Game & Wildlife Conservation Trust (GWCT)[1] response to the Defra call for evidence in relation to

Developing a National Food Strategy

Introduction

1. The GWCT welcomes the opportunity to contribute to the development of a national food strategy which we consider provides an opportunity to develop policy which links in with the Agriculture and Fisheries Bills, the Industrial Strategy, the Childhood Obesity Plan and the Environment Bill to create a "joined -up" and over-arching approach. This link is important in providing a balance between the objectives of each policy initiative and in our view the strategy will be vital in putting two key policy drivers 'up front' – agricultural productivity and soils. Both of these were absent from the Agriculture Bill.
2. The two areas we would like to address are:
    2.1. Food sustainability, domestic production, resilience in the face of global population growth and consumption, climate change and the importance of soil health.
    2.2. Sustainable Intensification – designing the Environmental Land Management Scheme (ELMS) to deliver productive, efficient farming in combination with ecosystem service provision.
3. **Soil health** is vital to agricultural productivity, the delivery of a range of ecosystem services, including carbon sequestration and flood prevention and the delivery of the objectives of this strategy. After all, soils support all terrestrial ecosystems and underpin 95% of all food production globally.
4. At the commencement of the Government's post-CAP vision for the environment and agriculture, soil health was a high priority and included in the 25 Year Environment Plan there was a general commitment to "improving soil health" (p.43) and as part of achieving the target to "[Use] resources from nature more sustainably and efficiently" a commitment to "*improving our approach to soil management: by 2030 we want all of England's soils to be managed sustainably…*"

[1] The Game & Wildlife Conservation Trust (GWCT) is a leading UK charity conducting conservation science to enhance the British countryside for public benefit. For over 80 years we have been researching and developing game and wildlife management techniques. The Allerton Project, the Trust's demonstration farm, researches the effects of different farming methods on wildlife and the environment. We use our research to provide training and advice on how best to improve the biodiversity of the countryside. We promote our work to conservationists, including farmers and landowners and offer an on-site advisory service on all aspects of game and wildlife management, so that Britain's countryside and its wildlife are enhanced for the public benefit.

5. However, this ambition appears to have slipped down the policy agenda as policy makers misguidedly categorise soil as a private asset rather than providing any public benefit. To categorise soil as a private asset repeats all the mistakes which have been made regarding soil management in post war agricultural policy. What is required is the adoption of the so-called "Blended Model" where all beneficiaries of the policy contribute, which includes farmers, the public and the food supply chain.
6. A National Soils Strategy is needed urgently. We discuss this further in section 1.
7. In Appendix 1 we outline the Trust's Allerton project's approach to soil management. The Trust has also produced a book called "The Soil and Water Balance - The Science Behind Soil Friendly Farming"[2] based on years of research carried out at the Trust's Allerton Project.

Section 1: Food sustainability, domestic production, resilience in the face of global population growth and consumption, climate change and the importance of soil health.

1.1. The sustainability of domestic food production is important but this should not be at the expense of 'exporting' environmental impacts to other nations as part of future trade deals. Focussing on soil health and the combined delivery of food production and other ecosystem services across the farming system (see section 2) rather than identifying single objectives in policy silos will be fundamental to this objective.

1.2. Food security attracted much debate as to whether it could be termed a public good. Population growth in the UK and the plateauing of crop yields means our self-sufficiency in indigenous foods has dropped from around 86% in the mid 1980's to less than 60% now and is still falling.

1.3. The National Food Strategy needs to define a level of home production, supported by incentives to encourage sustainable production methods, which will ensure the availability of sufficient quantities of safe, high quality UK-produced food. The post-war agricultural policy of seeking increasing self-reliance became discredited by heavily subsidised over-production but we forget at our peril the roots of this policy. We do not strive to seek self-sufficiency in any sector, but a base level of productive capacity needs to be defined and maintained. This should be an essential strategic objective in the National Interest and in the face of climate change, population growth and global food supply uncertainty. We believe this is as important a matter now as it last was at the end of WW2.

1.4. Given that some eminent soil scientists have stated that we have "only 40 harvests left in some of our best soils" any ambitions to increase self-sufficiency will need to be underpinned by a **National Soils Strategy**. Soil health is not only key to the sustainability and resilience of agricultural productivity but also the delivery of a wide range of environmental goods and services and it therefore warrants public investment. There is plenty of evidence to support the need to act quickly (see appendix 2)

[2] https://www.gwct.org.uk/news/news/2018/february/newly-published-book-explains-why-mud-matters/

1.5. England has the opportunity to create its own effective soils policy post-CAP as in contrast to the need to account for complexities across 28 EU member states, England has relatively homogenous factors determining soil types, cropping systems and climate. It is an historic opportunity which we must not miss.

