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# Aligning food systems with climate and biodiversity targets

## Assessing the suitability of policy action over the next decade

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# Summary


- Current global biodiversity and climate change mitigation plans up to 2030 lack detail and suitable levels of ambition. Critical funding gaps in the region of $536 billion per year risk destabilizing biodiversity and climate efforts. Meanwhile, temperature rise and biodiversity loss continue, increasing the possibility of irreversible climate impacts and ecosystem destabilization.
- Insufficient ambition, detail and funding in all countries are not the only barriers to progress on this issue. Food is a critical area in which climate change mitigation and biodiversity policies intersect. Food systems contribute one-third of global anthropogenic greenhouse gas emissions, and agricultural land-use change is the leading cause of biodiversity loss. These trends are expected to continue. Anything short of a food system transformation is at odds with meeting climate change mitigation and biodiversity goals – including those targeting the protection of land, and particularly those focused on biodiversity net gains and limiting temperature rise to 1.5°C.
- While improvements are required across the global food system, the immediate focus must be on reducing the burden of animal agriculture. However, current ambitions to decrease farm-level impacts alone are insufficient, and action is also needed to reduce production of animal-sourced foods.
- As the largest advanced economies and wealthiest liberal democracies, the G7 members have a vital role to play in the next decade, both in terms of domestic policy and influence over lower-income countries. Wealthy countries with a legacy of emissions and biodiversity loss have the means and moral obligation to not only align their domestic activities with climate and biodiversity goals, but to also facilitate the collective global action required to meet international climate and biodiversity targets.
- Actions for the wealthiest nations, including those in the G7, must include:
  - A shift to a strategic approach based on protecting areas with high biodiversity and climate value, at home and abroad. This must go beyond simply designating an area as protected on a map.
  - The restoration of carbon- and biodiversity-rich areas. There is substantial potential to achieve this in high-income and upper-middle-income countries – but it is only possible with large-scale reductions in agricultural land use, enabled by shifting production away from animal agriculture.
  - A change to food production *and* consumption that is commensurate with domestic climate and biodiversity goals. This shift should protect globally important carbon and biodiversity repositories by reducing the demand for agricultural land abroad.
- The key areas of biodiversity and climate action for all countries are to:
  - Ensure that domestic biodiversity and climate policies over the next decade align with global biodiversity and climate change mitigation goals.
  - Pursue only food policies that are consistent with domestic climate change mitigation and biodiversity targets, and do not preclude attainment of climate and biodiversity goals at the global level.

# Introduction

Tackling the dual crises of climate change and biodiversity loss requires extraordinary levels of action across all sectors, at an unprecedented speed. However, efforts on both fronts could be negated by the ongoing and forecast increase of environmental impacts from food systems. Food production is the biggest user of land, the main source of global methane emissions, a major contributor to total greenhouse gas (GHG) emissions, and the leading driver of deforestation and biodiversity loss. On its current trajectory, food production is likely to result in further loss of carbon sinks, such as forests, and the wildlife they support.[1] Animal agriculture accounts for the majority of negative environmental impacts from the food system – due to the large scale of production and energy loss in converting plant nutrients to animal nutrients. Hence, while there is real potential to limit impacts from the entire food system (including cutting food waste), reducing the impacts of animal agriculture presents the biggest opportunity over the next decade. Anything short of a food system transformation[2] is at odds with meeting global climate change mitigation and biodiversity goals. Conversely, transforming food systems can link climate and biodiversity action – enabling meaningful, joined-up change on both fronts.

**Food production is the biggest user of land, the main source of global methane emissions, a major contributor to total greenhouse gas emissions, and the leading driver of biodiversity loss.**

This paper focuses on land use, which is where approaches to tackling climate change and biodiversity loss mostly intersect. As the biggest user of land globally (50 per cent of habitable land), agriculture warrants scrutiny. Occupying 78 per cent of agricultural land, animal agriculture offers a substantial leverage point to reduce the negative impacts from the food system, particularly given its high resource use compared to output (only 18 per cent of global calories and 37 per cent of global protein supply).[3] Currently, animal agriculture exceeds its fair share of resources, and production needs to be scaled back substantially (by approximately 70 per cent) to align with a 2°C temperature rise above pre-industrial levels.[4]

**1** Benton, T. G. et al. (2021), *Food system impacts on biodiversity loss: Three levers for food system transformation in support of nature*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/2021/02/food-system-impacts-biodiversity-loss; Williams, D. R. et al. (2020), 'Proactive conservation to prevent habitat losses to agricultural expansion', *Nature Sustainability*, 4, pp. 314–22, https://doi.org/10.1038/s41893-020-00656-5.
**2** This paper defines 'food system transformation' as fundamental changes to: food production (in terms of what is produced, where it is produced, and how it is produced); food consumption (both in terms of changing how much is consumed and what is consumed); food loss and waste (in terms of substantial reductions at all stages of the food system); market incentives (to align with fundamental shifts in production and consumption); and food trade stipulations (to align with fundamental shifts in production).
**3** Poore, J. and Nemecek, T. (2018), 'Reducing food's environmental impacts through producers and consumers', *Science*, 360(6392), pp. 987–92, https://doi.org/10.1126/science.aaq0216.
**4** Springmann, M. et al. (2018), 'Options for keeping the food system within environmental limits', *Nature*, 562(7728), pp. 519–25, https://doi.org/10.1038/s41586-018-0594-0.

Land-use change is the biggest cause of biodiversity loss worldwide – primarily due to the conversion of native habitats for animal agriculture (grazing land and feed crop production). Despite this, animal agriculture is forecast to grow substantially up to 2050, causing further loss of biodiversity and carbon stores – while increasing global competition for land. Staying within a 1.5°C global temperature rise – the more ambitious Paris target – requires the removal of large amounts (100–1,000 gigatonnes) of carbon dioxide ($CO_2$) from the atmosphere by 2100 as well as a decrease in emissions. Reducing GHG emissions significantly in the short term, combined with lower demand for energy and land, could reduce the extent of $CO_2$ removal (CDR) required to meet the Paris targets to approximately 300 gigatonnes of $CO_2$ (Gt $CO_2$). The large-scale deployment of afforestation (establishing trees where they were previously absent) and bioenergy for CDR could have major implications for food production and biodiversity, due to competition for land and other key resources, such as water and nutrients.[5] Conversely, restoring portions of agricultural land to their native land cover (which includes reforestation – i.e. reinstating trees where they were previously present) could contribute substantially to this CDR goal, and simultaneously help restore functioning, biodiverse ecosystems.[6] At present, afforestation and ecosystem restoration (including reforestation) are the only options available to achieve this at the required scale of deployment.[7] Avoiding excessive rises in global temperatures is important for reducing the requirement for large-scale CDR that could adversely impact biodiversity through land-use change, such as bioenergy with carbon capture and storage (BECCS). Overshooting the temperature targets is likely to have negative and irreversible direct impacts on biodiversity.[8]

Expectations of wealthy nations to increase their climate change mitigation and biodiversity efforts are rising. Wealthy nations have disproportionately contributed to GHG emissions and biodiversity loss historically, and most have per capita GHG levels above the current global average. As such, these well-resourced and relatively well-governed countries have the potential to make substantial changes on both fronts – by reducing GHG emissions from production and consumption activities, protecting remaining important carbon stores and biodiversity, and restoring lost habitats and wildlife. The G7 members are the largest advanced economies and wealthiest liberal democracies, currently accounting for 44 per cent of global GDP[9] and more than 50 per cent of global net wealth.[10] The G7 countries (Canada, France, Germany, Italy, Japan, the UK and the US) are all within the top

**5** Intergovernmental Panel on Climate Change (2018), 'Special Report: Global Warming of 1.5°C: Summary for Policymakers', https://www.ipcc.ch/sr15/chapter/spm.
**6** Hayek, M. N., Harwatt, H., Ripple, W. J. and Mueller, N. D. (2020), 'The carbon opportunity cost of animal-sourced food production on land', *Nature Sustainability*, 45(1), pp. 21–24, https://doi.org/10.1038/s41893-020-00603-4.
**7** Intergovernmental Panel on Climate Change (2022), *Climate Change 2022: Mitigation of Climate Change: Summary for Policymakers*, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf.
**8** Meyer, A. L. S. et al. (2022), 'Risks to biodiversity from temperature overshoot pathways', Philosophical Transactions of the Royal Society B, 377(1857), 20210394, https://doi.org/10.1098/rstb.2021.0394.
**9** World Bank (2022), 'GDP (current US$)', https://data.worldbank.org/indicator/NY.GDP.MKTP.CD (accessed 1 Aug. 2022).
**10** Credit Suisse (2021), 'The Global wealth report 2021', https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html.

20 contributors to cumulative $CO_2$ emissions over the period 1850–2021, including emissions from fossil fuels, land use and forestry.[11] The G7 2030 Nature Compact arguably positions the G7 as a focal point for biodiversity and climate action.

This paper considers the land-use policy outlook over the current decade in terms of suitability of ambition, with a particular focus on the wealthy nations comprising the G7. In addition, it explores the role of food system transformation as an essential component of meeting climate change mitigation and biodiversity goals. Finally, it identifies three key steps for countries to take to produce suitably ambitious and effective policies across the climate–biodiversity–food nexus.

## The decade ahead for biodiversity and climate action

Two of the three Rio Conventions that emerged from the 1992 Earth Summit – the UN Convention on Biological Diversity (UNCBD) and the UN Framework Convention on Climate Change (UNFCCC)[12] – are long-running multilateral processes that have so far failed to deliver sufficient action. However, they have successfully maintained a level of multilateral engagement that could facilitate global alignment of efforts to halt and reverse climate change and biodiversity loss. Global net anthropogenic GHG emissions are the highest on record and have almost tripled since 1990 alone (increasing from 21 Gt $CO_2$ equivalent to 59 Gt $CO_2e$ in 2019).[13] Biodiversity loss continues, with current levels of losses unprecedented since the fifth mass extinction event 65 million years ago.[14] Time is running out on both fronts. Hence, the decade ahead is highly anticipated to be a 'make or break' one for biodiversity and climate change.

### The post-2020 global biodiversity framework

During the 2010s, efforts to protect biodiversity on land under the UNCBD were guided by the Strategic Plan for Biodiversity 2011–2020, which contained a comprehensive set of strategic goals and targets, known as the Aichi biodiversity targets. Despite most countries under the UNCBD – barring the only non-signatory, the US – submitting at least one national biodiversity strategy and action plan (NBSAP), implementation was weak and only six of the Aichi biodiversity targets were partially achieved – none were fully met.[15] After almost 30 years of CBD negotiations and limited progress on halting biodiversity loss, the upcoming 15th Conference of the Parties (COP15)[16] is hugely significant because parties are expected to adopt a new global biodiversity framework (GBF), with a long-term vision including four goals for 2050, 10 milestones for 2030, and 21 'action targets'

**11** Carbon Brief (2021), 'Analysis: Which countries are historically responsible for climate change?', 5 October 2021, https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change.
**12** The third being the UN Convention to Combat Desertification.
**13** Intergovernmental Panel on Climate Change (2022), *Climate Change 2022: Mitigation of Climate Change*.
**14** IPBES (2019), 'Global assessment report on biodiversity and ecosystem services', https://ipbes.net/global-assessment; Almond, R. E. A., Grooten, M., Juffe Bignoli, D. and Petersen, T. (eds) (2022), *Living Planet Report 2022: Building a nature positive society*, Gland, Switzerland: WWF, https://wwflpr.awsassets.panda.org/downloads/lpr_2022_full_report.pdf.
**15** Convention on Biological Diversity (2020), 'Global Biodiversity Outlook 5', https://www.cbd.int/gbo5.
**16** Scheduled to take place in Montreal, Canada, in December 2022.

to also be achieved by 2030. Many of the flaws of the Aichi biodiversity targets need to be addressed – including an increased emphasis on resource mobilization and a better 'line of sight' on global and country performance, enabled by explicit targets and supporting indicators.[17] The GBF will establish a new structure and theory of change for the biodiversity regime, and direct countries' efforts to ensure integrated spatial planning, restoration of degraded land and effective conservation of biodiversity. The system is supported by a monitoring framework and a suite of headline indicators against which progress can be tracked. This will be critical to improve on the incoherent reporting of parties under the previous framework.

