THE GLOBAL CLIMATE & HEALTH ALLIANCE

30 January 2026

Global Climate and Health Alliance (GCHA)

Submission to the UN Special Rapporteur on Climate Change: Food Systems, Fossil Fuels, Climate Change, and Health

Introduction

Food production is one of the largest contributors to climate change, accounting for nearly one third of global greenhouse gas emissions (GHGe).[i] Climate change in turn profoundly impacts food production, nutrition, and global food security. Climate modeling shows a reasonable concern that simultaneous climate change-induced weather extremes across multiple breadbasket regions could result in widespread failures of staple crops, gravely threatening food security and food supply chains,[ii],[iii] and disproportionately impacting import-dependent low-income regions.[iv],[v],[vi] The globalisation of food systems has depended on cheap energy from fossil fuels for intensive large-scale agricultural production and long-haul transportation that has transformed the diets of the world's population. The rise of corporate power in food systems correlates with the increasing industrialisation of food production. Corporate-led industrial food systems have increased rates of GHGe, biodiversity degradation, pollution, and systemic human rights violations.[vii]

The EAT-Lancet Commission's report on healthy, sustainable, and just food systems accurately places food systems at the nexus of health, environment, climate, and justice. The ability to live in a clean, healthy, and sustainable environment is a universal human right, as declared in 2022 by the United Nations General Assembly,[viii] and must be central to global public health. The Covid-19 pandemic illustrated the role of animals in human public health, emphasising the importance of the One Health concept that inextricably links human, animal, and ecosystem health. The emerging field of Planetary Health builds upon One Health, expanding scientific studies on the human impacts of climate change to include consideration of human rights and cultural contexts,[ix] as well as other planetary impacts. Transforming our food systems is fundamental to solving crises related to the climate, biodiversity, health, and justice.

Food Systems and Energy

According to the EAT-Lancet Commission, food systems are the largest driver of planetary boundary transgression. With respect to climate change, food systems' total impact on global GHGe is about 34%. Fossil fuels play a crucial role in the industrial production of food, and energy is required at every stage of the process, including the production of agrochemicals. GHGe from land use and direct production of foodstuffs represent only about 20% of the entire value chain. The remaining 80% of GHGe come from processing and packaging (42%) and retail, consumption, and waste (38%),[x] due to increased mechanisation and a growing use of fossil fuel-based inputs. Supply chains are globalised, and increased urbanisation around the world has led to a growing demand for meat, dairy, ultra-processed foods, and to some extent, new food trends including alternative meats.[xi],[xii],[xiii]

The industrialisation of our food systems, together with climate change, are having profound impacts on global nutrition. A growing epidemic of obesity, along with significant hunger and undernutrition, exacerbated by climate change, represent an intersection of issues that has been called a global syndemic.[xiv] Roughly the same percentage of people around the world are obese as those who lack access to nutritious and healthy food, approximately 2 billion at each end of the spectrum.[xv] Climate impacts threaten food production and therefore food security; while heightened levels of atmospheric CO_2 decrease the nutrient density of crops.[xvi] Global obesity has been increasing over recent decades, yet food insecurity has been only slightly decreasing. Of the 2.3 billion people who faced moderate or severe food insecurity in 2024, 828 million faced severe food insecurity and undernutrition.[xvii],[xviii] Extensive research on the developmental origins of health and disease has shown that fetal and infant undernutrition are risk factors for obesity and its adverse consequences throughout life, so the implications of these two related phenomena are enormous.[xix]

Agribusiness and Fossil Fuels

In much of the industrialised world, traditionally diversified farms have been replaced over the past century with operations that specialise in producing specific crops or animals at a large scale, buoyed by mechanisation, standardisation, and increased off-farm inputs (e.g., pesticides, pharmaceuticals).[xx] Expansion of global commercial agriculture, both large and small scale, is a major driver of deforestation, thereby increasing carbon emissions, reducing carbon sinks, and destroying vital ecosystems and communities.[xxi] Industrialised livestock production contributes more to biodiversity loss[xxii] and disruptions in nutrient cycles that exacerbate groundwater pollution, eutrophication[xxiii], and poor soil health than the production of crops for human consumption.[xxiv] A Save Soil study warns that the ongoing decline in soil health is directly contributing to nutritional loss in food. Foods produced in soil rich in organic matter contribute to a healthy gut microbiome, which has been found to play an important role in mood, immune function, and health. Soil degradation also undermines access to healthy environments by contributing to air pollution, vulnerability to natural disasters, and urban heat islands.[xxv]

