Sweden	0	1

Table 20c: Green urban areas and sports and leisure facilities

Member State	% of Member State area as green urban areas	% of Member State area as sports and leisure facilities
Austria	0	0
Belgium	0	1
Bulgaria	0	0
Croatia	0	0
Cyprus	0	1
Czechia	0	0
Denmark	0	2
Estonia	0	0
Finland	0	0
France	0	0
Germany	0	0
Greece	0	0
Hungary	0	0
Ireland	0	0
Italy	0	0
Latvia	0	0
Lithuania	0	0
Luxembourg	0	0
Malta	1	1
Netherlands	0	1
Poland	0	0
Portugal	0	0
Romania	0	0
Slovakia	0	0
Slovenia	0	0
Spain	0	0
Sweden	0	0

Table 21: bathing water points and economically significant aquatic species[288]

Member State	Bathing water points	Economically significant aquatic species (freshwater fish) - % of total territory	Economically significant aquatic species (freshwater fish) -number of lines	Economically significant aquatic species (freshwater fish) -length of lines (km, rounded to nearest km)
Austria	256			
Belgium	78			
Bulgaria	61	1	94	3368
Croatia	74	0	33	1896
Cyprus	73			
Czechia	155			
Denmark	530			
Estonia	35		111	2297
Finland	222			
France	2253			
Germany	2148		168	4318
Greece	1683		13	205
Hungary	199		7	236
Ireland	24		34	1210
Italy	1290	0	266	3426
Latvia	33	1	100	4431
Lithuania	108			
Luxembourg	17			
Malta	52			
Netherlands	653			
Poland	601			
Portugal	359			
Romania	22			
Slovakia	32			
Slovenia	23			
Spain	1271			
Sweden	254			

[288] As is noted in section 3.4.3 of this chapter, the Commission only possesses data from nine Member States in relation to economically significant aquatic species and five of those are in the form of number of lines and overall length of lines, from which it is not possible to gauge the percentage of total Member States territory affected.

Table 22: urban areas covered by a watercourse or water feature

The SUR proposal includes urban areas covered by a watercourse or water feature in the 'sensitive area' definition.[289] For these purposes, the term 'urban' can be taken to mean 'local administrative units' (LAU) classified as 'cities' and 'towns and suburbs', according to the Degree of Urbanization (Eurostat, 2018).[290] The terms 'watercourse or water feature' refer to 'surface water' as defined under the Water Framework Directive.[291]

Member State	% of Member State area as urban area covered by watercourse/ water feature
Austria	0
Belgium	1
Bulgaria	0
Croatia	0
Cyprus	0
Czechia	0
Denmark	0
Estonia	0
Finland	3
France	0
Germany	1
Greece	0
Hungary	1
Ireland	0
Italy	0
Latvia	0
Lithuania	0
Luxembourg	0
Malta	0
Netherlands	7
Poland	0
Portugal	0
Romania	0
Slovakia	0
Slovenia	0

[289] Article 3(16)(d) of the SUR proposal.
[290] The Degree of urbanisation data is based on the 2011 GEOSTAT Population Grid and Eurostat calculations without validation and refinements from the Member States.

[291] Article 2(1) of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1) defines 'surface water' as inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters.

Spain	0
Sweden	3

Table 23a: percentage of territory in Natura 2000 areas in each Member State

For calculation of total % of territory, the EEA uses the indicator on terrestrial protected areas. These values are aligned with the official Natura 2000 coverage in percentage by Member States as published in the Natura 2000 barometer.

Member State	% of Member State area in Nat 2000
Austria	16
Belgium	15
Bulgaria	36
Croatia	38
Cyprus	18
Czechia	15
Denmark	9
Estonia	19
Finland	13
France	14
Germany	16
Greece	28
Hungary	23
Ireland	15
Italy	20
Latvia	12
Lithuania	13
Luxembourg	27
Malta	14
Netherlands	15
Poland	20
Portugal	21
Romania	24
Slovakia	31
Slovenia	39
Spain	28
Sweden	14

Table 23b: percentage of arable land, permanent crops, pastures and heterogeneous agriculture affected by Natura 2000 in each Member State

Member State	% of arable land affected by Natura 2000	% of permanent crops affected by Natura 2000	% of pastures affected by Natura 2000	% of Hetero Agri affected by Natura 2000
Austria	10	32	6	13
Belgium	4	3	14	11
Bulgaria	15	17	35	33
Croatia	12	36	41	24
Cyprus	4	9	9	9
Czechia	2	8	16	13
Denmark	4	3	35	8
Estonia	1	0	6	10
Finland	1	0	47	1
France	6	8	12	8
Germany	7	14	18	15
Greece	17	9	23	15
Hungary	10	8	39	11
Ireland	2	0	4	13
Italy	8	5	18	9
Latvia	3	15	11	9
Lithuania	3	2	10	8
Luxembourg	11	13	29	27
Malta	0	0	0	9
Netherlands	1	0	5	2
Poland	7	2	31	13
Portugal	25	12	20	16
Romania	9	6	24	13
Slovakia	14	9	29	20
Slovenia	16	14	29	24
Spain	14	8	20	20
Sweden	1	0	17	3

Table 24a: percentage of territory in the CDDA in each Member State

For calculation of total % of territory, the EEA uses the indicator on terrestrial protected areas. These values are aligned with the official Natura 2000 coverage in percentage by Member States as published in the Natura 2000 barometer.

Member State	% of Member State area in CDDA
Austria	26
Belgium	6
Bulgaria	15
Croatia	13
Cyprus	35
Czechia	18
Denmark	19
Estonia	23
Finland	11
France	20
Germany	33
Greece	18
Hungary	9
Ireland	1
Italy	10
Latvia	19
Lithuania	16
Luxembourg	60
Malta	35
Netherlands	33
Poland	33
Portugal	9
Romania	5
Slovakia	24
Slovenia	41
Spain	15
Sweden	17

Table 24b: percentage of arable land, permanent crops, pastures and heterogeneous agriculture affected by the CDDA in each Member State

Member State	% of arable land affected by CDDA	% of permanent crops affected by CDDA	% of pastures affected by CDDA	% of Hetero Agri affected by CDDA
Austria	6	26	18	13
Belgium	2	2	4	6
Bulgaria	12	11	11	9
Croatia	4	4	10	6
Cyprus	7	42	27	40
Czechia	5	12	22	18
Denmark	10	8	60	38
Estonia	3	0	7	12
Finland	0	0	34	1
France	9	14	20	15
Germany	21	31	38	40
Greece	14	4	13	11
Hungary	2	4	6	4
Ireland	0	0	0	0
Italy	3	4	9	4
Latvia	11	24	15	14
Lithuania	5	6	13	13
Luxembourg	56	19	60	60
Malta	12	40	0	30
Netherlands	10	7	19	26
Poland	20	20	36	35
Portugal	7	6	8	6
Romania	1	1	4	3
Slovakia	4	3	28	17
Slovenia	17	23	30	26
Spain	3	5	12	11
Sweden	2	0	22	6

ANNEX 3: EXAMPLES OF MEMBER STATE INITIATIVES TO RESTRICT PESTICIDES IN URBAN AND PUBLIC AREAS AT NATIONAL AND REGIONAL LEVEL

Section 1: Examples of Member State restrictions on pesticide use in urban and public areas[292]

Austria:

Control on the use of pesticides is the responsibility of individual federal states and is regulated accordingly. Carinthia allows only low-risk pesticides in outdoor areas around hospitals, nursing homes, schools, nurseries, kindergartens, children's playgrounds, publicly accessible parks/gardens and publicly accessible sports/leisure grounds. There are some exceptions allowed. Tyrol has in place a complete prohibition of pesticide use around hospitals and convalescent homes, nursing homes, health care facilities, schools, nursery schools and kindergartens as well as other facilities for the care of children and publicly accessible playgrounds. In addition, there is a 2-5m buffer around such areas with the use of drift mitigation measure also required in instances with exceptions possible. Burgenland has a prohibition on glyphosate use in many municipalities. Vienna allows certain pesticides to be used as per principles of IPM in grounds of kindergartens, hospitals and areas open to the public. Such pesticide use should be notified to the authorities within 5 days of the use, accompanied by some details of location, user, date and the pesticide being used and enclosing the professional user’s training certificate. There is a general prohibition on pesticide use in Vorarlberg in a range of areas including areas accessible to the public, children's playgrounds, parks, gardens and sports facilities, grounds of hospitals, care facilities, schools, kindergartens, and other facilities for the care of children. Exceptions are possible.

Belgium:

Conditions linked to the sale and use of pesticides are at federal level in Belgium. In Flanders, public services have been prohibited from using pesticides since 1 January 2015 except under strict conditions. Areas subject to the prohibition include schools, hospitals, childcare and healthcare institutions. In private sports and recreational areas, there are obligations to decrease pesticides, use non-chemical alternatives where possible and take pesticide-free management into account in the design of sites. Since June 2019, it has been prohibited to use pesticides in public spaces or in areas frequented by vulnerable groups in Wallonia. In the Brussels Capital region, the use of pesticides in certain areas used by the general public or by vulnerable groups such as play areas, areas for consumption of drinks and food and healthcare facilities is prohibited. Special exemptions are available for reasons of public health and safety, nature or heritage conservation or in cases of invasive alien species.

[292] Most of the information in this section comes from Member State responses to a Commission request to the Council Working Party for information on restrictions on the use of pesticides in public and urban areas.

Bulgaria

There is a general prohibition in place regarding the use of professional use pesticides in areas used by general public or vulnerable groups, such as public parks and gardens, sports grounds, children's playgrounds and health or medical facilities. If a need arises to treat such an area, it is possible to use a pesticide for non-professional use or a pesticide which is low-risk or biological in nature.

Croatia

A new Act on Sustainable Use of Pesticides came into force in 2022 which places some restrictions on pesticide use in certain specific areas. Consequently, only low-risk pesticides may be used after conducting a risk assessment, in areas such as public green areas, public gardens and parks, sports and recreational fields, school and children's playgrounds, areas in the immediate vicinity of health facilities, special reserves and national parks. However, other pesticides may be used to control invasive or alien species in these areas.

Cyprus

The national action plan sets out restrictions relating to the use pesticides in areas used by the general public and in urban settings at the national, regional or municipal level.

Pesticides classified as toxic, very toxic, carcinogenic, mutagenic or toxic for reproduction cannot be used in areas used by the public or by vulnerable groups (e.g. public parks, gardens, picnic/camping areas, recreational facilities, schools, playgrounds). Use of low-risk pesticides, biological pesticides and non-chemical alternatives can be used in these areas. If there is a need to apply other pesticides (excluding those listed as prohibited above, which are always prohibited) in these areas, this can only be done with the written and signed opinion of a certified advisor, who must also propose risk mitigation measures to protect human health. Access to the treated area should be restricted in accordance with any required safety interval.