Although early drafts of the GBF signal stronger international ambition and renewed momentum for biodiversity protection, it is unlikely to become an equivalent of the 'Paris Agreement' for biodiversity. Global action on biodiversity loss is still immature and faces several barriers that are likely to stifle implementation. Firstly, the socio-economic impacts of biodiversity loss and benefits of biodiversity protection are not fully understood, especially by key decision-makers and influencers. Recent landmark reports[18] and the growth of natural capital accounting,[19] disclosures[20] and targets[21] are useful developments for some aspects of biodiversity protection, but efforts to account for the external costs of biodiversity loss lag far behind what is needed. This is despite more than half of global annual GDP being moderately or highly dependent on nature and its functions.[22] Secondly, domestic approaches to biodiversity loss have often been poorly resourced and delegated to executive arms with minimal powers over the key drivers of biodiversity loss, such as agriculture, trade relations, and patterns of resource production and consumption.[23] As such, biodiversity protection has been constrained to end-of-pipe solutions that are unable to reverse the devastating biodiversity trends caused by unsustainable food systems, excessive resource use, pollution, invasive species and climate change.[24] Finally, dominant narratives of biodiversity as a local, rather than global, common good have inhibited strong international cooperation. As a result, high-income nations have been reluctant to finance global natural commons, and biodiversity-rich nations have resisted ceding sovereignty to international treaties.[25]

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**17** Smart, J., Moreno, S. P. and Romero, V. (2021), *IUCN's Key Messages First Draft of the Post-2020 Global Biodiversity Framework*, Nyon: IUCN, https://www.iucn.org/sites/default/files/2022-07/iucn-key-messages-and-detailed-views-first-draft-post-2020-gbf.pdf; Green, E. J. et al. (2019), 'Relating characteristics of global biodiversity targets to reported progress', *Conservation Biology*, 33(6), pp. 1360–69, https://doi.org/10.1111/cobi.13322.
**18** Dasgupta, P. (2021), *The Economics of Biodiversity: The Dasgupta Review*, London: HM Treasury, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf; Waldron, A. et al. (2021), *Protecting 30% of the planet for nature: costs, benefits and economic implications*, working paper, Cambridge: Campaign for Nature, https://www.conservation.cam.ac.uk/files/waldron_report_30_by_30_publish.pdf.
**19** Hein, L. et al. (2020), 'Progress in natural capital accounting for ecosystems', *Science*, 367(6477), pp. 514–15, https://doi.org/10.1126/science.aaz8901.
**20** Taskforce on Nature-related Financial Disclosures (2022), 'Welcome to the TNFD Nature Related Risk & Opportunity Management and Disclosure Framework Beta v0.2', https://tnfd.global/tnfd-framework.
**21** Global Commons Alliance (2022), 'Science Based Targets Network', https://sciencebasedtargetsnetwork.org.
**22** WEF (2020), *Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy*, New Nature Economy series, Geneva, https://www.weforum.org/reports/nature-riskrising-why-the-crisis-engulfing-nature-matters-for-business-andthe-economy.
**23** Mansourian, S. and Parrotta, J. (2019), 'From addressing symptoms to tackling the illness: reversing forest loss and degradation', *Environmental Science & Policy*, 101(2019), pp. 262–265, https://doi.org/10.1016/j.envsci.2019.08.007.
**24** Balvanera, P. et al. (2019), 'Chapter 2.1: Status and trends-Drivers of change', in Lambin, E. and Mistry, J. (eds) (2019), *Global assessment report on biodiversity and ecosystem services,* Secretariat of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services, Bonn: IPBES, https://ipbes.net/global-assessment.
**25** Ring, I. et al. (2010), 'Challenges in framing the economics of ecosystems and biodiversity: the TEEB initiative', *Current Opinion in Environmental Sustainability*, 2(1–2), pp. 15–26, http://dx.doi.org/10.1016/j.cosust.2010.03.005.

Investments in nature-based solutions are a critical flow of biodiversity finance, which needs to grow substantially if climate change, biodiversity and land degradation targets are to be met, and confidence between nations strengthened. Currently, annual global investments in nature-based solutions amount to $133 billion, with over 98 per cent of this finance consisting of domestic government spending or private capital, rather than official development assistance (ODA). For international land, nature and climate targets to be met, overall funding should reach $536 billion per annum by 2050 – which means if funding remains at current levels there will be a cumulative gap of $4.1 trillion by mid-century.[26] Financial flows from higher-income to lower-income countries are an issue to be resolved in the GBF text at COP15, with potential figures ranging from $10 billion to $100 billion a year until 2030. So far, countries have broadly agreed on the need to increase financial support to lower-income, biodiversity-rich countries – although the amounts and delivery mechanisms are yet to be decided. In addition to continued disagreements around financing, most of the 21 GBF action targets – including area-based targets, the elimination of harmful subsidies, and the reduction of fertilizer and pesticide use – are still to be agreed, with the final text expected to be adopted at COP15. So far, text for only one action target (12) and one sub-target (19.2) has been agreed by all parties to the convention.[27]

**Investments in nature-based solutions are a critical flow of biodiversity finance, which needs to grow substantially if climate change, biodiversity and land degradation targets are to be met, and confidence between nations strengthened.**

### G7 2030 Nature Compact

Leading up to the COP15 summit, a growing number of high-level international alliances have called for more attention to be paid to the protection and restoration of biodiversity in the new GBF. Announced at the 2021 G7 summit, under the UK's presidency, the G7 2030 Nature Compact committed these developed countries to the global mission of halting and reversing biodiversity loss by 2030 – and specifically to take bold action to protect nature at the 2021 UNFCCC COP26 and the 2022 UNCBD COP15. G7 countries have committed to 'tackle these interdependent and mutually reinforcing crises in an integrated manner, thereby contributing to the achievement of the Sustainable Development Goals and a green, inclusive and resilient recovery from COVID-19'.[28]

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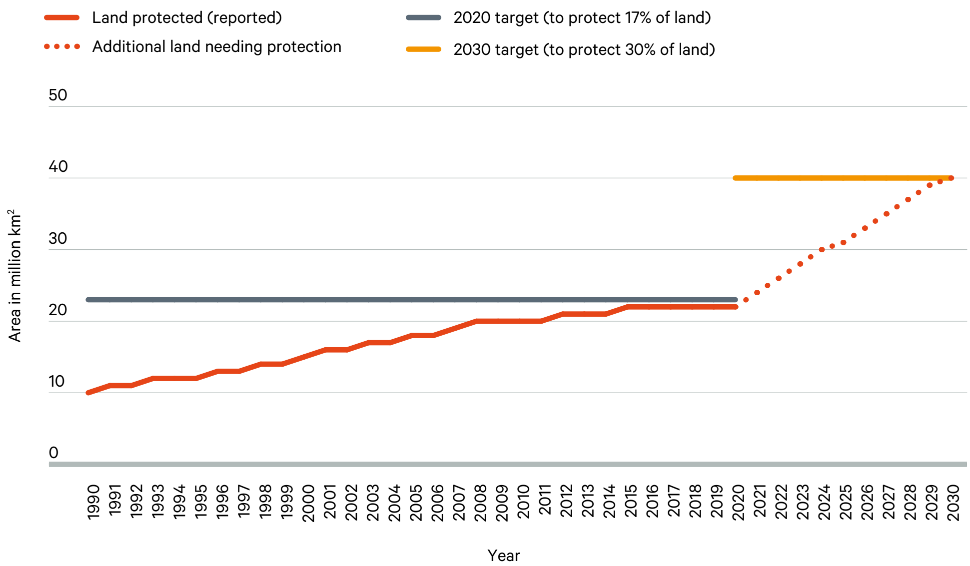
**26** United Nations Environment Programme (2021), *State of Finance for Nature 2021*, Nairobi: United Nations Environment Programme, https://www.unep.org/resources/state-finance-nature.
**27** Chandrasekhar, A. (2022), 'COP15: Key outcomes for nature loss and climate change from UN talks in Nairobi', Carbon Brief, 29 June 2022, https://www.carbonbrief.org/cop15-key-outcomes-for-nature-loss-and-climate-change-from-un-talks-in-nairobi.
**28** G7 (2021), *G7 2030 Nature Compact,* Carbis Bay, UK: G7, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1001131/G7_2030_Nature_Compact__PDF__120KB__4_pages_.pdf.

### Nature positive and 30 by 30

In the G7 2030 Nature Compact, leaders announced that 'our world must not only become net zero, but also nature positive'.[29] The term 'nature positive', which has recently gained significant momentum, encompasses several elements including halting and reversing biodiversity loss by 2030 from a baseline of 2020 levels, as well as creating an upward growth trajectory towards robust ecosystems by 2050.[30] Within this broader goal is the 30 by 30 target, which aims to conserve at least 30 per cent of global land and oceans by 2030, as proposed by the High Ambition Coalition for Nature and People, and based on the Global Deal for Nature.[31] The 30 by 30 target is included in the G7 2030 Nature Compact, and looks likely to be adopted into the new GBF as a higher-ambition replacement for Aichi target 11, which aimed to protect at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, by 2020.[32]

As indicated in Figure 1, increasing land protection to 30 per cent from current levels requires major changes. At the global level, the protected area must increase by 17 million km², which is equivalent of almost twice the land area of the US.

**Figure 1.** Total land area designated for protection globally as reported to 2020 and as required to 2030




Source: Compiled by the authors using data from Protected Planet (2021), 'Chapter 3: Coverage' in *Protected Planet Report 2020*, https://livereport.protectedplanet.net/chapter-3.
Note: Percentages in brackets represent the proportion of total global land area (134,944,171 km²).

**29** Ibid.
**30** Locke, H. et al. (2021), *A Nature-Positive World: The Global Goal for Nature*, New York: WBCSD, https://www.wbcsd.org/download/file/11960.
**31** Convention on Biological Diversity (2021), *First Draft of the Post-2020 Global Biodiversity Framework*, Montreal: Convention on Biological Diversity, https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf; Dinerstein, E. et al. (2019), 'A Global Deal for Nature: Guiding principles, milestones, and targets', *Science Advances*, 5(4), eaaw2869, https://doi.org/10.1126/sciadv.aaw2869.
**32** Convention on Biological Diversity (2022), 'Aichi Target 11', https://www.cbd.int/aichi-targets/target/11.

There is a strong rationale behind 30 by 30 in terms of economic benefits that could result from the enhancement of ecosystem processes such as flood control, carbon storage and climate regulation. Financial modelling of different 30 by 30 scenarios shows that extending area protection from current levels to 30 per cent of global land and seas could generate an additional $64 billion–$454 billion per year by 2050.[33] Meeting the 30 per cent goal in mangroves and forest ecosystems alone would prevent the loss of $170 billion–$534 billion per year by 2050.[34] However, there is some debate around the rationale behind, and suitability of, the 30 per cent figure. For example, the Intergovernmental Panel on Climate Change (IPCC) recently stated with high confidence that 'maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% to 50% of Earth's land, freshwater and ocean areas, including currently near-natural ecosystems'; the Global Deal for Nature suggests that 30 per cent of global land should be formally protected, and that an additional 20 per cent should be classified as 'climate stabilization areas' by 2030 to limit global warming to 1.5°C.[35] Allan et al. found that at least 64 million square kilometres ($km^2$), or 44 per cent, of global terrestrial land must be conserved in an 'ecologically sound' state to prevent major loss of biodiversity, and that the most important connectivity routes among protected areas are threatened by conversion, in addition to 1.3 million $km^2$ that are at risk of conversion for intensive uses by 2030.[36] According to the *Protected Planet Report*, 17 per cent of land and inland water ecosystems and 8 per cent of coastal waters and the ocean are currently protected, and the 30 per cent target is not additional to what has already been protected.[37]

## COP26 outcomes and the Glasgow Climate Pact

While specific negotiations have historically been the sole arena for biodiversity protection discussions, the need for healthy ecosystems to mitigate climate change is highlighting the importance of biodiversity protection under the UNFCCC. Climate negotiations are promising arenas for building momentum around biodiversity protection and restoration, as such forums can mobilize more resources and finance, and potentially exert more influence on countries' actions. However, despite terrestrial ecosystems absorbing around one-third of anthropogenic $CO_2$ emissions over the past decade, and land use representing a quarter of total emissions mitigation potential between now and 2050,[38] effective outcomes on land-based mitigation in the climate regime have been sparse to date.

