

Northumbria Research Link

Citation: Cimatti, Marta, Pacifici, Michela, Dragonetti, Chiara, Sessa, Andrea, Rondinini, Carlo, Casanova, Ivon Constanza Cuadros, Mendez, Valeria Y. A., Di Marco, Moreno, Cristiano, Andrea and Biancolini, Dino (2023) Opportunities and challenges for Common Agricultural Policy reform to support the European Green Deal. *Conservation Biology*, 37 (3). e14052. ISSN 0888-8892

Published by: Wiley-Blackwell

URL: <https://doi.org/10.1111/cobi.14052> <<https://doi.org/10.1111/cobi.14052>>

This version was downloaded from Northumbria Research Link:
<https://nrl.northumbria.ac.uk/id/eprint/50993/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

Opportunities and challenges from the new CAP reform to support the European Green Deal

Journal:	<i>Conservation Biology</i>
Manuscript ID	22-249.R2
Wiley - Manuscript type:	Practice and Policy
Keywords:	Biodiversity conservation, Climate change, Common Agricultural Policy, Environmental policy, European Green Deal, Farm to Fork Strategy, Food production, Sustainable agriculture
Abstract:	<p>The Common Agricultural Policy (CAP) is the European Union's main instrument for agricultural planning, with a new reform approved for 2023-2027. The CAP intends to be aligned with the European Green Deal, a set of policy initiatives underpinning sustainable development and climate neutrality in the EU, but several flaws cast doubts about the compatibility of the objectives of these two policies. We reviewed recent literature on the potential of CAP environmental objectives for integration with the Green Deal: protection of biodiversity, climate change mitigation and adaptation, and sustainable management of natural resources. We found the CAP lacks appropriate planning measures, furthering instead the risk to biodiversity and ecosystem services driven by landscape and biotic homogenization. Funding allocation mechanisms are not tailored to mitigate agricultural emissions, decreasing the efficiency of climate mitigation actions. The legislation subsidises farms making extensive use of synthetic inputs without adequately supporting organic production, hindering the transition towards sustainable practices. We recommend proper control mechanisms to be introduced in CAP Strategic Plans from each Member State, to ensure the EU is set towards a sustainable production and consumption path. These include proportional assignment of funds to each CAP objective, quantitative targets to set goals and evidence-based interventions, and relevant indicators to facilitate effective monitoring of environmental performance. Additionally, both the CAP and the Green Deal should maintain ambitious environmental commitments in the face of crisis, to avoid further degradation of the natural resources on which our production systems stand.</p>

1 **Opportunities and challenges for the CAP reform to support the European Green Deal**

2 **Abstract**

3 The Common Agricultural Policy (CAP) is the European Union's main instrument for agricultural
4 planning, with a new reform approved for 2023-2027. The CAP intends to be aligned with the
5 European Green Deal, a set of policy initiatives underpinning sustainable development and climate
6 neutrality in the EU, but several flaws cast doubts about the compatibility of the objectives of these
7 two policies. We reviewed recent literature on the potential of CAP environmental objectives for
8 integration with the Green Deal: protection of biodiversity, climate change mitigation and adaptation,
9 and sustainable management of natural resources. We found the CAP lacks appropriate planning
10 measures, furthering instead the risk to biodiversity and ecosystem services driven by landscape and
11 biotic homogenization. Funding allocation mechanisms are not tailored to mitigate agricultural
12 emissions, decreasing the efficiency of climate mitigation actions. The legislation subsidises farms
13 making extensive use of synthetic inputs without adequately supporting organic production, hindering
14 the transition towards sustainable practices. We recommend proper control mechanisms to be
15 introduced in CAP Strategic Plans from each Member State, to ensure the EU is set towards a
16 sustainable production and consumption path. These include proportional assignment of funds to
17 each CAP objective, quantitative targets to set goals and evidence-based interventions, and relevant
18 indicators to facilitate effective monitoring of environmental performance. Additionally, both the CAP
19 and the Green Deal should maintain ambitious environmental commitments in the face of crisis, to
20 avoid further degradation of the natural resources on which our production systems stand.

21

22 Introduction

23 In 2019 the European Commission reaffirmed its commitments to tackle sustainability challenges by
24 adopting the European Green Deal, a set of policy initiatives aimed at reducing the environmental
25 footprint of the EU. Under this overarching goal, the EU Green Deal aims to introduce new legislations
26 on the energetic and transport sectors, research and innovation, climate neutrality, and industrial and
27 agricultural sustainable development. To enhance the implementation of the Green Deal
28 environmental commitments, the EU adopted a Biodiversity Strategy, a Farm to Fork Strategy, and a
29 proposal for climate action (European Commission, 2019a), later ratified as a binding Climate Law, to
30 achieve climate neutrality by 2050 (Official Journal of the European Union, 2021). The specific
31 objectives of these strategies include restoring degraded ecosystems, establishing biodiversity-rich
32 landscape features on farmlands, halting and reversing species declines, increasing targets for the
33 reduction of greenhouse emissions, restoring and maintaining carbon sinks, managing agricultural
34 land under organic farming, reducing the use and risk of pesticides and fertilisers, and reducing soil
35 degradation. These strategies are especially relevant for the conservation of natural assets in
36 agricultural landscapes, but a significant challenge for their successful implementation is to have direct
37 alignment with other major European policies that could support similar environmental objectives,
38 such as the Common Agricultural Policy (CAP; European Commission, 2020a; Pe'er et al, 2022).

39 Established in 1957, the CAP is one of the world's largest and oldest agricultural policies in force. It is
40 the most expensive policy in the EU (34.5% of the total EU annual budget in 2020) intended for
41 planning and regulating support programmes for farms and rural areas. The CAP has undergone
42 several reforms since its establishment and is currently expected to be the main EU instrument to
43 address the challenges of sustainable development (European Parliament, 2020). Recognising the role
44 of agriculture as a primary producer of public goods, and responding to social demands to protect
45 them, a new focus on innovation, climate change, and the environment was pursued since the 2013
46 CAP reform (2014-2020 financial period), when greening payments for environmental goods were

47 agreed. Later, in the 2018 reform (2021-2027 financial period), the European Commission drafted the
48 first proposal with three specific objectives that were subsequently incorporated, confirming new
49 overall performance goals: i) contribute to the protection of biodiversity, enhance ecosystem services,
50 and preserve habitats and landscapes; ii) contribute to climate change mitigation and adaptation, as
51 well as sustainable energy; iii) foster sustainable development and efficient management of natural
52 resources such as water, soil, and air.

53 These objectives acknowledge the role of the CAP in preventing further environmental degradation
54 that past reforms failed to address, hindering the transition towards agricultural sustainability (Pe'er
55 et al., 2019). For example, over 70% of the CAP budget goes to Direct Payments under Pillar I, which
56 grant farmers a viable income support based on the number of hectares farmed. However, it has been
57 demonstrated that past payments favoured mostly input-intensive systems responsible for high
58 greenhouse gas (GHG) emissions and were disproportionately concentrated in regions where income
59 is already above the EU median, aggravating income inequality and providing only marginal support
60 to biodiversity-, climate- and environment-friendly practices (Scown et al., 2020). A smaller share of
61 the CAP budget (about 23%) goes to the Rural Development Programme under Pillar II. It contains
62 measures for rural development and voluntary actions for climate and environment, including
63 compensation for income foregone associated with environmentally friendly practices within a
64 scheme known as Agri-Environment-Climate Measures (AECM). Within AECMs, measures adopted can
65 vary significantly between Member States, and with them the criteria for fund allocation, creating
66 substantial discrepancies in how states use their funds (Alliance Environment, 2019). This also
67 provided monetary benefits to farmers engaging in agricultural practices without explicit
68 environmental protection goals, reducing the effectiveness of the scheme to achieve better
69 environmental performance (Simoncini et al., 2019)

70 With recently signed commitments on the European Green Deal, in 2020 the European Parliament
71 agreed on a general CAP reform, and in July 2021 it ratified the new CAP to enter into force for the

72 period 2023-2027 (with a two-year delay due to COVID-19). As a result of the reform, the new
73 environmental architecture of the CAP replaces the former Cross Compliance scheme, under which
74 farmers had to respect a basic set of rules to be eligible for receiving EU income support, with a new
75 payment approach based on a system of enhanced conditionality requirements. These include two
76 mechanisms, the Statutory Management Requirements (SMR), comprising National and EU
77 regulations, and a set of land maintenance conditions known as the Good Agricultural and
78 Environmental Conditions of land (GAEC). Farmers are eligible to receive payments according to their
79 performance measured on a set of indicators in accordance with Strategic Plans defined by Member
80 States. In an attempt to raise environmental ambition beyond conditionality requirements, voluntary
81 measures in the form of AECMs were confirmed in Pillar II, while the previous Greening instrument
82 has been replaced by Eco-Schemes under Pillar I (Council of the European Union, 2021). Within those
83 two instruments, Member States will decide how to allocate funding for voluntary measures tailored
84 to meet their own specific needs (European Commission, 2020a).

