11th October 2022 YEN Zero Discussion Workshop - Summary

Dear YEN Zero members,

We recently held the first of three discussion workshops as part of our second year of the YEN Zero network. This workshop was a fully open event for anyone to join us to hear more about the YEN Zero network and to see presentations and have the opportunity to discuss our workshop topic: the role of productivity in reaching net zero agriculture. The event was hosted as part of the Countryside COP weeklong programme, organised by CFE, of talks and discussions "for the UK's rural community to showcase its contribution to a just and equitable resilient net zero economy". Attendance was strong with of over 60 people taking part in the workshop. The virtual event was hosted on the online conference platform Remo to enable better interactivity between attendees.

The aim of the workshop was to discuss the role of productivity in reaching net zero agriculture. Specifically, the importance of maintaining and/or improving crop productivity to spare land elsewhere for ecosystem services such as supporting biodiversity and carbon storage. We heard from two expert speakers: Professor Andrew Balmford from the University of Cambridge, who summarised research which provided evidence for which land uses (sparing or sharing) provided the greatest benefit to biodiversity or carbon storage; and Dustin Benton, policy director from the Green Alliance who discussed how policy should be implemented to ensure land is used most appropriately (growing food or supporting ecosystem services) across the UK. The full agenda for the event can be found below with the main takeaway messages from each section.

YEN ZERO DISCUSSION WORKSHOP AGENDA: 09.00-11.00 am 11th October

1	Introduction, **Christina Baxter – ADAS**
2	Introduction to the workshop theme of the role of productivity, **Daniel Kindred – ADAS**
3	The opportunity to spare land for nature, **Andrew Balmford – Cambridge University**
4	The UK Land Use Framework, **Dustin Benton – Green Alliance**
5	Q&A, **Daniel Kindred – ADAS**
6	Introduction of breakout session, **Pete Berry – ADAS**
7	Discussion around how to determine most appropriate use of land, **Table facilitators**
8	Summary of breakout session, **Pete Berry – ADAS**
9	Meeting close, opportunity to network on tables, **Christina Baxter – ADAS**

Take home messages

- **The first discussion workshop of the year had over 60 attendees from the agriculture industry, which included YEN Zero sponsors, growers, agronomists, researchers, and other members of the industry.**
- **Sponsored and Independent places are available for growers to join the YEN Zero network now and receive benchmarked carbon footprints for 6 of their fields, in addition to access to future discussion workshops and our end of year results meeting.**

- **The GHG emissions associated with converting land elsewhere to grow a crop (Indirect Land Use Change, ILUC) should be considered within a crop's C footprint. This considers the opportunity cost associated with good crop productivity to spare land for nature and other ecosystem services.**
- **Land sharing is where low-intensity agriculture is combined with natural features. This contrasts with land sparing where productive agricultural land is focused on sustainable intensification while poor quality land is given entirely to supporting nature.**
- **Land sharing reduces yield, requiring more land for food production and therefore displacing land used for nature. Field studies on 5 continents showed that land sparing benefitted most species, compared to land sharing. The same is true for carbon storage.**
- **Livestock uses 85% of UK land, providing just 32% of our calories. The largest opportunity to spare land is to reduce a portion of the grass-fed beef production and grow crops instead.**
- **40% of the UK's farmland produces two thirds of our food. The less productive and unprofitable farmed areas could be incentivised to undertake landscape recovery or local nature recovery.**
- **Incentives are needed to both sustainably increase yields and spare land for nature and carbon storage, in the most appropriate areas.**

Introduction to YEN Zero

Christina Baxter, Crop Research Consultant, ADAS

The aim of YEN Zero is to create a net zero community for the agriculture industry to share their knowledge, agree key metrics, present ideas, and test 'what works'.

- The YEN Zero year will run from July 2022 – May 2023, with an initial focus on combinable and forage crops.
- Key activities taking place within the network include:
  - Collection and analysis of growers' agronomic and yield data, to calculate crop carbon (C) footprints
  - Interim and Benchmarking reports delivered to grower members, with proposals for mitigation strategies which can be implemented on-farm
  - Discussion Workshops on key topics within net zero to share knowledge and ideas
  - End-of-year results meeting to discuss the main findings from the benchmark analysis and highlight successful mitigation strategies in action.