Land-based mitigation in the climate regime is a multi-track process, and coordination with the biodiversity regime is limited.[39] Nonetheless, at COP26 an entire day was dedicated to nature, and several of the COP26 outcomes indicate

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**33** Waldron et al. (2021), *Protecting 30% of the Planet for Nature*.
**34** Ibid.
**35** Dinerstein et al. (2019), 'A Global Deal for Nature'; Intergovernmental Panel on Climate Change (2022), *Climate Change 2022.*
**36** Allan, J. R. et al. (2022), 'The minimum land area requiring conservation attention to safeguard biodiversity', *Science*, *376*(6597), pp. 1094–1101, https://doi.org/10.1126/science.abl9127.
**37** Protected Planet (2021), *Protected Planet Report 2020*.
**38** Intergovernmental Panel on Climate Change (2022), *Climate Change 2022*; Roe, S. et al. (2019), 'Contribution of the land sector to a 1.5°C world', *Nature Climate Change*, 9, pp. 817–828, https://doi.org/10.1038/s41558-019-0591-9.
**39** Pettorelli, P. et al. (2021), 'Time to integrate global climate change and biodiversity science-policy agendas', Journal of Applied Ecology, 58(11), pp. 2384–93, https://doi.org/10.1111/1365-2664.13985.

that land-based mitigation strategies could become more prevalent, offering potential synergies with the goals of biodiversity protection and restoration. The Glasgow Climate Pact provides a window of opportunity for countries to further enhance their nationally determined contributions (NDCs) to 'keep 1.5°C alive', and makes explicit reference to the interlinked nature of the climate and biodiversity challenge: 'Noting the importance of ensuring the integrity of all ecosystems, including in forests, the ocean and the cryosphere, and the protection of biodiversity…' and, '[r]ecognizing the interlinked global crises of climate change and biodiversity loss, and the critical role of protecting, conserving and restoring nature and ecosystems in delivering benefits for climate adaptation and mitigation'.[40]

In addition to the Glasgow Climate Pact, a number of 'side deals' agreed at COP26 set out a range of pledges that intersect with the biodiversity agenda. For example:

- The Glasgow Leaders' Declaration on Forests and Land Use is a multilateral agreement endorsed by 141 world leaders, including those of the G7, to halt forest loss and land degradation, accounting for over 36,000 km$^2$ of forest cover.[41] The number of signatories (excluding subnational jurisdictions) to the agreement is up 46 per cent compared to the New York Declaration in 2014.
- The Forest, Agriculture and Commodity Trade Dialogue provides guidelines to address the shared challenges associated with increasing demand for agricultural commodities and with increasing clearance of forests for unsustainable agriculture. Twenty-eight countries launched a roadmap to protect forests through a global shift to sustainable development and trade of agricultural commodities. The key features include trade and market development; smallholder support; traceability and transparency; and research, development and innovation.[42]
- The Global Forest Finance Pledge is a commitment from 12 developed countries to provide $12 billion of public climate finance for the 2021–25 period to support further ambition from countries eligible for overseas development aid.[43]

The detail on this set of COP26 'side deals' is largely still to emerge. Major points of clarification are needed on the language around deforestation in particular. For example, it is unclear whether the pledge to halt forest loss implies an intention to end all deforestation, and whether it allows for management of plantations, such as timber and palm, to be counted as forested land.[44]

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**40** UN Framework Convention on Climate Change (2021), *Decision -/CP.26 Glasgow Climate Pact*, Glasgow: UNFCCC, https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf.
**41** UK government and UNFCCC (2021), 'Glasgow Leaders' Declaration on Forests and Land Use', 2 November 2021, https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use.
**42** Forest, Agriculture and Commodity Trade (FACT) Dialogue (2021), 'FACT Roadmap', https://www.factdialogue.org/fact-roadmap.
**43** UK government and UNFCCC (2021), 'The Global Forest Finance Pledge', 2 November 2021, https://ukcop26.org/the-global-forest-finance-pledge.
**44** Ungku, F. and Widianto, S. (2021), 'Indonesia signals about-face on COP26 deforestation pledge', Reuters, 4 November 2021, https://www.reuters.com/business/cop/indonesia-signals-about-face-cop26-zero-deforestation-pledge-2021-11-04.

## Are biodiversity and climate commitments suitably ambitious?

Given that the world is already more than two years into this critical decade for action, major concerns include the lack of detail on pledges that emerged from COP26, the likelihood of NDCs being suitably revised to align with 1.5°C with limited or no overshoot, and the largely unknown level of commitment that countries have to the GBF. So far, countries' climate change mitigation pledges for 2030 collectively align with around 2.4°C of warming this century – if countries meet both conditional and unconditional NDCs.[45] For both biodiversity and climate, urgent and suitably ambitious decisions around land use and GHG emissions are critical.

**The fate of biodiversity over the coming decade largely depends on the extent to which it is affected by climate change, as well as by changes in land use.**

The fate of biodiversity over the coming decade largely depends on the extent to which it is affected by climate change, as well as by changes in land use, which will be at least partly influenced by the detail of the COP26 pledges around deforestation and the extent to which natural carbon sinks are used to offset fossil fuel emissions. For example, if deforestation continues unabated until 2030, the resultant loss of carbon sinks and biodiversity could be a major problem. In the current decade alone, under business-as-usual deforestation rates, 16.5 Gt of irrecoverable $CO_2$ could be emitted[46] – in turn reducing the available emissions budget consistent with 1.5°C (around 312 Gt $CO_2$ remain for a two-thirds chance, and current annual global emissions are around 36 Gt $CO_2$)[47] and requiring stronger mitigation efforts to compensate. Irrecoverable carbon is defined as 'a permanent debit from the remaining carbon budget that cannot be recovered by mid-century'.[48] Climate ambition this decade will largely determine the extent to which CDR deployment will be necessary. The current level of ambition to mitigate climate change, as indicated by NDCs up to 2030, suggests that large-scale deployment of CDR will be required by 2100. The impacts of CDR on biodiversity can vary greatly depending on the method, location and scale of implementation. Some CDR methods, such as reforestation, can have a positive impact on biodiversity, but other methods such as afforestation and BECCS could have adverse impacts.[49]

**45** Evans, S. et al. (2021), 'COP26: Key outcomes agreed at the UN climate talks in Glasgow', Carbon Brief, 15 November 2021, https://www.carbonbrief.org/cop26-key-outcomes-agreed-at-the-un-climate-talks-in-glasgow.
**46** Goldstein, A. et al. (2020), 'Protecting irrecoverable carbon in Earth's ecosystems', *Nature Climate Change*, 10(4), pp. 287–95, https://doi.org/10.1038/s41558-020-0738-8.
**47** Intergovernmental Panel on Climate Change (2022), *Climate Change 2022*.
**48** Goldstein et al. (2020), 'Protecting irrecoverable carbon in Earth's ecosystems'.
**49** Intergovernmental Panel on Climate Change (2022), *Climate Change 2022*.

The draft GBF offers a way to preserve and restore biodiversity through ambitious action, supported by a monitoring framework and a suite of headline indicators.[50] However, its success in delivering meaningful impacts depends not only on the level of ambition that countries commit to, but more crucially on the implementation pathways and coherence of monitoring and reporting. Ecological impact pathways are immensely complex and therefore hard to summarize in simple metrics. Drivers such as invasive species, habitat loss and fragmentation, poaching, climate change, pollution and natural resource exploitation are not measured in the same way and are difficult to compare. While the consequences of biodiversity loss and climate change have been strongly articulated in recent decades,[51] the biodiversity crisis often unfolds in ways that are diffuse, intangible, scale-dependent or specific to localities and cultures, complicating coherent measurement and reporting.

To reflect the complexities of ecological impact pathways, both the Aichi targets and the draft GBF contain a multitude of process and outcome objectives, each representing drivers, consequences or impacts of concern. Despite an international mechanism mirroring the complexity of the issue at hand, the political rhetoric around biodiversity protection has historically been reduced to the extent of protected land. Low public awareness, targeted campaigning from conservation interests and the urge to apply simple metrics to a complex problem have resulted in a reductionist approach to the biodiversity crisis.[52] Worryingly, the GBF might continue this narrow focus as negotiations are already strongly associated with the 30 by 30 area protection initiative.

## The limits of land protection

Despite many nations focusing their efforts on the extent of terrestrial land protection, progress has been slow and there are serious issues with how countries report their achievements. A recent study on the extent of protected land in the UK demonstrated that the proportion of terrestrial land effectively conserved for nature – according to agreed methodologies under the International Union for Conservation of Nature (IUCN) – could be as low as 5 per cent,[53] in contrast with the UK government's reported figure of 28 per cent.[54] A recent analysis suggested that 'transformative changes in thinking and policy are necessary for the UK to attain 30% coverage of effective area-based conservation designations by 2030' and 'the areas that count must effectively protect nature in practice,

**50** Convention on Biological Diversity (2022), 'Conference Documents from WG2020-04: Plenary', https://www.cbd.int/conferences/post2020/wg2020-04/documents.
**51** Dasgupta (2021), *The Economics of Biodiversity.*
**52** Barnes, M. D., Glew, L., Wyborn, C. and Craigie, I. D. (2018), 'Prevent perverse outcomes from global protected area policy', *Nature Ecology & Evolution*, 2(5), pp. 759–62, https://doi.org/10.1038/s41559-018-0501-y.
**53** Starnes, T. et al. (2021), 'The extent and effectiveness of protected areas in the UK', *Global Ecology and Conservation*, 30, e01745, https://doi.org/10.1016/j.gecco.2021.e01745.
**54** Joint Nature Conservation Committee (2019), *Sixth National Report to the United Nations Convention on Biological Diversity: United Kingdom of Great Britain and Northern Ireland – Overview of the UK Assessments of Progress for the Aichi Targets*, Peterborough: JNCC, https://www.cbd.int/doc/nr/nr-06/gb-nr-06-p3-en.pdf.

and not merely exist as lines on a map'.[55] Similarly across all G7 countries, the designation of areas does not effectively protect biodiversity (Table 1). While most G7 countries report relatively high levels of land protection, most areas are degraded, or are at least partially used for farming. Furthermore, protected areas largely fail to cover the most biodiverse habitats (key biodiversity areas) in G7 countries. Only the UK has more than half of its key biodiversity areas under complete protection (Table 1).

The approach should not simply be to designate more land as protected, but also to transform existing protected areas to deliver for nature.[56] Even where large areas have been designated for protection, resources allocated to habitat conservation are inadequate[57] and there is limited evidence of protected areas leading to positive biodiversity outcomes.[58] Aichi target 11 specified that in addition to the extent of protected land, such areas must be (i) of particular importance, (ii) effectively and equitably managed, (iii) ecologically representative, and (iv) well connected and integrated. On all these accounts, the *5th Global Biodiversity Outlook* from the UNCBD deemed that there is 'some progress', but efforts are not on track to meet the target.