85 The approved CAP reform aims to reflect the Green Deal objectives, but substantial flaws in the design
86 of its mechanisms raise doubts about the effectiveness of resource allocation to achieve the
87 environmental commitments (Pe'er et al., 2021). Here we present the challenges that the approved
88 CAP faces to fulfil its sustainability ambitions, and the opportunities it provides for Member States to
89 improve their environmental performance, with the aim of successfully integrating with the Green
90 Deal mandate. Based on the framework of the Biodiversity Strategy, the European Climate Law, and
91 the Farm to Fork Strategy, we provide recommendations for the implementation of CAP national
92 Strategic Plans that can support the achievement of the Green Deal's objectives for the protection of
93 biodiversity, climate change mitigation and adaptation, and the sustainable management of natural
94 resources.

95

96 **Protection of biodiversity**

97 The protection and restoration of biodiversity in agricultural landscapes is a priority action to ensure
98 sustainable food systems in the EU. Accordingly, the Green Deal set provisions in its Biodiversity
99 Strategy for 2030, with objectives and commitments that will enable transformative changes to
100 benefit both nature and people (Table 1). In accordance with those provisions, CAP objective 6 aims
101 at protecting biodiversity and their derived ecosystem services. Yet, several concerns exist about how
102 the CAP mechanisms could support the achievement of the Green Deal objectives of protecting
103 natural landscapes and species, envisioned under the Biodiversity Strategy. In contrast with the Green
104 Deal commitment to restore degraded ecosystems and farmland biodiversity, previous CAP
105 regulations that contributed to the intensification of European agriculture through production-
106 oriented mechanisms such as payments per hectare or number of livestock heads (Emmerson et al.,
107 2016; Pe'er et al., 2017) remain unchanged in the current reform. Although economically beneficial
108 for some, the widespread adoption of such policy brought detrimental unintended effects on farmland
109 biodiversity. The continuation of these practices can hinder the environmental ambitions of both the
110 CAP and the Green Deal (Scown et al., 2020). For example, payments based on farmland size resulted
111 in major economic revenues to bigger farms incentivizing increments in field size, while incentives to
112 growing mainly eligible crops increased production of a few selected varieties. This resulted in the
113 homogenization of large cropland extensions that negatively affected biodiversity through different
114 mechanisms. Directly, the reduction of landscape features such as hedges, trees, and wetland areas
115 led to a decrease of permanent refuges for species that rely on these features, thereby depleting
116 reservoirs of biodiversity in farm landscapes. Indirectly, the larger the field the smaller the amount of
117 different crop types that coexist in a landscape, further aggravating landscape homogenization and
118 biodiversity loss (Lefebvre et al., 2012). Landscape homogenization acts as a facilitator of invasive
119 species due to simplified ecological communities (Gamez-Virués et al., 2015), and leads to the loss of
120 beneficial species such as wild pollinators and pest control organisms, with significant negative effects
121 on crop productivity (Potts et al., 2016). Agricultural intensification remains one of the main causes of
122 biodiversity loss and ecosystem degradation in Europe (EEA, 2019), with severe consequences on

123 farmland species including widespread insect and bird populations declines (European Court of
124 Auditors, 2020a). Preventing such effects would be cheaper than correcting them after an impact has
125 occurred (Hanley and Roberts, 2019), making the protection of species within agricultural landscapes
126 both ecologically and economically advantageous.

127 Failure of intensively managed landscapes to deliver ecosystem services urges to protect and restore
128 native species within them (Garibaldi et al., 2019). Accordingly, the Green Deal proposes a return of
129 at least 10% of Europe's agricultural area to lands with high-diversity landscape features, while the
130 CAP recognized the ecological relevance of certain agricultural systems to maintain biodiversity and
131 deliver ecosystem services beyond food production. With the purpose of improving on-farm
132 biodiversity, the CAP set GAEC 8 to devote at least 4% of arable land to non-productive features,
133 notably falling short of the corresponding Green Deal ambition (Table 1). The CAP also integrated an
134 indicator to measure the area under commitments that support conservation and restoration,
135 including high-nature-value farmlands (HNVs; Result Indicator R.31^{PR}). HNVS consist of production
136 systems characterised by low-intensity practices with strategic importance for the EU because of their
137 remarkably good biodiversity values and ecosystem services provision including water and soil
138 protection, carbon storage, and fire and climate change mitigation. Despite their ecological value, the
139 persistence of HNVS is threatened by agricultural intensification (Keenleyside et al., 2014), and their
140 delineation remains unclear and as such any practical implementation to prioritise them (Navarro and
141 López-Bao, 2018). The latest reform did not allocate specific targets to define and increase HNVS areas,
142 nor specific income support to make them economically viable (Alliance Environment, 2019). HNVS
143 biodiversity and ecosystem service provision are valuable to meet growing demands for multi-
144 functional agricultural landscapes, consequently clear criteria to identify them should be defined,
145 while Member States should prioritise their maintenance, expansion and monitoring of the
146 biodiversity state within them.

147 As both the Green Deal and the CAP aim at protecting biodiversity-rich landscapes, appropriate
148 indicators are crucial to establish effective monitoring programs to identify and measure the state of
149 farmland biodiversity features and address biodiversity threats accordingly. Indicators should thus
150 provide the baseline to quantify progress towards the achievement of biodiversity objectives both
151 within the CAP and Green Deal. Yet, the indicators adopted within the CAP fail to address the
152 complexity of farmland biodiversity and how it is impacted by agricultural activities. Two context
153 indicators were adopted to measure trends in species populations: the Farmland Bird Index (I.19),
154 measuring changes in the relative abundance of common bird species, and Enhancing Biodiversity
155 Protection (I.20), which measures the percentage of species and habitats of Community interest
156 related to agricultural landscapes with stable or increasing trends. Other indicators refer to general
157 habitat state: the optional Natura 2000 areas indicator, measuring the area protected that is used for
158 agriculture and forestry; and two mandatory indicators, measuring Share of agricultural land covered
159 with landscape features (I.21), and Share of Utilised Agricultural Area under supported commitments
160 for managing landscape features (R.34^{PR}). These indicators do not comprehensively assess the status
161 of farmland biodiversity nor the impacts of agriculture. For example, insects and freshwater species
162 that declined due to agricultural practices are not specifically considered (European Court of Auditors,
163 2020a). The implementation of additional indicators, such as the European Grassland Butterfly
164 Indicator, has been repeatedly suggested due to its well established monitoring programme, but was
165 never considered (Pe'er et al., 2020). Since data collection depends mostly on different programs
166 unrelated to the CAP, associating biodiversity trends with specific agricultural practices remains
167 challenging. CAP biodiversity assessments should aim to evaluate species population trends, measure
168 the impact of specific interventions, and timely identify threats. A monitoring framework tailored to
169 measure the effects of agriculture and food production systems on biodiversity would enable faster
170 decision making processes to take timely actions and reverse negative trends (Table 2).

171

172 **Climate change mitigation and adaptation**

173 In order to tackle the pressing challenge of climate change, the European Commission enacted the
174 Climate Law and the 2030 Climate Target Plan as part of the Green Deal strategies. Their main
175 objective is to incentivize the reduction of industrial, agricultural and civil GHG emissions by 2030,
176 with the ultimate aim to reach climate neutrality by 2050. Agriculture is deeply interconnected with
177 climate change, being one of the drivers of GHG emissions and highly sensitive to its effects. Extreme
178 weather events affect agricultural production, causing reduced yields and economic losses which are
179 expected to aggravate in the future, warranting the need for mitigation policies. Agriculture is
180 responsible for 12.7% of the EU's GHG emission, with a mitigation potential of around 90 million t
181 CO₂eq per year by 2050 (Alliance Environment, 2018). Cutting emissions from agriculture is
182 subsequently one of the overarching principles of the CAP, reflected in the specific objective 4 (Table
183 3).