1.6. We are concerned that the complexity of the soil ecosystem is hampering the development of practical policy initiatives. Whilst we recognise that more research is needed there are simple actions that can be taken by farmers/land managers now and these should be incentivised in the new ELM (we note however that none of the current Tests and Trials that have been commissioned explicitly includes soil health). We give examples in Appendix 3.

1.7. **Sustainable crop rotations** offer the single most important means of building resilience into soil, and therefore food production, against climate change (see appendix 3).

1.8. **Measuring soil health** is one of the proposed 25YEP monitoring metrics. But because of the complex nature of soil, defining what constitutes a 'healthy' soil is difficult. We are concerned that this could result in the desire to develop an over-complicated metric. In our view it is important that the metric is practical and simple and designed to engage farmers whose involvement in embracing ELM options will be vital in addressing any shortcomings (see appendix 4 for a **simple soil organic matter accounting system**).

1.9. Increased biomass and species assemblages in soils provides provisioning services to other organisms in the food chain and can help to support farmland biodiversity. It would be helpful to identify some key indicator species which could be used as a proxy indicator of overall soil health.

1.10. We accept that farmers will benefit from this approach through increased yields and reductions of fertilisers and crop protection inputs. De-intensifying exploitative rotations brings many other agronomic and environmental benefits and the hence the entire costs need not be borne solely by the public purse.

1.11. The supply chain in many cases is recognising the importance of soil health to the long-term supply of sustainably sourced food and their partnership and investment in such approaches should be encouraged and welcomed. A report into soil metrics supported by Business in the Community demonstrates how the food chain can contribute (copy attached).

Section 2: Sustainable Intensification - designing the ELM scheme to deliver productive, efficient farming in combination with ecosystem service provision.

2.1. There are two approaches to balancing environmental benefits with sustainable food production - *Land sharing* and *land sparing*.

2.2. Land sparing at a national level is difficult to achieve in England. Given the size of England (and the UK) it would be difficult to dedicate sufficient land to nature reserves and re-wilding to achieve desired objectives whilst also maintaining current domestic production levels (as a minimum).

2.3. Some areas of low agricultural productivity might lend themselves to a re-wilding approach. There is wider discussion to be had in these areas encompassing tradition, community, social, environmental and landscape impacts including economics.

2.4. However, this approach is effective at the field/farm level where the least productive land is managed for wildlife and other ecosystem services whilst the most productive land is dedicated to food production. This approach is also referred to as **Sustainable Intensification.**

2.5. We propose that the ELM scheme encourages farmers to identify the least productive 10% of their land and to dedicate this to options that promote the restoration and enhancement of the natural environment.

2.6. Research has demonstrated that 10% of land managed well for nature can provide a significant offset to the loss of biodiversity in the centres of fields practicing intensive production techniques (the Farm4Bio project[3]).

2.7. An holistic approach adopted at the Allerton project[4] involving removing unproductive land from agriculture, increased the farm's yield per hectare of land farmed whilst doubling the number of songbirds recorded, demonstrating that some areas are best given over to food production whilst other areas can deliver wildlife.

2.8. Such an approach if adopted widely could help support Nature Recovery Networks and encourage landscape scale improvements through improved habitat connectivity, as advocated in the Lawton Review – "Making Space for Nature".

2.9. Agro-forestry is another example of how such an approach could work (see appendix 5).

2.10. ***Conclusion.*** For too long we have treated the production of food as a provisioning ecosystem service in isolation from the landscape it operates in. The development of a National Strategy provides an opportunity to bring together all aspects relating to the production, processing and consumption of our food supply to create a more holistic policy. Our food, our nature and wildlife, and our soils are inherently linked and our future thinking must recognise this.

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[3] https://www.gwct.org.uk/research/habitats/farmland/farm4bio/

[4] The Allerton Project's aims are to research the effects of different farming methods on wildlife and the environment, and to share the results of this research through educational activities. The Allerton Project has been working to this end for the past 25 years. https://www.gwct.org.uk/allerton/

Appendix 1 - Soil management at the Allerton Project (taken from https://www.gwct.org.uk/allerton/farming/soil-management/)

Soil is at the core of our food production system. Soil aids:

- The flow of air, water and nutrients
- The ecological infrastructures of plants and animals
- Seed germination and root development

Soil health has always been important. However, it has too often been neglected as other factors have influenced land management, such as agricultural support and grants, nutrients, crop protection products and rotation profitability. Farms are businesses and have to produce a return on investment to remain viable.