Czech Republic

Czech law restricts the use of pesticides in certain areas. Restrictions placed on certain pesticides come directly from the risk assessments performed during the pesticide authorisation process and it is on this basis that a decision is made as to whether the specific pesticide can be used in areas visited by the general public. Protective set-back distances and buffer zones are also assigned during this process and requirements are laid down as to information to be provided to the public.

Denmark

The use of pesticides is limited in certain areas and on certain surfaces used by the general public. On grass areas accessible to the public, only low-risk pesticides authorized specifically for those areas are allowed. Similarly, only pesticides specifically authorized for use on golf courses are allowed on golf courses. Pesticide use on sealed surfaces and very permeable surfaces is restricted to pesticides that degrade quickly. Exemptions are allowed for, on or around airports, railways, highways using certain crash barriers, and protected cultural heritage sites. The use of toxic and very toxic pesticides may not be used in private gardens, on outside areas with public access or for treatment of plants situated on the boundary of private gardens or public roads.

There are strict laws relating to possession, use and sale of pesticides which are not allowed for use on certain areas.

Estonia

The use of pesticides in public places and in areas used by vulnerable groups is allowed by professional users only. Low-risk substances and biological control methods should be preferred, and the users must follow the principles of IPM. At municipal level Tallinn is a member of the European Pesticide Free Towns Network and there now exists the Tallinn Pesticide Reduction Action Plan. In addition, the second biggest city of Estonia, Tartu, is prescribing in the current landscape management procurement that mechanical weed control should be used and that any chemical treatment requires a special permit.

Finland

Restrictions on pesticide use are prescribed in the individual pesticide authorisation. However, the use of glyphosate is prohibited in paved areas, children's playgrounds or in school or day-care settings. When applying pesticides in public areas, particular care must be taken of the safety of humans and animals. Glyphosate use in forestry is restricted in areas with wild berries or mushrooms. In such areas, the treated area must be marked with tape with signs stating the treatment date, name of pesticide applied, the contact information of the person responsible for the spraying and also there must be a sign with the following text 'Berry and mushroom picking is prohibited from the date of treatment until the end of the year'. Also, in areas with wild raspberries, treatment can only occur before the ripening phase of the fruit. For certain herbicides there is a requirement to designate the treated area with varying product-specific requirements.

France:

The 'Labbée' law came into force in 2017 and regulates the use of pesticides in certain specific areas. Only biological control, low-risk pesticides or pesticides used in organic production can be used in the maintenance by public authorities of green spaces, forests, walks and roads accessible or open to the public (except for safety reasons). From July 2022 restrictions have been extended to other living areas such as private/public parks and gardens, vegetated areas, hotel grounds, campsites, cemeteries, educational and health establishments, sports facilities and a whole plethora of other areas. There are areas excluded such as railways, airports and roads not open to the public but also these provisions do not apply where the control of a quarantine or invasive pests are concerned, or where the survival of historical or heritage areas is at risk. Pesticide marketing authorisations contain provisions on 'no treatment zones' around areas used by vulnerable people, residential areas etc. and these can extend up to 20m.

Germany:

In Germany, the application of pesticides is prohibited a) on paved areas (e.g. roadsides, pavements, paved squares) and b) on all open areas not used for agriculture, forestry or horticulture/gardening. The competent authority may allow derogations, for example to control invasive harmful organisms. In addition, for areas used by the general public, only pesticides for which the suitability for application on these areas within the scope of the authorisation has been assessed are permitted. Areas intended for the general public include public parks and gardens, green spaces in publicly accessible buildings, publicly accessible sports grounds including golf courses, school and kindergarten grounds, playgrounds, cemeteries and areas in the immediate neighbourhood of health care facilities. Only competent users may use pesticides on areas that are intended for the general public. These include, for example, publicly accessible parks and gardens, cemeteries, sports, school and kindergarten grounds, outdoor swimming pools or golf courses. In the house and small garden sectors, pesticides may only be used if they are authorised for use by non-professional users or if they are only authorised for professional use if the use is specifically authorised in the home garden area.

Many German towns and local community in the initiative ‘Pesticide Free Communities’ (*Pestizidfreie Kommunen*) have committed themselves to avoiding the use of chemical pesticides either completely or to the greatest extent possible (Frische et al., 2018). More than 550 German cities and municipalities have so far decided to manage their urban greenery partially or completely without pesticides. These include large cities such as Hanover, Leipzig, Dresden and Munich, but also whole rural districts. Some municipalities are phasing out a specific active ingredient or group of active ingredients. Other municipalities have already completely cut the use of pesticides. Some cities, such as Saarbrücken, Celle, Bielefeld and Tübingen, have been managing their green areas without pesticides for more than 20 years.[293]

Greece

Measures to reduce the use or risk of pesticides areas used by vulnerable groups of the population are in place and involve using biological control measures and low-risk pesticides as a priority and establishing minimum set back distances from the spraying area.

Hungary:

Only pesticides belonging to certain categories may be used in accordance with the permit document in public areas, in built-up areas, in recreational areas, including railway tracks passing through such areas, in areas serving community purposes (e.g., educational, health, social and religious institutions), in home gardens and in public areas.

A pesticide authorised for use in public spaces and in areas serving Community purposes may be applied under the direction of a specialist manager who is a member of the Hungarian Chamber of Plant Protection Engineers and Plant Medicine and there is a requirement to notify the population concerned.

[293] Pesticide-free regions: good examples | Heinrich Böll Stiftung | Brussels office - European Union (boell.org); Pestizidfreie Kommune | Umweltbundesamt.

Ireland:

National legislation provides for restricted use of pesticides in certain designated areas. These areas include areas used by the general public or vulnerable groups (public parks, hospitals, public schools, public playgrounds etc.). Pesticides can only be used in these areas under strictly controlled conditions and only where deemed absolutely necessary and requires a full risk assessment to be carried out before using pesticides in any of the listed areas. Guidance documents on 'Best Practice' and 'Responsible Pesticide Use' in all public areas have been produced on a national government website.

Italy:

The national action plan forms the basis for all the measures related to pesticide use in areas used by the general public. The national action plan allows the Regions and Autonomous Provinces to prepare guidelines on the use of pesticides in urban green areas and/or areas for use by the public.

Areas used by the general public or by vulnerable groups include urban green areas, public use areas, public parks and gardens, sports fields, recreational areas, yards and green areas within and next to schools, children's playgrounds, areas next to healthcare facilities, cycling paths, heritage and landscape attractions and associated grounds, archaeological sites and cemeteries.

If pesticide application must take place in such areas, the general public must be notified by signs indicating the active substance used, the spraying date and the re-entry restrictions. Where no re-entry period is indicated in areas used by vulnerable groups the re-entry period shall not be less than 48 hours. The pesticides used must not have re-entry periods of more than 48 hours. Access to these areas is prevented and where possible, applications are made at times of the day when inconvenience for the public is minimised.

Certain pesticides with particular classifications may not be applied to agricultural land within 30 m of the above recreational and public areas.

In urban areas, the local authorities responsible for weed management shall determine the areas where chemical weeding is prohibited and the areas where herbicides may be used only as part of an IPM approach combining non-chemical methods, based on a multi-annual management plan. In relation to fungicides, insecticides or acaricides, priority is to be given to low-risk pesticides and biological control and more hazardous pesticides are prohibited. The Regions and Autonomous Provinces are obliged to adopt technical specifications regarding applications in areas used by the general public or by vulnerable groups.

A revised national action plan, yet to be adopted, allows for more defined distances of between 15m and 50m depending on the classification of the pesticide concerned and the risk posed.

In the City of Venezia, the city management has not used synthetic pesticides in the maintenance of public surfaces for last 3 years, with the exception of cemeteries. In relation to management of weeds on public land, 5 operations are carried out annually, of which 3 are carried out with acetic acid and 2 are carried out using mechanical measures, mainly scraping and cutting off. Starting from 2023, the use of synthetic pesticides is prohibited also on cemeteries.

Luxembourg:

Luxembourg has had a ban on using pesticides in public spaces since 2016 under Article 11(3) of the national law on pesticides. Public spaces, as defined by Article 1(10) of the same law, include public paths, roads, sidewalks, as well as spaces accessible to the general public such as public parks, playgrounds, schools or cemeteries. Derogations are possible but none have been granted so far.

Malta:

In general pesticide use is prohibited or severely restricted in areas used by the general public or by vulnerable groups, such as public parks and gardens, sports and recreation grounds, school grounds, playgrounds, paved areas in civil areas, cemeteries, child-care centres and in the close vicinity of healthcare facilities. In addition, the use of pesticides containing the active substance 'metaldehyde' can only be sold by certified distributors and purchased by professional users, even if the product is in the ready to use form.

The Netherlands:

In the Netherlands, professional use of pesticides outside agriculture is not permitted. However, exemptions are possible if it can be demonstrated that use of pesticides is necessary a) to combat quarantine organisms, invasive alien species, or plants or their products that are a threat for human health b) for a safe exploitation of corporate activities and establishments c) for the practice of sports in areas that cannot be exploited and maintained otherwise. In 2018, the Central Statistics Office in the Netherlands reported that Dutch public authorities were using about 82% less pesticides than 5 years earlier. Most of the pesticides used (69%) were used to keep railway tracks and marshalling yards free of weeds.

Both municipalities and companies must comply with the ban. Site management is usually carried out by contractors, on behalf of municipalities or companies. Contractors prefer to use one technique, rather than using both chemical and non-chemical techniques. Because most municipalities ask for non-chemical management, contractors prefer to manage all areas with non-chemical techniques.

The explanatory memorandum that accompanied the initial publication of the prohibition in the State Journal explained that the reason for this change is the protection of human health and the quality of surface water against avoidable use of pesticides. The exceptions are kept under review. For example, an evaluation in 2019 of the specific exceptions as regards use of pesticides necessary for the protection of human health, animals and the environment found that 14 exceptions (species) could be dealt with in a chemically free manner and should therefore be removed from the list of exceptions. It further recommended that further practical investigations be carried out for the remaining species in order to decide whether to maintain or include them on the list of exceptions.

Poland:

There is a general prohibition in using pesticides classified as hazardous to human health in areas such as playgrounds, nurseries, kindergartens, primary schools, hospitals, or spa protection areas. However, a provincial inspector may authorise the use of other pesticides if certain situations arise, for example where there is a quarantine pest, a threat to nature conservation, a risk to human health or organisms whose eradication by non-chemical methods is considered economically unjustified or ineffective.

Portugal:

In Portugal national legal provisions permit additional risk reduction measures for the protection of vulnerable groups of the population from exposure to pesticides used in non-agricultural areas such as public parks, gardens, recreation/ sports grounds, public paths and close to public schools, health care and elderly care institutions (hospitals, day care centres). Use of pesticides in these settings is not permitted except under derogation in special circumstances. i.e., emergency measures due to plant health or quarantine pest issues, or where no alternative control methods (mechanical, biological, biotechnical) are available and where it is possible to minimize the exposure from the application. Derogations are subject to authorization from the Competent Authority.