Growers can submit up to 6 fields from any previous harvest year for C footprint analysis. C footprints will be reported on a **per ha** and **per tonne** basis, broken down into the main emission sources associated with crop management.

The role of productivity in reaching net zero

Daniel Kindred, Head of Agronomics, ADAS

- In 2004 it was estimated that yields could increase substantially (by maximising capture and use of light and water), but there has been little appetite for investing in yield increases.
- The amount of agricultural land globally is finite, though demand continues to increase. Conversion of natural habitats to farming is very harmful. The biofuel debate in 2008 brought to the forefront the importance of using our land efficiently because using crops for biofuels increases pressure on land and can cause Indirect Land Use Change (ILUC). Increased crop yields reduce the need for ILUC.
- Productivity is increasingly advocated as a sustainable route to spare land for nature and carbon.

- When the greenhouse gas (GHG) emission costs of ILUC are considered in a crop C footprint, the optimum nitrogen (N) fertiliser application rate is only around 50 kg N/ha lower than the optimum N rate for yield. This is due to improved yields reducing emissions associated with ILUC as less land needs to be converted to farmland to keep up with the global demand for food.

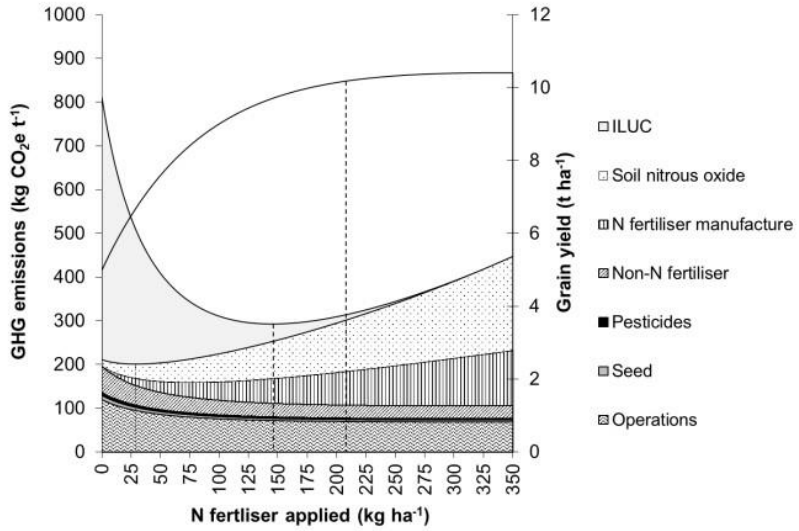


Figure 2. GHG intensity from a typical wheat crop on a per tonne grain basis showing how the constituent sources of embedded emissions change as N fertiliser rates increase and yields increase (solid line, right axis). The consequences from lost production on Indirect Land Use Change (ILUC) are also shown. Vertical dashed lines show rates that are economically optimal for yield (right), that minimise grain GHG intensity without ILUC (left) and that minimise GHG intensity including ILUC (middle).

Land sparing, land sharing, and the measurement of environmental outcomes

Professor Andrew Balmford, Department of Zoology, University of Cambridge

- Globally, farming causes 20-30% of the total GHG emissions. Farming already covers more than 50% of the useable land and the crop area is continuing to grow.
- Agriculture has a strong impact on biodiversity, through habitat conversion and through farmland intensification.

Two solutions have been proposed to meet future food needs:

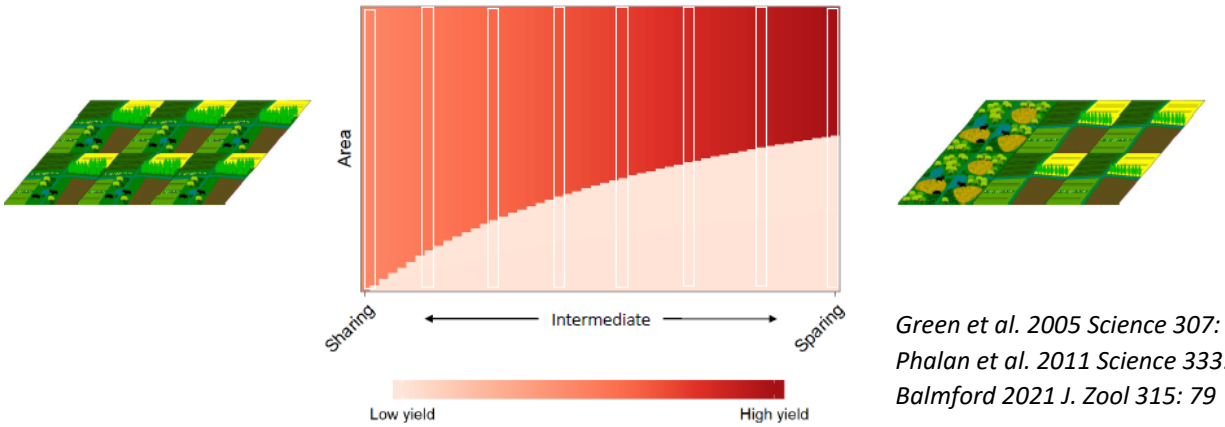
- **Land sharing** - reducing chemical inputs, keeping hedgerows, etc. so more wildlife and carbon can be supported and stored on farm. This scenario reduces yields so ultimately requires more farmland.
- **Land sparing** - sustainably increasing yields on farms, reducing the need for more farmland, and leaving more space for nature in the landscape. This scenario requires sustainable yield increases and policies to retain/restore natural habitat.

Some species do better in the land sharing model than the land sparing model and vice versa. Therefore, we need to look at biodiversity as a whole to make decisions on which strategy is best. When looking at other areas across the globe it was found that land sparing consistently outperforms land sharing. Particularly, species with narrow global ranges do well with land sparing.

In the UK the effect of land sparing and sharing was assessed. Mean outcomes show that the best strategy was land sparing, through increasing yields in already existing farmland and increasing the natural habitat area.

To implement land sparing, incentives and/or regulations need to be put in place for retaining/restoring natural habitat; and we need to identify and then support ways of increasing yields sustainably.

Often there is no linear trade-off between input and yield benefit. Therefore, it would be important to find an optimum to ensure crop management is as efficient as possible.



Green et al. 2005 Science 307: 550
Phalan et al. 2011 Science 333: 1289
Balmford 2021 J. Zool 315: 79

References: Phalan et al. 2011 Science 333:1289; Hulme et al. 2013 PLoS ONE 8:e54597; Kamp et al. 2015 J appl. Ecol. 52:1578; Dotta et al. 2016. Cons. Biol. 30:618; Williams et al. 2017 Glob. Ch. Biol. 23: 5260; Feniuk et al. 2019 Proc. R. Soc. B. 286:20191483.

The UK land use framework

Dustin Benton, Green Alliance

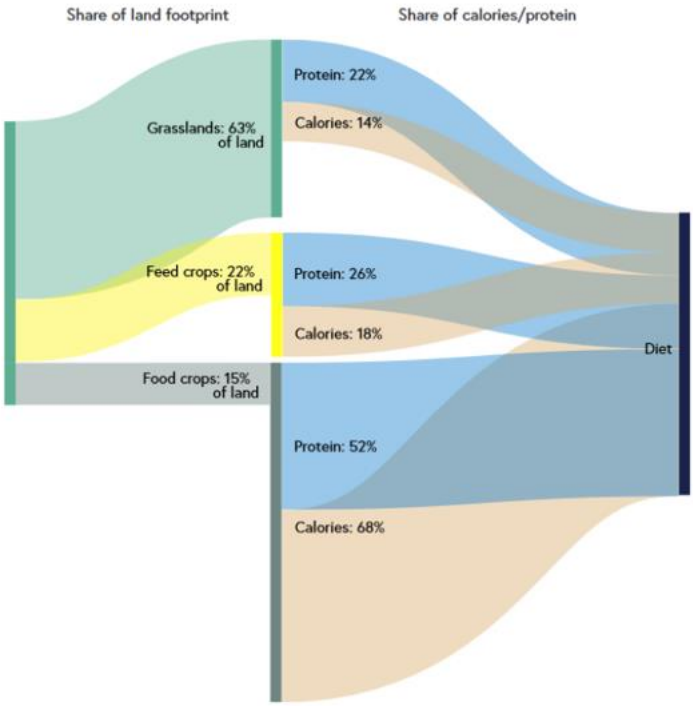
- The food footprint for the UK is 1.5x the size of the UK; 70% of the UK land, and an area about the same size overseas, is used to grow food.
- To improve food security the government has set the following goals:
    - Climate – Aim for net zero carbon and a 30% reduction in methane output from ruminants by 2030
    - Nature – Increasing farm and non-farm species abundance, 30% of land used for nature by 2030 and clean water by 2027
    - Food – Similar food security to today and at a similar price