As demand for fossil fuels for transport, power, and heating declines thanks to electrification, the rise of clean renewable energy sources, and demand reduction measures, companies are pivoting their investments in petrochemicals to produce plastics and agrochemicals.[xxvi] Agrochemicals, including fertilisers and pesticides, and plastics, including for packaging, are a bulwark for some industrial food systems activities, and the fossil fuel industry plans for continued growth will sustain their profits.[xxvii] Many agri-food sectors are dominated by a handful of firms with vested interests in promoting and perpetuating fossil fuel and chemical-dependent, industrial food systems, and these companies make significant political contributions to protect their interests.[xxviii] Meanwhile, governments pay more than $670 billion annually in direct agriculture and fishery subsidies that support fossil fuel use and damaging food system practices.[xxix] The additional downstream costs from pollution, GHGe, road congestion, and the destruction of nature as a result of these direct subsidies bring the total, direct plus indirect, subsidies of harmful food system practices to several trillion US dollars per year.

THE GLOBAL CLIMATE & HEALTH ALLIANCE

Environmental and Health Justice

Low-income and middle-income countries experience the greatest burdens of malnutrition, impacting as well direct healthcare costs and lost economic productivity.[xxx] Moreover, malnutrition and undernutrition are often driven by the impacts of climate variability and extremes, with the greatest burden falling on low-income populations and children. These same demographics often suffer the greatest morbidity from additional health implications of climate change, such as extreme heat, and directly from fossil fuel production plants.[xxxi]

One Health

Industrialised agriculture and food production sites became breeding grounds for pathogens that may have caused the Covid-19 pandemic.[xxxii] This catalysed the creation of a multidisciplinary, international One Health High-Level Expert Panel. A specified purpose of this panel is to "better [understand] the impacts of food systems…and ecological, and environmental factors that may be contributing to zoonotic disease emergence/re-emergence and spillover events."[xxxiii]

While climate change did not directly bring about Covid-19, we know that a warming climate promotes the growth and spread of human pathogens, including viruses, fungi, and bacteria. Increased morbidity from bacterial infections is likely to be accompanied by a corresponding increase in the use of antibiotics. This makes antimicrobial resistance (AMR) especially concerning, as higher temperatures and humidity promote a higher prevalence of bacterial infections, and in particular, infections from certain hard to treat "gram-negative" bacteria.[xxxiv] By volume, farmed animals consume at least two-thirds of all antibiotics, often belonging to the same classes used in humans,[xxxv] to treat infections, and to prevent and control the spread of disease among healthy animals in herds. This is especially the case in concentrated animal feeding operations, where the probability of infection is high, and where they are also used as growth promoters to increase productivity. This indiscriminate use of antibiotics on such a massive scale is a major cause of increasing AMR, significantly weakening a vital tool of modern medicine.

The reduced biodiversity from industrial agriculture applies at the microscopic level as well as the macroscopic. Reduced microbial biodiversity and increased risk of AMR are downstream effects of land use change, soil transformation and depletion, eutrophication of aquatic ecosystems, and the emission of chemical pollutants.[xxxvi],[xxxvii],[xxxviii],[xxxix]

Fossil fuels also directly contribute to increasing AMR through the production of plastics and resultant microplastic accumulation.[xl],[xli],[xlii],[xliii] AMR genes have been identified on the surface of microplastics obtained from freshwater and marine ecosystems, leachate from landfills, and cultivated soil.[xliv],[xlv] Microplastics can facilitate bacterial growth and create favorable conditions for the selection of resistance traits in a variety of ways. This is especially alarming given the great distances that these particles travel in their life cycle. Moreover, studies show that the emission of pesticides, often derived from fossil fuels,

and toxic metals intended to inhibit bacterial growth, can actually lead to AMR.[xlvi],[xlvii],[xlviii],[xlix] In 2020 alone, global pesticide use in agriculture amounted to 2.7 million tons of active ingredients.[l],[li]

