FOOD FORWARD NDCs

Implementing nature-positive food production practices

Overview

Globally, almost half (7.4 gigatons of CO2e) of all emissions generated by food systems occur at the farm level, including those arising from the use of synthetic fertilizers and the reduction of organic soil matter. A shift to **nature-positive food production** which uses natural resources in a regenerative, agroecological, non-depleting and non-destructive way can yield not only climate mitigation and adaptation benefits, but also improve biodiversity, food security and the health and wellbeing of current and future generations. Nature-positive food production aims to maintain and enhance ecological processes and functions through the production of food. This includes processes such as pollination, climate regulation, **nutrient cycling**, water retention, soil regeneration, carbon storage and **nitrogen fixation**.

Concrete measures to implement

Nature-positive food production entails a change in agricultural practices at the farm level as well as a shift in management practices at the landscape level. These changes could include, among others:

At the farm level:

Redesign the farm to improve soil and animal health, enhance diversification and recycling, optimise the use of on-farm inputs, reduce the dependence on external inputs and increase synergies on farms and across landscapes:

- Implement practices that reduce or eliminate the need for costly, scarce or environmentally damaging inputs (e.g. synthetic fertilizers), for example, by reducing the dosage of urea fertiliser and blue-green algae. This **decreases yield-scaled greenhouse emissions** as compared to the recommended dose of nitrogen application.
- Implement integrated soil fertility management and integrated pest and disease management approaches that are safe for plants, animals, people and the environment.

- Reduce use of conventional inputs that have negative impacts on the environment while promoting the use of co-existing biota (such as the plant microbiome or natural pest-control) to improve plant nutrient uptake, stress tolerance and defences against pests and diseases.
- Implement practices which can enhance biodiversity while improving food production, including:

    - Agroforestry or the introduction of more trees on farm, in field-boundaries or near water areas. Tree-selection should have value for local communities and be tailored to local needs and knowledge.
    - Promote the use of species that support ecosystem services, such as flowers in field-boundaries to attract pollinators, provide cover, and contribute to improving soil quality and preventing erosion. Promote the use of species to manage pests and diseases (e.g. push-pull approaches).
    - Promote complex crop rotation and intercropping schemes to boost nutritional yields and improve soil quality, mimicking diversity and enhance soil biodiversity richness.
    - Enhance intraspecific diversity to reduce climate risks, for example, through the promotion of certain populations of animals or using different varieties of crops and plants in different plots of the farm.
    - Promote highly diverse polyculture systems.
    - Diversify animal populations to boost production of biofertilizers and recycling options (fish, chicken, shoats or cattle). Manage animals with a variety of feeds and forages, depending on soil carbon characteristics and needs.
    - Enhance nutrient cycling, natural pest management, water conservation, mulching, the use of (green) manures, crop rotation,

cover and companion cropping, crop diversification, nutrient balancing, recovery and reuse, and the inclusion of landscape elements such as hedgerows and flower strips.

    - Minimize **soil disturbance** and tillage.
    - Lower livestock densities and introduce managed and free-range grazing.

- Reduce use of fossil fuel-based equipment. See ***Shifting to clean energy at the farm level*** for more.

At the landscape level:

- Integrate production and conservation in managing landscape components of agricultural systems– from hedges, woodland patches and clearings in forests, to waterways, ponds or other biodiversity-friendly features of the production environment – that can provide habitat for specific species and improve connectivity. Special attention should be given to watersheds and water towers where rainwater is collected. Suitability of measures varies across landscape types as well as local and farm-level needs.
- Facilitate breeding of plants and animals, community seed exchanges and food fairs to increase the diversity of varieties, breeds and traditional foods in the landscape.
- Encourage the use of indigenous crops, breeds and varieties that are adapted to local climatic conditions and develop markets for such crops, breeds and varieties by removing obstacles to their commercialization. Using traditional varieties and supporting agrobiodiversity can serve as a living germplasm bank, continuing the process of adaptation and thereby increasing resilience to future challenges including climate change.
- Encourage use of organic fertilizer already available in the landscape, for instance, by sourcing cattle manure from neighbours to foster landscape resilience to reduce the dependency of food systems on external inputs.
- Develop opportunities for direct sales and new alternative food networks from farmers' markets to community supported agriculture to inclusive producer organizations, as well as inclusive value chain approaches, and other direct marketing arrangements to strengthen food resilience and biodiversity at the landscape level. This could involve adopting territorial approaches and boosting responsible investment in infrastructure, services, logistics, and technologies, with a particular focus on benefiting

populations where multidimensional poverty is widespread. See ***Improving physical and economic access to food***.