Romania:

The use of pesticides in certain specific areas is prohibited or minimized, taking into account the necessary public hygiene, public health and biodiversity protection requirements, and considering the results of relevant risk assessments. These areas include areas used by the public or vulnerable groups such as parks, public gardens, sports and recreation grounds, school yards, playgrounds and the immediate vicinity of public health institutions. Risk management measures include prioritising the use of low-risk and biological active substances.

Slovenia:

Only non-chemical methods are permitted to be used for pest or weed control in public areas. However, the use of pesticides on some public areas (not school or children's playgrounds) may be allowed subject to conditions. In such cases, the provision of information (name of pesticide, method of application, date and estimated time and area of treatment) to the public about the intended pesticide treatment is compulsory at least 24 hours in advance. In addition, the public are prevented from accessing such areas, signs are put in place and the more appropriate time for treatment is chosen. Buffer zones around the treatment location and facilities where the pesticide use is not allowed are also used. Pesticides may not be used for weed control on public areas and such areas include golf courses, sports fields and roads. However, limited treatment along railways and highways may occur.

Spain:

The use of pesticides in non-agricultural areas is restricted to pesticides with a favourable toxicological and environmental profile and use in certain areas requires prior authorisation. Professional users treating non-agricultural areas are required to prevent access by the general public both during and for a period after the treatment and during a period when public access is less likely. Where such an area is used by 'vulnerable' groups, the person in charge of that area is allowed 48 hours' notice where they can propose an alternative date or time. Only pesticides authorised for the particular use are permitted. The Ministry of Agriculture, Fisheries and Food (MAPA) has prepared and published two guides for IPM applicable to non-agricultural areas.

In Spain, the autonomous community of La Rioja enacted legislation on 31 January 2023 providing that the treatment of green areas, urban trees and tree pits by local entities or any other public Administration of La Rioja must be carried out in a priority way avoiding phytosanitary products and herbicides of chemical and industrial origin and prohibiting the use of glyphosate in the treatment of urban green infrastructure.[294]

Sweden:

In Sweden, there has been a ban since 2021 on the use of pesticides in schoolyards, courtyards of preschools or in playgrounds to which the public has access, in recreational areas, primarily intended for recreation, such as parks and gardens, in allotment garden areas or in greenhouses used for non-professional purposes, on land for residential buildings and in private gardens and on plants indoors, except in production premises, warehouses and similar places. The Swedish Chemicals Agency may decide on exemptions from the ban and has exempted low-risk pesticides and substances that are considered to pose only limited risk to human health and the environment. A permit is required for certain uses of pesticides in certain areas including publicly accessible parks and gardens (mostly commercial gardens) and sports and leisure facilities. There is a notification requirement for use of pesticides in certain areas, including publicly accessible areas exceeding 1,000 square metres that are not covered by other restrictions. Exemptions also apply in the case of permits or of the notification requirement. There is also an obligation to inform the general public, if the use of pesticides is intended to be spread in areas where the public may move freely, with the exception of arable land.

[294] Article 14(2) of Ley 2/2023, de 31 de enero, de biodiversidad y patrimonio natural de La Rioja, Anuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La RiojaAnuncio del boletín oficial de La Rioja

Section 2: Case studies of pesticide use restrictions in specific cities[295]

Paris:

In 2022, the Department of Green Spaces and Environment in Paris managed a large number of green spaces, includes 531 gardens and green parks (454 hectares), 20 cemeteries, 2 large woods (around 2,000 hectares), green roofs and green walls (131 hectares) and urban agriculture (33 hectares). There are 7 sectors in the Paris green spaces ‘zéro phyto’ strategy: green parks and gardens, vines, cemeteries, a horticultural school, woods, trees and orchards, a botanical garden and horticultural production centres. These sectors operate with an annual work plan that consolidates the experiences of each sector and includes continuous on-site visits and experience sharing.[296]

The objectives of the strategy in Paris are to assert a strong environmentally friendly approach, anticipate national legislation and work towards ‘total’ zero pesticides, including non-chemical pesticides. A number of measures taken in the city pre-dated the national legislation (the ‘Labbé Law’). For example, there have been herbicide-free cemeteries since 2015. The first insect larvae releases instead of insecticides occurred in City of Paris greenhouses in the 1990s. From the 2000s, differentiated management in urban parks and gardens began. This allowed for a different type of management depending on the areas and the access to the public within each park. In addition to creating safe havens for beneficial insects and birds, this also led to a reduced need for pesticides.[297]

Prior to the start of the ‘Zero Phyto Paris’ strategy in 2014, the city of Paris had relied on ISO certification processes and labels as benchmarks for its work. For example, it created its own ‘eco-friendly management’ label (‘Gestion Ecologique’) unique to the city of Paris to promote green space sustainable management with no use of chemical pesticides. In 2012, the national EcoJardin label was applied to Parisian green spaces. Currently, over 90% of the City of Paris green spaces have the EcoJardin Label, which goes beyond national requirements as it bans all products classified as hazardous (for the environment, for health, etc.).[298]

The city of Paris uses a number of alternatives to herbicides for weed control: mulching, groundcovers, greened cobblestones, hand weeding, mechanical weeding, thermal weeding, grazing. 422 hectares of Parisian cemeteries (inside and outside Paris territory) have been managed without any chemical pesticides since 2015. This was a particularly sensitive change as there was public unease with the change of aesthetics. Therefore, the city used an awareness-raising campaign, for example with a photo exhibition on biodiversity found in cemeteries. The city also manages orchards without the use of pesticides and has planted 1,702 fruit trees in 214 Parisian schools under the 2014-2020 mandate ‘an orchard in my school’.[299]

Urban agriculture is also encouraged through the Parisculteurs scheme, which is managed without the use of chemical pesticides. Since 2016, there have been over 70 projects within and outside Paris, covering 15 hectares. Finally, there is a ’Green fingers’ scheme for community gardens, with eco-friendly management of over 150 community gardens. More than 7,000

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[295] Most of the information in this section comes from contacts with staff in municipal authorities.
[296] City of Paris - Green Spaces and Environment - Plant and Soil Expertise Division, Paris’ Zero Phytosanitary product Strategy ‘‘Zero Phyto Paris’’ or ‘‘Phyto free Paris’’, presentation made to Commission staff in Paris on 1 January 2023.
[297] *Ibid*.
[298] *Ibid*.
[299] *Ibid*.

people have participated in the scheme and they receive free expertise and technical advice from the municipality. Nearly 3,000 permits have been delivered by the city of Paris to citizens who wish to engage in eco-friendly planting in public spaces (such as around public trees). Communication with the public is a key part of the strategy, for example through public events, online tutorials, poster campaigns and other educational activities. [300]

There are certain current and emerging phytosanitary challenges in Paris. For example, there are some limited biological treatments for the box-tree moth in Paris, which is an invasive alien species. The strategy is to allow restricted treatments on box-tree moth of heritage interest (for example plant sculptures) in sites that can be closed to the public at night with an EcoJardin compatible biological solution (*Bacillus thurengiensis*) and close the area to the public for 12 hours after treatment. For other types of box-trees or box-trees in other types of sites, the solution is to replace the plants gradually with other plants or landscaping solutions (such as a metallic barrier or wooden edges).[301]

The Paris Horticultural Production Centre (4 production sites around Paris including greenhouses and field production, with over 83 hectares) are not subject to the pesticide restrictions under the national Labbé Law. Therefore, chemical pesticides are still permitted. However, there is a strong engagement on sustainable practices – for example they are fully herbicide free. They employ a number of alternative practices to limit the use of pesticides such as insect larvae release instead of insecticides and plant pot mulching or mechanical weeding instead of herbicides. Employees are trained on pest and disease awareness and pesticides are only used as a last resort if all else fails. There are specific phytosanitary challenges in greenhouses, such as fungal diseases or certain insect pests. Where available, biological control solutions or organic agriculture compatible treatments are used.[302]

As regards the management of invasive alien species in Paris, no pesticides are used. Instead of herbicides, there is management with cultural practices (such as pruning, grubbing up or sheeting). In relation to Japanese knotweed management, depending on where it is found it can be left to develop freely, with programmes to mow and remove at some point, mowed up to 6 times a year, excavated with an excavator or buried under a tarp.

Other phytosanitary challenges in Paris do not justify use of pesticides at the moment, for example processionary caterpillars. Processionary caterpillars are dealt with by removal of the nests or installation of traps around pine tree trunks as the only efficient product (Bt) would kill many other species of butterflies.[303]

Malmö

The city of Malmö has historically had a more ambitious policy than under national restrictions. The city has had a restrictive stance on pesticides for approximately 20 years and this has tightened over time, linked to a municipal target on increased biodiversity and ecosystem services for 2030.[304] It now operates under national restrictions that were adopted in Sweden in 2021. As noted above[305], these provide for a ban on the use of pesticides in a large number of

[300] *Ibid*.
[301] *Ibid*.
[302] *Ibid*.
[303] *Ibid*.
[304] Goda exempel på miljö- och klimatsatsningar - Malmö stad (malmo.se); Ekosystemtjänster och grönytefaktor - Malmö stad (malmo.se).
[305] See section 1 of this Annex.

areas, with limited exemptions in relation to low-risk pesticides and substances as determined by the Swedish Chemicals Agency.[306] In line with national restrictions, there is a ban on professional use of pesticides applies in areas such as schoolyards, kindergarten yards or playgrounds, parks, gardens and public recreational areas, land for residential buildings, private gardens and on indoor plants except in production rooms or warehouses. In the case of areas, including road areas as well as gravel and other highly permeable surfaces, a person who wishes to use pesticides professionally must report this in writing four weeks before the start of operations to the environmental administration. The Environmental Administration inspects the site and checks that the notified product has been approved by the Swedish Chemicals Agency. Permission to use chemical pesticides is only given if there are no other alternatives.[307]

Public land such as parks and cemeteries are generally pesticide-free. Permission is granted to use pesticides even in banned areas in the case of certain invasive alien species, which are not very common (tree of heaven, Japanese knotweed and giant hogweed).[308]

When the municipality authorities want to use pesticides, they also have to apply to the Environmental Department for a permit. Generally, the reasons for such applications are that fire or hot water cannot be used because the area is too close to wood panels that might start a fire. The Environmental Department then normally has a dialogue with the person seeking the permit to ask whether it is really necessary to use a pesticide or whether ascetic acid could be used instead. Occasionally there is a fungus on the grass in golf courses that leads to pesticide applications, but sports managers try to use as little as possible and then only on the parts that really need it. Thus, sport managers try to maintain their grasses in other ways.

The experience within the municipality is that it is simpler to apply the new legislation (in force since 2021) as many more areas have a ban in place (except in the case of invasive alien species) and at the same time, there are no restrictions on low-risk substances such as ascetic acid, so that the process of granting permits has been simplified.

The city's pesticide-free policies are linked to wider initiatives to improve biodiversity such as less frequent cutting of roadside grass, planting mixed seeds and allowing higher grasses on roundabouts and putting big pots with trees in them on certain streets (summer streets) and prohibiting driving on them during a couple of months.