184 Within the CAP, several farming practices have been listed as potential strategies to reduce emissions,
185 including the conversion of arable land to grassland (when soil is not managed for intensive livestock),
186 tillage reduction, agroforestry practices, and wetlands conservation and restoration (Martineau et al.,
187 2016). However, the feasibility of these practices is not addressed by the CAP reform, which lacks
188 specific targets and pathways for GHG reduction. Animal production systems and synthetic
189 agricultural inputs are the major causes of agricultural emissions, but clear mechanisms to reduce or
190 mitigate their impacts are missing from the reform. As such, there is no baseline for Member States
191 to plan the transition towards sustainable production systems of both livestock and crops. The CAP
192 instituted GAECs to safeguard permanent grasslands, carbon rich soils and soil organic matter, but
193 decreases in the grassland/cropland ratios are still allowed, effectively depleting carbon stocks,
194 despite the Green Deal commitments. The lack of guidelines for the protection of soils and organic
195 matter also raises concerns on the consistency of the measures that farmers could adopt across
196 different regional contexts (Table 3).

197 The mismatch between climate mitigation requirements and the expected outcomes derives in part
198 from the funding allocation mechanisms. According to the Green Deal, funds allocated to climate
199 action should be at least 40% of the CAP overall budget. Yet Member States are only required to assign
200 25% of their Pillar I budgets (approximately 19% of the total CAP resources) to Eco-schemes targeting
201 climate and environmental action. Additionally, only 30% of the European Agricultural Fund for Rural
202 Development in Pillar II (around 7% of the total CAP budget) is bound to finance environment and
203 climate investments, and fundings allocation is not systematically linked to any effective climate
204 mitigation or adaptation strategy. In delineating the requirements for GAECs, Eco-schemes and
205 AECMs, Member States can adopt measures with only marginal effects on climate mitigation and
206 adaptation, such as mechanical weed control or the cultivation of leguminous plants for crop rotation.
207 Therefore, there is a risk that funds may not be properly assigned, leading to farmers responsible for
208 disproportionately higher emissions to receive more money compared to those who comply with
209 more restrictive practices. This unresolved drawback evidenced in the past CAP formulation is caused
210 by funding not being allocated based on the effective implementation of sustainable measures, but
211 on farm area size (Pe'er et al., 2020). If large, intensively managed farms continue to receive the
212 majority of income support without conforming to clear environmental targets, the policy will not
213 achieve a substantial reduction of GHG emissions (Scown et al., 2020). Without a solid strategic
214 framework for national plans delineation and international coordination, and with no measures to
215 monitor the efficiency of the CAP in reducing emissions, the pledge to contribute to the EU reduction
216 of GHG emissions by 2030 seems unlikely to be achieved.

217 Member States are allowed to dispose of funding to select greening-equivalent practices tailored to
218 their national contexts, but this flexibility has been used as a shortcut to facilitate the implementation
219 of greening measures without substantial changes in farming practices (Simoncini et al., 2019).
220 Member States should implement climatic measures in order to attain the commitment set in the
221 Green Deal objectives to reduce emissions by 55% by 2030. Eco-schemes represent a powerful tool to
222 achieve meaningful mitigation objectives, consequently assigning fixed portions of the budget for

223 specific climate-friendly measures would ensure that the CAP will finance climate action in farmlands
224 (Guyomard et al., 2020). Eco-schemes could also act as support and compensation tools for farmers
225 that are willing to downsize livestock production systems in favour of other less impactful practices.
226 Livestock production systems, which encompass meat and dairy production as well as pasture and
227 animal waste management (Robinson et al., 2011), account for two thirds of the EU agricultural GHG
228 emission and their reduction in size would remarkably decrease the environmental footprint of EU
229 agriculture. Finally, eco-schemes could also bolster the creation of national programmes to preserve
230 peatlands and marshlands against drainage and degradation, which are currently responsible for a
231 significant portion of agricultural emissions. Measures funded by AECMs could incentivize the
232 implementation of long-term mitigation targets and compensate for market-based inequalities to
233 facilitate the transition towards sustainable agriculture.

234

235 **Sustainable management of natural resources**

236 Within the Green Deal, the Farm to Fork Strategy is the main tool to address sustainability challenges
237 in agriculture. The overarching goal of the Strategy is to reduce the environmental impact of
238 agriculture while ensuring access to fair, healthy and environmentally friendly food systems, with the
239 same commitments being addressed by CAP specific objective 5 (Table 4). In this regard, pesticide
240 reduction is key to halt environmental degradation. The unregulated use of synthetic farm inputs
241 negatively affects wild communities, reducing ecosystem functions and services. Up to 50% of fruits,
242 vegetables and cereals grown in the EU contain pesticide residues, raising concern about their possible
243 negative effects on human health (Bjørning-Poulsen et al., 2008). Since 1997, the European
244 Commission recognised the relevance of setting limit values in synthetic inputs as an effective strategy
245 to promote their reduction and avoid the undesired consequences of long-term exposure on human
246 health and the environment. More than two decades later, limits are not yet enforced, pesticides sales
247 have not decreased, and the level of human exposure remains largely unknown (Eurostat, 2021). To

248 address these concerns, the Farm to Fork strategy set objectives to reduce the use and risk of
249 pesticides, and the CAP conditionality scheme included two old directives, SMR 12 and 13, on Plant
250 protection products. However, their unsuccessful application in the past (European Commission,
251 2020b) raises doubts on the effects they could have in future reforms if the same mechanisms persist.
252 Besides these directives, no strategies were included to encourage pesticide reduction, and the lack
253 of targets and standardised monitoring is likely to limit CAP achievements. Organic farming aims to
254 produce food using natural substances and processes, therefore it has great potential to reduce
255 synthetic input use, and prevent the pollution of soils, water, and air. It is one of the few
256 environmental practices with a specific support mechanism in AECMs payments for converting to or
257 maintaining it. However, the policy lacks specific targets to incentivize the shift towards organic
258 practices, which remain marginal in extent (European Commission, 2020c). Moreover, farmers are still
259 unprotected against supply-demand imbalances that put them at a disadvantage over conventional
260 market competitors, and hinder the accessibility of organic products to consumers (Naspetti & Zanoli,
261 2012).

262 The protection of soil and water resources is a priority of the Green Deal. Still, the CAP conditionality
263 measures do not provide adequate thresholds and criteria to enforce it, nor efficient strategies to
264 mitigate nutrient losses as a consequence of intensive agricultural practices. GAEC 7 concerning crop
265 rotation fails to address the issues already highlighted in the previous CAP reforms by setting
266 exemptions that greatly diminish its efficacy, while measures for water protection rely on articles of
267 old European directives that are inadequate to respond to current environmental challenges.
268 Specifically, the directives in SMR 1 and 2 concerning protection of waters against nitrate and
269 phosphate pollution, disregard the negative environmental and health effects of other pollutants,
270 such as copper and cadmium associated with unsustainable agricultural practices. Adequate pesticide
271 and nitrates usage reporting should complement the obligatory requirements aimed at preserving soil
272 potential (Guyomard et al., 2020).

273 The Green Deal also acknowledges unsustainable food production as an important driver of natural
274 resources degradation and GHG emissions globally, and the Farm to Fork Strategy pledges to reduce
275 such impacts of food supply chains by ensuring sustainable production and facilitating the shift to
276 healthy diets (European Commission, 2019a). CAP subsidies can influence production patterns and
277 lead the EU towards sustainable food systems, but Direct Payments excessively subsidise the
278 production of dairy and meat products, associated with high levels of resource consumption and
279 environmental impacts. Incentives to increase meat and dairy production indirectly promote higher
280 demand for livestock feeds, like soy. About 97% of the total soy products required by the EU in 2020
281 was imported, and 72% of the imports came from biodiversity-rich countries in South America,
282 bringing about deforestation with all its associated environmental impacts (Boshnakova et al., 2021;
283 Kuepper and Stravens, 2022). Direct Payments also continue to offer income security for crops used
284 as substitutes for fossil fuels which, although necessary to reduce fossil fuels demand, promoted
285 native habitat loss in overseas territories (Muller and Bautze, 2017). Approved subsidies to oilseed
286 plantations in pristine areas of French Guiana's Amazon forest, with a premise to incentivise jobs and
287 improve the energetic provision of biofuels, pose the risk of promoting large-scale deforestation in
288 previously unaffected areas (Catanoso, 2020). Despite these effects, the approved legislation lacks
289 clear mechanisms or sanctions to prevent detrimental practices, and it is up to Member States to
290 properly address CAP resources towards environmentally sustainable production.

291 The Green Deal also recognized food waste and unsustainable consumption as key drivers of
292 biodiversity loss, contamination of soil and water resources, excessive carbon footprint, use of
293 pesticides and health issues (European Commission, 2020d). Consumption of meat and dairy above
294 healthy consumption levels and their unsustainable production should be specifically addressed in the
295 CAP. Yet the legislation actively subsidises their production, and overlooks practices to reduce
296 unhealthy intake of such products. Discouraging unhealthy consumption of livestock products could
297 benefit both the environment and public health, and the CAP should not disregard its potential key
298 role in preventing unsustainable practices (Table 2).