Despite apparent progress on area-based conservation, increased percentages of protected land have not halted ecosystem degradation. Protecting areas as a sole intervention does not guarantee good biodiversity outcomes.[59] Aiming for 30 per cent by 2030 on this basis is not enough; equally important will be to target the right 30 per cent and to ensure biodiversity protection is effective, well resourced and integrated with other policy domains (Box 1), as well as being resilient to the projected impacts of climate change. Designation of protected land is simply the first step in a long process towards delivering beneficial biodiversity outcomes. A recent report suggested four criteria for assessing the effectiveness of area-based conservation, stating that schemes must: i) deliver for nature in the long term; ii) build ecological resilience and maximize biodiversity; iii) achieve conservation outcomes through effective management and monitoring; and, iv) develop and deliver inclusively.[60]

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**55** Bailey, J. J. et al. (2022), *Protected Areas and Nature Recovery: Achieving the goal to protect 30% of UK land and seas for nature by 2030*, London: British Ecological Society, https://www.britishecologicalsociety.org//wp-content/uploads/2022/04/BES_Protected_Areas_Report.pdf.
**56** Ibid.
**57** Zafra-Calvo, N. et al. (2019), 'Progress toward Equitably Managed Protected Areas in Aichi Target 11: A Global Survey', *BioScience*, 69(3), pp. 191–97, https://doi.org/10.1093/biosci/biy143; Oldekop, J. A., Holmes, G., Harris, W. E. and Evans, K. L. (2015), 'A global assessment of the social and conservation outcomes of protected areas', *Conversation Biology*, 30(1), pp. 133–41, https://doi.org/10.1111/cobi.12568.
**58** Geldmann, J. et al. (2019), 'A global-level assessment of the effectiveness of protected areas at resisting anthropogenic pressures', *Proceedings of the National Academy of Sciences*, 116(46), 23209–15, https://doi.org/10.1073/pnas.1908221116; Barnes, Glew, Wyborn and Craigie (2018), 'Prevent perverse outcomes from global protected area policy'.
**59** Wauchope, H. S. et al. (2022), 'Protected areas have a mixed impact on waterbirds, but management helps', *Nature*, 605(7908), pp. 103–107, https://doi.org/10.1038/s41586-022-04617-0.
**60** Bailey et al. (2022), *Protected Areas and Nature Recovery.*

**Table 1.** Extent of land protection in the G7

| Country | % land designated for protection *(year)* | % land that is protected and 'natural' to a high degree *(year)* | % of key biodiversity areas under complete protection *(year)* |
|---|---|---|---|
| Canada | 10.5% *(2018)* | 4.09% *(2021)* | 6.12% *(2021)* |
| France | 29.5% *(2019)* | 0.53% *(2021)* | 30.69% *(2021)* |
| Germany | 16.2% *(2020)* | 0.04% *(2021)* | 35.61% *(2021)* |
| Italy | 21.0% *(2018)* | 1.08% *(2021)* | 22.09% *(2021)* |
| Japan | 20.3% *(2018)* | 0.40% *(2021)* | 24.74% *(2021)* |
| UK | 28.0% *(2018)* | 0.95% *(2021)* | 72.52% *(2021)* |
| US | 13.0% *(2021)* | 1.13% *(2021)* | 9.47% *(2021)* |

Source: The Clearing-House Mechanism of the Convention on Biological Diversity (CHM) (undated), '6th National Reports', available at: https://chm.cbd.int/search/reporting-map?filter=nr6; for the US, which is not a party to the CBD, Protected Planet (undated), 'United States of America', https://www.protectedplanet.net/country/USA; Protected Planet (undated), 'Protected Areas (WDPA) – IUCN PA classification I-III counting as 'most natural', https://www.protectedplanet.net/en/thematic-areas/wdpa; Key Biodiversity Areas (undated), 'KBA Data', https://www.keybiodiversityareas.org/kba-data.
Note: Please note that differences in years and the use of WDPA data means that the third column cannot be directly compared against data in the first and second columns. Please also note that countries self-report their degree of protected land. For example, the UK includes areas of outstanding natural beauty (AONB), which are often converted land used for farming. Much of France's reported area under protection is designated as Parcs naturels régionaux, which are inhabited rural areas with specific management guidelines. Around 3.5 million French citizens live in such protected areas.

### **Box 1.** More land is reported as protected, but is this enough?

In the last 30 years, the amount of terrestrial land designated for protection has more than doubled, but this apparent progress hides numerous issues with the qualitative aspects of protected land. While the global target of 17 per cent terrestrial protection by 2020 was possibly achieved, much of the protected land is not representative, well connected or effectively managed, nor is it of particular importance to biodiversity or ecosystem functionality.[61]

For example, the UK is one of the leading European countries in terms of reported extent of protection, but a closer review of the protected land highlights serious flaws. The UK reports that 28 per cent of its land is protected, with different site designations for protecting areas of importance for biodiversity, ecosystem functioning and natural beauty. Most of the UK's protected land falls under the international protected areas (PA) classification IUCN Category V: Protected Landscape, which generally indicates less strict protection and less natural conditions than IUCN Categories I to IV. Much of this 'protected' land is in fact used for agriculture, urban areas or infrastructure. Furthermore, the UK's regular monitoring of trends and conditions in protected areas

**61** From under 8 per cent in 1990 to likely exceeding the 17 per cent target in 2020, according to Protected Planet (2021), *Protected Planet Report 2020*.

has revealed that management of protected areas is not always effective. If 'more natural' (IUCN categories I to IV) sites in a favourable condition are strictly considered to be effectively protected, such areas only represent around 5 per cent of UK land. With a more generous view on site categories and management effectiveness, the extent of effectively protected land is still only 21 per cent of the UK, in stark contrast with what is reported by the UK government.[62]

The over-reliance on simplistic success metrics has created a perverse incentive for countries to increase the extent of protected land, without taking meaningful conservation and restoration measures that halt or reverse biodiversity loss.[63] This issue is reflected across all G7 countries. The *State of Nature in the EU* report is likely the most comprehensive and comparable assessment of countries' efforts to protect biodiversity – with the latest report unveiling alarming results for nature in European G7 countries including Germany, Italy, France and the UK.[64] The EU Natura 2000[65] site network covers a range of habitats – but some (e.g. grasslands and forests) are less well represented by protected areas than others (scrub, dunes and rocky habitats) – and 70 per cent of habitats are in 'poor' or 'bad' condition in all European G7 countries. For the habitats that are not in a 'good' condition, the conservation status is deteriorating more often than it is improving in all European G7 countries. This trend of deteriorating habitats is most pronounced in France, the G7 country that boasts the largest reported percentage (29.5 per cent) of terrestrial land designated for protection. Comparable assessments of biodiversity protection are not available for Canada, Japan and the US, but like their G7 counterparts they experience increasing extinction risk and declining wildlife populations, according to their performance on the Red List Index[66] and Living Planet Index,[67] respectively.

## Is the G7 leading the way on climate and biodiversity action?

The G7 has the potential to encourage action across the world, building on current multilateral engagement with the UNFCCC and UNCBD. The G7 2030 Nature Compact has attracted substantial attention and raised expectations of the G7 nations to lead action at the climate–biodiversity intersection. During its 2022 presidency of the G7, Germany aimed to focus strongly on climate policy, partly in the interest of having robust foreign and security policies: 'We can be under the illusion that the West is an island, but even here the water will continue

**62** Starnes et al. (2021), 'The extent and effectiveness of protected areas in the UK'.
**63** Barnes, Glew, Wyborn and Craigie (2018), 'Prevent perverse outcomes from global protected area policy'; Coad, L. et al. (2019), 'Widespread shortfalls in protected area resourcing undermine efforts to conserve biodiversity', *Frontiers in Ecology and the Environment*, 17(5), pp. 259–264, https://doi.org/10.1002/fee.2042; Pringle, R. M. (2017), 'Upgrading protected areas to conserve wild biodiversity', *Nature*, 546(7656), pp. 91–99, https://doi.org/10.1038/nature22902.
**64** European Environment Agency (2020), *State of nature in the EU: Results from reporting under the nature directives 2013-2018*, https://www.eea.europa.eu/publications/state-of-nature-in-the-eu-2020.
**65** Common EU classification of protected land, covering some of Europe's most valuable nature.
**66** IUCN (2022), 'Red List: Type > Red List Indices > National', https://www.iucnredlist.org/search (accessed 1 Apr. 2022).
**67** Almond, Grooten, Juffe Bignoli and Petersen (eds) (2022), *Living Planet Report 2022: Building a nature positive society*.

to rise inexorably if we do not act now.'[68] The German presidency aims to deliver progress on climate and biodiversity. At the G7 summit in June 2022, there was an agreement to establish an 'open and cooperative Climate Club by the end of 2022 as a global response to the climate crisis'.[69] The Climate Club aims to be an inclusive intergovernmental forum of high ambition, open to countries committed to the full implementation of the Paris Agreement and Glasgow Climate Pact.[70] Furthermore, all G7 countries have declared a net zero climate target for 2050 (or sooner, e.g. 2045 for Germany) – and all targets except for the US's are legally binding.

At the United Nations General Assembly in September 2022, Chancellor Olaf Scholz brought attention to the GBF and announced Germany's intention to increase annual biodiversity funding by €870 million ($843 million), doubling the country's previous commitment:

> The UN Biodiversity Conference in December needs to be a turning point for our conservation efforts. Germany resolutely supports the idea of an ambitious global framework on biodiversity… At the G7 Summit in Germany, we agreed to substantially increase funding for nature by 2025… With this contribution, we want to send a strong signal for an ambitious outcome of the biodiversity COP15.[71]

While G7 countries generally do not possess the most biodiverse ecosystems, the largest deposits of irrecoverable carbon or the most intact ecosystems, the bottom-up international agreement under CBD means they must pursue ambitious biodiversity policies at home to inspire action abroad. For example, without robust domestic policies to achieve 30 per cent protected land by 2030, G7 calls for the protection of critical areas such as the Amazon Rainforest, Congo Basin and Great Barrier Reef will ring hollow.

**Protecting 30 per cent of land with a high biodiversity value by 2030 would require G7 countries to pursue transformative and joined-up policies.**

Protecting 30 per cent of land with a high biodiversity value by 2030 would require G7 countries to pursue transformative and joined-up policies. While credible mechanisms to accelerate biodiversity protection are still lacking, some relevant policy approaches are emerging in individual G7 countries. In the UK, the 25 Year Environment Plan sets out a series of measures to protect biodiversity. A new Environment Act in 2021 introduced the framework for at least one legally binding target on biodiversity and established a 10 per cent 'net biodiversity gain'

**68** Kinkartz, S. (2022), 'Germany takes over G7 presidency', *Deutsche Welle*, 1 January 2022, https://www.dw.com/en/germany-takes-over-g7-presidency/a-60288173.
**69** G7 (2022), 'G7 Statement on Climate Club', https://www.g7germany.de/resource/blob/974430/2057926/2a7cd9f10213a4819244929942dd660a1/2022-06-28-g7-climate-club-data.pdf?download=1.
**70** G7 (2022), 'G7 Summit at Schloss Elmau: The outcomes at a glance', https://www.g7germany.de/g7-en/current-information/g7-summit-outcomes-2058314.
**71** WWF (2022), 'New biodiversity commitments announced as world leaders declare nature summit COP15 a priority', 21 September 2022, https://wwf.panda.org/wwf_news/?6450966/New-biodiversity-commitments-announced-as-world-leaders-declare-nature-summit-COP15-a-priority.

requirement on new housing developments[72] – meaning efforts to replace and recover nature must exceed the biodiversity value lost from exploitation. However, there are some key concerns regarding structural inadequacies of the scheme, including monitoring and enforcement to tackle issues such as developers trading biodiversity 'credits' before any benefits have materialized, and local authorities being under-resourced to implement the scheme.[73] At the same time, a new 'sustainable farming incentive' seeks to gradually shift approaches towards farming practices that promote biodiversity, such as the use of winter cover crops and protecting hedges through restructuring subsidies.

Similarly, the EU's Farm to Fork (F2F) strategy aims to ensure food systems are fair, healthy and environmentally friendly. Two key goals of the strategy are reversing the loss of biodiversity and helping to mitigate climate change. Additionally, parallels can be drawn with the 30 by 30 target as F2F stresses the importance of preserving and restoring land, freshwater and sea-based resources. The EU will also focus on halving nutrient losses, especially nitrogen and phosphorus, which in turn helps protect biodiversity in rivers, lakes, wetlands and seas by reducing nutrient run-off. Like the UK's sustainable farming incentive, the F2F strategy includes a shift from payments based on land ownership to those based on results.