Tallinn

The city of Tallinn comprises about 35% of the Estonian population. One of the strategic goals of the Tallinn 2035 Development Strategy, adopted in December 2020, is to ensure a green transformation, including through protecting the biodiversity of urban nature. The Development Strategy notes the city has exceptional species richness thanks to its biodiverse nature, extensive green network and support for spontaneous flora.[309] In August 2018, Tallinn joined the European Pesticide Free Towns Network. Cities participating in the network commit to drastically reduce the use of pesticides over a period of three years in order to achieve the objective of phasing out pesticide use in the public area of the city. The city employs a

[306] Ban on use of plant protection products in certain areas - Kemikalieinspektionen.
[307] Kemiska bekämpningsmedel - Malmö stad (malmo.se).
[308] For further details, see Gudaträd (naturvardsverket.se); Parkslide (naturvardsverket.se) and Jätteloka (naturvardsverket.se).
[309] https://strateegia.tallinn.ee/en/green-transformation; https://www.tallinn.ee/en/strateegia/strategic-planning.https://strateegia.tallinn.ee/en/green-transformation; https://www.tallinn.ee/en/strateegia/strategic-planning.

differentiated management approach[310] and on 22 June 2021, Tallinn adopted a plan for pesticide reduction activities.[311]

In 2022, the municipal authorities included a condition in their template contract for new public procurement tenders that private companies engaged in basic maintenance of public land must use alternatives to pesticides such as manual or mechanical weeding or hot steam methods. Herbicides are no longer used in the extensive green areas maintained by the city authorities. There is an emphasis on alternative techniques, such as a stipulation that gravel paths must be proactively maintained to prevent the spread of weeds and that mechanical means should be used to prevent weeds in areas such as sports grounds.[312]

Municipal authorities consider integrated plant protection at every stage of the life cycle – planning, designing, construction work and maintenance – rather than focussing purely on maintenance. The city of Tallin produced guidance material on the use of pesticides in urban greening and maintenance procurement as a tool for commissioning plant protection work to the offices, districts and sub-offices of the city of Tallinn. This emphasizes the importance of considering pesticide reduction in greening design (e.g. plant selection, plant density and mulching) and recommends that for weed control, alternatives to pesticides such as hot water and incineration should be preferred where possible. [313]

In public urban spaces, pesticides may only be used by a professional trained user. There is a requirement to follow prophylactic pest and disease control and surveillance, including a requirement to use copper sulphate and iron sulphate to proactively control pests and diseases on roses. Detailed records must be kept of any pesticide user, including the name of the pesticide, the time of application, the standard of consumption and the area and crop on which the pesticide was used. The pest and the percentage and extent of damage must also be determined.[314] The use of pesticides is not required in urban forests and pesticides have not been used by the municipal authorities in urban forests.[315]

In the case of horticulture, private companies must do everything possible to reduce the use of pesticides. This is regularly supervised by the authorities and private companies are obliged to report the pesticides used, the time of use and the reason. One of the main challenges in the city in relation to pesticide reduction is the maintenance of roses in specific areas. In cases like this, the work is controlled through regular discussion between the companies and the municipal authorities. In addition, private maintenance companies receive a fixed budget regardless of how much pesticides they use in horticulture and therefore they have an incentive to use fewer pesticides and keep more money.

The city has produced guidance for citizens and private landowners on how to avoid pesticides and there are also guidelines on IPM, including specific advice in relation to horticulture and landscaping.[316] In addition, the city authorities have produced an online catalogue to promote sales of plants that are good for biodiversity.[317] It is also in the process of producing guidance

[310] Tallinna haljastute hoolduse nõuded–Riigi Teataja.
[311] Juhendmaterjal pestitsiidide käsitlemise kohta linna asutuste haljastus- ja hooldushangetes (tallinn.ee).
[312] European Parliament Webstreaming page (europa.eu)
[313] Juhendmaterjal pestitsiidide käsitlemise kohta linna asutuste haljastus- ja hooldushangetes (tallinn.ee).
[314] Juhendmaterjal pestitsiidide käsitlemise kohta linna asutuste haljastus- ja hooldushangetes (tallinn.ee).
[315] Tallinna haljastute hoolduse nõuded–Riigi Teataja.
[316] Integreeritud taimekaitse | Põllumajandus- ja Toiduamet (agri.ee) . See also the conference organised in the European Parliament in September 2022 where the Deputy Mayor of Tallinn presented its pesticide-free policies. See also European Parliament Webstreaming page (europa.eu)
[317] Elurikka haljastuse kataloogist - Putukaväila elurikka haljastuse kataloog (tallinn.ee).

on planting for planners and designers of public spaces to ensure that they take account, among other things, of the suitability of particular plants for integrated plant protection.

Municipal authority staff engage in public media outreach on the importance of reducing the use and risk of pesticides. It is reported that citizens are interested in natural gardening techniques and share ideas on social media. The city also incentivizes private citizens to engage in non-profit activities[318], which can include the creation of pesticide-free gardens and kitchen gardens on publicly owned urban land. The authorities provide specialist advice to private citizens to support them in this.

[318] Mittetulundustegevuse toetamine Tallinnas | Tallinn

ANNEX 4: SUMMARY OF INFORMATION FROM MEMBER STATES ON PESTICIDE USE IN FORESTRY[319]

Austria

In broad terms, only certain pesticides, when used properly in accordance with the principles of good plant protection practice and the principles of integrated plant protection, are allowed in forests. Use in forest situations may be further restricted or prohibited at provincial level by decree, where areas are protected by water or nature conservation law. While there is currently no statistical data on actual pesticide usage in forests, use is very low. Pesticide use tends to be dominated by prevention of damage by wild game, bark beetles and other pests including the control of invasive and alien weed species. Pesticide use tends to be infrequent, but the regulations (Forest Act 1975) also cover Christmas trees, forest nurseries and short rotation coppices and pesticide use can be more frequent on these niche forest types. Sometimes forest owners are required by law to protect their plantations, particularly from cloven-hoofed game.

Belgium:

No pesticides are used in forestry in the Brussels region as such use is prohibited in legislation. In the region of Wallonia, limited use of pesticides is allowed in the forest sector, e.g., herbicide use against invasive or alien species, or in new plantations or in forest nurseries, and insecticides or fungicides for particular pest problems.

Bulgaria:

Pesticides can be used in the forest areas in Bulgaria. Pesticides authorised for aerial application only include EU approved active substances. Where pesticide treatment by aerial application takes place under derogation, only two active substances are allowed, *Bacillus thuringiensis var. Kurstaki* and spinosad. A greater number of active substances can be used by non-aerial means. These include herbicides, insecticides, fungicides and rodenticides.

Croatia:

Forestry accounts for about 47% of the continental part Croatia, and only 1% is treated (mainly in forests that are in the phase of restoration, i.e. changing generations, and in nurseries and clonal seed plantations). Forestry in karst areas is almost never treated, but where they are, it is usually with biological insecticides and this accounts for about 400 ha per annum. Oak powdery mildew *Microsphaera alphitoides* is the most important forestry disease and young plantations and nurseries are protected, accounting for about 5000 ha per annum. Pesticides are used for this purpose. In recent years experimental ecological treatments have been tested but so far, no effective treatment or technology has been found. Other forest pests include Lepidoptera (butterflies): scaly beetle, large and small frost beetle, goldenrod, oak beetle which occur periodically. The Oak net bug *Coritchucha arcuata* is an invasive pest species which is particularly challenging and currently there are no pesticides identified that can control this pest. Currently, about 9-10 million saplings are planted annually and the protection of these

[319] The information in this Annex comes from Member State responses to a Commission request to the Council Working Party for information on restrictions on the use of pesticides in forestry.

plants for the early part of their life is seen as being critical. Croatia's use of pesticides in forestry is not high but it is considered critically important.

Cyprus:

Main issues around pesticide use in forest stands focus on control of Pine processionary moth mostly by biological pesticides mostly by aerial application. Aerial spraying is done only using the biological control *Bacillus thuringiensis* (Bt), while ground applications may use both *B. thuringiensis* and spinosad, an insecticide approved for use in organic farming. Control of alien invasive pest species including weed species is also an issue of continued concern. Use of fungicides and insecticides on both century old trees and in forest nurseries is also practiced. However, public spaces within forests (mostly controlled by the Department of Forests) are subject to a prohibition of all pesticides except where the entire health of the forest stand could be compromised.

Czech Republic:

About 35% of the land mass of the Czech Republic comprises of forest areas. The restoration, establishment and maintenance of high-quality forest stands is considered more important since recent pest problems caused by bark beetles and extreme weather events. To ensure progress on replanting of forest stands there are nurseries (about 2000 ha) devoted to producing sapling trees for planting. In volume terms there is negligible pesticide use in forestry and the bulk of pesticide use comes from use of game repellents to protect newly planted forest stands. Pesticide use is generally by individuals. There is also some herbicide use, again mostly in newly planted forest sites and occasional use of pheromones and insecticides to protect against various pests when saplings are at their most vulnerable stage but also for use on felled tree trunks.

The Czech Republic reports that a shortage of pesticides before and after planting would mean increased costs for protecting small saplings from weed infestation as labour shortages leave manual weeding expensive. Where other pests cause the death of planted areas, replanting would then be required.

Denmark:

The data show that the use of pesticides is most prevalent in Christmas tree plantations, and only show a limited use in forestry in general, with an equal distribution of use of insecticides and herbicides. Data from 2015 show that there are about 640,835 ha of forestry in Denmark with privately owned forestry accounting for about 190,000 ha. Data from 2020 show that 21,711 ha of farmland were devoted to the production of Christmas trees. Moreover, pesticide use data in forestry shows that the bulk of such use is related to Christmas tree production but also to the establishment of new forestry plantations (generally at 60-year intervals), with a fairly equal distribution of insecticide and herbicide use. Pesticide use in Christmas trees can occur throughout the lifetime of the tree and it is estimated that only 2% of Christmas trees are grown organically.

The impact of banning pesticides in Christmas tree plantations has not been quantified, however a ban will have a substantial impact on the ability to uphold current production rates.

Estonia:

The use of pesticides in forests is quite uncommon in Estonia and more an exception than a rule. The Estonian Forest Law specifies that pesticides can only be used in forests in cases specified by the forest management regulation. Information from the Environmental Board indicate that between 2019 and 2022, general advice in accordance with their forest conservation expertise, to apply pesticide, was given on only 4 occasions. Use of the biological active substance *Phlebiopsis gigantea* VRA 1835 on harvested root stumps also took place in 520 cases to prevent the spread of root rot.

The forest management regulation provides that pesticides can be used in a forest only when justified by the results of a forest conservation expert assessment (carried out by the Environmental Board). If and when the pesticides are being used such use should take place in the way laid down in the Plant Protection Law. The regulation also specifies that to control the tree heart rot caused by *Heterobasidion spp.* the stumps of coniferous trees may be treated with biological pesticides or carbamide.

