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UK Agricultures Impact on Biosphere Integrity: Improving and Aligning Current Policies Across All Government Departments.

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Executive Summary:

Agriculture has been a leading driver in biosphere integrity loss for decades, the use of pesticides, fertilisers, and excessive consumption of meat wreaks-havoc on British farmland, which covers 69% of England. In a new Farming age outside on the European union's CAP, Britain has proposed some new solutions to 'farm for the future'. These include the replacement of subsides with the 'Sustainable Farming Incentive' which provides monetary rewards for those that aid environmental restoration. However, these policies need to be implemented more swiftly and favour small-scale farms to maximise biodiversity. At a more individual level we also strongly suggest the reduction of food waste and meat intake, to take pressure off the agricultural industry and ease the transition to what the food industry will look like with a larger population. Despite these ambitious policies many financial sectors in the UK fail to align with goals to protect biodiversity. The UK's relationships with other countries through the trade of pesticides and funding deforestation in the Amazon reverse any progress that could have been made. To reduce activities like these occurring the Environmental Bill requires serious amendments.

Foundational Science: Discussion and Analysis:

The current state of biosphere integrity has been put under threat from several factors, one specifically being the agricultural industry. Anthropogenic demand has side-lined the planetary needs for humankinds' desires. Biosphere integrity/biodiversity loss (Steffan et al 2015/Rockstrom et al, 2009) is currently one of the most under threat environmental planetary boundaries (Steffan et al, 2015) and its importance is often underestimated.

The ecosystem services (Millennium Ecosystem Assessment, 2005) provided by high biodiversity are vast, these include:

Services	Supporting	Provisioning	Regulating	Cultural
Benefits	soil formation, photosynthesis, and nutrient cycling.	food, water, timber, and fibre.	climate, floods, disease, wastes, and water quality.	recreational, aesthetic, and spiritual

The way in which these planetary boundaries are designed ensures that there is a 'zone of uncertainty', even if a boundary has been surpassed these if still a buffer between it and true irreversible change, this means that despite Biosphere integrity being at such high risk there is still time for intervention (Steffan et al, 2015:2).

Food production is a necessity for human survival, however the destruction that comes along with it is not. In 2018 half of all habitable land was utilised for agriculture and 77% of it is used for grazing and feed production (Ritchie and Roser, 2020). Livestock production has been classified as the leading driver of habitat loss globally and the consumption of meat is directly linked to the extinction of multiple species (Machovina et al, 2015). In England, farmland accounts for 69% of our land (DEFRA, 2020b:9) which is higher than the global average and the environmental impacts from this sector span from greenhouse gas production to freshwater availability, but the most effected is biodiversity and in figure 1 we can see that 94% of all species are now made up of livestock (NFS, 2020).

Farmlands have very low biodiversity, livestock animals like sheep (*Ovis aries*) have overgrazed the land (Boatman et al, 2007:2) and the planting and harvesting of crops disrupts the abundance of plants and insects that multiple species rely on for food (McLaughlin and Mineau, 1995). The use of pesticides and fertilisers also have a detrimental effect on biosphere integrity; pesticides are not limited to just farmland, they can contaminate the water table through leaching and even enter the food chain through run off (Sud, 2020:8).

1. Pesticides have been classed as the main driver in the decline of farmland birds (Geiger et al, 2010), their increased abundance in water bodies puts aquatic organisms like fish, and algae at risk (Malaj, et al, 2014) and insecticides like neonicotinoid have even been detected in 75% of honey samples across the world, putting pollinators at great risk (Mitchell, et al. 2017)
2. Fertilisers contain high levels of nutrients such as nitrogen and phosphorus. As shown in figure 1, agriculture is responsible for 78% of eutrophication (NFS, 2020) and this is a direct consequence of phosphorus pollution (Sud, 2020:10-11). Eutrophication causes algal blooms in lakes and reservoirs which alters aquatic ecosystems, most algal blooms are comprised of cyanobacteria which has potentially toxic effects on those inhabiting and drinking the water (Amorin and Moura, 2020;2).

