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ARCHE NOAH

CULITVATED PLANT DIVERSITY AND THE CLIMATE CRISIS

How increasing the diversity of the crops we grow can reduce the impact of our food system on the environment while increasing its resilience to climate change

The climate crisis is one of the biggest threats facing humanity. Our food security is at risk as more extreme climatic events, such as high temperatures, drought, and torrential rains, and changes in the spread of pests and diseases affect crop yields. However, our food system is also a signifcant driver of climate change. The Intergovernmental Panel on Climate Change (IPCC) estimates that 9-14% of total greenhouse gas (GHG) occur from crop and livestock activities within the farm gate[1]. The contribution of the food system as a whole, including transport, processing, packaging, retail, and consumption as well as agriculture is placed at 21-37%.

Increasing the diversity of plants in our fields and on our plates can both reduce the impact of agriculture on the climate, and help mitigate the negative impact of climate change on our food system. For this to happen, as part of a wider package of ambitious climate action, **politicians must urgently take action to conserve, promote and develop the diversity of our cultivated plants**.

Increasing cultivated plant diversity to reduce GHG emissions

In this paper, term cultivated plant diversity capture the diversity of species, varieties, and the genetic diversity within those varieties and species. Increasing this diversity can help to mitigate climate change by…

…reducing the need for emission-intensive chemical inputs

It is estimated that the production and use of **synthetic nitrogen fertiliser accounts for 2.4% of global emissions**, making it one of the top climate polluting industrial chemicals[2]. The emissions from the synthetic nitrogen fertiliser supply chain are higher than the total global emissions of commercial aviation (1,250 vs 900 million tonnes CO2 in 2018)[3]. As opposed to highly specialised hybrids designed for cultivation in large-scale monocultures and reliant on the application of synthetic fertilisers and pesticides to deliver promised yields, **promoting the development of open-pollinated seeds suited to**

[1] IPCC, 'Food Security. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems' (2019)

[2] GRAIN, Greenpeace International & Institute for Agriculture and Trade Policy, 'New research shows 50 year binge on chemical fertilisers must end to address the climate crisis' (2021) https://grain.org/en/article/6761-new-research-shows-50-year-binge-on-chemical-fertilisers-must-end-to-address-the-climate-crisis

[3] Ibid.

cultivation under low input conditions, such as in organic agriculture, would therefore **significantly reduce the need for chemical inputs** and with it the impact of our food system on the environment[4].

...making plant based diets more attractive

According to the UN Food and Agriculture Organisation (FAO), the livestock sector is a key driver of agricultural emissions, principally as a result of feed production and processing, the output of GHG during digestion by cows, and manure decomposition[5]. Increasing the diversity of plant species and varieties that are cultivated for food production, for example protein-rich legumes and neglected and under-utilised species such as einkorn, would help to **make more attractive the alternatives to meat consumption**, and thus help reduce the overall emissions linked to the food system.

... enabling more local, seasonal and lower emission food production

The development of new, climate-friendly varieties, for example new tomato varieties that grow healthy fruits outdoors as opposed to in emission-intensive heated greenhouses (this is one of the goals of the ARCHE NOAH "Bauernparadeiser" project[6]) or winter-hardy vegetables, would also better support the **transition to a food system based principally on low emission, regional and seasonal produce**. For this, **a reform of the outdated, restrictive legislation governing the production and marketing of plant reproductive material** as well as **public funding for the breeding of open-pollinated, organic cultivars** is urgently needed.

<u>Increasing cultivated plant diversity to adapt to climate change</u>

Diversity creates resilience. To ensure our future food security in light of dramatic changes to our climate, weather conditions, and plant pests and diseases, we need to harness...

...the diversity of species and varieties

The adaption of existing varieties is unlikely to be sufficient to keep pace with the rate and severity of climate change, meaning **recourse to species and varieties from other climate zones** will become necessary. Seed producers and farmers in the north will need to access seeds from the south, and with it the traditional knowledge associated with their cultivation and processing.

...the genetic diversity of cultivars

A high degree of genetic uniformity, as is required by the current EU rules on variety registration, makes crops vulnerable to biotic and abiotic stresses. In contrast, **high genetic diversity reduces the risk of a**

[4] FAO, 'The state of the world's biodiversity for food and agriculture' (2019), 20-21

[5] FAO, 'Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities' (2013) https://www.fao.org/news/story/en/item/197608/icode

[6] https://www.arche-noah.at/sortenerhaltung/sorten-entwickeln/das-bauernparadeiser-projekt

total crop failure, and protects against and limits the spread of pests and diseases[7]. Crucially, genetic diversity enables cultivars to **continuously evolve in response to changes in the climate**[8].

...the diversity of actors supplying seeds

The seed market is dominated by a handful of global seed corporations. Three chemical giants (Bayer, Syngenta-ChemChina and DuPont-Dow) control over 60% of the global seed market and over 71% of the global pesticide market[9]. In the EU, five corporations control 95% of the vegetable seed market[10]. These global corporations produce highly uniform varieties for a global market, with seed production typically taking place outside of the cultivation region, often in countries of the Global South where wages and labour standards are lower. These **global supply chains make seed supply vulnerable to external shocks**, such as disruptions to international transport, or wars. In contrast, **local seed production, including Community Seed Banks, informal seed networks focussed on the dynamic management of cultivars, and participatory plant breeding schemes** can provide seeds adapted to local envrionmental conditions with short supply chains, providing for **resilience, adaptation, and the minimisation of risks**[11].

ARCHE NOAH is a seed savers' association dedicated to the conservation, sustainable use and development of crop diversity. We manage one of Europe's biggest private collections of cultivated plants, maintaining over 6,200 accessions of endangered vegetable, fruit and grain varieties. Our aim is to bring these traditional and rare cultural assets back into gardens, fields and markets. Over 14,500 members, 150 private seed guardians, 50 farmers and numerous partners ensure with us the decentralised and locally adapted preservation of varieties. www.arche-noah.at

[7] Biodiversity International, 'Using diversity to fight and manage crop pests and diseases' https://www.bioversityinternational.org/fileadmin/user_upload/research/research_portfolio/agricultural_ecosystems/Pests_and_diseases_factsheet.pdf

[8] Ceccarelli S. and Grando S,, 'Evolutionary Plant Breeding as a Response to the Complexity of Climate Change' (iScience 23, 2020) https://www.sciencedirect.com/science/article/pii/S2589004220310129

[9] IPES-Food, 'Too big to feed: Exploring the impacts of mega-mergers, concentration, concentration of power in the agri-food sector' (2017) https://www.ipes-food.org/_img/upload/files/Concentration_FullReport.pdf

[10] Greens/EFA Group in the European Parliament, 'Concentration of Market Power in the EU Seed Market' (2014) http://extranet.greens-efa.eu/public/media/file/1/5728

[11] IPCC, 'Land degradation: IPCC special report on climate change, desertification, land 5 degradation, sustainable land management, food security, and 6 greenhouse gas fluxes in terrestrial ecosystems' (2019), 43