Finland:

Pesticides are authorised in Finland for use in forestry containing 28 different active substances. These include fungicides, herbicides and insecticides, but by the far the most important active substance currently in the forestry sector is urea. Pesticides containing urea are only authorized for the control of root rot on conifers. When a plantation is harvested in certain areas and at certain times of the year, there is a legal requirement to prevent the spread of ‘root rot’ by applying certain pesticides. Up to 75% of the total pesticides sold in Finland contain urea and are for this purpose. With this disease accounting for an estimated over €50 million p.a., any restriction in pesticide use for this purpose could have significant consequences.

The total use amounts of all other pesticides authorised for use in forestry are not known but are assessed to be minor compared with other, mostly agricultural, uses of the same product.

Some herbicides are used to control weeds in young tree stands, but most pesticides authorized for use on trees are used in forest tree nurseries on young plants. Other pesticides are authorised as insecticides for the protection of some plants from Pine weevil. This treatment is centralized and takes place only in tree nurseries before the plants are transported to plantation sites. There are also pesticides authorised for use as fungicides but are used in forest tree nurseries before the tree plants are transported to plantation sites, where annual production is about 150 million trees.

In case of large forest damage, the Ministry of Agriculture and Forestry can require the Finnish Forest Centre to take immediate action to prevent the spreading of such damage, primarily based on biological or mechanical means. Although aerial application of pesticides is primarily not allowed in Finland, the action necessary may include aerial application of a biological plant protection product. However, such cases have occurred very rarely.

France

There are about 17 million hectares of forestry and woodland in metropolitan France. Pesticide use in forestry is very limited, with cultural and preventive methods being preferred to combat forest pests. France reports that the main reasons for the non-use of pesticides in forestry is a low return on investment for pesticide treatments in terms of growth, or even its ineffectiveness, as well as a desire not to intervene in a 'balanced' natural environment. Public forests are managed by the National Forestry Office and make up about 4 million hectares. Since 2017, only low-risk pesticides, biological control products and pesticides that can be used in organic farming can be used in these forests. However, where invasive or quarantine pest requires controlling or if there is another unforeseen pest which threatens the overall sector, other pesticides may be considered. Some pesticide use also takes place in forest nurseries to ensure the continued production of healthy saplings for planting of new plantations. Pesticide use during the establishment phase of new plantations can be carried out, to protect new plants from weed competition and also to protect from certain insect species such as *Hylobius spp*. control in new conifer plantations. The prevention of conifer root rot *Heterobasidion annosum* is achieved usually by using a biological control product. Occurrence and control of other pests may arise depending on the season.

Germany:

There are no pesticide regulations specific to forestry areas. Pesticides can be used in a forestry context in accordance with the individual pesticide authorisation, and subject to National Plant Protection Act. Restrictions on the use of pesticides on land accessed by the general public, include using only pesticides authorised specifically for use in areas intended for the general public.

Hungary:

Aerial application of pesticides is possible, including for forestry purposes, after the required derogation is obtained. It is prohibited to fly aircraft with pesticide application equipment over certain areas including forest reserves except in limited cases. Similar restrictions apply to unmanned aircraft used for pesticide application.

Ireland:

Pesticides are specifically authorised for the specific uses intended. These may include use in forestry stands or forestry nurseries. Pesticides can only be used as authorised and any restrictions or mitigation measures will be included as part of the product authorisation, resulting from the risk assessment performed.

Italy:

There is no specific legislation for the use of pesticides in forest areas. Within the areas classified as forest or similar, it is forbidden to use pesticides to control the vegetation in the areas with particular functional destination (e.g. gas pipelines), without prejudice to the possibility of derogations in the presence of particular phytosanitary and conservation emergencies. Currently there are no pesticides authorized for use in forestry and so in the rare cases where treatment is needed, emergency authorisation is considered. Where necessary pesticide application by aerial spraying is authorized in accordance with the Sustainable Use of Pesticides Directive[320] and provisions of the national action plan.

Regional rules also apply and may require forest owner to react or act in response to a plant health problem, to minimize its spread etc.

Luxembourg:

Many forest types are classified biotypes in which the use of pesticides is prohibited. Forests not covered by that prohibition include for example spruce and fir plantations. Detailed pesticide use data in forests is not currently available. In cases where pesticides are used, it tends to be insecticides against weevils and repellents to prevent damage by game in newly established plantations.

Malta:

Forest cover in Malta is around 1.5% (Eurostat, 2020). In accordance with the Trees and Woodlands Protection Regulations, the use of biocides near protected trees or within tree protection areas is prohibited unless authorised by the Environment and Resources Authority. The Authority also issues permits in relation to any intervention on a protected tree, but allows the Director responsible for plant health to carry out certain interventions related to phytosanitary purposes without a permit.

The Netherlands:

There is a ban on pesticide use outside agriculture and this would also apply to forest situations. The Netherlands reports that forest areas that are managed with a production objective only (e.g. wood production) are limited or non-existent and there is no statistical information on pesticide use in forestry currently available.

Poland:

Poland is at the intersection of the oceanic and continental climate and can experience mass infestations of a diverse range of insect pests, some of which can be quite intense. Some pest outbreaks threaten the viability and stability of forest stands. Pesticide use can protect the area sprayed but importantly also prevents the further spread of the pest to other areas. Thus, an absence of protection in an area could result in larger areas being affected. In addition, large scale damage to forest stands can lead to an increased vulnerability to fire.

[320] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

Portugal:

The forest area in Portugal consists of around 3,2 million ha, representing about 36% of the national territory. While there are pesticides authorised for use in forestry there is no specific pesticide use data available for the forest sector. Chestnut tree production is considered important and covers 50,000 ha, as is the cork tree which covers about 720,000 ha. Several pesticides with different active substances are authorised to combat various insect, fungal and weeds pests etc. These pesticides include chemical active substances and non-chemical active substances. Such pesticides are used in specific national control plans as part of an IPM programme for the control of particular pest species.

Romania:

There are several products authorized for the control of harmful organisms in forests.

Slovenia:

Use of pesticides in forests is generally prohibited, however in exceptional circumstances and where the overall health of the forest is threatened, certain authorised pesticides can be used to protect young plants from damage by game and to control insect populations and tree diseases that cannot be achieved by other measures. Permission for such an exceptional use is issued by the Slovenian Forest Service.

Spain:

There are pesticides authorised for use in forestry there is no specific pesticide use data currently collected or available. There are four IPM guides produced and used in the forestry sector.

Sweden:

Of the 28 million ha of forest in Sweden, about 1.2 million ha are in sensitive areas designated by the SUR proposal. Pesticide use in forest stands is quite limited and is mostly confined to use of the micro-organism *Phlebiopsis gigantea* against root rot, sheep fat and blood meal as a repellent to protect young trees from game and very limited use of insecticides, predominantly in forest nurseries and newly planted areas. Some forest areas may require prior notification to the municipality before pesticides can be used and there is also an obligation in certain cases to inform the general public of any pesticide application.

ANNEX 5: FURTHER DETAILS ON IMPACTS OF PESTICIDE USE RESTRICTIONS IN URBAN AND PUBLIC AREAS[321]

Section 1: Costs and tools for the transition

As noted above, in the Netherlands, professional use of pesticides outside agriculture is not permitted (with limited exceptions). In the explanatory memorandum that accompanied the initial publication of the prohibition in 2006, reference was made to the fact that according to studies of the advantages and disadvantages of various weed control techniques, the quality level sought by site managers can be achieved with all non-chemical techniques and combinations of techniques examined. The application of non-chemical methods to both paved and unhardened surfaces was regarded as technically feasible, subject to a few exceptions. According to qualitative research on non-chemical techniques and methods, these were deemed not technically feasible and financially affordable for all types of unpaved surfaces, leading to limited exceptions in certain areas such as sports grounds and certain recreational grounds.[322]

A detailed study of pesticide reductions in public and urban areas in French municipalities found that the transition to 'zéro-phyto' (zero phytosanitary products) is not a matter of pure technical substitution which would lead to an increase in management costs, but is based on the overall change in space management, and on daily optimisation of resources, under budgetary constraints.[323] When moving towards a pesticide-free policy, the main budgetary issue is efficient management of working time.[324] During the transition, it takes more time to weed and manage spontaneous flora without the use of pesticides. However, this is temporary while managers change their maintenance objectives through mulching, landscape adjustments and above all, acceptance of spontaneous flora.[325]

This experience is mirrored in Luxembourg, where 40% of municipalities were already voluntarily pesticide-free by the end of 2015 and almost all public spaces have had a ban on the use of pesticides since 2016. Pesticide-free policies require a broad-based approach is taken to promote biodiversity and there is a change in citizens' aesthetic expectations as well as more planning and semi-natural areas.[326] When switching to pesticide-free care, it is not possible to maintain the usual herb-free appearance without increasing the number of municipal staff. A change of mindset is needed in relation to tolerance of spontaneous flora. Municipalities are therefore advised to set a tolerance threshold, taking account of differentiated management and different aesthetic expectations for different areas.[327] It is also mirrored in Germany, where cities have successfully practiced pesticide-free management on the basis of planning, alternative methods and greater tolerance for grasses and wild flowers in public spaces.[328]

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[321] In addition to the specific references mentioned in this section, some of the information in this section comes from contacts with staff in municipal authorities.
[322] See explanatory memorandum accompanying the Decree of 9 March, Staatsblad 2016, 112 | Overheid.nl > Officiële bekendmakingen (officielebekendmakingen.nl).
[323] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr). This study adopted a definition of "zéro-phyto" that corresponds to the EcoJardin label, which authorises products for use in organic farming that are not synthesized chemical pesticides dangerous for auxiliary fauna or the environment.
[324] Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .
[325]
Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .
[326] merkblätter_kampagne_ouni_pestiziden_einführung__unternehmen_.pdf (ounipestiziden.lu)
[327] merkblätter_kampagne_ouni_pestiziden_einführung__unternehmen_.pdf (ounipestiziden.lu)
[328] Broschüre "Pestizidfreie Kommunen" (bund.net)

Most managers surveyed in France managed their transition without increasing their overall costs of managing green spaces.[329] The geographical location of a municipality had a greater influence on policies than the wealth of that municipality.[330]

The main wage cost item was for weed control, with variations depending on the weed control technique used: from 70 % for chemical weed control to almost 100 % for manual weeding. Investment costs in equipment, amortised over 2500 to 5000 hours, amounted to less than 10 %. Investment expenditure could be estimated to be 5 to 20 times less than the annual operating costs including the wage bill.[331]

As regards whether alternative techniques to pesticides are more expensive, French research suggests that everything depends on the context of the intervention, the technical knowledge of the field staff and the ability of the manager to time weeding correctly. The cost of weed control is mainly linked to the labour force and thus to the time spent on the ground, which can be optimised through training, appropriate work organisation and clear management objectives.[332]

For a given site, modelling shows that the overall annual cost of weed control is cheapest for chemical, with burning more expensive and mechanical most expensive. However, costs can also be controlled by changing the action thresholds (avoiding unnecessary early interventions or more labour-intensive late interventions) and by improving the effectiveness of weed control, though appropriate training and the right equipment. In two case studies, managers showed a budgetary saving linked to the cessation of treatments and the need to resort to biological control.[333]