299

300 Opportunities for cross-cutting integrations

301 Despite the commitments of the policy, the set of CAP conditionality requirements and voluntary
302 schemes are functionally disconnected from the objectives set under the EU Green Deal, weakening
303 the CAP ability to achieve pressing environmental objectives. The majority of monetary resources is
304 still pooled into payments that encourage input-intensive and high-emission systems, while the
305 economic and environmental added value from ecosystem services provided by low-input agricultural
306 areas has been largely overlooked. The new measures added by the enhanced conditionality scheme
307 establish lower levels of environmental protection compared to the previous obligatory greening
308 requirements under Cross-Compliance. The criteria to assess the efficiency of environmental practices
309 and to reject those that are ineffective remain unclear, while administrative penalties for beneficiaries
310 who do not comply appear to be less dissuasive than those previously enforced. Also, some of the
311 measures previously implemented as compulsory will now only be addressed in the voluntary Eco-
312 schemes, delegating responsibility to individual Member States (Appendix S1).

313 Due to the flexibility granted to Member States to promote interventions according to their assessed
314 priorities, environmental funds can be reallocated to other purposes which do not necessarily
315 prioritise environmental measures. To avoid this, Member States should allocate fixed portions of Eco-
316 schemes and AECM budgets to each environmental objective. Evidence-based interventions should
317 be defined to pursue specific targets that go beyond basic conditionality requirements and are
318 consistent with the overall goals of the Green Deal (Table 2). Their evaluation should be based on
319 quantitative assessments done on a regular basis, and specifically designed to measure the impact of
320 interventions. Embedding assessments in long-term monitoring programmes will allow for early
321 identification of trends and correction actions, especially if payments are based on performance.
322 Regionally predefined interventions could provide farmers with guidelines on how to implement Eco-
323 schemes and AECMs with proven positive environmental effects. Practices potentially benefiting

324 multiple CAP objectives should be strongly encouraged, such as reducing synthetic input usage to
325 benefit biodiversity, climate change mitigation, and water and soil quality (Figure 1).

326 The unprecedented degradation of nature and its negative effects on human wellbeing demand bold
327 policy measures to bring production sectors on the path of sustainable use of natural resources.
328 Although the CAP offers a variety of tools for the EU agricultural sector to do so, it fails to genuinely
329 compile mechanisms of adhesion to such schemes. Procedures introduced by the European
330 Commission to analyse Strategic Plan outcomes before their adoption (ex-ante impact assessments),
331 during implementation and after the end of the financial period (ex post evaluations), will remain
332 important mechanisms to monitor and strengthen the contribution of environmental interventions to
333 the CAP and Green Deal objectives. The European Commission and independent evaluators will need
334 to ensure that the allocation and use of funds is consistent with the expected results, and the urgency
335 to enhance the applicability of effective environmental measures (European Commission, 2019b;
336 2022). Ambitious implementation by Member States will define if environmental and climate
337 commitments proposed under the Green Deal will be achieved.

338

339 **Environmental commitments amidst global crises**

340 The Russian invasion of Ukraine exposed the fragility of unsustainable food systems reliant on
341 industrial intensive inputs such as agrochemicals and fossil fuel (Hanson et al., 2022). The market crisis
342 followed by the war put food security at risk within the EU and worldwide, pushing legislators for rapid
343 roll-backs of elusive environmental progress made over recent years. For example, the temporal
344 derogation of the Ecological Focus Areas, one of the few greening measures set in CAP 2014-2020 with
345 the objective to increase the area for crop production, may have disproportionately negative effects
346 on biodiversity and ecosystem services in comparison with the expected increase in food production.
347 Since Ecological Focus Areas can increase the capacity of landscapes to supply important ecosystem
348 services, their suspension will likely worsen the negative effects of climate change and environmental

349 degradation on crop and dairy production in the long-term. The abolition of these areas to increase
350 cereal production in 2007 already showed the irreversible effects of similar measures on European
351 diversity (Herzon et al., 2011). The Green Deal strategies and the CAP have the potential to redesign
352 production and consumption patterns in the EU to rightfully respond to the current biodiversity and
353 climate emergencies by maintaining its environmental ambition to make its food system sustainable,
354 resilient, and climate neutral. Consequently, the environmental commitments of those policies should
355 not be watered down nor counteracted in times of crisis and shifting political priorities (Strange et al.,
356 2022). The consequences of doing so threaten the natural resources and biodiversity on which the
357 foundation of food systems stand. Food insecurity and the social and economic impacts of it will only
358 increase if unsustainable production and consumption practices continue defining our food systems,
359 as demonstrated by the food and energy crisis following the Russo-Ukrainian War.

360

361 **Supporting Information**

362 Additional Supporting Information may be found in the online version of the article at the publisher's
363 website.

364

365 **References**

- 366 Alliance Environment. (2018). *Evaluation study of the impact of the CAP on climate change and*
367 *greenhouse gas emissions*. Final Report. European Commission
- 368 Alliance Environment. (2019) *Evaluation of the impact of the CAP on habitats, landscapes,*
369 *biodiversity*. Final Report. European Commission.
- 370 Boshnakova, M., Fischer, J., Krautgartner, R., Omnes, M. (2021). *EU 28: Oilseeds and products semi-*
371 *annual*. GAIN Report Number: AU1501. USDA Foreign Agricultural Service.
- 372 Bjørling-Poulsen, M., Andersen, H. R., & Grandjean, P. (2008). Potential developmental neurotoxicity
373 of pesticides used in Europe. *Environmental Health*, 7(1), 1-22.
- 374 Catanoso, J. (2020). French Guiana soy biofuel power plants risk massive Amazon deforestation.
375 Mongabay. [https://news.mongabay.com/2020/12/french-guiana-soy-biofuel-power-plants-](https://news.mongabay.com/2020/12/french-guiana-soy-biofuel-power-plants-risk-massive-amazon-deforestation/)
376 [risk-massive-amazon-deforestation/](https://news.mongabay.com/2020/12/french-guiana-soy-biofuel-power-plants-risk-massive-amazon-deforestation/)
- 377 Corporate Europe Observatory. (2020). *CAP vs Farm to Fork. Will we pay billions to destroy, or to*
378 *support biodiversity, climate, and farmers?*. Corporate Europe Observatory.
- 379 Council of the European Union. (2021). Proposal for a Regulation of the European Parliament and of
380 the Council establishing rules on support for strategic plans to be drawn up by Member
381 States under the Common agricultural policy and financed by the European Agricultural
382 Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development
383 (EAFRD) and repealing Regulation (EU) No 1305/2013 of the European Parliament and of the
384 Council and Regulation (EU) No 1307/2013 of the European Parliament and of the Council.
- 385 Emmerson, M., Morales, M. B., Oñate, J. J., Batary, P., Berendse, F., Liira, J., ... & Bengtsson, J. (2016).
386 How agricultural intensification affects biodiversity and ecosystem services. *Advances in*
387 *ecological research*, 55, 43-97.

- 388 European Commission. (2019a). The European Green Deal. COM/2019/640 final.
- 389 European Commission. (2019b). *Indicative outline of terms of reference for the ex-ante evaluation of*
390 *the CAP strategic plan. TWG-7 / Tool 1.2.*
- 391 European Commission. (2020a). Analysis of links between CAP Reform and Green Deal. SWD(2020)
392 93 final.
- 393 European Commission. (2020b). *Report from the commission to the European parliament and the*
394 *council on the experience gained by Member States on the implementation of national*
395 *targets established in their National Action Plans and on progress in the implementation of*
396 *Directive 2009/128/EC on the sustainable use of pesticides.*
- 397 European Commission. (2020c). EU agriculture in numbers – Performance on the nine specific
398 objectives of the CAP. EU country factsheets. Agriculture and Rural Development.
399 [https://agriculture.ec.europa.eu/cap-my-country/performance-agricultural-](https://agriculture.ec.europa.eu/cap-my-country/performance-agricultural-policy/agriculture-country/cap-specific-objectives-country_en)
400 [policy/agriculture-country/cap-specific-objectives-country_en](https://agriculture.ec.europa.eu/cap-my-country/performance-agricultural-policy/agriculture-country/cap-specific-objectives-country_en)
- 401 European Commission. (2020d). Farm to fork strategy: for a fair, healthy and environmentally-
402 friendly food system. Communication from the Commission to the European Parliament, the
403 Council, the European Economic and Social Committee and the Committee of the Regions.
- 404 European Commission. (2022). Commission Implementing Regulation (EU) 2022/1475 of 6
405 September 2022 laying down detailed rules for implementation of Regulation (EU)
406 2021/2115 of the European Parliament and of the Council as regards the evaluation of the
407 CAP Strategic Plans and the provision of information for monitoring and evaluation.
- 408 European Court of Auditors. (2017). *Greening: a more complex income support scheme, not yet*
409 *environmentally effective. Special Report 21/2017. Publications Office of the European*
410 *Union.*