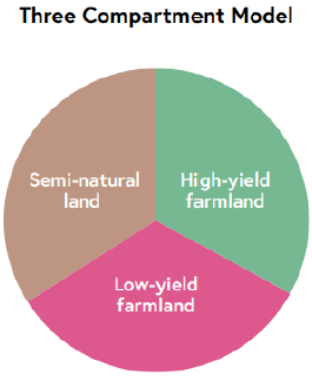
We can explore the possibilities by looking at the land footprint and how many calories/proteins are provided by each sector.

Apart from livestock taking up a lot of land but contributing a relatively low amount to the total amount of calories/protein available, livestock also produces ~70% of our food system's total greenhouse gas emissions.

When we look at where our food is grown, we see that food production is heavily located in the East. If we could increase the food production in these areas, then we will be able to reduce the amount of farming in low productive areas and convert these areas to natural habitat.

In numbers this would mean that if we give 21% of the least productive farmland to nature, this will result in only 3% less calories. In contrast, 40% of the most productive farmland provides us with ⅔ of our food.





What should the land use framework do?

- Guide farm investment spatially
- Link subsidies to national goals:
- ⅓ of ELMs on landscape recovery, in low-yielding areas
- Invest in innovation to keep yields high with less input, in high-yielding areas
- Bring local nature recovery forward

When designing new policies, we need to keep in mind the three-compartment model. This model was supported under The National Food Strategy, it offers the opportunity for our land to meet all our needs by creating a mosaic of different landscapes. Wild land, low intensity farmland and higher intensity farming can have the broadest beneficial effect for the most species.

Breakout session: How can growers be rewarded for productivity?

Pete Berry, Head of Crop Physiology, ADAS

The attendees of the workshop took part in a breakout session to discuss ways in which growers can be rewarded for productivity. In this session attendees were asked to discuss three questions. Some of the responses to these questions are provided below. The discussion around this topic is continuing online at FarmPep; do get involved if you have further comments or questions.

1. How should the most appropriate use of land be determined?

a. Geographic location and appropriateness for food production need to be considered
b. Local weather, rotation, tradition, and people need to be taken into account
c. Size of the farm and fields need to be taken into account
d. Appropriate use of land can be difficult to determine for tenant farmers as they are unable to work under longer term timescales

e. Is there a public perception that 'intensification' is undesirable? Crop prices are a current incentive for intensification but it comes with risks (e.g. agro-chemical prices). Does the current countryside stewardship scheme encourage the best use of land?

2. How to ensure that farms are fairly rewarded for managing land for different purposes?

a. Decisions on land sharing should be made on a field-by-field basis as all farms have good fields and poor fields.
b. If land is going to be out of production for a period of time, then the farmer needs to be rewarded with rates of return which are in line with the markets. The question is who is rewarding - government, supply chain, external finance.
c. Need to make sure that the wildlife has access to the resources at all times of year.
d. Enhancing our agricultural soils and increasing soil carbon is important to sustain our cropping landscape and maintain/increase yields. This needs to be incentivised.
e. Land management into larger areas may make a bigger difference rather than trying to combine smaller areas together. Are there any other models around the world that could be adopted?
f. Scale - can we incentivise some farmers to spare land based on increased yields on more productive farms - is there a market or policy mechanism?

3. At what scale should decisions about land use be taken?

a. On a farm scale can we use yield maps to decide on land use?
b. Decisions on carbon should be made on a global scale, whereas biodiversity is much more localised. We may need to bring the scale down to country level to make gains on carbon, but there is a need for connecting policies across borders.
c. Less productive areas are where changes need to be made to tackle climate change. Hard decisions need to be made but history and tradition should be protected.

Future Discussion Workshops

This 1st discussion workshop was hosted on the online conference platform Remo which facilitated great discussion on virtual tables. Our next discussion workshop will take place in January 2023. Get in touch if you have suggestions for a particular topic you would like to see covered in this session.

We would like to acknowledge our YEN Zero Sponsors for making the setting up of this network possible and to all those who contributed to this YEN Zero discussion workshop.

Any questions or comments please get in touch: yenzero@adas.co.uk