Recommendations

1. Establish Healthy Dietary Guidelines

Only a few countries have developed dietary guidelines that promote environmentally sustainable eating patterns that ensure food security and improve diet quality, human health and wellbeing, social equity, and reasonably respond to climate change challenges.[lii] The potential for profound planetary benefit exists if many more countries incorporate even some of the following recommendations into their guidelines:

- Less processed, more whole foods: Production of ultra-processed food is 2-10 times more energy intensive than whole foods.[liii]
- More plant-rich diets: Guidelines that call for a reduction in animal products and that promote plant-rich, low emissions diets are viable and necessary for many high-income, high-emitting countries facing challenges with obesity and heart disease. Similar guidelines are necessary for low-income and climate-vulnerable groups to increase food security and food sovereignty.[liv],[lv]
- Plant-based meat substitutes: From an environmental perspective, plant-based meat substitutes can provide substantial benefits over industrially farmed beef. The data for other alternative proteins, especially lab-grown meats, are mixed, however.[lvi] It should also be noted that livestock and animal products remain an important source of adequate nutrition and household income for many communities in the Global South and low-income countries, and those living in isolated rural or nonarable environments around the world.[lvii],[lviii]
- Indigenous practices and local knowledge: These should be prioritised for their efficacy and non-reliance on fossil fuels. A focus on smaller and more traditional practices regarding production and consumption of native plants has also been an important part of the nutritional foundation for many of these communities and can offer important guidance for a less fossil fuel dependent food systems future.[lix]
- Develop the evidence on healthy and sustainable diets from a range of cuisines (beyond the Mediterranean diet), so that evidence-based, healthy and sustainable dietary guidelines can be developed that are culturally relevant and accessible in all countries and regions.

2. Distinguish Fact from Fiction

Industry tactics include marketing practices that spread false health and nutrition claims, as well as lobbying and the use of trade associations and front groups. Many food and beverage corporations also market their products to appeal directly to children, and in ways that creates a false perception of environmental and social stewardship.[lx]

- Require front-of-package warning labels on unhealthy foods and beverages. Chile, Peru, Uruguay, and Mexico have already done so, despite strong opposition from corporations.[lxi]

- Restrict advertising of unhealthy foods to young target audiences.[lxii]
- Implement public health campaigns to educate the public about the health harms of fossil fuel pollution, even at low, everyday levels of exposure. This is another antidote to intentional misinformation from industry lobby groups.[lxiii]

3. Decarbonise Food Systems

The current projection of global food demand is an expected increase of 35-56% by 2050.[lxiv] In order to prevent catastrophic climate change that would result from a proportionate increase in fossil fuel use, food production needs to be divorced from fossil fuels.

- Electrify food processing and transport using renewable energy and improve energy efficiency. This can reduce emissions while proving cost effective.
- Model, monitor, and correct for unintended consequences in decarbonisation strategies. For example, financial incentives for increased production of biofuel feedstocks, such as soy and corn, in practice has come at the expense of land availability for food production thereby worsening food insecurity; and has instead increased GHGe, while causing water scarcity, air pollution, and increased food costs.[lxv]
- Beware of greenwashing, and carefully assess proposed tech-fixes, such as green hydrogen and genetically modified crops. Some purported solutions can reinforce negative fossil fuel-based practices such as synthetic fertiliser and pesticide use, as well as adversely impact biodiversity and further exacerbate inequitable concentrations of power and profit.[lxvi]

4. Employ Nature Smart Solutions

- Methane is a potent GHG, and reduction a salient feature of climate change mitigation efforts. No-cost solutions for reducing methane emissions from livestock and rice production include improved feeding and manure management, selective breeding, and improved irrigation methods.[lxvii]
- Agroecology is a holistic approach that incorporates ecological, health, social, and economic considerations into agricultural and food systems design and implementation. As both a scientific and policy approach, it is gaining recognition as a viable option for transforming food systems.[lxviii] Fossil fuel based-inputs and their associated impacts are reduced with agroecological approaches such as integrated crop-livestock and/or multi-species farming, and well-managed pasture-based livestock production systems. These practices can also reduce dependence on synthetic fertilisers through nutrient recycling, fostering soil health, and sustaining biodiversity of grassland ecosystems.[lxix],[lxx],[lxxi],[lxxii] Agroecology and other conservation agriculture practices confer additional benefits including reduced soil erosion, improved water access, and health benefits of reduced pesticide exposure, reduced food insecurity, and reduced exposure to contaminated water.[lxxiii]