However, both the UK and EU agricultural incentive reforms have been criticized for lack of ambition. The UK's policy goes the farthest of the two, but higher-ambition interventions that reclaim land for biodiversity, like planting trees and rewetting peat bogs, are not compensated by the scheme.[74] Meanwhile, in the EU, political inertia on agricultural subsidies means that only 25 per cent of funds between 2023 and 2027 are ring-fenced for eco-schemes.[75] While reform of area-based agricultural payments is critical to reduce the loss of natural land to farming, the pace of change does not match biodiversity protection targets for 2030. It is unclear if and how a potential reduction in harvest yields associated with nature-friendly farming practices would be dealt with – i.e. whether more land will be converted to agriculture, or whether overall demand for food will be reduced through waste reduction and dietary changes to avoid land expansion.

In Canada, the 30 by 30 target is complemented with a '25% by 2025' milestone and some policies to achieve these aims have been detailed in the 'A Healthy Environment and a Healthy Economy' plan. Over the next decade, CAD 3.16 billion ($2.42 billion) will be directed to tree planting and CAD 631 million ($483 million) to the restoration of peatlands, wetlands, grasslands and agricultural lands in a push to enhance and conserve carbon-rich ecosystems. Despite large investments in the designation and management of protected areas in Canada, additional

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**72** UK government (2021), 'Environment Act 2021 c. 30, Part 6: Biodiversity gain in planning', https://www.legislation.gov.uk/ukpga/2021/30/part/6/crossheading/biodiversity-gain-in-planning/enacted.
**73** Ermgassen, S. Z. et al. (2022), 'An Open Letter to The Rt Hon Michael Gove, The Rt Hon George Eustice, and Tony Juniper: Ensuring that mandatory Biodiversity Net Gain fulfills its potential for nature recovery', *Policy Commons*, https://policycommons.net/artifacts/2269109/read-our-open-letter-to-the-uk-government/3028922.
**74** Wilson, S. (2021), 'Charities label post-Brexit scheme for sustainable farming a 'huge disappointment'', *Big Issue*, 2 December 2021, https://www.bigissue.com/news/environment/charities-label-post-brexit-scheme-for-sustainable-farming-a-huge-disappointment.
**75** Fortuna, G. and Foote, N. (2021), 'Final CAPdown: Negotiators seal a deal on future EU farming subsidies programme', *Euractiv*, 25 June 2021, https://www.euractiv.com/section/agriculture-food/news/final-capdown-negotiators-seal-a-deal-on-future-eu-farming-subsidies-programme.

effort could be made to help address the impacts of other land uses. For example, on a per acre basis, investment in climate-friendly agriculture in Canada ($0.54) is far lower than the investment in the US ($6.55) and EU27 ($40.03).[76]

Other signatories to the G7 2030 Nature Compact show little sign of accelerating biodiversity protection. For example, Japan is taking steps to increase the certification of privately managed land,[77] but little is being done to tackle the expansive pressures of the agricultural sector.[78] Japan's agricultural subsidies remain among the highest in the OECD, and agricultural commodity production targets indicate that land used for food will continue to exert pressure on biodiversity in the next decade. In the US, the Biden administration issued an executive order establishing US support for 30 by 30 in January 2021, but releasing funds to realize this ambition will prove challenging. The Federal Bureau of Land Management faces a backlog of $19 billion in maintenance of existing federal lands that was not completed when scheduled, in addition to the cost of almost tripling the amount of land under protection.[79]

**In some cases, economic interests have even led to the reversal of biodiversity protection, in so-called 'protected area downgrading, downsizing and degazettement'.**

More generally, G7 action on biodiversity conservation at home faces structural barriers to progress that must be addressed in order to halt and reverse biodiversity decline this decade. Firstly, protected areas need not only be designated on the map, but also adequately funded and resourced to make a real difference. Not only does conservation face a multi-billion-dollar funding gap,[80] but it is also subject to uncertain and project-based finance, which jeopardizes the long-term nature of conservation efforts and nature-based solutions. The stop-start nature of funding can weaken partnerships, lead to a loss of expertise, and ultimately compromise or reverse biodiversity and climate outcomes.[81] A second structural problem inhibiting effective conservation in the G7 and beyond is biodiversity protection being treated in isolation from policy areas that can have conflicting objectives. Mining, agriculture, infrastructure, biofuel production and urban development all compete for space with nature, and policy regimes often create incentives and land-use classifications that present trade-offs with biodiversity protection by undermining

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**76** Farmers for Climate Solutions (2021), *A Down Payment for a Resilient and Low-GHG Farm Future*, https://static1.squarespace.com/static/5dc5869672cac01e07a8d14d/t/603cf540ca355d0ac5009619/1614607684484/FCS_BudgetRecommendation2021.pdf.
**77** Jiji Press (2022), 'Japan to Certify Privately Held Woods for Conservation', 2 January 2022, https://web.archive.org/web/20220108230514/https://jen.jiji.com/jc/eng?g=eco&k=2021123000170.
**78** OECD (2021), *Agricultural Policy Monitoring and Evaluation 2021: Japan*, Paris: OECD, https://www.oecd-ilibrary.org/sites/e4c38702-en/index.html?itemId=/content/component/e4c38702-en.
**79** Congressional Research Service (2021), *Deferred Maintenance of Federal Land Management Agencies: FY2011-FY2020 Estimates and Issues*, https://crsreports.congress.gov/product/pdf/R/R43997.
**80** Maxwell, S. L. et al. (2020), 'Area-based conservation in the twenty-first century', *Nature*, 586(7828), pp. 217–227, https://doi.org/10.1038/s41586-020-2773-z.
**81** Coad, L. et al. (2019), 'Widespread shortfalls in protected area resourcing undermine efforts to conserve biodiversity', *Frontiers in Ecology and the Environment*, 17(5), pp. 259–264, https://doi.org/10.1002/fee.2042; Campaign for National Parks (2021), *National Parks and the Climate Emergency*, https://www.cnp.org.uk/sites/default/files/uploadsfiles/CNPClimateReport2021Full.pdf.

living conditions of species and habitats.[82] In some cases, economic interests have even led to the reversal of biodiversity protection, in so-called 'protected area downgrading, downsizing and degazettement' (PADDD). In the G7, recent PADDD events have been linked to oil exploitation, and during the Trump administration the downsizing of several areas of protected land, or 'national monuments', led to an overall decline in US protected area coverage in 2017.[83]

The impact of the G7 at home is mostly dependent not on the conservation of existing land use, but on the extent to which the group's members pursue restoration of land and habitats and tackle GHG emissions. Abroad, the G7 must drive the restoration of degraded and lost habitats and the preservation of existing natural habitats. France's president, Emmanuel Macron, has described the challenge of tackling the biodiversity and climate crises as 'the fight of the century'.[84] With ambitious targets for biodiversity and climate change mitigation leading up to 2030, the challenges of funding gaps and competing land uses will only become greater. With the global estate of protected areas set to almost double in the next decade, incremental change will not suffice – a rethink of land use is essential.

## A joined-up approach to the climate–biodiversity nexus

Reorganizing land use and reducing GHG emissions are the most critical aspects of meeting biodiversity and climate change mitigation goals. Joined-up policy is essential to achieve successful outcomes. This goes beyond the avoidance of inconsistent approaches, such as clearing pristine biodiverse habitats to grow biofuels, and will entail coordinated biodiversity and climate action. Assessing current land use and future demand is a key aspect of this approach. Food production already occupies the largest area (50 per cent) of habitable land, with greater land claims expected leading up to 2050. This is, to some extent, in line with human population growth, but increased demand for land-intensive commodities (mainly from animal agriculture) is the key driver.[85] In addition, agriculture contributes around 25 per cent to global GHG emissions – and annual emissions are likely to increase by around 60 per cent up to 2050.[86] By 2030,

**82** Merckx, T. and Pereira, H. M. (2015), 'Reshaping agri-environmental subsidies: From marginal farming to large-scale rewilding', *Basic and Applied Ecology*, 16(2), pp. 95–103, https://doi.org/10.1016/j.baae.2014.12.003; Brack, D., Birdsey, R. and Walker, W. (2021), *Greenhouse gas emissions from burning US-sourced woody biomass in the EU and UK*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/2021/10/greenhouse-gas-emissions-burning-us-sourced-woody-biomass-eu-and-uk; Vijay, V. and Armsworth, P. R. (2021), 'Pervasive cropland in protected areas highlight trade-offs between conservation and food security', *Proceedings of the National Academy of Sciences*, 118(4), https://doi.org/10.1073/pnas.2010121118; Geldmann et al. (2021), 'A global-level assessment of the effectiveness of protected areas at resisting anthropogenic pressures'.
**83** Richards, R. (2018), *Measuring Conservation Progress in North America*, Center for American Progress https://americanprogress.org/wp-content/uploads/2021/05/Measuring-Conservation-Progress.pdf?_ga=2.139808115.1328994813.1658493811-1871071819.1658493811.
**84** Nature (2020), 'The United Nations must get its new biodiversity targets right', editorial, 18 February 2020, https://doi.org/10.1038/d41586-020-00450-5.
**85** Bodirsky, B. L. et al. (2020), 'The ongoing nutrition transition thwarts long-term targets for food security, public health and environmental protection', *Scientific Reports*, 10(1), pp. 1–14, https://doi.org/10.1038/s41598-020-75213-3; Springmann, M. et al. (2018), 'Options for keeping the food system within environmental limits', *Nature*, 562(7728), pp. 519–25, https://doi.org/10.1038/s41586-018-0594-0.
**86** Clark, M. A. et al. (2020), 'Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets', *Science*, 370(6517), pp. 705–708, https://doi.org/10.1126/science.aba7357.

GHGs from livestock production alone will account for around half of the GHG budget consistent with limiting temperature rise to 1.5°C.[87] Without addressing food production, tackling biodiversity loss and limiting temperature rise to 1.5°C will be impossible – even if all fossil fuel emissions ceased immediately.[88]

Several aspects of the Aichi framework aimed to address food and agriculture-related impacts on biodiversity. These included a series of targets for the removal of harmful subsidies, the sustainable management of agriculture, the reduction of pollution and excess nutrients, as well as the creation of a global network of protected areas to shield nature from agricultural exploitation.[89] However, meaningful change to food systems has not been implemented in any UN member state[90] and indicators are going in the wrong direction with increasing production of, and demand for, the most environmentally expensive commodities (mostly meat and dairy from animal agriculture). The GBF provides an opportunity over the next decade to address this with a number of food-relevant targets for 2030, including: reducing nutrients lost to the environment by at least 50 per cent and pesticides by at least 66 per cent; redirecting, repurposing, reforming or eliminating incentives harmful for biodiversity, and reducing them by at least $500 billion per year; ensuring all areas under agriculture are managed sustainably; fully integrating biodiversity values into policies and regulations; encouraging businesses to reduce negative biodiversity impacts by at least 50 per cent and increase positive impacts; and enabling people to avoid overconsumption of food and halve food waste.[91]

Similarly, on the climate change mitigation front, most NDCs do not specify targets and measures for reducing agricultural emissions despite these being included in their scope.[92] Only two countries mention diet change in their revised NDCs (Costa Rica and Ethiopia). Of the 12 countries that include mitigation in their livestock sectors, none aim to reduce production.[93] The Global Methane Pledge announced at COP26 does not align with the 1.5°C goal – doing so would require a 45 per cent reduction of methane emissions by 2030 and necessitate the inclusion of agriculture, specifically livestock. Farmed ruminant animals are the largest source of anthropogenic methane accounting for around 30 per cent of global emissions.[94] While negotiations on the role of land and food systems in addressing climate change, as part of the Koronivia Joint Working Group on Agriculture, are moving towards international agreement at COP27,[95]