In relation to costs in the Netherlands, the shift from application of pesticides to non-chemical techniques and methods may lead to higher management costs for site managers in certain situations, but this cost was assessed in 2016 as affordable with some limited temporary exceptions.[334] A survey-based cost study by the Dutch Ministry of Infrastructure and the Environment found that the desired quality level is achievable with all techniques and combinations (mechanical, thermal and chemical weed control techniques). Purely non-chemical weed control is significantly more expensive than purely chemical weed control. However, with a good approach, non-chemical control costs can still reduce significantly.[335]

In similar vein to the conclusions drawn in French research, the cost study by the Dutch Ministry of Infrastructure and the Environment also found that higher costs do not automatically mean higher maintenance budgets. While there are municipalities that gradually increase the budget for weed control, there are also municipalities that 'shift within the budget' or accept a slightly lower level of quality. Among the municipalities interviewed, the budget

[329] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[330] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[331] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[332] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[333] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[334] See explanatory memorandum accompanying the Decree of 9 March, https://zoek.officielebekendmakingen.nl/stb-2016-112.htmlSee explanatory memorandum accompanying the Decree of 9 March Staatsblad 2016, 112 | Overheid.nl > Officiële bekendmakingen (officielebekendmakingen.nl),.
[335] Inventarisatie onkruidbestrijding op verhardingen, Microsoft Word - R001-1214386JGC-rlk-V03-NL (officielebekendmakingen.nl).

for weed control amounted to 0.3 - 3.6% of the total budget for public space management. In half of these (15) municipalities, it was less than 1%.[336]

An evaluation of the ban on chemical weed control on paved areas outside agriculture in 2021, 5 years after it entered into force, confirmed the conclusions of the feasibility study from 2013: chemical-free weed control is feasible and about four times more expensive. Comparing the cost of chemical-free weed control in 2021 with chemical-free weed control in 2013, the costs appear to decrease slightly (10-15 %). This was assessed as being due to a combination of better equipment, cheaper equipment (more supply) and, above all, more efficient operation (through better management).[337] To put this in context, it must be remembered that the budget for weed control is a very small percentage of the total budget for public space management in Dutch municipalities (0.3% to 3.6%), as noted above.[338]

To avoid chemical weed control without increasing overall costs, managers studied in France used three overall strategies: 1) limiting weed control tasks by avoiding grass growth or by planting the spaces; 2) using suitable alternative management techniques and equipment; and 3) reallocating resources and change management modes at service level.[339]

Despite the introduction of different strategies to limit the use of weed control, the labour requirements of 'zéro-phyto' strategies often (but not always) remain higher than with use of pesticides. Case studies show that there is room for manoeuvre in terms of resource allocation for the management of green spaces to meet both budgetary requirements and environmental objectives that often go beyond the issue of pesticide reduction. Differentiated management is key to this reallocation of resources.[340]

Differentiated management is a tool for optimising financial, human and technical resources. Its implementation, coupled with environmentally friendly practices, makes it possible to work in a healthier setting without generating significant costs. To this end, the spaces are divided into 3 to 6 categories according to uses and services, ranging from natural or hardy areas to horticultural or prestigious areas.[341] Differentiated management has been found to be useful many Member States, including Estonia, Germany and Luxembourg.[342] For example, in Tallinn, municipal authorities have adopted a differentiated management approach with four levels of maintenance intensity.[343]

Experience in Germany and Luxembourg also shows the importance of design and construction materials in paved areas.[344] Sealing as few areas as possible is the objective of municipal planning, so only areas whose function does not allow plant cover should be completely

[336] Inventarisatie onkruidbestrijding op verhardingen, Microsoft Word - R001-1214386JGC-rlk-V03-NL (officielebekendmakingen.nl), p. 12
[337] NVRD, Grip op Onkruid De huidige stand van zaken in Nederland, 2021, Microsoft Word - Grip op onkruid. Stand van zaken onkruidbestrijding Nederland (nvrd.nl), p. 33.

[338] See section 3.1.4.1 of this chapter.
[339] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[340] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[341] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[342] Broschüre "Pestizidfreie Kommunen" (bund.net); merkblätter_kampagne_ouni_pestiziden_einführung__unternehmen_.pdf (ounipestiziden.lu)
[343] Tallinna haljastute hoolduse nõuded–Riigi Teataja.
[344] Broschüre "Pestizidfreie Kommunen" (bund.net)

sealed.[345] The importance of urban design for reduction in pesticides was also stressed in a meeting with a municipal staff member from Tallinn.

These commonly used strategies can be adapted and complemented for each heritage, climate, economic, organisational and cultural context. The need for weed control may be limited by a change of perception favouring the acceptance of the spontaneous flora, landscape changes with or without redevelopment, grazing strategies or prevention strategies for the installation of weeds. The choice of suitable materials, the training of staff, and the planning of medium-term steps (changes in practices and alterations) are essential. Consideration of management classes (differentiated management), the suitability of flowering and the development and maintenance of shrubs and hedges make it possible to release resources that can be reallocated to grass management.[346]

The Plant & Cité study mentioned above found that the duration of the transition to 'zéro-phyto' varies widely depending on the managers and local circumstances. Some managers instantaneously stopped the use of PP, often following a political decision. Other city managers had experimented for decades with new management practices before transitioning to 'zéro-phyto'. While in most cases, managers switched to 'zéro-phyto' on a gradual basis, starting with green areas and ending with cemeteries, in others, pesticide use was suddenly ceased throughout the city territory. The increased number of tools now available makes it easier for managers to have a shorter transition. Finally, even after making the transition, a number of years may be needed for profound changes in aesthetics and the introduction of new management practices, both of which are essential for a sustained approach.[347]

Plante & Cité have identified a number of tools that are very useful to city managers in transitioning to 'zéro-phyto'. The use of city charters is a way for municipalities to receive support and formalise their commitments. It can be a driving force in the early stage or a means of communicating and endorsing existing commitments.[348] If the SUR proposal is adopted with a harmonised approach to pesticide restrictions in urban areas, such charters might still be a useful for cities that want to take voluntary measures beyond the requirements of the SUR proposal. The use of eco-management labels is another means of communicating and promoting the measures implemented. Environmental practices monitored by external audits are a goal for many municipalities. Labels promote public acceptance of new management practices. They reward gardeners for the excellence of their practices and are a management tool based on the new perspectives of their profession.[349]

In its *Guidance material on the use of pesticides in urban greening and maintenance procurement*, the Tallinn Urban Environment and Public Works Department emphasizes that the reduction in pesticide use begins when urban greening is designed. Plant species or varieties should be selected that are as disease- and pest-resistant as possible. Attention should be paid to the density of planting and to consider mulching in order to reduce weed formation and spread. It is important to prepare the planting area for greening, so that it is as clean as possible from weed roots and seeds. It is also important to take account of soil control and, where appropriate, the use of good bacteria for soil improvement, as well as plant intensifiers (based on rock meal and plant infusion) to increase the plant's resistance. Once the green space is well

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345 ounipestiziden.lu/uploads/2/2/4/8/22480338/merkblatt_n°1_befestigte_strassen_wege_und_plätze__gemeinden_.pdf

346 Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).

347 Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).

348 Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).

349 Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).

designed and built, later maintenance will be easier. It is important that all maintenance work is carried out in a timely manner.[350]

Management plans are also essential as the transition in a constrained budgetary context cannot take place without rethinking the ways in which space is managed and maintained. These include plans for differentiated management, weed control or site redevelopment.[351] For land areas that must be kept entirely free of growth, non-toxic alternatives are available. Hot water-operated machines use the temperatures to kill off the parts of plants that are above ground and exposed roots. Brushes are also used to mechanically remove plant growth above ground.[352] In addition, several other tools are used, including participatory governance, experience-sharing, financial aid for the purchase of equipment, training, communication with users and awareness-raising measures on nature in cities.[353] Each municipality can choose from a wide variety of tools as they move through necessary steps: commitment, diagnosis, training, organisation plan, operation, evaluation, with the following tools being helpful to assist with this work:

- Commitment: newsletters, charters, awareness-raising meetings
- Diagnosis: monitoring book or questionnaire, practice commitment sheet
- Training: training of staff/ elected representatives, technical days, demonstrations, guides to alternative solutions
- Decision to organise: decision-support tools for alternative weeding, specific plans for weed control, differentiated management, communication
- Operation: financial aid, time records, weeding reinforcement team, GIS installation support
- Evaluation: charter evaluation grid, monitoring indicators (e.g. working time), municipal/ territorial review[354]

Public communication and engagement is also very important, for example through participatory workshops, information posters or public consultation.[355] In Luxembourg, support is provided to municipalities that want to promote tolerance for spontaneous flora, including provision of information and publicity materials.[356] As noted above, in Tallinn, the city has produced guidelines for private gardeners and municipal authorities engage in media outreach in relation to reducing the use and risk of pesticides.

A Discreet Choice Experiment[357] was administered in France in 2017, when a pesticide ban in all urban green spaces was implemented. The purpose of the study was to address how the transition to pesticide-free urban green spaces can be implemented so that it increases welfare for the majority of the population. The study identified the urban green space characteristics

[350] Juhendmaterjal pestitsiidide käsitlemise kohta linna asutuste haljastus- ja hooldushangetes (tallinn.ee).
[351] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[352] Fighting dandelions with a brush and hot water | Umweltbundesamt; https://www.julius-kuehn.de/a/tagungsbeitraege/
[353] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[354] Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .
[355] Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .

[356] merkblatt_n°1_befestigte_strassen_wege_und_plätze__gemeinden_.pdf (ounipestiziden.lu)
[357] A discrete choice experiment is a preference elicitation technique asking respondents to make choices from two or more alternatives where at least one attribute is systematically varied and a series of choice tasks can elicit preferences.

most preferred by the users and the trade-offs they are willing to make in the context of a defined budget. The study found that citizens have a strong preference for a natural visual appearance, which suggests that the costly control of the vegetation is not always desirable. It also found that fauna abundance and the improvement in the recreational opportunities available in urban green spaces are valued by a large majority of respondents. Preferences for information campaigns were not shaped by self-declared knowledge but rather by gender, with a utility gain for female but not for male respondents (Lefebvre, Maslianskaia-Pautrel, et al., 2022).

Managers tend to overestimate the importance of information on the pesticide ban for both citizens and workers. Moreover, managers are less willing to accept an increase in budget to have wild-looking urban green spaces with abundant fauna, despite these characteristics being valued by the majority of citizens (Lefebvre, Espinosa Goded, et al., 2022). Respondents also care about the working conditions of the urban green space maintenance teams: a majority prefer that their working conditions are improved, and even more numerous are those who are strongly against their deterioration. Overall, the transition is more likely to be accepted by making sure that recreational opportunities are not restricted, and workers' conditions do not deteriorate. The study acknowledges certain methodological limitations, such as the ambiguity surrounding the meaning of natural visual appearance (Lefebvre, Maslianskaia-Pautrel, et al., 2022).