- 411 European Court of Auditors. (2020a). *Biodiversity on farmland: CAP contribution has not halted the*
412 *decline. Special Report*. Publications Office of the European Union.
- 413 European Court of Auditors. (2020b). *Protection of wild pollinators in the EU - Commission initiatives*
414 *have not borne fruit*. Special Report. Publications Office of the European Union.
- 415 European Environment Agency. (2019). *The European Environment—State and Outlook 2020:*
416 *Knowledge for Transition to a Sustainable Europe*.
- 417 European Parliament. (2020). Towards a post-2020 common agricultural policy. Fact Sheets on the
418 European Union. [https://www.europarl.europa.eu/factsheets/en/sheet/113/towards-a-](https://www.europarl.europa.eu/factsheets/en/sheet/113/towards-a-post-2020-common-agricultural-policy)
419 [post-2020-common-agricultural-policy](https://www.europarl.europa.eu/factsheets/en/sheet/113/towards-a-post-2020-common-agricultural-policy)
- 420 Eurostat (2021). Agri-environmental indicator - consumption of pesticides.
421 [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_consumption_of_pesticides)
422 [environmental indicator - consumption of pesticides](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_consumption_of_pesticides)
- 423 Gamez-Virués, S., Perovic, D. J., Gossner, M. M., Börschig, C., Blüthgen, N., de Jong, H., ... Westphal,
424 C. (2015) Landscape simplification filters species traits and drives biotic homogenization.
425 *Nature Communications*, 6(1), 1-8.
- 426 Garibaldi, L. A., Pérez-Méndez, N., Garratt, M. P., Gemmill-Herren, B., Miguez, F. E., & Dicks, L. V.
427 (2019). Policies for ecological intensification of crop production. *Trends in ecology &*
428 *evolution*, 34(4), 282-286.
- 429 Guyomard, H., Bureau, J., Chatellier, V., Détang-Dessendre, C., Dupraz, P., Jacquet, F., Reboud, X.,
430 Requillart, V., Soler, L., Tysebaert, M. (2020). The Green Deal and the CAP: policy
431 implications to adapt farming practices and to preserve the EU's natural resources. Policy
432 Department for Structural and Cohesion Policies. European Parliament.
- 433 Hanley, N., & Roberts, M. (2019). The economic benefits of invasive species management. *People*
434 *and Nature*, 1(2), 124-137.

- 435 Hanson, C., Ranganathan, J., Davey, E., Searchinger, T., & Holzer, J. (2022). The Ukraine Crisis
436 Threatens a Sustainable Food Future. World Resources Institute.
437 [https://www.wri.org/insights/ukraine-food-security-climate-](https://www.wri.org/insights/ukraine-food-security-climate-change?utm_medium=email&utm_source=rasa_io)
438 [change?utm_medium=email&utm_source=rasa_io](https://www.wri.org/insights/ukraine-food-security-climate-change?utm_medium=email&utm_source=rasa_io)
- 439 Herzon, I., Ekroos, J., Rintala, J., Tiainen, J., Seimola, T., & Vepsäläinen, V. (2011). Importance
440 of set-aside for breeding birds of open farmland in Finland. *Agriculture, ecosystems &*
441 *environment*, 143(1), 3-7.
- 442 Keenleyside, C., Beaufoy, G., Tucker, G., & Jones, G. (2014). *High Nature Value farming throughout*
443 *EU-27 and its financial support under the CAP*. Institute for European Environmental Policy,
444 London, 10, 91086.
- 445 Kuepper, B. & M. Stravens (2022). *Mapping the European Soy Supply Chain – Embedded Soy in*
446 *Animal Products Consumed in the EU27+UK*. Profundo. The Netherlands
- 447 Lefebvre, M., Espinosa, M., & Gomez y Paloma, S. (2012). *The influence of the Common Agricultural*
448 *Policy on agricultural landscapes*. Report EUR 25459 EN. European Commission.
- 449 Martineau, H., Wiltshire, J., Webb, J., Hart, K., Keenleyside, C., Baldock, D., Bett., Watterson, J.
450 (2016). *Effective performance of tools for climate action policy-meta-review of Common*
451 *Agricultural Policy mainstreaming*. Institute for European Environmental Policy
- 452 Muller, A., & Bautze, L. (2017). *Agriculture and deforestation: The EU Common Agricultural Policy,*
453 *soy, and forest destruction*. FERN.
- 454 Naspetti, S., & Zanolli, R. (2012). Organic meat production in Europe. Market and regulation. Pages
455 53-66 in Ricke, Van Loo, Johnson, O'Bryan. *Organic meat production and processing*.
- 456 Navarro, A., & López-Bao, J. V. (2018). Towards a greener common agricultural policy. *Nature*
457 *ecology & evolution*, 2(12), 1830-1833.

- 458 Official Journal of the European Union. (2021). Regulation (EU) 2021/1119 of the European Parliament
459 and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality
460 and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').
- 461 Pe'er, G., Lakner, S., Müller, R., Passoni, G., Bontzorlos, V., Clough, D., & Sutherland, W. (2017). *Is*
462 *the CAP Fit for purpose. An evidence-based, rapid fitness-check assessment*. German Centre
463 for Integrative Biodiversity Research (iDiv). Halle-Jena-Leipzig.
- 464 Pe'er, G., Zinngrebe, Y., Moreira, F., Sirarmi, C., Schindler, S., Müller, R., ... & Lakner, S. (2019). A
465 greener path for the EU Common Agricultural Policy. *Science*, 365(6452), 449-451.
- 466 Pe'er, G., Bonn, A., Bruelheide, H., Dieker, P., Eisenhauer, N., Feindt, P. H., ... & Lakner, S. (2020).
467 Action Needed for the EU Common Agricultural Policy to Address Sustainability Challenges.
468 *People and Nature*, 2(2), 305-316.
- 469 Pe'er, G., Birkenstock, M., Lakner, S., & Röder, N. (2021). *The Common Agricultural Policy post-2020.*
470 *Views and recommendations from scientists to improve performance for biodiversity: Volume*
471 *1 - Synthesis Report*. (No. 311098) Johann Heinrich von Thuenen-Institut (vTI).
- 472 Pe'er, G., Finn, J. A., Díaz, M., Birkenstock, M., Lakner, S., Röder, N., ... & Guyomard, H.
473 (2022). How can the European Common Agricultural Policy help halt biodiversity loss?
474 Recommendations by over 300 experts. *Conservation Letters*, e12901.
- 475 Potts, S. G., Ngo, H. T., Biesmeijer, J. C., Breeze, T. D., Dicks, L. V., Garibaldi, L. A., ... & Vanbergen, A.
476 (2016). *The Assessment Report of the Intergovernmental Science-Policy Platform on*
477 *Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production*.
478 Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem
479 Services. Bonn, Germany.
- 480 Robinson, T. P., Thornton, P. K., Francesconi, G. N., Kruska, R. L., Chiozza, F., Notenbaert, A. M. O., ...
481 & See, L. (2011). *Global livestock production systems*. FAO and ILRI.

- 482 Scown, M. W., Brady, M. V., & Nicholas, K. A. (2020). Billions in Misspent EU Agricultural Subsidies
483 Could Support the Sustainable Development Goals. *One Earth*, 3(2), 237-250
- 484 Simoncini, R., Ring, I., Sandström, C., Albert, C., Kasymov, U., & Arlettaz, R. (2019). Constraints and
485 opportunities for mainstreaming biodiversity and ecosystem services in the EU's Common
486 Agricultural Policy: Insights from the IPBES assessment for Europe and Central Asia. *Land use
487 policy*, 88, 104099.
- 488 Strange, N., Geldmann, J., Burgess, N. D., & Bull, J. W. (2022). Policy responses to the Ukraine crisis
489 threaten European biodiversity. *Nature Ecology & Evolution*, 1-2.
- 490 Tanneberger, F., Appulo, L., Ewert, S., Lakner, S., Ó Brolcháin, N., Peters, J., & Wichtmann, W. (2020).
491 The Power of Nature-Based Solutions: How Peatlands Can Help Us to Achieve Key EU
492 Sustainability Objectives. *Advanced Sustainable Systems*, 5(1), 2000146.
- 493 Thomson, A. M., Ellis, E. C., Grau, H. R., Kuemmerle, T., Meyfroidt, P., Ramankutty, N., & Zeleke, G.
494 (2019). Sustainable intensification in land systems: trade-offs, scales, and contexts. *Current
495 Opinion in Environmental Sustainability*, 38, 37-43.