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**87** Harwatt, H. (2018), 'Including animal to plant protein shifts in climate change mitigation policy: a proposed three-step strategy', *Climate Policy*, 19(5), pp. 533–541, https://doi.org/10.1080/14693062.2018.1528965.
**88** Clark et al. (2020), 'Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets'; Williams, D. R. et al. (2020), 'Proactive conservation to prevent habitat losses to agricultural expansion', *Nature Sustainability*, 4, pp. 314–22, https://doi.org/10.1038/s41893-020-00656-5.
**89** CBD (2022), 'Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets', https://www.cbd.int/sp.
**90** Benton, T. G. et al. (2021), 'A 'net zero' equivalent target is needed to transform food systems', *Nature Food*, 2(12), pp. 905-906, https://doi.org/10.1038/s43016-021-00434-2.
**91** CBD (2022), 'Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets'.
**92** Climate Watch (2022), 'Countries' Actions in their NDCs', https://www.climatewatchdata.org/sectors/agriculture?category=sectoral_mitigation_measures#coutries-actions-in-their-ndcs.
**93** CGIAR Research Program on Climate Change, Agriculture and Food Security (2021), 'Agricultural sub-sectors in new and updated NDCs: 2020-2021 dataset', https://ccafs.cgiar.org/resources/publications/agricultural-sub-sectors-new-and-updated-ndcs-2020-2021-dataset.
**94** United Nations Development Programme & Climate and Clean Air Coalition (2020), *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions*, Nairobi: United Nations Environment Programme, https://www.ccacoalition.org/en/resources/global-methane-assessment-full-report.
**95** UNFCCC (2021), 'COP26 Sees Significant Progress on Issues Related to Agriculture', 12 November 2021, https://unfccc.int/news/cop26-sees-significant-progress-on-issues-related-to-agriculture.

the recommendations are not expected to be transformational in scope. They will likely focus on reducing relative environmental impacts per unit of food produced rather than reducing absolute impacts at the overall system level. For agriculture, one of the five 'Glasgow Breakthroughs' under the Breakthrough Agenda – which focuses on the role of clean technologies in meeting climate targets – aims to encourage the adoption of 'climate-resilient, sustainable agriculture' by 2030 through the coordination and strengthening of climate action. Over 40 state-level parties have committed to the Breakthrough Agenda, including the US, India, the EU and China.[96] There is a real risk that focusing on the reduction of relative impacts per unit of production could instead result in an increased absolute impact at the system level – for example, if reduced costs per unit of production incentivize an increase in total production.[97] However, one outcome from COP26 was the opportunity to revise NDCs at COP27 – therefore providing scope for countries to raise ambition.

**In terms of restoring carbon sinks and biodiversity on land currently used for food production, the greatest potential exists in high and upper middle-income countries.**

### Food system transformation at the intersection of biodiversity and climate policy

While ongoing GHG emissions from food systems preclude attainment of the 1.5°C goal,[98] agricultural land use holds the biggest potential for connecting climate and biodiversity policy approaches. Firstly, current food production methods that seek to maximize food outputs per unit of area limit the potential for integrated land uses or 'co-benefits'. Secondly, land-intensive food production drives land-use change, such as deforestation in tropical regions,[99] resulting in the loss of ecosystems and their associated deep carbon sinks and rich biodiversity. Thirdly, much of the land used for food production has been at the cost of biodiversity and increased GHG emissions. Hence, reducing the amount of land required for food production not only removes pressure to convert more land to agriculture, but also allows a restoration effort with benefits for biodiversity and the climate. Reconfiguring food consumption is an essential part of such a land-use shift.[100]

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**96** UK government (2021), 'World leaders join UK's Glasgow Breakthroughs to speed up affordable clean tech worldwide', press release, 2 November 2021, https://www.gov.uk/government/news/world-leaders-join-uks-glasgow-breakthroughs-to-speed-up-affordable-clean-tech-worldwide.
**97** Benton, T. G. and Harwatt, H. (2022), *Sustainable agriculture and food systems: Comparing contrasting and contested versions*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/2022/05/sustainable-agriculture-and-food-systems; Benton et al. (2021), *Food system impacts on biodiversity loss: Three levers for food system transformation in support of nature*.
**98** Clark et al. (2020), 'Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets'.
**99** Pendrill, F. et al. (2022), 'Disentangling the numbers behind agriculture-driven tropical deforestation', *Science*, 377(6611), DOI: 10.1126/science.abm9267.
**100** Benton et al. (2021), *Food system impacts on biodiversity loss: Three levers for food system transformation in support of nature*; Gaupp, F. et al. (2021), 'Food system development pathways for healthy, nature-positive and inclusive food systems', *Nature Food*, 2(12), pp. 928–934, https://doi.org/10.1038/s43016-021-00421-7; Leclère, D. et al. (2020), 'Bending the curve of terrestrial biodiversity needs an integrated strategy', *Nature*, 585(7826), pp. 551–556, https://doi.org/10.1038/s41586-020-2705-y.

These changes could also deliver public health benefits, especially in higher-income countries where imbalanced food consumption (too little fruits, vegetables, whole grains, legumes, nuts and seeds – and too much red and processed meats) is one of the leading causes of poor health and mortality.[101]

In terms of restoring carbon sinks and biodiversity on land currently used for food production, the greatest potential exists in high and upper middle-income countries.[102] The opportunity to make progress in this area could help G7 countries, for example, to shift their focus from conserving current land uses to restoring lost habitats and biodiversity. Doing so would also contribute substantially to the large amount of $CO_2$ removal that will likely be needed to limit temperature rise to 1.5°C this century.[103] For example, returning land currently under permanent pasture in high and upper middle-income countries back to native land cover has the potential to remove around 380 Gt $CO_2$ over a 30-year period[104] – an amount equivalent to around 12 years of current global $CO_2$ emissions. Most countries in the G7 dedicate the majority of their land to agriculture, except Canada and Japan where agriculture occupies 7 per cent and 15 per cent, respectively (Table 2). Despite all G7 countries spanning at least one forest biome (boreal and/or temperate), naturally regenerating forest as a proportion of land area is generally low – amounting to 37 per cent, 27 per cent,16 per cent, 30 per cent, 40 per cent, 1 per cent and 31 per cent in Canada, France, Germany, Italy, Japan, UK and US, respectively.[105] France, Germany, Italy, the UK and US have substantial potential for restoring pasture back to native land cover, particularly in the UK and US where pasture is the biggest land use. For example, such a land-use shift in the UK could remove up to 3.2 Gt $CO_2$ from the atmosphere over a 30-year period – an amount equivalent to around nine years of current UK $CO_2$ emissions.[106] With such land-use and food production shifts, there is the potential to achieve a 'double dividend' for climate change mitigation, as current GHG emissions from food production could also be reduced substantially.[107]

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**101** Global Nutrition Report (2021), 'Global Nutrition Report 2021, Chapter 02 – What we eat matters: Health and environmental impacts of diets worldwide', https://globalnutritionreport.org/reports/2021-global-nutrition-report/health-and-environmental-impacts-of-diets-worldwide.
**102** Sun, Z. et al. (2022), 'Dietary change in high-income nations alone can lead to substantial double climate dividend', *Nature Food*, 2(12), pp. 29–37, https://doi.org/10.1038/s43016-021-00431-5; Hayek, Harwatt, Ripple and Mueller (2020), 'The carbon opportunity cost of animal-sourced food production on land'.
**103** Intergovernmental Panel on Climate Change (2018), 'Special Report: Global Warming of 1.5°C: Summary for Policymakers'.
**104** Hayek, Harwatt, Ripple and Mueller (2020), 'The carbon opportunity cost of animal-sourced food production on land'.
**105** Food and Agriculture Organization of the United Nations (2022), 'FAOSTAT: Land Use – Land Area and Naturally Regenerating Forest, 2020', https://www.fao.org/faostat/en/#data/RL.
**106** Harwatt, H. and Hayek, M. (2019), *Eating away at climate change with negative emissions: Repurposing UK agricultural land to meet climate goals*, Harvard Law School, http://animal.law.harvard.edu/wp-content/uploads/Eating-Away-at-Climate-Change-with-Negative-Emissions%E2%80%93%E2%80%93Harwatt-Hayek.pdf.
**107** Sun et al. (2022), 'Dietary change in high-income nations alone can lead to substantial double climate dividend'; Springmann, M. et al. (2018), 'Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail', *Lancet Planet Health*, 2(10), pp. e451–e461, https://doi.org/10.1016/S2542-5196(18)30206-7.

**Table 2.** Agricultural land use in the G7

| | Cropland '000 ha (% of total land area) | Pasture '000 ha (% of total land area) |
|---|---|---|
| Canada | 38,815 (4) | 24,886 (3) |
| France | 19,075 (35) | 12,683 (23) |
| Germany | 11,913 (34) | 7,727 (22) |
| Italy | 9,329 (32) | 6,265 (21) |
| Japan | 4,397 (12) | 962 (3) |
| UK | 6,132 (25) | 12,583 (52) |
| US | 160,437 (18) | 250,969 (27) |

Source: Food and Agriculture Organization of the United Nations (2022), 'FAOSTAT: Land Use', https://www.fao.org/faostat/en/#data/RL.
Note: Pasture land is mostly permanent pasture, except for Japan, which only has temporary pasture.

**For G7 countries, continued growth in livestock production contradicts their commitment to the G7 2030 Nature Compact – to halt and reverse global biodiversity loss by 2030 and create a 'nature positive' economy.**

Hence, in addition to the raft of biodiversity and climate change mitigation policies being tabled for the decade ahead, it is crucial to consider structural transformation of food systems. This will require assessments of what is grown, how much is grown, how it is grown and where it is grown, as well as changes on the demand side to incentivize healthier, and less wasteful, patterns of consumption.[108] To align with biodiversity and climate change mitigation goals, actions on food must go beyond the current aspirations to improve the efficiency of production. For example, assuming an ambitious 40 per cent reduction of GHGs per unit of food produced would not be sufficient to align the global food system with 1.5°C (at neither 50 per cent nor 66 per cent probabilities). While improving yields and decreasing food waste can also reduce GHGs, neither measure aligns the food system with 1.5°C. Shifting to plant-rich diets has the most potential as a sole measure – aligning with a 50 per cent chance of global temperature rise staying within 1.5°C – but in combination with reduced food waste, higher yields and improved efficiency,

**108** Benton et al. (2021), *Food system impacts on biodiversity loss: Three levers for food system transformation in support of nature;* Gerten, D. et al. (2020), 'Feeding ten billion people is possible within four terrestrial planetary boundaries', *Nature Sustainability*, 3(3), pp. 200–208, https://doi.org/10.1038/s41893-019-0465-1.

the food system could be net negative in terms of GHG balance.[109] Similarly, to achieve at least a 50 per cent reduction in nitrogen loss levels, diet shift is essential, in addition to technological measures and management at the farm level.[110]

An important starting point is to tackle commodities associated with high environmental costs in regard to GHGs, land use and biodiversity loss. Globally, meat and dairy production has the highest impacts, accounting for around 15 per cent of GHG emissions and occupying 38 per cent of all habitable land – in addition to a large legacy of deforestation and biodiversity loss.[111] The outsized impact of animal agriculture is partly due to high levels of production, but is mainly a result of the substantial losses incurred – or the inefficiency inherent in converting nutrients from plant to animal form. For example, to produce 1 kg of beef requires 25 kg of feed crops – with only 3.8 per cent of the protein content and 1.9 per cent of the caloric content of the feed crops converted to beef (Figure 2). The production of feed crops uses 43 per cent of global cropland.[112] Cereals are a major feed source: 42 per cent of global cereal production is dedicated to feeding farmed animals. Within the G7 countries, except Japan, the majority of cereal production (excluding that for beer) is used for livestock feed (83 per cent in Canada, 68 per cent in France, 73 per cent in Germany, 61 per cent in Italy, 45 per cent in Japan, 58 per cent in the UK, and 81 per cent in the US).[113] The production of livestock commodities has continued to increase globally since the 1992 Earth Summit – with growth in production extending far beyond that enabled by yield improvements (Figure 3), and is expected to continue rising substantially up to 2050[114] – increasing the likelihood of further loss of pristine habitats and carbon sinks particularly in tropical areas.[115] In the G7, meat, milk and egg production has increased 139 per cent, 127 per cent and 129 per cent, respectively, since 1992; these seven countries alone account for 26 per cent of current global production. On average, livestock production contributes 0.7 per cent to each of the G7 countries' GDP, and around 1.4 per cent to global GDP.[116] For G7 countries, continued growth in livestock production contradicts their commitment to the G7 2030 Nature Compact – to halt and reverse global biodiversity loss by 2030 and create a 'nature positive' economy.[117] COP26 signaled that achieving 'peak fossil fuel' and 'peak deforestation' were within reach, but the target of 'peak livestock' must also be added to the mix in order to tackle the biodiversity and climate crises.[118]