THE GLOBAL CLIMATE & HEALTH ALLIANCE

5. Recognise Indigenous People and Local Communities

- Recognise tenure rights, and moratoria on conversion of forestlands, to preserve and restore vital natural resources.
- Support local food production and procurement programs, such as farmers' markets and food cooperatives, which can help restore ecosystem health as well as human physical and social capital. This is particularly important for maintaining cultural identity and preserving socioeconomic equity.

6. Eliminate Direct and Indirect Subsidies that Support Harmful Food System Practices

- Phase out government subsidies for industrial food production that depends on fossil fuel-based inputs, and in its processing and distribution.
- Phase out subsidies that incentivise the overproduction of corn, soy and wheat to produce highly processed foods and biofuels.
- Redirect subsidies to incentivise sustainable energy, agricultural, and food system practices that promote plant-rich diets and ecosystem regeneration.[lxxiv]
- Eliminate indirect subsidies by establishing mechanisms that require food companies causing health or environmental harms to pay the costs of those harms and of their remediation.

Conclusion

Food systems emphasise the interdependence of climate change, health, and, currently, fossil fuel dependence. This warrants food systems change to be a unifying force across global economic, governance, and policy domains. The planetary health diet simply and directly prescribes culturally appropriate, sustainable, balanced dietary patterns that are plant-rich and responsive to local needs. What is best for us is best for our planet. To this end, we should ardently strive to achieve the recommendations from the EAT-Lancet Commission. We must swiftly and emphatically shift towards a planetary health diet, reduce food loss and waste, and adopt agricultural approaches that merge productivity with practices that protect and restore soil, water, and ecosystem health,[lxxv] for food systems that feed us well now, and for generations to come. Real change will come from transforming our economies, food, and financial systems to place nature and people at the center.[lxxvi] Public demand for action can ignite the political will necessary to implement effective policies.