Stated preference methods such as Discrete Choice Experiments could support managers in their transition by aiding them to gain a deeper understanding of public preferences and how they vary, but also ways to measure the implications for public welfare of different management approaches (Lefebvre, Maslianskaia-Pautrel, et al., 2022). Given that technical solutions for a successful transition exist, shedding light on the specific urban green space characteristics where preference diverge can help to remove the remaining barriers to a successful implementation of cosmetic pesticide bans (Lefebvre, Espinosa Goded, et al., 2022).

Section 2: Specific challenges: cemeteries and sports grounds

The Plante & Cité study mentioned above found that it is possible to switch to 'zéro-phyto' (zero phytosanitary products) in all municipalities, regardless of their size or geographical location.[358] The transition to 'zéro-phyto' was the easiest to make in parks, historical gardens and flowering areas. Only 1 out of 10 French municipalities still used pesticides in such areas in 2016.[359] Most challenging are cemeteries and sports grounds.

- **Cemeteries**

Cemeteries were the most sensitive transition to zero pesticide use in French municipalities, although in 2017 a third of them no longer used pesticides. The level of maintenance requirements and landscape expectations are high due to cultural pressure[360] The conversion of these spaces requires particular attention, optimising the management strategies adopted on the other spaces.[361] The City of Venezia has banned the use of synthetic pesticides on cemeteries, hiring more staff in order to maintain them. Particular challenges were found in relation to limiting spontaneous grass in gravel fields, requiring manual scraping or organic weed control,

[358] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[359] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[360] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[361] Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .

with reduced efficiencies. Manual weeding, biological control and scraping are used. Due to increased costs and reduced efficiency, so the city is keeping its policy under review.[362]

In France, cemeteries used for walking are affected by a ban on pesticides under the Labbé Law since 1 January 2017, which permits only pesticides suitable for use in organic, low-risk and biological control farming. Derogations apply for roads and for regulated organisms (such as red palm weevil). A report published in 2017 found that for the majority of those cemeteries surveyed that had stopped using pesticides entirely (68%), the transition took only 3 years or less, with the more recent transitions being significantly shorter.[363] 76% of cemeteries surveyed found the transition to zero pesticides was accompanied by changes in work organisation. These included an increase in the need for labour, a change in work arrangements to avoid excessive overtime, training of staff and purchase of new equipment. Human health and protection of biodiversity were among the 3 main reasons cited for ceasing to use pesticides in cemeteries.[364]

There are specific cultural issues in France in relation to according respect to the deceased, with many families viewing the policy of tolerating spontaneous flora as disrespectful and a failure on the part of the municipality to maintain the cemetery.[365] This is also an issue in Belgium.[366] Several conditions appear to facilitate greater acceptance: if these plants are kept at an acceptable height, for example by shearing; if they have an aesthetic flowering or foliage; if they are not too numerous; if mixed with horticultural plants.[367] The use of grass to limit weeds may also be an aesthetically satisfactory tool and public communication through for examples signs at the entrance to cemeteries or specific exhibitions can also help public acceptance.[368] It should also be noted that the cultural pressure for a particular aesthetic in cemeteries may vary from Member State to Member State given the cultural specificities of cemeteries. Finally, it should be noted that related incentives may support the transition, such as incentives for municipalities in Wallonia to welcome more biodiversity into cemeteries.

- **Sports grounds:**

Another area that has specific challenges associated with it is restrictions on the use of pesticides on sports grounds. Maintenance of these areas may require a certain degree of technicality and a significant investment in the introduction of suitable alternative practices (purchase of equipment, training).[369] The maintenance requirements of clubs using the infrastructure may also present particular challenges.[370] To maintain the requirements of sports grasslands in terms of quality of play and safety of players, a comprehensive agronomic approach to plant health is required.[371]

The requirements in terms of quality of the playing surface increase with the level of professionalism of teams and are often higher in urban settings in France.[372] More detailed

[362] Citta' di Venezia, Allegato a Relazione Istruttoria – Nuova Proposta di Adeguamento Degli Standard Previsti per la Gestione del Verde Cimiteriale Da Parte di Veritas S.P.A.
[363] Paysages et entretien des cimetière... - Plante & Cité (plante-et-cite.fr).
[364] Paysages et entretien des cimetière... - Plante & Cité (plante-et-cite.fr).
[365] Paysages et entretien des cimetière... - Plante & Cité (plante-et-cite.fr).
[366] Les cimetieres.pdf (adalia.be).
[367] Paysages et entretien des cimetière... - Plante & Cité (plante-et-cite.fr).
[368] Les cimetieres.pdf (adalia.be).
[369] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[370] Passer au "Zéro Phyto" dans votre c... - Plante & Cité (plante-et-cite.fr) .
[371] Vers le "Zéro phyto" des terrains d... - Plante & Cité (plante-et-cite.fr).
[372] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).

requirements (technical and aesthetic) are required for the management of sports fields for high-level competitions and for race-tracks and golf courses.[373] Croplife has made representations to the Commission that it is not realistic to move towards low-risk and chemical pesticides by 2025. The European Golf Association also represented that while it embraced the transition, more time and certain exceptions will be needed. Finally, the Union of European Football Associations (UEFA) has represented in meetings with the Commission that there is a need to distinguish between elite sports grounds, where public access is limited, and maintenance requirements are high, and other sports grounds.

Despite the challenges associated with pesticide restrictions in sports grounds, Member States have successfully implemented pesticide restrictions in sports grounds. For example, in the summer of 2016, two out of three French municipalities reported that they did not use pesticides (rising to 9/10 for rural municipalities).[374] French legislation is moving towards abolishing the use of synthetic pesticides for sports grounds, with two deadlines in July 2022 and then January 2025.[375] In The Netherlands, in 2021, more than three quarters of municipalities, which manage around 5,500 of the 7,500 grass sports grounds, did not use pesticides. This was an increase from half the municipalities in 2019.[376] However, the sharp decline in the use of pesticides between 2019 and 2021 appeared to diminish in 2022 as municipalities were using pesticides on sports fields at about the same rate as in 2021. Despite this, the majority of those municipalities that still used pesticides in 2022 intended to stop in 2023.[377]

In the Netherlands, pesticides are only permitted for the practice of sports in areas that cannot be exploited and maintained otherwise.[378] Pesticides are permitted on sports pitches for the organised practice of open-air sport, in so far as the playable part of the site includes a limited area around it necessary for the practice of sport, but excluding the parts not covered by grass cover and the specific parts marked as excluded for particular pesticides in an Annex to the relevant legislation.[379] A 'Green Deal' was signed between the Ministry of Infrastructure and Environment with the aim of minimizing the use of pesticides on sports fields. This pledged that from 2020 no pesticides would be used on sports fields except in those situations where it is strictly necessary, that reasoned proposals be made for those situations in which the use of certain pesticides are necessary for the time being and that in those remaining situations only low-risk pesticides are used as soon as they are available and sufficiently effective for the relevant application.[380]

In January 2022, the second opinion by an *ad hoc* committee of independent agronomists determining the minimum pesticide input necessary after IPM is applied was published.[381] The

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[373] Vers le "Zéro phyto" des terrains d... - Plante & Cité (plante-et-cite.fr) .
[374] Conditions technico-économiques du ... - Plante & Cité (plante-et-cite.fr).
[375] Vers le "Zéro phyto" des terrains d... - Plante & Cité (plante-et-cite.fr) .
[376] Monitor milieuvriendelijk beheer van grassportvelden 2021 – Mulier Instituut . Half of the municipalities provide support to other parties who carry out (part of) the major maintenance on municipal grass sports grounds. One out of five municipalities provide support to those who carry out major maintenance on privatised grass sports pitches.

[377] Monitor milieuvriendelijk beheer van grassportvelden 2022 – Mulier Instituut .
[378] Netherlands, answers to Czech Presidency questionnaire on sensitive areas, 18 November 2022.
[379] See Article 8.4(1)(a) and Annex XVII of Regeling gewasbeschermingsmiddelen en biociden (Plant protection products and biocides scheme), wetten.nl - Regeling - Regeling gewasbeschermingsmiddelen en biociden - BWBR0022545 (overheid.nl)
[380] GD189-samenvatting-Gebruik-van-gewasbeschermingsmiddelen-op-sportvelden.pdf (greendeals.nl)
[381] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.

committee concluded that there are sufficient technical possibilities for chemically free management of competition, training and related fields outside stadiums. In particular in the case of municipal management of the sport fields, chemical-free management, i.e. the implementation of preventive or non-chemical weed control, should pose few problems. The use of pesticides against weeds is not in principle necessary.[382]

A number of tools can be used to assist with pesticide restrictions in sports grounds. Design and maintenance tools can help create conditions for the quality of sports grasslands and turf health. These can be adapted according to the characteristics of the sports ground and the resources available to the manager. Such measures include selection of grasses to meet agronomic and use requirements, taking account of the use and playing intensity that is appropriate to the grass and avoiding repetitive use in the same areas, preventive cleaning and disinfection measures to limit occurrence of diseases, pests or weeds, manual and mechanical weed control, ventilation operations to improve soil health, sanding operations and optimum watering to preserve plant health.[383]

Epidemio-surveillance is a cornerstone of integrated sports lawn management. This approach is based on knowledge, diagnosis and monitoring of the relevant symptoms and pests. Some species can provide valuable indications on the fragilities and agronomic weaknesses of the land. This knowledge also makes it possible to distinguish between spontaneous species and weeds to be checked. Knowledge of the main phytosanitary issues on sports grasslands also helps to limit the associated damage by intervening early or even preventing their development.