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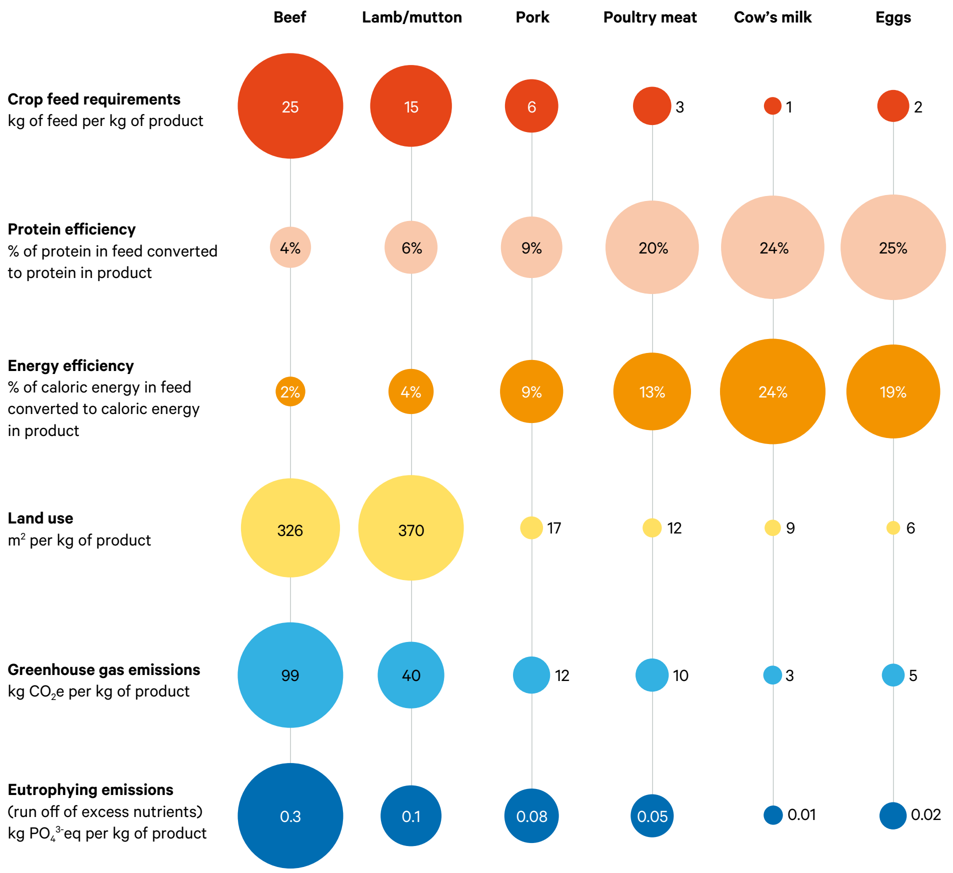
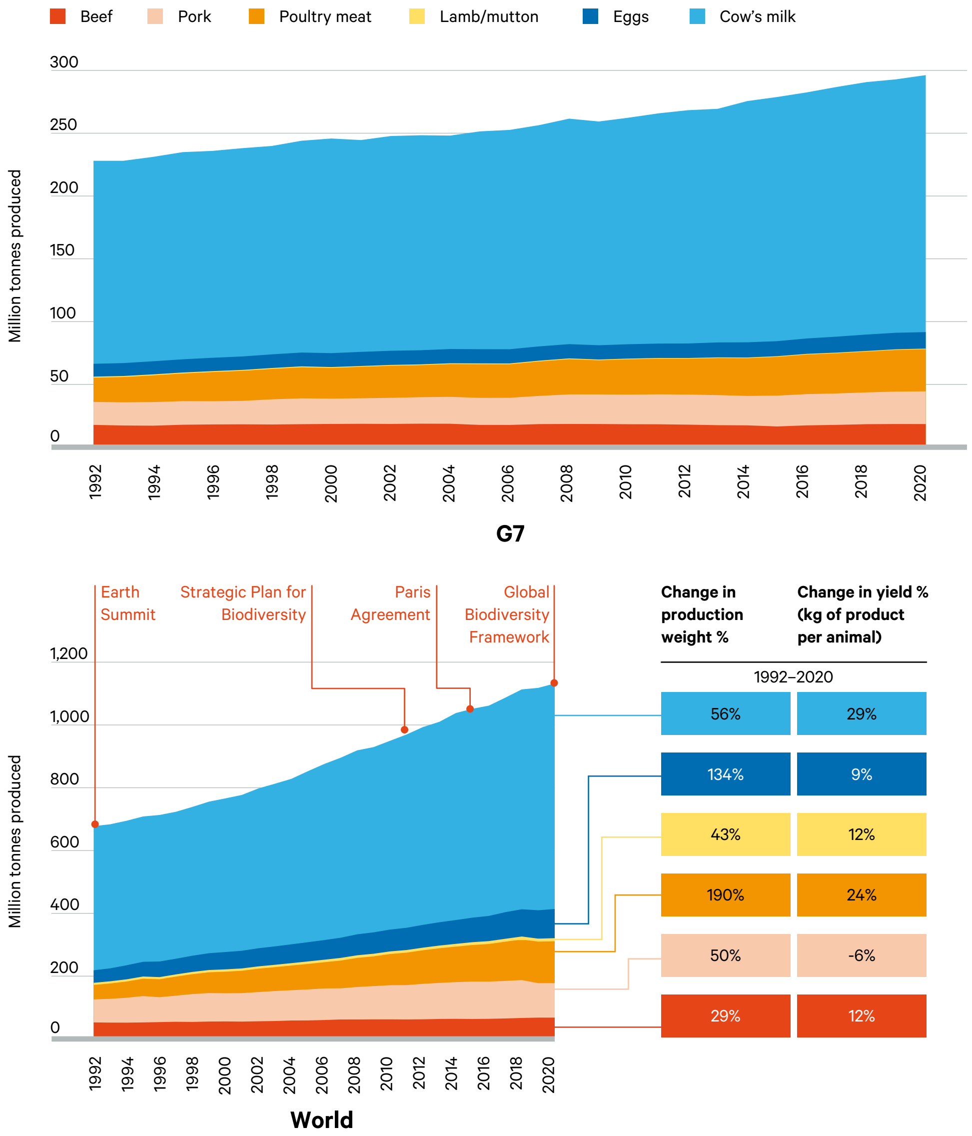
**109** Clark et al. (2020), 'Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets'.
**110** Leip, A. et al. (2022), 'Halving nitrogen waste in the European Union food systems requires both dietary shifts and farm level actions', *Global Food Security*, 35, 100648, https://doi.org/10.1016/j.gfs.2022.100648.
**111** Benton et al. (2021), *Food system impacts on biodiversity loss: Three levers for food system transformation in support of nature.*
**112** Poore and Nemecek (2018), 'Reducing food's environmental impacts through producers and consumers'.
**113** Food and Agriculture Organization of the United Nations (2019), 'FAOSTAT: Food Balances (2010-)', https://www.fao.org/faostat/en/#data/FBS.
**114** Komarek, A. M. et al. (2021), 'Income, consumer preferences, and the future of livestock-derived food demand', *Global Environmental Change*, 70, 102343, https://doi.org/10.1016/j.gloenvcha.2021.102343.
**115** Erb, K. H. et al. (2016), 'Exploring the biophysical option space for feeding the world without deforestation', *Nature communications*, 7(1), pp. 1–9, https://doi.org/10.1038/ncomms11382.
**116** Ranging from 0.6 per cent for the UK to 1 per cent for France and Canada. Derived using current dollar value of livestock production and GDP, from Food and Agriculture Organization of the United Nations (2022), 'FAOSTAT: Value of Agricultural Production', https://www.fao.org/faostat/en/#data/QV; World Bank (2022), 'GDP (current US$)', https://data.worldbank.org/indicator/NY.GDP.MKTP.CD (accessed 1 Apr. 2022).
**117** G7 (2021), *G7 2030 Nature Compact.*
**118** Harwatt, H. et al. (2020), 'Scientists call for renewed Paris pledges to transform agriculture', *The Lancet Planetary Health*, 4(1), pp. e9–e10, https://doi.org/10.1016/S2542-5196(19)30245-1.

**Figure 2.** Relative efficiencies and environmental impacts of animal-sourced foods




Source: Compiled by the authors from Alexander, P. et al. (2016), 'Human appropriation of land for food: The role of diet', *Global Environmental Change*, 41, pp. 88–98, http://www.sciencedirect.com/science/article/pii/S0959378016302370?via%3Dihub#bib0330; Poore and Nemecek (2018), 'Reducing food's environmental impacts through producers and consumers'.

**Figure 3.** Production levels and yield change (%) for a range of animal-sourced foods (1992–2020)




Source: Food and Agricultural Organization of the UN (undated), 'FAOSTAT 2020: Production quantity and yield https://www.fao.org/faostat/en/#data/QCL.
Note: Change in yield compares the amount of product (meat, eggs, milk) harvested per animal in 1992 and 2020. Change in production compares production levels in 1992 and 2020.

G7 countries, in particular, can play a major role by repurposing portions of domestic land currently used for animal agriculture, assisting consumption shifts at the national level, and negotiating international trade agreements that stipulate environmental conditions to reduce their overseas impact.[119] In recognition of the links between current crises and the implications for national security going forward, under its current presidency of the G7, Germany is seeking to accelerate

**119** Ibid.; Kehoe, L. et al. (2020), 'Inclusion, Transparency, and Enforcement: How the EU-Mercosur Trade Agreement Fails the Sustainability Test', *One Earth*, 3(3), pp. 268–272, https://doi.org/10.1016/j.oneear.2020.08.013.

action on biodiversity, climate and food. The country intends to focus on sustainable agriculture and sustainable supply chains[120] – and provide an early opportunity for collaboration among G7 countries in these key areas. Incentives are required to restore carbon sinks and biodiversity at home and abroad, particularly in low-income countries, which could include a restructuring of land and agricultural subsidies.[121] In addition, there is a need for climate and biodiversity valuation or stipulation components in policy mechanisms to link climate goals with the GBF. Given the G7's significant contribution to GHG emissions and biodiversity loss, both past and present, and its influence on consumption patterns in low-income countries, member states must lead and assist other countries in transforming food systems in line with planetary health goals. Domestic restoration efforts on both the climate and biodiversity fronts would also help give credence to calls from higher-income countries to conserve existing carbon and biodiversity repositories in lower-income countries.

