Sustainable and Regenerative Agriculture – Ten Principles of Practice

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Sustainable and regenerative agriculture describes an agricultural system that meets the basic needs of a population indefinitely by utilising resources at a replenishable rate and adopting regenerative agricultural practices which do not compromise the continued viability of the agricultural system and the wider human, social, economic, and environmental systems in which it resides.

Sustainable agriculture and regenerative agriculture are two different but overlapping concepts. Therefore, it is important to define both separately and then a combined definition can be reached, and best practices can be listed.

Sustainable agriculture can be defined as a system that meets the basic needs of a population indefinitely because it utilises resources at a replenishable rate, and the agricultural practices used do not compromise the continued viability of the agricultural system and the wider human, social, economic, and environmental system in which it sits.

Regenerative agriculture describes a soil-focused approach to agriculture which aims to increase carbon drawdown (combating climate change), (re)build soil health and fertility, improve the water cycle, and enhance the health and resilience of biodiversity and ecosystems. To achieve these aims, the following practices or principles are often followed: no-/minimum-tillage, continuous soil coverage, maintaining living roots in the soil, rotating crops, and growing a diversity of crops. Regenerative principles are generally associated with agriculture but could be applied to other types of land use. It should also be noted that sustainable agriculture is regenerative by definition because if it did not incorporate regenerative principles, it would not be sustainable.

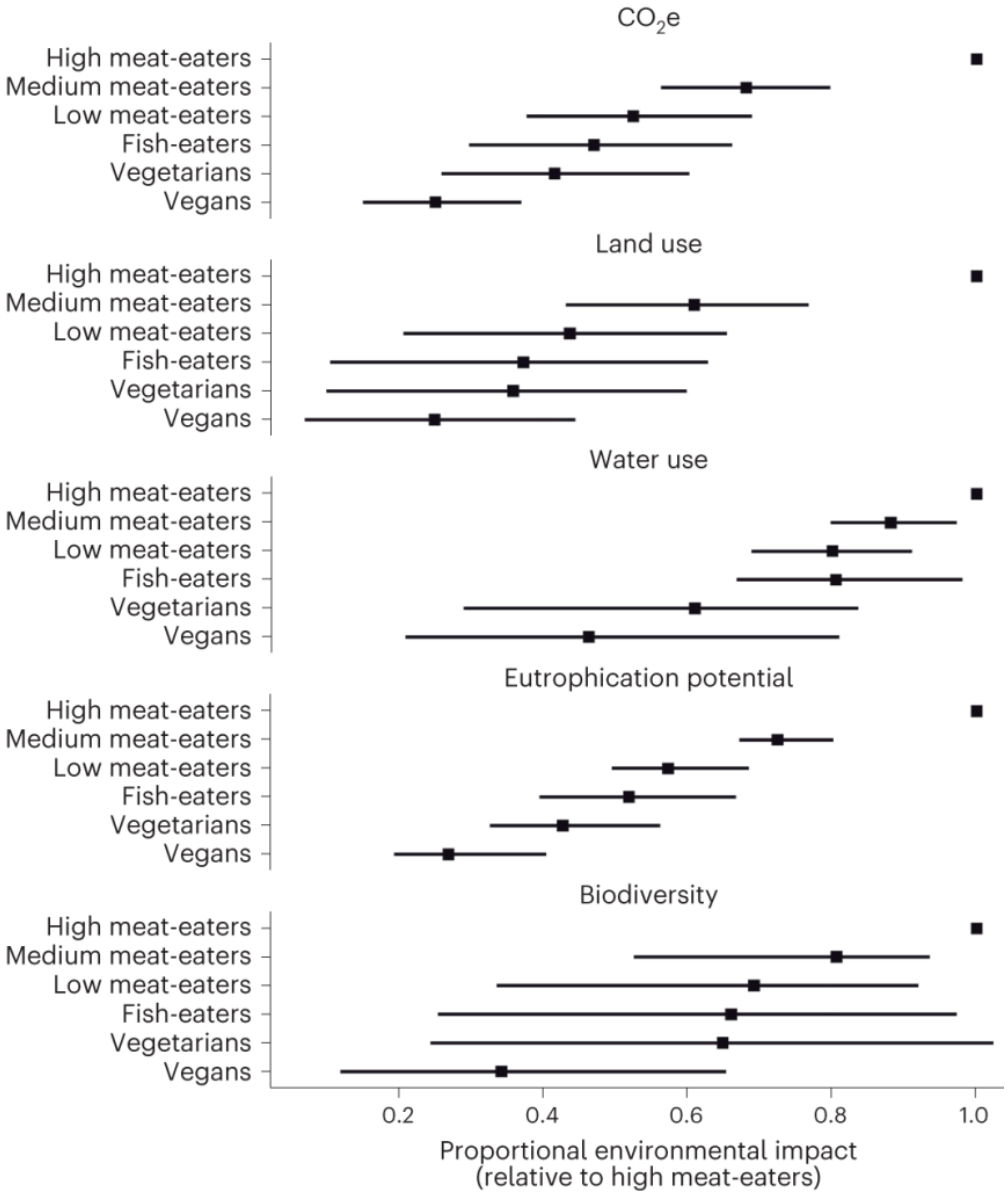
Therefore, sustainable and regenerative agriculture describes an agricultural system that meets the basic needs of a population indefinitely by utilising resources at a replenishable rate and adopting regenerative agricultural practices which do not compromise the continued viability of the agricultural system and the wider human, social, economic, and environmental systems in which it resides.