496 **Table 1.** Comparison of EU Green Deal Biodiversity Strategy and the corresponding Common Agricultural Policy (CAP) objectives regarding protection of biodiversity and habitats^{1*}
497

EU Green Deal objectives	CAP objectives and measures	CAP provisions and mismatches with the Green Deal	References
Halting and reversing the decline of pollinators	Contribution to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes (CAP specific objective 6)	<ul style="list-style-type: none"> No targets or interventions to maintain or enhance wild pollinators diversity at local or landscape level. Species monitoring is restricted to threatened species, according to the species of Community interest in the Natura 2000 framework. However early detection of threats or decreasing population trends requires comprehensive monitoring programmes of species, areas, and environmental practices for which there are no clear financing mechanisms. Species trends are assessed using multiannual output indicators, which can potentially hinder timely actions to deter threats occurring within shorter timeframes. Member States can include advisory services, technical assistance, training, information, and exchange of best practices to beekeepers' organisations. However, there are no indicators to measure the effectiveness of these tools 	Council of the European Union, 2020 European Court of Auditors, 2020b
Manage established invasive alien species and decrease by 50% the number of Red List species they threaten by 2050		<ul style="list-style-type: none"> There are no landscape planning strategies dedicated to maintaining biodiversity for farmers willing to increase productivity by the intensification of agricultural activities. As a result, agricultural expansion and intensification might further homogenise landscapes and biological communities, reducing their resistance to threats such as biological invasions and pest outbreaks. The introduction and management of invasive animal species are not addressed in the CAP. Only optional measures for avoiding invasive plant species are mentioned. The management of invasive animal species should also be addressed. 	Gamez-Virués et al., 2015 Thomson et al., 2019
Increasing land for biodiversity and bringing at least 10% of agricultural area under high-diversity landscape features	Maintenance of non-productive features and areas to improve on-farm biodiversity (GAEC 8)	<p><u>“Minimum share of agricultural area devoted to non-productive areas or features. Minimum share of at least 4% of arable land at farm level devoted to non-productive areas and features, including land lying fallow. Where a farmer commits to devote at least 7% of his/her arable land to non-productive areas and features [...]. Minimum share of at least 7% of arable land at farm level if this includes also catch crops or nitrogen fixing crops, cultivated without the use of plant protection products [...], of which 3% shall be lying fallow or non-productive feature [...]. Ban on cutting hedges and trees during the bird breeding and rearing season. As an option, measures for avoiding invasive plant species.” (GAEC 8).</u></p> <ul style="list-style-type: none"> Thresholds are too low to be effective compared to successful intervention programmes. Fast-growing crops are unlikely to deliver significant results for native or endangered biodiversity. Hedges and trees can be cut out during the breeding season. Member States can exempt holdings from the obligation under several conditions, greatly decreasing the extent and the effectiveness of GAEC 8. In 2018, only 0.5% of agricultural area was covered by landscape features, and 4.1% by land lying fallow. The new optional measure does not raise environmental ambition to match the Green Deal commitment, despite declining on-farm biodiversity trends. Following the introduction of greening measures in CAP 2014-2020, holdings where the Ecological Focus Areas (now GAEC 8) did result in a positive change in farming practices is estimated to be 1% of total EU arable land. 48% of farmed areas were exempt due to small farm size. Semi-natural habitats declined and the new conditionality system is not addressing the issue to halt the trend. 	European Commission, 2020b European Court of Auditors, 2017 Pe'er et al., 2019 Scown et al., 2020 Pe'er et al., 2021
	Protection of habitat and species (GAEC 9)	<p><u>“Ban on converting or ploughing permanent grassland designated as environmentally-sensitive permanent grasslands in Natura 2000 sites” (GAEC 9).</u></p> <ul style="list-style-type: none"> In 2018 there were 16.6 million ha of permanent grasslands in Natura 2000 areas. Of this, 9.54 million ha (57.6%) was designated as environmentally-sensitive permanent grasslands, but only 4.9 million ha (29.6%) were declared by farmers as such. Natura 2000 areas not designated as “sensitive sites” are excluded, hence subsidies to practices converting species-rich natural land might persist within Protected Areas. The CAP has a limited effect since environmentally-sensitive permanent grasslands cover approximately 16 % of all permanent grassland in the EU. About 38% of all Natura 2000 habitat types are linked to agriculture, and only 7% show a favourable conservation status compared to 21% for non-agricultural habitats. High Nature Value farmlands were used to identify agricultural areas with the highest environmental and biodiversity value, but their preservation was poorly operationalized, resulting in no targeted funding. 58% of Direct Payments under Pillar 1 went to 40% of regions maintaining the lowest fraction of High Nature Value farmland. The new result indicator on High Nature Value farming assesses the area covered with this measure, rather than the actual contribution to biodiversity. Without proper assessments tailored to biodiversity improvement the effectiveness of interventions will be unknown. 	Alliance Environment, 2019 European Court of Auditors, 2017 Simoncini et al., 2019

^{1*} Table 1 highlights challenges between Common Agricultural Policy (CAP) measures and the achievement of environmental objectives set under the Green Deal Biodiversity Strategy. Underlined words refer to the Good Agricultural and Environmental Conditions of land (GAECs) approved on 28 July 2021 by Member States' (MS) delegations and the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027.

498 **Table 2.** Recommendations for Member States for implementing Strategic Plans to facilitate the compatibility between The Green Deal and the achievement of Common Agricultural Policy (CAP) specific objectives^{2*}.
499

Protection of biodiversity (Biodiversity Strategy, CAP specific objective 6)	
AECMs	<ul style="list-style-type: none"> • Set a target to maintain or recover 10% of native habitats with non-productive areas as proposed by The Green Deal. All landscape feature areas should be eligible for support. • Set a target of 20% native habitat protected across all agricultural landscapes, to maintain ecosystem services at large (not just food production). • Define clear regional criteria to identify and register High Nature Value farmlands. Set short-term stepping stone targets within Annual Performance reviews to spatially document them.
Eco-schemes	<ul style="list-style-type: none"> • Prioritise improvement and restoration of landscape heterogeneity by providing economic incentives to increase the amount of in-farm habitats (e.g., margins and buffer strips, pollen providing crops) from 4% (GAEC 8) to 10% (as proposed by the Green Deal) through stepping stone targets. • Support biodiversity monitoring schemes to assess population trends and to measure threats to biodiversity in agricultural landscapes, according to the sites' ecological features, as part of the Strategic Plans performance reviews. • Prioritise interventions to address threats driving species population declines. • Establish cooperative support programs to reward and promote the maintenance of functional connectivity between patches of ecological importance (e.g. reed beds, shrublands, grassland) across farmland areas hosting species or habitats of high conservation relevance. • Achieve a 50% expansion and, where needed, restoration of environmentally-sensitive permanent grasslands in regions well below the EU average.
Climate change mitigation and adaptation (Climate Law, CAP specific objective 4)	
AECMs	<ul style="list-style-type: none"> • Set quantitative progressive targets for the reduction of GHG emissions, verifiable during each Annual Performance Review, towards the final commitment of reducing emissions of 55% by 2030. • Differentiate emission reduction targets for livestock, fuel, and food crops according to their impact and extent.
Eco-schemes	<ul style="list-style-type: none"> • Discontinue eco-schemes support if short-term goals are not achieved during two following years. Extra funds should be used to increase the ceiling of support to compliant farmers. • Establish incentives for farmers who avoid ploughing grassland plots, and expand the proportion of on-farm permanent grassland beyond the requirements of GAEC 1 (i.e. 10% following the Green Deal). • Promote and incentivise the maintenance and restoration of natural habitats with high capacity of carbon retention (e.g., saltmarshes, native forests, wetlands, peatlands), and make paludiculture set of practices eligible for support payments • Provide financial incentives to agroforestry schemes in abandoned agricultural areas for their potential to restore carbon retention and biodiversity values. • Provide compensation to support farmers switching their current agricultural systems towards carbon sustainable practices (e.g. agroforestry, silvopasture, organic composting, guiding and monitoring the process with progressive targets following a long-term strategy complemented by AECMs. • Set targets and actions to reduce consumption of red meat products to favour both greenhouse gases emission reduction and health indicators, according to the European Commission recommendations and projection (Current consumption: 1.5kg/week; Projected in 2030: 1.3kg/week. Recommended: 0.3kg/week per person).
Sustainable management of natural resources (Farm to Fork Strategy, CAP specific objective 5)	
AECMs	<ul style="list-style-type: none"> • Set yearly targets of organic farming expansion according to countries' 2023-year baseline, and in accordance with the EU overall goal set by the Farm to Fork strategy of 25% by 2030. • Provide incentives to farmers who use a significant portion (e.g. 50%) of low-impact alternative livestock feed, with the aim of reducing habitat loss in feed producing areas.
Eco-schemes	<ul style="list-style-type: none"> • Establish advisory services to provide farmers with continuous access to updated information regarding the implementation of sustainable practices and measure the percentage of farmers trained per administrative area (e.g. Integrated Pest Management). • Define Integrated Pest Management principles into practical and assessable criteria and incentivize their implementation in Strategic Plans. • Promote the use of secure Information tools to record the amount, extent, and frequency of application of pesticides along with their toxicity level for humans and wild plants and animals.