THE GLOBAL CLIMATE & HEALTH ALLIANCE

Endnotes

[i] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[ii] Mehrabi, S. Food system collapse. *Nat. Clim. Chang* 10, 16–17 (2020).
[iii] Anderson, et al., Synchronous crop failures and climate-forced production variability. *Sci. Adv.* 5, 1–10 (2019).
[iv] Puma, M. J., Bose, S., Chon, S. Y. & Cook, B. I. Assessing the evolving fragility of the global food system. *Environ. Res Lett.* 10, 024007 (2015).
[v] Bren d'Amour, et al., Teleconnected food supply shocks. *Environ. Res Lett.* 11, 035007 (2016).
[vi] https://www.nature.com/articles/s41467-023-38906-7
[vii] https://docs.un.org/en/A/80/213
[viii] https://www.weforum.org/stories/2022/08/the-un-just-declared-a-universal-human-right-to-a-healthy-sustainable-environment-here-s-where-resolutions-like-this-can-lead/
[ix] https://pmc.ncbi.nlm.nih.gov/articles/PMC9658854/
[x] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[xi] Marco Springmann, Daniel Mason-D'Cros, Sherman Robinson, Tara Garnett, H Charles J Godfray, Douglas Gollin, Mike Rayner, Paola Ballon, Peter Scarborough,2016. Global and regional health effects of future food production under climate change: a modelling study. The Lancet, Volume 387, Issue 10031,2016. Online
[xii] 22 Mbow, Cheikh et al, 2019. IPCC Special Report on Land and Climate Change. Chapter 5: Food Security.
[xiii] https://climateandhealthalliance.org/wp-content/uploads/2023/08/MethaneReport-Ag-FINAL.pdf
[xiv] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext
[xv] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext
[xvi] https://pmc.ncbi.nlm.nih.gov/articles/PMC12616468/
[xvii] Food and Agriculture Organisation of the United Nations
The Second International Conference on Nutrition: Committing to a future free of malnutrition
Food and Agriculture Organisation of the United Nations, Rome, 2014
[xviii] https://climateandhealthalliance.org/wp-content/uploads/2023/08/MethaneReport-Ag-FINAL.pdf
[xix] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext
[xx] Ikerd, J. E. (2008). *Crisis and Opportunity: Sustainability in American Agriculture*. Lincoln, NE: University of Nebraska Press.
[xxi] California Council on Science and Technology and Blue Forest (2023). The Human Health Benefits of Improving Forest Health in California.pdf
[xxii] Machovina, B., Feeley, K. J., and Ripple, W. J. (2015). Biodiversity conservation: the key is reducing meat consumption. *Sci. Total Environ.* 536, 419–431. doi: 10.1016/j.scitotenv.2015.07.022
[xxiii] Bouwman, L., Goldewijk, K. K., Van Der Hoek, K. W., Beusen, A. H., Van Vuuren, D. P., Willems, J., et al. (2013). Exploring global changes in nitrogen and phosphorus cycles in agriculture induced by livestock production over the 1900–2050 period. *Proc. Natl. Acad. Sci. U. S. A.* 110, 20882–20887. doi: 10.1073/pnas.1012878108
[xxiv] https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2020.00134/full#B22
[xxv] https://earth.org/new-report-reveals-crucial-links-between-soil-quality-and-human-health-calls-for-global-action/
[xxvi] https://www.ciel.org/wp-content/uploads/2022/10/Fossils-Fertilisers-and-False-Solutions.pdf
[xxvii] https://www.cnbc.com/2022/01/29/how-the-fossil-fuel-industry-is-pushing-plastics-on-the-world-.html
[xxviii] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[xxix] https://www.worldbank.org/en/news/press-release/2023/06/15/trillions-wasted-on-subsidies-could-help-address-climate-change
[xxx] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext
[xxxi] https://pmc.ncbi.nlm.nih.gov/articles/PMC9658854/
[xxxii] https://docs.un.org/en/A/80/213
[xxxiii] The One Health High-Level Expert Panel (OHHLEP)