In practice, this means a number of things, but key points to consider are:

1. **A sustainable farm or croft should work within a closed-loop system as much as possible**, supplemented by local resources if needed. A closed-loop agricultural system aims towards self-sufficiency and sustainability by using inputs generated on the farm and by recycling materials and energy back to the soil to preserve nutrient and carbon levels. In practice, this includes

generating fertility through green manures instead of mineral fertilisers; controlling pests and diseases naturally by attracting beneficial insects and through crop diversity instead of agrochemical use; and by planting catch and cover crops to limit the leaching of nutrients, prevent soil loss, and suppress weeds naturally.

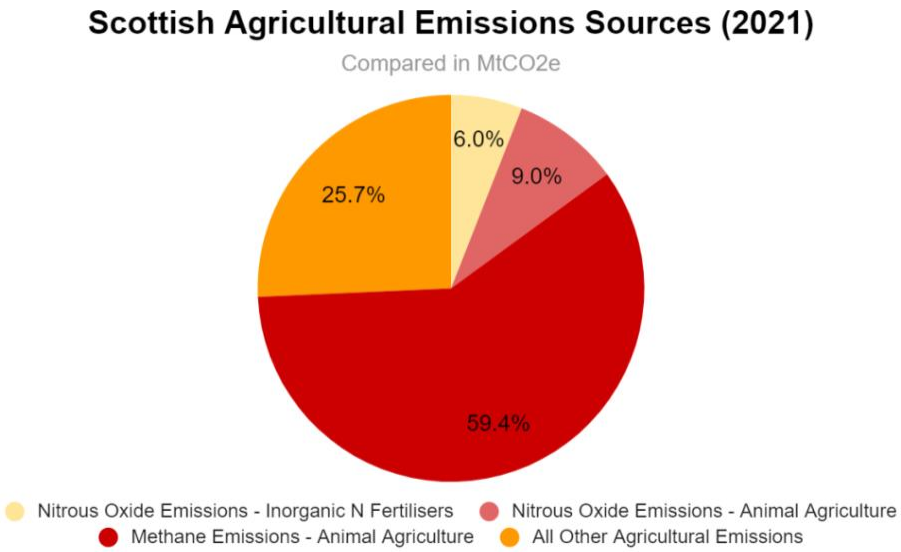
2. **Resources should be used efficiently so that agricultural outputs are produced with minimal inputs.** For example, it would be preferable to produce food (whether that is primarily for protein, calories, fat and/or micronutrients) which requires less land and inputs as opposed to food which requires more land and inputs. This lends itself to food security and releases land for nature recovery. The agricultural outputs chosen by a farm or croft should also suit the local soil, topographical and climatic conditions in order to avoid excessive inputs of resources.
    - Scarborough et al. (2023) found that food production for an exclusively plant-based diet is linked to the lowest land-use, water-use and biodiversity loss when compared with other dietary patterns (see figure from the study below).



2. (*cont'd*)
    - Earlier studies by Poore and Nemecek (2018), Clark and Tilman (2017) and Aleksandrowiczet al. (2016) had similar findings to Scarborough et al. in that plant-based foods/diets consistently had the lowest impacts for a variety of different environmental indicators (water-use, eutrophication, land-use, GHG emissions).
    - Regarding nitrogen, a stockfree organic arable system has been shown to have a better nitrogen input/output ratio than an organic or conventional arable system (Evaluation Planty Organic 2012-2020).
    - Harwatt and Hayek (2019) found that growing food directly for human consumption on all existing UK arable land would meet the population's nutritional requirements for energy and protein whilst freeing up large areas to restore ecosystems.