500

501

^{2*} The Common Agricultural Policy (CAP) Environmental Infrastructure of Agri-Environment-Climate Measures (AECMs), Eco-schemes and Good Agricultural and Environmental Conditions of land (GAECs) refers to provisions approved on 28 July 2021 by Member States' delegations and the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027.

502 **Table 3.** Comparison of EU Green Deal Climate Law and the corresponding Common Agricultural Policy (CAP) objectives regarding climate mitigation and adaptation^{3*}.

503

EU Green Deal objectives	CAP objectives and measures	CAP provisions and mismatches with the Green Deal	References
Increase the EU greenhouse gas emission reductions target for 2030 to at least 55% compared to 1990 (from 1990 levels)	Contribute to climate change mitigation and adaptation, as well as sustainable energy (CAP specific objective 4)	<ul style="list-style-type: none"> • Agriculture's share in total net emission increased from 11.8% to 12.6% between 1995 and 2017. 68% of total agricultural land is used for animal production, which accounts for nearly 70% of emissions. Within the CAP there are no specific targets for greenhouse gases mitigation with regards to agriculture production. The policy does not address differences in emissions coming from agricultural land or pastures. • Between 2013 and 2020, 70% of Direct Payments were paid to the highest 50% of greenhouse gases emitting regions. Payments were 1.5 higher in more polluting regions than in the lowest polluting regions. The reform does not address this standing issue. 	European Commission, 2020b Scown et al., 2020
Grow carbon sink to reach 300 million tons CO ₂ equivalent by 2030	General safeguard against conversion to other agricultural uses to preserve carbon stock (GAEC 1)	<p><u>"Maintenance of permanent grassland based on a ratio of permanent grassland in relation to agricultural area at national, regional, sub-regional, group-of-holdings or holding level in comparison to the reference year 2018. Maximum decrease of 5% compared to the reference year" (GAEC 1).</u></p> <ul style="list-style-type: none"> • Rather than promoting grassland conservation, this measure allows further declines with subsequent losses of carbon stocks. • Afforestation and reforestation will be implemented by Member States via the Rural Development Fund, however no comprehensive strategic plan has been delineated, ignoring that positive outcomes are context dependent. Poorly planned conversion of grassland to forest can be detrimental for grassland biodiversity. 	Pe'er et al., 2019 Pe'er et al., 2020
Grow carbon sink to reach 300 million tons CO ₂ equivalent by 2030	Protection of carbon rich soils (GAEC 2) Maintenance of soil organic matter (GAEC 3)	<p><u>"Protection of wetland and peatland" (GAEC 2).</u></p> <ul style="list-style-type: none"> • There are no clear guidelines on the minimum degree of protection required. Member States can delay the application of GAEC 2 for up to two years, further hindering climate mitigation progress. <p><u>"Ban on burning arable stubble, except for plant health reasons" (GAEC 3).</u></p> <ul style="list-style-type: none"> • GAECs are not mandatory for all farmlands. • Agriculture on drained peat soils constitutes only 2.5% of the EU agricultural area but generates approximately 25% of the total agricultural greenhouse gas emissions. CAP payments between 2014 and 2020 heavily supported the drainage of peatlands, depleting existing carbon stocks. The CAP reform does not address this mismatch with the Green Deal commitment. 	Scown et al., 2020 Tanneberger et al, 2020
At least 40% of CAP budget (2023-2027) would contribute to climate action	At least 30% of European Agricultural Fund for Rural Development (EAFRD) must be allocated to investment in the environment and climate, the development of woodland and improving the viability of forests, Agri-Environment-Climate Measures, organic farming, and Natura 2000 payments.	<ul style="list-style-type: none"> • EAFRD budgets were reduced in the post-2020 proposal from €99 to €77 billion, accounting for 22% of CAP expenditure. Climate and environment investments correspond to less than 7% of the total CAP budget. • Only 13% of the physical EU area is under Agri-Environment and Climate Measures that can mitigate CO₂ emissions. Strong differences still persist between Member States, compromising the overall efforts. • Average farm incomes in regions with highest agricultural greenhouse gases emission are almost 60% higher than those with lower emissions. CAP payments are not properly incentivizing climatic measures. • MS shall provide support for voluntary eco-schemes for climate and environment, however Member States can allocate funding to measures that are not related to climate action regardless of the thresholds envisioned by both the Green Deal and the CAP itself. 	European Parliament, 2020 Pe'er et al., 2019 Scown et al., 2020

504

505

^{3*} Table 3 highlights challenges between Common Agricultural Policy (CAP) measures and the achievement of environmental objectives set under the Green Deal Climate Law. Underlined words refer to the Good Agricultural and Environmental Conditions of land (GAECs) approved on 28 July 2021 by Member States' (MS) delegations and the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027.

506 **Table 4.** Comparison of EU Green Deal Farm to Fork strategy and the corresponding Common Agricultural Policy (CAP) objectives regarding sustainable management of natural resources^{4*}.
507

EU Green Deal objectives	CAP objectives and measures	CAP provisions and mismatches with the Green Deal	References
Achieve 25% EU agricultural farmland to be put under organic production by 2030		<ul style="list-style-type: none"> Total Utilised Agricultural Area for organic farming only increased from 2% in 2000 to 8% in 2018. Mechanisms regulating the distribution of CAP direct payments do not encourage the transition towards organic production and can instead reward environmentally harmful agricultural practices. There are no incentives for maintaining measures in the long-term, nor mandatory targets in the CAP to follow the Green Deal commitment. 	European Commission, 2020b Scown et al., 2020 Simoncini et al., 2019
50% reduction in antibiotics sale for farmed animals and aquaculture by 2030	Foster sustainable development and efficient management of natural resources such as water, soil and air (CAP specific objective 5)	<ul style="list-style-type: none"> The overall sales of veterinary antimicrobials across EU-27 decreased by one third between 2010 and 2017, but only for MS that provided yearly data. There are large differences between Member States. Member States shall include in their Strategic Plans a system providing farm advisory services to support land and farm management, aiming to prevent antimicrobial resistance, following "A European One Health Action Plan against Antimicrobial Resistance". However, Member States are not obliged to do so, and can rely on already existing systems, hindering the consistency of measures across EU states. 	Corporate Europe Observatory, 2020 European Commission, 2020b
Reducing by 50% the use and the risk of chemical pesticides by 2030		<ul style="list-style-type: none"> In the past, the European Crop Protection Association has not been able to provide data on pesticide use and supplies, hindering the reduction. The CAP reform does not enforce compliance. No appropriate measures and targets to monitor or reduce use, risk and impacts of pesticides by 2030. Poor enforcement has slowed down achievement of goals proposed in old directives. 	Corporate Europe Observatory, 2020
20% reduction in fertiliser use by 2030		<ul style="list-style-type: none"> Nitrogen surplus in EU-27 has not decreased between 2005-2015, remaining at 50 kg/ha per year. There are no measures in the CAP concerning the sustainable use of fertilisers and nutrients. The Farm Sustainability Tool for Nutrients to monitor and optimise usage of nutrients across farmlands was proposed, but later cancelled. 	Corporate Europe Observatory, 2020 European Commission, 2020b
Reduce nutrient losses by at least 50%, while ensuring no deterioration on soil fertility		<p>Minimum land management reflecting site specific conditions to limit erosion (GAEC 5)</p> <p>Protection of soils in periods that are most sensitive (GAEC 6)</p> <p>Preserve the soil potential (GAEC 7)</p>	<p><u>"Tillage management, reducing the risk of soil degradation and erosion, including consideration of the slope gradient" (GAEC 5).</u></p> <ul style="list-style-type: none"> The measures are not mandatory and they do not address nutrient loss due to soil degradation. <p><u>"Minimum soil cover to avoid bare soil in periods that are most sensitive" (GAEC 6).</u></p> <ul style="list-style-type: none"> There is no minimum threshold specified and no clear criteria to identify sensitive areas and/or periods. In 2016, 23% of EU arable land was left as bare soil with no vegetation cover during winter, with negative effects on soil erosion and run-off of both pesticides and nutrients. <p><u>"Crop rotation in arable land, except for crops growing under water" (GAEC 7).</u></p> <ul style="list-style-type: none"> <10 ha holdings are exempted from the requirement, and Member States can exempt from the standard holdings where 75% of the land is permanent grassland or used for the production of grasses or other herbaceous forage. The inefficiency of this practice to enhance soil conditions is not addressed by the new regulation. Under the current legislation, a single crop could cover up to 75% and two crops up to 95% of a farm area. Farms with <10 ha of arable area were exempt, accounting for 92% of arable holdings in new Member States and 13% of arable area across the EU. The most constraining component among diversification measures was the 75% threshold for the main cultivated crop, however the proportion of reallocated area due to the diversification measure represents less than 1% of total agricultural area.