[xxxiv] Eber, M.R., Shardell, M., Schweiser, M.L., Laxminarayan, R., Perencevich, E.N., 2011. Seasonal and temperature-associated increases in gram-negative bacterial bloodstream infections among hospitalised patients. PLoS One 6, e25298.
[xxxv] Van Boeckel, T.P., Glennon, E.E., Chen, D., Gilbert, M., Robinson, T.P., Grenfell, B.T., Levin, S.A., Bonhoeffer, S., Laxminarayan, R., 2017. Reducing antimicrobial use in food animals. Science 357, 1350–1352.
[xxxvi] Geng, M., Shang, W., Hu, T., Wang, R., Cheng, X., Wang, J., 2022. Eutrophication causes microbial community homogenisation via modulating generalist species. Water Res. 210, 118003.
[xxxvii] Walder, et al., 2022. Soil microbiome signatures are associated with pesticide residues in arable landscapes. Soil Biol. Biochem. 174, 108830.
[xxxviii] Wu, et al., 2022. Reduction of microbial diversity in grassland soil is driven by long-term climate warming. Nat. Microbiol. 7, 1054–1062.
[xxxix] Yang, Y., Liu, G., Song, W., Ye, C., Lin, H., Li, S., Liu, W., 2019. Plastics in the marine environment are reservoirs for antibiotic and metal resistance genes. Environ. Int. 123, 79–86.
[xl] Kaur, et al., 2022. Microplastic-associated pathogens and antimicrobial resistance in environment. Chemosphere 291, 133005.
[xli] Marathe, N.P., Bank, M.S., 2022. The microplastic-antibiotic resistance connection. In: Microplastic in the Environment: Pattern and Process. Springer International Publishing, Cham, pp. 311–322.
[xlii] Pham, D.N., Clark, L., Li, M., 2021. Microplastics as hubs enriching antibiotic-resistant bacteria and pathogens in municipal activated sludge. J. Hasard. Mater. Lett. 2, 100014.
[xliii] Tuvo, et al.,2023. Microplastics and antibiotic resistance: the magnitude of the problem and the emerging role of hospital wastewater. Int. J. Environ. Res. Publ. Health 20, 5868.
[xliv] Lu, X.-M., Lu, P.-S., Liu, X.-P., 2020. Fate and abundance of antibiotic resistance genes on microplastics in facility vegetable soil. Sci. Total Environ. 709, 136276.
[xlv] Wang, S., Xue, N., Li, W., Shang, D., Pan, X., Luo, Y., 2020. Selectively enrichment of antibiotics and ARGs by microplastics in river, estuary and marine waters. Sci. Total Environ. 708, 134594.
[xlvi] Hassen, A., Saidi, N., Cherif, M., Boudabous, A., 1998. Resistance of environmental bacteria to heavy metals. Bioresour. Technol. 64, 7–15.
[xlvii] Munos, et al., 2012. Heavy metal tolerance of microorganisms isolated from wastewaters: Identification and evaluation of its potential for biosorption. Chem. Eng. J. 210, 325–332.
[xlviii] Paul, D., Mandal, S.M., 2019. Microbial adaptation and resistance to pesticides. In: Bacterial Adaptation to Co-resistance. Springer Singapore, Singapore, pp. 233–249.
[xlix] Turner, R.J., Huang, L.-N., Viti, C., Mengoni, A., 2020. Metal-resistance in bacteria: Why care? Genes 11, 1470.
[l] FAO, 2022. Pesticides Use, Pesticides Trade and Pesticides Indicators. FAO.
[li] Climate warming, environmental degradation and pollution as drivers of antibiotic resistance.pdf
[lii] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext#sec-1
[liii] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[liv] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext#sec-1
[lv] https://climateandhealthalliance.org/wp-content/uploads/2023/08/MethaneReport-Ag-FINAL.pdf
[lvi] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[lvii] T. F. Randolph et al, 2007. Invited Review: Role of livestock in human nutrition and health for poverty reduction in developing countries. Journal of Animal Science, Volume 85, Issue 11.
[lviii] Reynolds, et al., 2015. Importance of Animals in Agricultural Sustainability and Food Security. The Journal of Nutrition, Volume 145, July 2015.
[lix] https://climateandhealthalliance.org/wp-content/uploads/2023/08/MethaneReport-Ag-FINAL.pdf
[lx] https://docs.un.org/en/A/80/213
[lxi] https://www.paho.org/en/news/29-9-2020-front-package-labeling-advances-americas

[lxii] https://www.bbc.com/news/articles/cq5y2vslyldo
[lxiii] https://psr.org/wp-content/uploads/2025/11/fueling-sickness.pdf
[lxiv] M. S. Jacobson, M. A. Delucchi and S. A. F. Bauer, et al., 100 percent clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for 139 countries of the world, Joule, 2017, 1, 108–121.
[lxv] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[lxvi] https://futureoffood.org/wp-content/uploads/2023/11/ga_food-energy-nexus_report.pdf
[lxvii] https://climateandhealthalliance.org/wp-content/uploads/2023/08/MethaneReport-Ag-FINAL.pdf
[lxviii] https://www.sciencedirect.com/science/article/abs/pii/S221191242100050X
[lxix] Jansen, H. H. (2011). What place for livestock on a re-greening earth? *Anim. Feed Sci. Technol.* 166, 783–796. doi: 10.1016/j.anifeedsci.2011.04.055
[lxx] Röös, et al. (2017). Protein futures for western Europe: potential land use and climate impacts in 2050. *Reg. Environ. Change* 17, 367–377. doi: 10.1007/s10113-016-1013-4
[lxxi] Martin, et al. (2020). Potential of multi-species livestock farming to improve the sustainability of livestock farms: a review. *Agric. Syst.* 181:102821. doi: 10.1016/j.agsy.2020.102821.
[lxxii] https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2020.00134/full#B22
[lxxiii] Nature-based solutions are essential for climate and health action.pdf
[lxxiv] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2818%2932822-8/fulltext#sec-1
[lxxv] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(25)01201-2/fulltext
[lxxvi] Pacheco et al. (2021). Deforestation Fronts - Drivers and Responses in a Changing World.pdf