At the Allerton Project we concentrate on the physical, chemical and biological properties of soil. It is important to understand how these areas affect the functionality of soil.

Physical properties	Structure
	Composition
	Erosion
	Drainage
Chemical	Nutrients
Biological	Organic matter
	Earthworms
	Other micro and macro fauna

Sustainability in practice: direct drilling for resilient soils

It is important we get our soil structure right, and that we aim to increase our organic matter so our soils rejuvenate and become a living, breathing entity. Earthworms are particularly important as they assist aeration, root development and nutrient recycling. We have lost touch with what is good for our soil - soil health has been neglected for too long.

At Allerton we are trying to make our soils more resilient. We have successfully widened our rotations, introduced cover crops, and we are now making the transition towards direct drilling. The direct drill approach allows our soils to remain undisturbed by leaving crop residues on the surface from harvest until sowing.

Seeds are placed into narrow slots created by purpose-built drills. We have developed a two pass operation. A low disturbance sub-soiler, such as the Sumo LDS, is used to remove compaction. To complement this we have also reduced the size of our machinery and replaced the tyres on our combine with tracks. This approach to soil management is very dependent on the weather. Due to our heavy soils, direct drilling is more difficult in wet conditions but we think it will be very successful in dry years.

Soil management also helps us to deal with our key challenges around slugs, blackgrass and volunteer crop management. We can grow crops successfully without too many cultivations and our yields are competitive. We have definitely seen the benefits in terms of increased soil flora and fauna. From a financial point of view, there is an opportunity to save on machinery, fuel costs and labour, and hopefully this will increase our profitability. We strongly believe that soil and water protection are key ingredients for a successful farming business.

Appendix 2 – evidence to support the need to act quickly on soil health

1. The annual costs of soil degradation in England & Wales are estimated at £1.2bn through compaction, loss of organic content and erosion;
2. the contribution of damaged soils to flooding is estimated at £233m pa;
3. the Committee on Climate Change has highlighted that 84% of our fertile top soil has been lost, the majority since 1950, and soil erosion continues at a rate of 1-3cm per year; and,
4. in 2015, a consultation highlighted that farmers were losing nitrogen and phosphorus through diffuse pollution, both essential nutrients to maintaining crop production but significant contributors to the degradation of water quality and aquatic ecosystem diversity.

Appendix 3 – practical actions that can be taken now to improve soil health.

Introducing sustainable crop rotations[5] that incorporate a balanced sequence of restorative (plants which help restore N levels in the soil such as legumes) and exploitative (plants which require N such as wheat) phases. Such rotations benefit soil health and minimise carbon emissions as the biologically fixed N is tied to the carbon in the plant i.e. the organic matter. This organic matter provides numerous benefits to soil health, including increasing

[5] https://www.gwct.org.uk/farming/advice/sustainable-farming/crop-rotation/

biological activity, reducing bulk density and compaction whilst improving structure, increasing water infiltration, rooting structures, nutrient capture and crop yields.

Promoting a systems approach to food production such as Conservation Agriculture and the Integrated Farming System (IFS) developed by Linking Environment And Farming (LEAF) and promoted across Europe by European Initiative for Sustainable Agriculture (EISA). We note that concerns about the use of inorganic fertilisers and pesticides have resulted in calls for increased reliance on organic farming principles. But the widespread adoption of such an agricultural system is problematic as yields are up to 40% lower across the rotation (Leake, 1999). Integrated systems can support soil health, promote improved nutrient usage and encourage integrated pest management thereby reducing environmental impacts.

Scientific evidence supports the ***continuation of high-yielding agriculture*** in areas where the natural habitat has been replaced by an agricultural landscape. Maintaining (but not necessarily maximising) output in these areas makes an important contribution to protecting the areas of natural and semi natural habitat still left (Balmford *et al,* 2018). See section 2.

Introducing support payments for grass/clover leys in all-arable rotations as an investment in soil health. The leys are cut and mulched in-field to build soil organic matter and fertility. Substantial gains can be made in a short period using this method. This removes the need to re-introduce livestock, which comes with a huge capital and operational burden. Not all the cost would need to be covered by the ELM scheme as the farmer also benefits from better crop yields elsewhere in the rotation and a reduction in the use of agro-chemical and fertiliser inputs.