**Domestic restoration efforts on both the climate and biodiversity fronts would also help give credence to calls from higher-income countries to conserve existing carbon and biodiversity repositories in lower-income countries.**

The potential for food system transformation is greatest in higher income countries as food production tends to occupy a large proportion of territorial land, and consumer demand at the national level drives land-use conversion abroad, from pristine habitats to agriculture. For example, the G7 countries contribute to deforestation and GHG emissions abroad through imports of agricultural commodities. Japan is the world's largest importer of cereals, 4th largest importer of meat and 14th largest importer of oil seeds from Brazil. Germany (8th), France (9th), Italy (12th) and Japan (15th) are major importers of soybeans from Brazil. Germany (8th), France (9th) and Italy (13th) are also major importers of oil seeds from Brazil, while Canada (12th) and the US (14th) are major importers of sugar. Japan (5th), the US (7th), Italy (11th) and Germany (18th) are major importers of palm oil from Indonesia.[122] Brazil and Indonesia are the second and third largest contributors to GHG emissions from land-use change since 1850 (the US is number one).[123] Expanding agricultural production in these areas is particularly concerning given that the largest and highest-density of irrecoverable carbon reserves are in the tropical forests and peatlands of the Amazon (31.5 Gt) and Insular Southeast Asia (13.1 Gt).[124] While cattle production is the single largest

**120** Federal Government of Germany (2022), *Policy Priorities for Germany's G7 Presidency in 2022*, https://www.g7germany.de/resource/blob/998352/2000328/6cb78b73c9f000183e69738c255d9cc9/2022-01-21-g7-programm-en-data.pdf?download=1.
**121** Springmann, M. and Freund, F. (2022), 'Options for reforming agricultural subsidies from health, climate, and economic perspectives', *Nature communications*, 13(1), pp. 1–7, https://doi.org/10.1038/s41467-021-27645-2.
**122** Chatham House (2022), 'Data: Commodity > Agricultural products; Measure > Weight', https://resourcetrade.earth/?year=2020&category=1&units=weight&autozoom=1.
**123** Carbon Brief (2021), 'Analysis: Which countries are historically responsible for climate change?'.
**124** Goldstein et al. (2020), 'Protecting irrecoverable carbon in Earth's ecosystems'.

direct cause of deforestation, animal agriculture is also a major indirect cause. Soy production is the third largest driver of deforestation and is mostly used for animal feed (e.g. 77 per cent of soy production is used for animal feed, of which 74 per cent is used to feed pigs and chickens).[125] While restoring large swathes of land currently allocated to animal agriculture would make a substantial and much needed contribution to climate change mitigation and biodiversity goals, protecting high value areas is also crucial. Given that tree cover loss is a reasonable proxy for irrecoverable carbon loss over the last decade,[126] protecting forested areas offers a useful starting place.

Shifting agricultural land use to help meet climate change mitigation and biodiversity goals would initially impact revenues, but this can potentially be recouped in other ways. For example, eco-tourism could possibly be elevated in 'restored' areas, potentially diversifying income streams from animal agriculture. Such socio-economic aspects are important to assess in detail to ensure adequate provisions are in place, such as financial and practical support to transition livelihoods where relevant.

Meeting ambitions to tackle climate change and biodiversity loss this decade would likely improve outcomes in comparison to business as usual. However, major tensions over land use will remain. For example, inadequate action to reduce GHGs in the short term increases the requirements for CDR in the longer term. All CDR options require large areas of land but have varying impacts on biodiversity and food production. BECCS deployment in line with a 1.5°C pathway would take 25–46 per cent of global arable land for biofuel production. One BECCS scenario being considered by the UK government would require 27–31 per cent of the UK's current agricultural land area. Dedicating such substantial proportions of cropland to help mitigate climate change could have a range of adverse implications, including for food security and biodiversity.[127] Concurrently, increased demands for land for both biodiversity protection and food production will increase the incompatibility of food, climate and biodiversity policy aspirations. Land-use shifts enabled by transforming the global food system are essential for meeting climate and biodiversity targets. The potential climate and biodiversity outcomes of three contrasting pathways are illustrated qualitatively in Figure 4.

Another key tension between climate, biodiversity and food policy of increasing importance, which could be at least partly alleviated with land-use changes enabled by food production shifts, is the emergence of zoonotic disease with potential to cause global pandemics. Habitat degradation and destruction (also impacted by climate change) – including deforestation, expansion of agricultural land and intensive animal farming – are all factors in the emergence

**125** Ritchie, H. and Roser, M. (2021), 'Soy', https://ourworldindata.org/soy; World Resources Institute (2020), *Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fiber, Cocoa, Coffee, and Rubber*, Technical Note, Washington, DC: World Resources Institute, https://www.wri.org/research/estimating-role-seven-commodities-agriculture-linked-deforestation-oil-palm-soy-cattle.
**126** Goldstein et al. (2020), 'Protecting irrecoverable carbon in Earth's ecosystems'.
**127** Quiggin, D. (2021), *BECCS deployment: The risks of policies forging ahead of the evidence*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/sites/default/files/2021-09/2021-10-01-beccs-deployment-quiggin.pdf; Intergovernmental Panel on Climate Change (2022), *Climate Change 2022*.

of diseases that can potentially spread from wild animals to humans. The COVID-19 pandemic provided a wake-up call to the reality of such systemic risks to food systems.[128]

Linking climate and biodiversity agendas through an integrated land assessment would allow countries to identify how climate, biodiversity and food policies interact and which policy pathways can deliver the most benefits and tackle the biggest threats over the current decade.

**Figure 4.** Relative implications of three alternative global pathways along the climate–biodiversity–food nexus to 2030

| Pathway | Continuation of current approach to climate change and biodiversity loss | Anticipated biodiversity and climate targets | Anticipated climate and biodiversity targets combined with food system transformation |
|---|---|---|---|
| Implications for food production | Animal agriculture grows without limits | Farm-level interventions reduce some environmental impacts of food production per kg, but growth of animal agriculture is unrestricted | Food production shifts focus from animal-sourced to plant-sourced foods |
| Implications for biodiversity | – Increased demand for land removes the possibility to protect or restore ecosystems<br>– Nature-friendly farming trades off with increasing demand for land<br>– Biodiversity loss increases | – Limited scope for ecosystem preservation or restoration<br>– Limited scope for nature-friendly farming<br>– Biodiversity loss continues | – Reduced demand for land provides maximum scope for ecosystem protection and restoration<br>– Nature-friendly farming can become common practice<br>– Biodiversity loss can be halted and reversed |
| Implications for climate | – Increased GHGs from land-use change such as deforestation<br>– Increased GHGs from the food system | – Increased GHGs from land-use change such as deforestation<br>– Potential decrease in GHGs from food production at farm level | – Potential to increase $CO_2$ sequestration through habitat restoration such as reforestation<br>– Decreased GHGs from land-use change<br>– Decreased or net negative GHGs from the food system |

Source: Compiled by the authors.

**128** King, R. (2021), *Implications of COVID-19 for UK food supply resilience: Risks to food and nutrition security during and after the pandemic*, Research Paper, London: Royal Institute of International Affairs, https://www.chathamhouse.org/2021/12/implications-covid-19-uk-food-supply-resilience; Bernstein, J. and Dutkiewicz, J. (2021), 'A Public Health Ethics Case for Mitigating Zoonotic Disease Risk in Food Production', *Food ethics*, 6(2), pp. 1–25, https://doi.org/10.1007/s41055-021-00089-6; Daszak, P. et al. (2020), *IPBES Workshop on Biodiversity and Pandemics*, Workshop Report, Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services https://ipbes.net/sites/default/files/2020-12/IPBES%20Workshop%20on%20Biodiversity%20and%20Pandemics%20Report_0.pdf; Brooks, D. R. and Boeger, W. A. (2019), 'Climate change and emerging infectious diseases: Evolutionary complexity in action', *Current Opinion in Systems Biology*, 13, pp. 75–81, https://doi.org/10.1016/j.coisb.2018.11.001; Settele, J., Diaz, S., Brondizio, E. and Daszak, P. (2020), 'COVID-19 Stimulus Measures Must Save Lives, Protect Livelihoods, and Safeguard Nature to Reduce the Risk of Future Pandemics', *IPBES Guest Articles*, 27 April 2020, https://ipbes.net/covid19stimulus.

# Conclusions

Most nations lack sufficient detail and ambition in their plans for tackling the overlapping challenges of climate change and biodiversity loss in the decade ahead, and critical funding gaps further threaten suitable action being taken. This is particularly concerning given the current warming trajectory and lead time for ecosystem restoration, and the potentially irreparable damage that could occur through rising temperatures and ongoing land-use change activities such as deforestation.

Land use and GHG emissions are the most crucial aspects of climate and biodiversity plans. As the biggest land user and a significant contributor to global GHG emissions, currently food systems are fundamentally incompatible with climate change mitigation and biodiversity goals. Moreover, under current expectations, food-related land use and GHG emissions are both due to increase. Without a drastic shift in food systems, halting and reversing biodiversity loss and limiting temperature rises to 1.5°C will be unattainable.

Despite the essential role of food system transformation in meeting biodiversity and climate change mitigation goals, this is not currently a strategy proposed by any nation and it represents a major opportunity. The onus is on high-income nations – as significant land users, GHG emitters and contributors to the loss of biodiversity and carbon sinks – to lead the way by addressing their impacts at home and abroad. There are numerous ways to do this over the coming decade, including through revised NDCs at COP27 and committing to the GBF at COP15. However, efforts must be made to link the climate and biodiversity agendas, and to integrate food system transformation within this strategy.

Solutions must go beyond a technical linking of multilateral regimes. It is imperative to build resilient, diverse and highly functional ecosystems; to focus on food systems that sustain healthy human populations within Earth's biogeophysical limits; and to keep global average temperatures below thresholds associated with ecosystem destabilization.

The previous decade of action for biodiversity and climate was far from successful – biodiversity loss continued and global temperatures increased. Another decade of inaction is unaffordable in the long term. Efforts this decade must be transformative and sufficiently ambitious. For example, moving away from a focus on conserving existing land use to protecting and restoring biodiverse habitats and carbon sinks. Protection *and* restoration are crucial.

While efforts to reduce impacts across the entire food system must be pursued, a huge and immediate shift is needed to address the burden of animal agriculture as reducing this offers the most substantial potential contribution to climate change mitigation and biodiversity goals. Food policy must move beyond merely tackling supply side impacts on a per unit basis and also reduce overall production levels.

The impacts of animal agriculture must be acknowledged and accounted for in climate and biodiversity policies. In addition to the ideas of peak fossil fuel and deforestation, the introduction of the concept of peak livestock production in the near term would signify strong intentions for action on biodiversity and climate.

While this paper focuses on the G7 to explore the climate change mitigation and biodiversity policy landscape and food system drivers in more detail, an international effort is required to align with global limits on temperature change and biodiversity loss. Also, the implications extend beyond the supply side – reconfiguring agricultural land use to align with biodiversity and climate change mitigation goals necessitates fundamental changes to food production *and* consumption. Building on existing international treaty architecture enabled by the Rio Conventions is likely the most expedient way to address the global challenge of biodiversity loss and climate change over the coming decade.

## Recommendations

— Food systems must be transformed to align with climate change mitigation and biodiversity goals. Organizers should include a 'food–nature–climate day' at both COP27 and COP15 to highlight the intersection of biodiversity and climate change mitigation goals and the crucial role of food system transformation in meeting them. Additionally, and perhaps most importantly given expectations of the wealthiest nations to lead by example, this agenda could be included at the next G7 summit.

— The G7 could also show leadership by mobilizing finance and accepting differentiated responsibilities for restoring ecosystems. For example, applying the principle of 'common but differentiated responsibilities (CBDR)' – which was formalized into international environmental law in 1992 at the Earth Summit in Rio de Janeiro – would establish that the issues are international and require action from all countries, but that all countries are not equally responsible. For example, targets for land restoration and GHG reduction could take into account a country's historical contribution, and financing could be allocated on a similar basis, taking into consideration a country's ability to provide such support.

— Linking climate and biodiversity agendas through an integrated land assessment would allow countries to identify how climate, biodiversity and food policy interact and, crucially, which policy pathways deliver the most benefits, resolve inconsistencies and tackle the biggest threats over the current decade. One aspect of such an assessment would be to ensure protection of important natural resources (e.g. where high levels of irrecoverable carbon and important biodiversity repositories exist) and regions at risk of degradation. The assessment would usefully include the impacts of food trade to address the offshoring of food consumption impacts. The assessment could also be used to determine agricultural land that can be restored to its native ecosystem condition, where possible.

- Three key steps for countries over the next decade are to:

  1. Ensure that biodiversity and climate change mitigation targets align with 1.5°C and the GBF, and that countries with a large legacy of emissions and biodiversity loss, such as G7 member states, increase ambition accordingly – which should include the large-scale restoration of ecosystems.

  2. Pursue food policy across production *and* consumption that is consistent with climate change mitigation and biodiversity targets. This policy mix should cover areas including agricultural subsidies, land-use tenure, food and environmental taxation, regulation and incentives aimed at food consumers.

  3. Address impacts abroad through trade relationships, including a deforestation phase-out with full terms and references (e.g. a minimum standard would be to immediately cease deforestation of intact/biodiverse/irrecoverable forests), and incentives to support change.

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