Finally, training and communication are essential to support pesticide restrictions. A study in France found that the buy-in of management teams and users is essential to ensure that the necessary compromises and efforts are sustained. Support for maintenance teams is essential to allow them to acquire the skills needed for new practices and to help them decide on the measures to be implemented to improve the health of sports grasslands. Training and diagnostic experiments make it possible to give meaning to the new maintenance objectives from the outset. Stopping the use of pesticides on sports lawn can lead to visible changes or even imperfections, particularly during a transitional period. These changes can be accompanied by tailored and motivational communication in order to raise awareness among the user audiences. Awareness-raising can include onsite notice boards, dedicated webpages, press articles, public meetings and presentation of the approach to club members.[384]

The importance of support for municipalities was also emphasized in a 2022 study on the management of grass sports municipalities in the Netherlands. Three quarters of the municipalities surveyed indicated a need for support, including general information, exchange of good practice, knowledge sharing and a roadmap for environmentally friendly work.[385] 84% of those surveyed in 2022 had an understanding of the nutritional status of grass sports pitches and 67% had an understanding of the identification of the fields where weeds, diseases and pests are most likely to occur due to environmental factors. Most municipalities were in the process of monitoring, aeration or mowing to promote a robust grass and well-developed roots.[386] An evaluation of the Green Deal published in 2020 of the Dutch ‘Green Deal’ for sports pitches also recommended better provision of information to operators of sports grounds

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[382] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.
[383] Vers le "Zéro phyto" des terrains d... - Plante & Cité (plante-et-cite.fr).
[384] Vers le "Zéro phyto" des terrains d... - Plante & Cité (plante-et-cite.fr).
[385] Monitor milieuvriendelijk beheer van grassportvelden 2021 – Mulier Instituut; Monitor milieuvriendelijk beheer van grassportvelden 2022 – Mulier Instituut.
[386] Monitor milieuvriendelijk beheer van grassportvelden 2022 – Mulier Instituut.

on legal requirements as regards products requiring to be authorised for sports grounds.[387]

The second report of the expert committee of agronomists in the Netherlands in 2022 also identified the importance of supporting sports clubs in their efforts. One specific issue that was identified was that cities ask sports clubs to organise the field maintenance themselves and clubs do not always have enough volunteers to carry out these tasks or sufficient knowledge of maintenance without the use of pesticides. It was also noted that reducing the budget at the time of transition can cause practical problems because the first years after a change have to take into account higher costs depending on the structure of the fields and the maintenance situation of the fields.[388]

In relation to practical incentives for site managers to design and implement their management so that pesticides are no longer used against weeds, the committee recommended the following:

- A transitional period of, for example, two years, because the transition to chemical-free management is possible but it takes time and can be financially challenging. A transition period also makes it clear that action is necessary.
- During the transition period, the build-up of the field should be rectified. This reduces management costs in the longer term, with exceptions. These include mechanical processing, fertiliser application, (one-off) consultancy costs of independent experts, etc.
- Some low-hanging fruit can already be effective at minimum cost, such as using competition fields for training, which is a cheap and effective weed protection measure, or allowing grass to rest in warm dry periods to save water and allow the grass to grow back stronger.
- By making the management of sport fields less to non-dependent on the use of pesticides, the sports fields will become more robust and climate resilient, more resilient to longer dry and hot periods, but also more wet periods.
- In the longer term, the ad hoc committee noted that the development in precision agriculture will facilitate a preventive and ultimately cost-effective approach.[389]

The committee also recommended that an exception for unforeseen circumstances is reasonable, so that significant damage caused by diseases and pests can be made good. It also recommended differentiating between golf courses and other sports fields, arguing that zero use of pesticide on short-grass courses is technically not feasible or is difficult to achieve or financially impractical.[390]

In discussing the trade-offs, the committee noted that if the limited exceptions allowing the use of pesticides in certain circumstances were ended, there might be a risk of unwanted effects. If fields deteriorate too quickly in quality, managers may decide to switch to artificial grass. From the point of view of sustainability, artificial grass is a much worse option than occasional use

[387] Green Deal gewasbeschermingsmiddelen sportvelden | RIVM
[388] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.
[389] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.
[390] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.

of pesticides. Moreover, the use of artificial grass may lead to not playing enough on natural fields when artificial grass fields are present, leading to avoidable presence of weeds. [391]

Within the framework of Sports Sustainability Roadmap, an Integrated Sports Management Manual was published in the Netherlands in 2023. This manual emphasizes the need for a structured, cyclical planning approach, in which the monitoring of field quality has an important role to play. It explains the importance of monitoring, applying damage thresholds and incorporating IPM into the management cycle. It stresses the importance of making the management quality of grass fields visible as a measure for the success of IPM measures and discusses how to translate the indicative values of weeds and diseases into improvements in management. It also explains the use of field work forms for quality assessment of different types of sports fields and provides a digital bank of checklists and forms.[392]

[391] Noodzakelijk gebruik van gewasbeschermingsmiddelen op sportvelden met natuurgras; addendum 2022 | Rapport | Rijksoverheid.nl.
[392] Handleiding_Geintegreerd_Sportgrasbeheer_Mrt2023_6da1cb7d6b.pdf (windows.net).

ANNEX 6: TECHNICAL CLARIFICATIONS IN RELATION TO AREAS FOR WHICH THE FUTURE MONITORING ESTABLISHES THAT THEY SUSTAIN ONE OR MORE POLLINATOR SPECIES THREATENED WITH EXTINCTION

A number of Member States have raised concerns regarding areas designated for future monitoring of pollinators, as the areas to be designated in the future under the Nature Restoration Law proposal[393] are not yet known. These technical clarifications are an attempt to address those concerns.

The methodology for the monitoring of pollinators is expected to be defined in an Implementing Act, in accordance with Article 8 (2) of the Nature Restoration Law proposal. The first data of the monitoring can be expected by 2025/2026.

To date, European Red Lists exist for three pollinator groups: butterflies, bees, and hoverflies[394]. Species categorised as threatened at European level typically have very specific habitat requirements to meet essential needs such as forage, shelter, breeding, nesting, and over-wintering.

Sensitive areas are to be established where at least one threatened pollinator species is sustained. This means that the species in question have a population in this area that is likely to persist over time. The existence of such population is conditioned by the existence of specific habitats that the species requires. Thus, the sensitive area should cover all relevant habitat area, and a functional buffer zone around it to mitigate drift effects.

As a direct consequence of these specific ecological requirements, the likelihood that a population of a red-listed pollinator species classified as being threatened with extinction will ever be recorded on intensively used grasslands or croplands is extremely small. Red-listed pollinator species classified as being threatened with extinction can occur in semi-natural species-rich grasslands and other unfertilised Natura 2000 grassland habitats but are very unlikely to be detected on other agricultural lands.

<u>Examples</u>:

- Most red-listed butterflies are dependent on specific habitats with host plants for the development of their caterpillars. As an example, the Apollo Butterfly (*Parnassius apollo*) is confined to fresh meadows and rocky slopes that sustain the food plants of its caterpillars, the stonecrop (*Sedum* and *Hylotelephium* species) or the houseleek (*Sempervivum* species).
- Threatened solitary bees are often specialists for a small range of wild flower species. As an example, some Pantaloon Bees (*Dasypoda* species) only collect pollen from teasel plants (*Dipsacus* species). The location of these plants can be identified and used for the designation of a sensitive area after a population of the endangered species has been located.
- Most threatened hoverfly species rely on natural or semi-natural habitats that are themselves threatened, from forest with over-mature trees to specific types of bogs, fens, marshes and semi-natural grasslands. In the Mediterranean region, many threatened hoverfly species depend on wild bulb plants that have restricted distributions.

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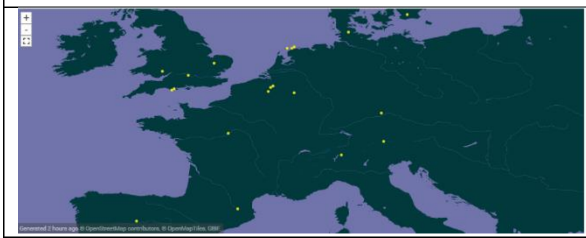
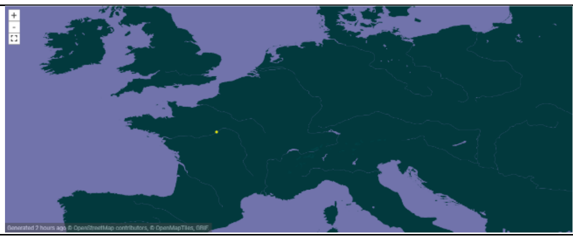
[393] Proposal for a regulation of the European Parliament and of the Council on nature restoration (2022/0195(COD)).
[394] https://wikis.ec.europa.eu/display/EUPKH/Endangered+species+-+Red+List.

Most wild pollinator species move across rather limited ranges (Hofmann et al., 2020; Woodgate et al., 2016) in a local environmental context. In particular, wild bees are central place foragers that move back and forth between the food sources and a nesting site. Long flight ranges across several kilometres are observed for the managed honeybee but are rare for wild pollinator species.

Observations of individual specimens of threatened pollinator species that cannot be linked to the presence of a local population and suitable habitats should not necessarily mean this species is established in this area and that the area should be designated as sensitive.

In this Annex, geo-referenced data of recorded sightings of bee species are presented (yellow dots). The data are taken from the Global Biodiversity Information Facility (GBIF, www.gbif.org), which is a comprehensive database of recorded occurrences of wild species. The recorded occurrences are presented for two different time spans: on the left side over the entire time for which there are observations included in the GBIF database, and on the right side for the more recent period from 2000 to 2022. This indicates that the distribution ranges of species threatened species has been reduced in many cases.

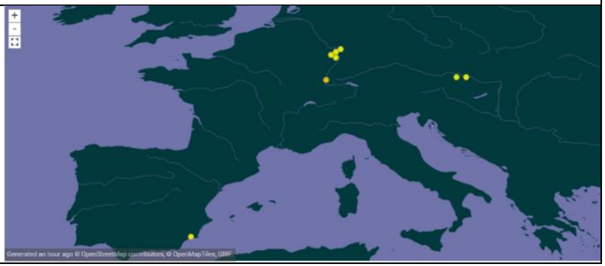
Bombus collumanus, critically endangered

1886 – 2022	**2000 – 2022**
	

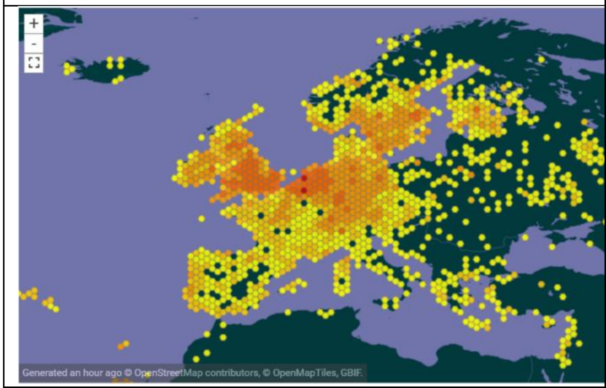
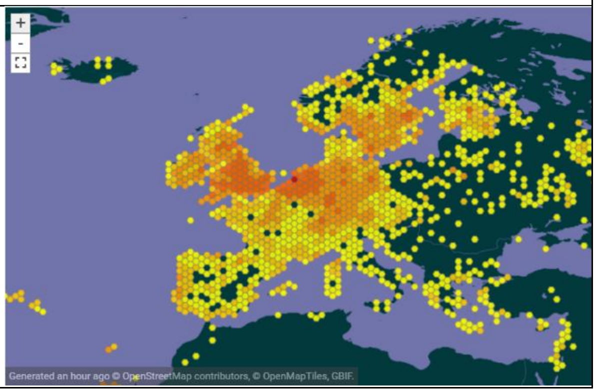
Lasioglossum quadrisignatum, endangered

1875 – 2022	**2000 – 2022**
	

Systropha planidens, vulnerable

1875 - 2022	2000 – 2022
	

By means of comparison, data are also presented for a common wild bee species, ***Bombus terrestis***. This species, which is not threatened by extinction, should not be taken into account for the designation of sensitive areas. These data are solely presented in order to show the reliability of the datasets currently available.

1720 - 2022	2000 – 2022
	

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