Encouraging the adoption of low-impact cultivation techniques through reduced intensity of tillage. Minimum till or zero till techniques have been promoted as a means of reducing GHG emissions (although the overall benefits once methane and nitrous oxide have been considered are uncertain as yet in UK soils) but these are also important in supporting soil health through improved soil structure. Poorly structured soils can emit more GHG's, but they also restrict root growth and the ability of crops to scavenge nitrogen and generate optimum yields reducing efficiency. Soils with a low bulk density and high porosity are best suited for root development and buffering against extremes of weather including both excessive rainfall and drought conditions. Crops will continue to perform well in both scenarios where the porosity is good. Earthworms are key to the creation of this structure but are negatively affected by intensive soil cultivations[6]. Another practical solution would be to incentivise the use of low ground pressure tyres to reduce compaction.

[6] Trials at the Allerton Project have shown that after 7 years of zero till earthworm numbers increased from 200 m2 to 700 m2. A recent meta-analysis relating earthworm numbers to crop yield showed that once earthworm numbers exceeded 400m2 then increases of up to 20% were recorded. This is attributed to better rooting by the crop, better uptake of nutrients and an increase in soil mineral nitrogen brought about by the

Cover crops and organic additions to improve soil organic matter. Growing and fixing carbon within the field is only one way to increase soil carbon. Carbon rich materials from other processes can be recycled back to land. These include all animal manures and slurries, biosolids from waste water processing, paper waste, water pre-treatment waste, digestate from anaerobic digesters, municipal compost and biochar.

Grassland farming systems – the intensification of grass dominated farms, through the replacement of species rich hay meadows with high nitrogen input monocrops of Perennial Rye Grass (PRG) cut up to four times a season for silage, has not attracted the same level of research as in arable systems and so mitigation strategy options within agri-environment schemes are lacking. However these have the potential to be the next big farmland environmental issue due to, for example, their impact on water quality, soil health and biodiversity. The National Food Strategy needs to encourage the adoption of livestock farming systems that deliver both environmental benefits and support productive livestock farming. Research in Ireland (SmartGrass project) has shown that the dry matter yield of multi-species grassland managed at relatively low N input levels has been underestimated and that where legumes are present the yield may actually outweigh that of PRG. However management approaches need to be developed to maximise this gain.

Appendix 4 - a simple soil organic matter accounting system

We propose a ***simple soil organic matter accounting system*** which seeks to maintain or enhance soil organic matter across crop sequences and that this should be partially supported by public funds. The system requires the farmer to estimate, from standard figures, the potential losses and gains of organic material for each crop in the sequence. Gains are recorded for imported organic additions (e.g. digestate, FYM, slurry etc.); for plant matter returned from the crop itself - e.g. an 8.0 tonne/ha crop of wheat grain will return approximately 8.0 tonnes of straw if chopped, plus root biomass; for plant matter created e.g. the use of catch and cover crops, returned to the soil. Losses are recorded for crop removal and the oxidisation of organic matter related to tillage intensity – direct drilling has low losses, ploughing and bed-forming high losses. The system accepts that the organic matter levels will increase and decrease across crop sequences; the accounting system seeks to at least maintain or increase levels from the start to the end of the sequence. It does not involve endless soil sampling as the fluxes can be modelled.

Appendix 5 – Agro-forestry

Agro-forestry could address the need for more woodland planting to move towards achieving net zero, without re-purposing productive land which affects a farm's profitability

recycling of organic matter by the worms themselves. This helps to offset some of the reductions in soil nitrogen which occur in the absence of ploughing.

and reduces food production, whilst also providing welfare benefits to grazing livestock and soil health and water quality benefits. Payments would encourage farmers to plant small areas of woodland on agriculturally unproductive land, such as field corners or buffer strips. A large number of smaller plantings have the capacity to achieve more than a few large-scale ones, provide other ecosystem services in the process and avoid dramatic landscape transformations that result in changes to ecological balances that affect biodiversity. This would, however, involve a change to the current grant scheme, which is badly in need of reform. The Trust is undertaking research which will collate data that will ultimately enable us to make environmental and economic assessments of tree planting on pasture under a range of scenarios, and recommendations for future policy and practice elsewhere.[7]

References:

Balmford et al 2018 The environmental costs and benefits of high yield farming. Nature Sustainability, vol 1, SEPTEMBER 2018 pp477–485 https://doi.org/10.1038/s41893-018-0138-5 www.nature.com/natsustain

Leake, A R 1999. An appraisal of CWS Agriculture's organic farming experiments 1989-1996. Journal of The Royal Agricultural Society of England, Vol 160, 1999.

[7] https://www.gwct.org.uk/allerton/research/agroforestry/