3. **Long-term soil fertility should be sought through practices like minimal/no-tillage, continuous soil coverage, adding/retaining organic matter, green manures, maintaining living roots in soils, and the recycling of agricultural outputs** (e.g. crop residues) back onto the land.

4. **Agricultural practices which are polluting in any way should be avoided as much as possible** (GHG emissions, leaching of chemicals and excessive nutrients into waterways).
    - In terms of GHG emissions, the Scottish government's dataset for Scotland's GHG emissions in 2021 shows that approximately 75% of the agricultural sector's emissions are due to methane emissions from the enteric fermentation of farm animals (~59.4%), management of manure from farm animals (~9%), and nitrous oxide emissions from inorganic N fertilisers (~6%).



4. (*cont'd*)
    - Stockfree organic farms like Tolhurst Organics eliminate these sources of emissions and consequently have a very low carbon footprint, In term of inputs and outputs their goods are 90% more carbon efficient than conventionally-grown supermarket produce. Contrary to rote criticism that systems such as Iain Tolhurst's are anecdotal and irreplicable at scale, trials at both Elm Farm Research Centre and ADAS Terrington have shown

that large-scale stockless systems work in terms of sustainability and economic viability, including cereal and potato production.
    - John Lett's pioneering work with stockless organic heritage grainsproves this point with Cotswolds' famer, Henry Astor, successfully growing 450 acres of cereals using John's methodology.
    - Even in the northern and western isles of Scotland, where once a variety of crops were grown, pioneering farmers are showing that a wide range of foods can be grown in harmony with the land and nature, sequestering carbon, massively boosting biodiversity, requiring minimum labour, and using inputs generated on-farm in a stockless, organic system.
    - The winner of the 'Agricultural Entrepreneur of the Year' (2022) in the Netherlands is a carbon negative 90ha stockfree organic farm which has maintained yields, increased biodiversity, improved soil structure, reduced water usage, and eliminated over-fertilisation.
    - Scarborough et al. (2023) verifies that food production for exclusively plant-based diets has the lowest GHG emissions and eutrophication impacts when compared to other diets (see previous figure).
    - A multi-year agricultural field trial in the Netherlands found that stockfree organic systems have the lowest amount of nitrogen leaching and losses when compared with organic and conventional systems (Evaluation Planty Organic 2012-2020)

5. **Food produced by agricultural systems should be of high nutritional quality and of a sufficient quantity to feed a population.**
    - A modelling study suggests that a stockless organic farm could supply the crude protein for 19 adults/hectare, or the energy/calories for 25 adults/hectare, or the fat for 7 adults/hectare depending on which macronutrient the farm is optimised for (Galler 2023, Modelling organic farming systems).

6. **Finite inputs like fossil fuels and other mineral resources (e.g. NPK fertilisers) should be kept to a minimum.**
    - Locavore CIC (now acquired by the social enterprise, The Chard Holding Group) has taken many steps to reduce their carbon footprintin processing and distributing their products. On their market gardens they utilise a lot of manual labour and little machinery.

7. **The farming system must be economically viable, providing a fair livelihood and good living conditions for all agricultural workers.**Making agricultural work more appealing and commonplace, particularly for school leavers and graduates, would increase labour availability, reduce reliance on machinery, and support farms and crofts in the production of crops which require more harvesting labour.

8. **Regional processing, distribution and marketing of agricultural products should be prioritised.**
    - Hodmedod's is a great example of a business which is successfully linking up UK farms producing sustainable, nutritious plant foods with UK food businesses and consumers. However, more support for the decentralised processing of plant foods (especially grains and pulses) in Scotland and the UK is needed. For example, more farmers might want to grow and process oats for human consumption, but the equipment needed to do so is prohibitively expensive and designed with large scale farms in mind. This makes oat growers beholden to a few large processing companies.

9. **Areas of wildlife habitat should be preserved, created, and restored.**Doing so enables agricultural systems to function through ecosystem services like pollination and natural pest control as illustrated by the farms highlighted above. It also creates the opportunity for vital biodiversity to return whilst sequestering carbon.

10. **The system must be humanly and ethically just and sustainable** in terms of worker health, wellbeing, growth, and quality of life, with accessible and adequate support to ensure these life-affirming elements.

Many of these principles were adapted from the fantastic book 'Growing Green – Organic Techniques for a Sustainable Future' (revised 2015 edition) by Jenny Hall and Iain Tolhurst which we would encourage you to read if you haven't already.