508

^{4*} Table 4 highlights the challenges between Common Agricultural Policy (CAP) measures and the achievement of environmental objectives set under the Green Deal Farm to Fork strategy. Underlined words refer to the Good Agricultural and Environmental Conditions of land (GAECs) approved on 28 July 2021 by Member States' (MS) delegations and the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027.

509 **List of Figures**

510 **Figure 1.** Synergies between measures to pursue sustainable food production in the Common Agricultural Policy (CAP) reform and the proposed strategies of
511 the European Green Deal. The three main axes represent the Green Deal Strategies that support the environmental objectives of the CAP. Small boxes running
512 through the peripheral arrows and their direction indicate practices that can enhance the achievement of simultaneous CAP objectives or Green Deal
513 strategies. Arrows converging at the centre indicate measures, objectives and strategies that, if correctly implemented, have the potential to contribute to
514 the achievement of sustainable food production, the underlying scope of both the Green Deal and the CAP. Image credit: “Happy Cow” by Hagen Meischner,
515 retrieved from www.flickr.com/photos/hagens_world/14407622114 licensed under CC-BY-NC-ND 2.0.

516

517 **List of Tables**

518 **Table 1.** Comparison of EU Green Deal Biodiversity Strategy and the corresponding Common Agricultural Policy (CAP) objectives regarding protection of
519 biodiversity and habitats. Table 1 highlights challenges between CAP measures and the achievement of environmental objectives set under the Green Deal
520 Biodiversity Strategy. GAECs refer to Good Agricultural and Environmental Conditions of land approved on 28 July 2021 by Member States’ delegations and
521 the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027

522 **Table 2.** Recommendations for Member States while implementing their Strategic Plans to facilitate the compatibility between The Green Deal and the
523 achievement of CAP specific objectives. The CAP Environmental Infrastructure of Agri-Environment-Climate Measures (AECMs) and Eco-schemes refers to

524 provisions approved on 28 July 2021 by Member States' delegations and the Council Presidency, constituting a general approach on the CAP proposal for
525 2023-2027.

526 **Table 3.** Comparison of EU Green Deal Climate Law and the corresponding Common Agricultural Policy (CAP) objectives regarding climate mitigation and
527 adaptation. Table 3 highlights challenges between CAP measures and the achievement of environmental objectives set under the Green Deal Climate Law.
528 GAECs refer to Good Agricultural and Environmental Conditions of land approved on 28 July 2021 by Member States' (MS) delegations and the Council
529 Presidency, constituting a general approach on the CAP proposal for 2023-2027.

530 **Table 4.** Comparison of EU Green Deal Farm to Fork strategy and the corresponding Common Agricultural Policy (CAP) objectives regarding sustainable
531 management of natural resources. Table 4 highlights the challenges between CAP measures and the achievement of environmental objectives set under the
532 Green Deal Farm to Fork strategy. GAECs refer to Good Agricultural and Environmental Conditions of land approved on 28 July 2021 by Member States' (MS)
533 delegations and the Council Presidency, constituting a general approach on the CAP proposal for 2023-2027.

534

535 **Supporting Information**

536 **Appendix S1.** Additional recommendations for Member States to implement during the development of their Strategic Plans to improve the effectiveness and
537 efficiency of Good Agricultural and Environmental Conditions (GAECs¹). GAECs refer to the provisions in the CAP Environmental Infrastructure of conditionality

538 requirements approved on 28 July 2021 by Member States' delegations and the Council Presidency, constituting a general approach on the CAP proposal for
539 2023-2027.

For review only

Biodiversity Strategy

Enhanced ecosystem services

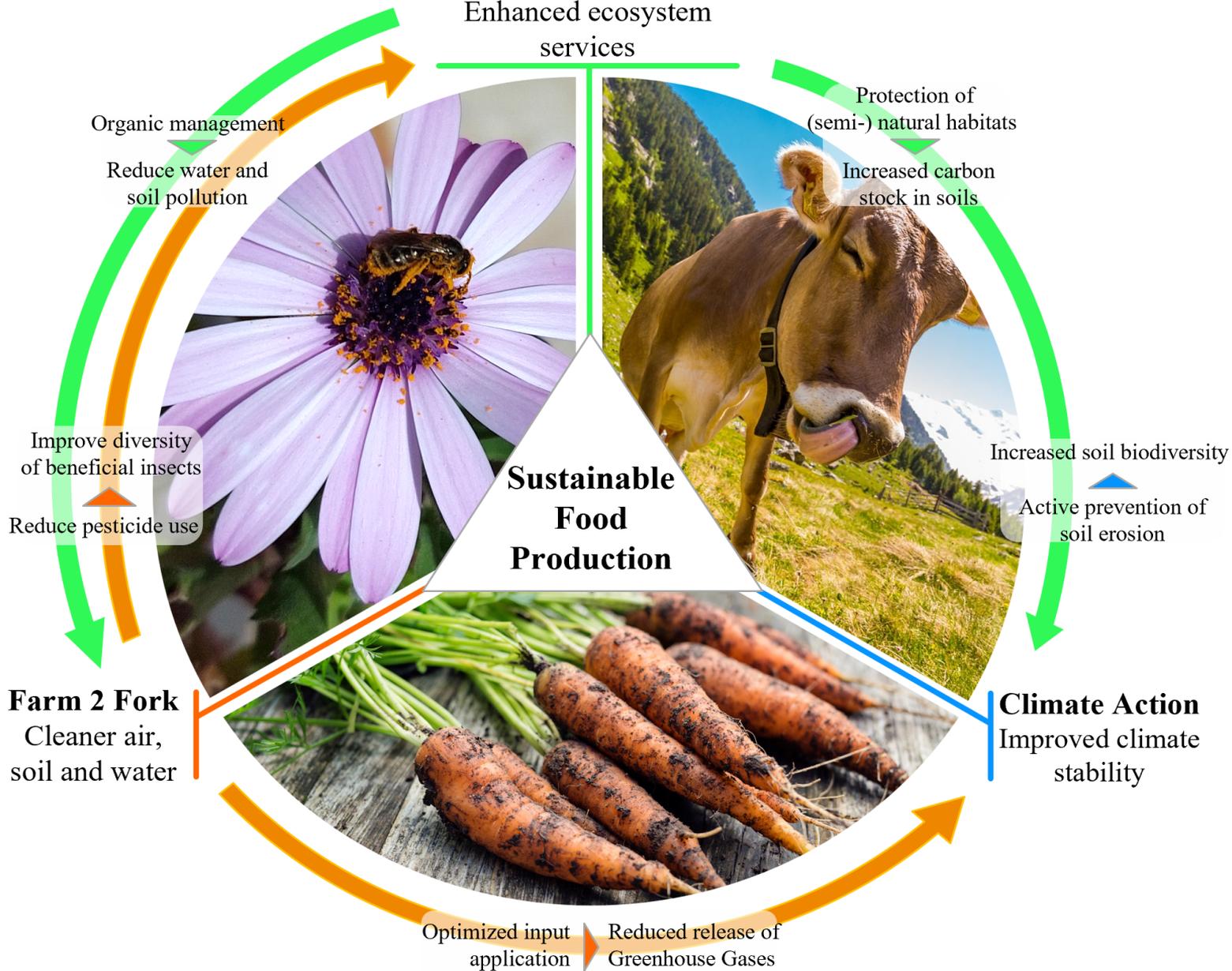


Figure 1. Synergies between measures to pursue sustainable food production in the Common Agricultural Policy (CAP) reform and the proposed strategies of the European Green Deal. The three main axes represent the Green Deal Strategies that support the environmental objectives of the CAP. Small boxes running through the peripheral arrows and their direction indicate practices that can enhance the achievement of simultaneous CAP objectives or Green Deal strategies. Arrows converging at the centre indicate measures, objectives and strategies that, if correctly implemented, have the potential to contribute to the achievement of sustainable food production, the underlying scope of both the Green Deal and the CAP.