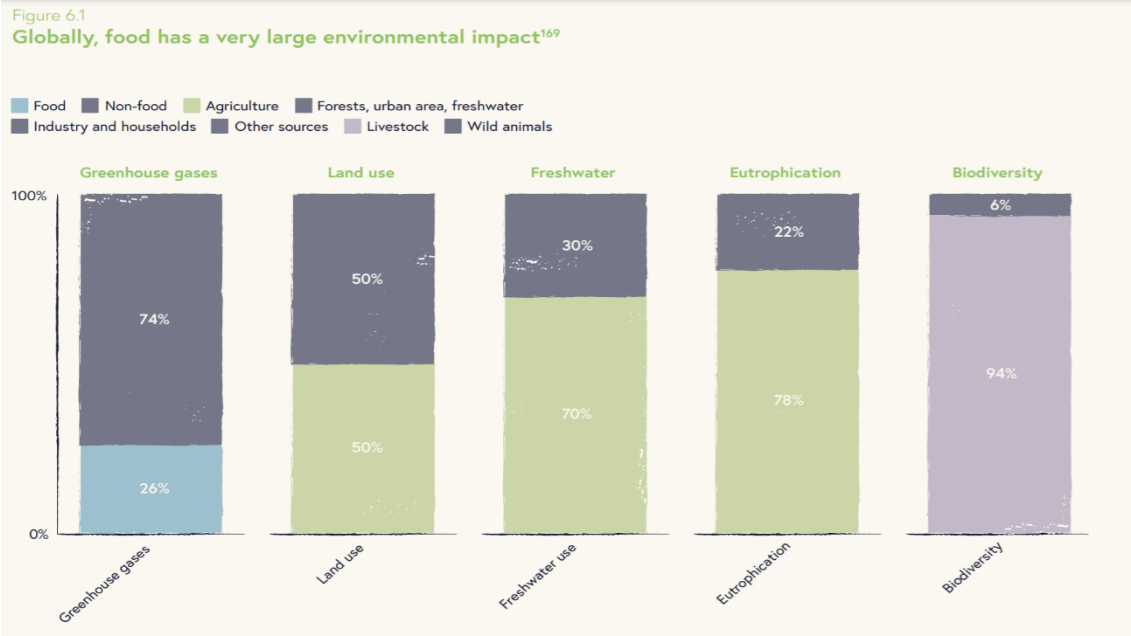

Figure 1: NFS (2020) [Food's impact on the environment, globally]

Biosphere integrity currently uses 'extinction rate' to measure 'genetic diversity' however these methods are only being used as an interim until a more effective one is introduced (Steffan et al, 2015:5); therefore, the picture of biosphere integrity could be even worse that we have anticipated, losing the ecosystem services it provides will result in irreversible changes which is why action is needed, urgently.

Assessment of Existing Governance:

Now the United Kingdom has left the European union, new agricultural policies are being devised that no longer need to follow the Common Agricultural Policy (CAP) regulations (DEFRA, 2020b:5). This change has prompted a multitude of new policies that aim to promote sustainability, reach their net-zero emission goal by 2050, and protect biodiversity.

"Larger, richer population living on a hotter, less resilient planet"- DEFRA, 2020

The Department for Environmental, Food and Rural affairs (Defra) published their 'Farming is Changing' report in January 2021 which listed a variety of new policies, the key ones are:

1. Phase out of Direct Payments
2. Environmental Land Management Scheme (ELM)

These policies acknowledge future challenges faced by British governments when addressing the issues with a "larger, richer population living on a hotter, less resilient planet" (DEFRA, 2020b:5). Despite their advances there are still areas where these policies require improvements in order to tackle biosphere integrity more effectively.

-*Direct Payments* or farm subsidies being phased out is a massive shift in the right direction, membership within the CAP saw £3 billion a year (Stokstad, 2020) fund an industry that sped up biodiversity loss in the UK (Burns et al, 2016:13), instead this money will be redirected into public goods and improving the current farming sector through the Environmental Land Management scheme (DEFRA 2020b:35).

-The *Environmental Land Management scheme* will offer economic incentives to sustainably manage land, it is devised of 3 separate subdivisions, the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery (DEFRA, 2021a):

1.The Sustainable Farming Incentive provides a replacement for direct payment recipients and seeks to redirect funding to restore under threat wildlife and rich habitats via hedgerow management, carbon friendly farming (DEFRA, 2021c), sequestering carbon and enhancing habitats with pollinator friendly flowers (Stokstad, 2020). Despite these positive advancements there is still a group of farmers that are classed as 'harder to reach' (Hurley et al, 2020b:2), and most funding goes to larger corporations leaving smaller farms behind, ultimately missing out on the opportunity for higher biodiversity (Winter and Lobley:50).

2. Nevertheless, the Local Nature Recovery strategy is targeting a variety of groups across England, from small farmers to landowners to work at identifying habitats under threat at local and national levels (DEFRA, 2020a). However, as we have previously seen most habitats are under threat in the first place because of fertiliser and pesticide use, yet the government has only made promises to fund 'Slurry investment' which will provide a more natural alternative, but Slurry is still associated with an increase in Eutrophication (Smith et al, 2001). In point one we have already seen that Direct Payments are being reallocated and one of these areas is the funding of more 'productive' farms (DEFRA, 2020b:17) which will ultimately favour the use of these fertilisers.

3.The Landscape Recovery scheme seeks to restore wilder landscapes where possible and establish peatland, salt marshes and trees (DEFRA, 2021a). Unfortunately, many of these initiatives focus too heavily on landscapes being 'tidy' or possessing 'beauty' (Boatman et al, 2007) (DEFRA, 2021a) that it becomes an inhabitable environment for many species, to avoid this biodiversity needs to be prioritised over visual appearance, not placed on the same scale. (DEFRA, 2021b:10)

Are these policies reflected in other areas?

Although these proposed policies are indeed moving in the right direction for the UK, this sentiment is not felt through all their policies when interacting with agriculture in other countries, this is necessary since the planetary boundaries are measured on a global scale, not just regional (Steffan et al, 2015:2).

Firstly, Britain relies on multiple other countries for food imports, in the spring over 60% of Fruit and Vegetables originate from continental Europe (Dimbleby, 2020:15), which does not

follow the principle of leaving the CAP due to its steep subsidies if these exports mean that that the UK is still funding this harmful 'deeply flawed' institution (DEFRA, 2020b:5).

Secondly, two UK companies have been found sending harmful pesticides to 'developing countries' that have not passed EU standards (Harvey, 2020). These pesticides have been found to contain 'Paraquat' which is classified as a carcinogen, harmful to humans and wildlife. The leaching of this pesticide into nearby water systems has damaging effects on the fish for example, causing aneurysms and alterations to their gills. (Badroo et a, 2020).

Finally, despite the UK government pledging £16 million to prevent further amazon deforestation (BEIS, 2020) but there is still between £500 million and £2 billion countering this initiative from the UK Finance industry (Green Alliance, 2021/ Howard, Wasley, Heal, 2020) This money is being directed into three of the largest beef producers, all of which intend to convert more the Amazon rainforest into pasture for livestock (Green Alliance, 2021). This is such an issue because of abundance of wildlife in the Amazon and the ecosystem servicea it provides for human by acting as carbon sink and cooling the climate (Green Alliance, 2021). Although, the UK Government has added to their 'Environmental bill' by ensuring due diligence checks by businesses they still require improvements.

Overall, the UK must ensure that all sectors linked to biodiversity loss, especially those related to agriculture align with these targets to take pressure off the planetary boundary, globally not just regionally.

Governance Recommendations:

Current farming policies do seem promising; however, they need to be introduced faster to keep up with the rate of decline, the UK has some of the 'lowest amount(s) of biodiversity remaining' (Davis, 2020), in the last 50 years 41% of species have declined (Davis, 2019). Although we understand that farmers will need a transition period to be able to successfully move away from subsidies, the **landscape/local nature recovery should be introduced after a shorter pilot period**, not in 2024 (DEFRA, 2021b:11). The successful restoration of ecological sites must also take socio-economic impacts into consideration alongside ecological when monitoring its success (Wortley, Hero, and Howes: 542), this will encourage more participants and ensure a successful restoration process.

We also recommend that **small-scale farms are actively prioritised over larger farms** for 'The Sustainable Farming Incentive'. It has been scientifically proven that smaller farms are better for the environment and have a higher 'conservation value' (Winter and Lobley:50), they are more willing to sacrifice areas of farm to wildlife, and biodiversity levels are also more easily monitored (Winter and Lobley:49), and they are much less likely to use harmful pesticides, In a North Carolina study many of their small-scale farms had thriving wildlife which was aided by the absence of pesticide use (Yeboah et al, 2009:9), ultimately protecting biosphere integrity.

The reduction of agricultural impacts on biosphere integrity will also decrease if there is less demand for food and more specifically food with high impacts on biodiversity. We suggest that the government creates an initiative **to promote the reduction of meat intake and food waste**, at the consumer level and producer level. Although Cereals and breads are the largest contributors to food waste, meat has the most environmental impacts (Scherhaufer et al, 2018:112), with beef and pork possessing the highest 'eutrophication potential' (Scherhaufer et al, 2018:109), which we know has detrimental impacts on biodiversity. This will also reduce the UK's reliance on other countries (like the EU) for food supply, moving towards a self-sufficient food system.

Prior to being published in April 2021 (UK Parliament, 2021) 'The Environmental Bill' had been delayed three times already (Harvey, 2021) but despite these delays many errors remain in it, such as illegal loopholes. The classification of deforestation as 'illegal' within the UK only (Green Alliance, 2021), permits financial companies to fund biosphere integrity loss in other countries. Considering that the bill is at the report stage in the House of Commons, I would recommend **they amend it with a 'deforestation-free standard'** (Green Alliance, 2021), this would make deforestation illegal globally and passing this as soon as possible will help save multiple habitats and one of largest carbon sinks (Green Alliance, 2021). UK Standards associated with any environmental concern must also remain the same across all countries, a prime example of this is pesticide trade, The UK is 'Europe's biggest exporter of toxic pesticides' (Dowler, 2020), the Environmental bill must make it clear that **pesticides banned in the UK should be banned in all countries**, their impact on the degradation of ecosystems is the same regardless of location.

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