- Recognize the interconnectedness of terrestrial and aquatic ecosystems and ensure that agricultural interventions do not lead to the degradation of aquatic ecosystems (e.g. through disturbance to hydrological regimes), near or far. It is important that flow-related outcomes arising from land cover and land management changes (e.g. impacts on groundwater recharge, baseflows and flood flows) are considered.

Drone photograph of trees and buffer zones where agricultural fields meet the [TK] river

Enabling governance measures

A successful transition to nature-positive food production practices at the farm and landscape level requires enabling regulatory and financial conditions, including:

- Clear and secure tenure and resource rights, especially for smallholders, women, Indigenous Peoples and Local Communities.
- Clean environment and animal welfare standards.

- Health, labor protection, and worker safety standards, policies, and programs for protecting food workers.
- Improved and equitable access to resources, markets for inputs, outputs, and financial services or government support for smallholders, women, Indigenous Peoples, Local Communities, youth and other disenfranchised groups.
- Responsible investment in skills development, mentorship, business education and incubation, and vocational programs, particularly for groups facing inequalities including Indigenous Peoples, local communities, women, and youth.
- Support for (enhanced) local and community action.
- Collaborative and inclusive management, planning and decision-making.
- Awareness raising and education about nature-positive food production practices.
- Responsible investment and improvements in logistics, services, technologies, supply chains, and physical infrastructure (e.g. roads; irrigation infrastructure; facilities for bulking, processing, and storage; and information and communications systems), especially in rural areas, to improve connectivity and facilitate market access for rural producers. Particular focus should be on benefitting populations where multidimensional poverty occurs.
- Appropriate seed regulatory framework, as well as regulatory frameworks for other agricultural inputs. Peasant seed systems should be recognized as important element of biodiversity-friendly and resilient food production.
- Public and private efforts for creating consumer market for nature-positive food (e.g., educational, and awareness-raising activities targeting consumers, easily recognizable product labels and appropriate product branding). See ***Increasing demand for healthy and sustainable diets***, ***Introducing food systems-based dietary guidelines*** and ***Integrating healthy sustainable diets in public procurement*** for more information.
- **Subsidy reform** by prioritizing and redirecting public finance flows to support nature-positive agricultural production.

Solar panels and wind turbines generating renewable energy for green and sustainable future. Netherlands.

Tools and MRV systems to monitor progress:

Tool for Agroecology Performance Evaluation (TAPE)

This tool from FAO supports agroecological transition processes at different scales and in different locations by proposing a diagnostic of performances over time, identifying areas of strengths/weakness and enabling/disabling factors.

Link: https://www.fao.org/3/ca7407en/ca7407en.pdf

The Farm Level Agroecology Criteria Tool (F-ACT)

A digital decision-making tool that enables farmers to identify ways for making their farms more efficient, resilient, equitable and ultimately agroecological and nature-positive.

Link: https://www.agroecology-pool.org/fact/

Climate Risk Planning & Managing Tool for Development Programmes in Agri-Food Systems (CRISP)

An interactive tool supporting the mainstreaming of climate adaptation options in agricultural farming systems.

Link: https://crisp.cgiar.org/

Participatory Integrated Climate Services for Agriculture (PICSA)

A participatory agricultural advisory and climate services approach that empowers smallholder farmers to make better decisions in response to individual agricultural challenges.

Link: https://research.reading.ac.uk/PICSA/

Action Guide on Boosting Nature-Positive Food Production

A guide from The UN Convention to Combat Desertification

Link: https://catalogue.unccd.int/419_UNCCD_series_AG1_Nature-Positve_final_for_web.pdf

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FAO Action Plan on Mainstreaming Biodiversity Across Agricultural Sectors

Based upon the Framework for Action on Biodiversity for Food and Agriculture, the Action Plan is based upon the principles of effective governance, a knowledge-based approach, partnerships, inclusiveness, gender equality and empowerment of women.

Link: https://openknowledge.fao.org/items/efef8ccc-dc90-4eb4-a710-cf530a769869

Agrobiodiversity Index – Alliance Biodiversity International (CIAT)

A collection of data on biodiversity across nutrition, agriculture, and genetic resources domains. Besides measuring agrobiodiversity's status, the Index identifies actions, opportunities, and risks for the increased use and conservation of agrobiodiversity.

Link: https://alliancebioversityciat.org/

Module on climate-smart crop production

FAO provides an open-source, online Climate Smart Agriculture Sourcebook that contains a module on climate-smart crop production

Link: https://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b1-crops/b1-overview/en/

A farm management tool to measure trade-offs and farm performance is also under development by Wageningen University & Research.

Climate change mitigation benefits

- Soil carbon sequestration: achieved through the implementation of agroecology, agroforestry, crop diversification, climate-smart agriculture, conservation agriculture, integrated crop-livestock systems, improved crop management and/or organic farming.
- Reduced GHG emissions from farming: achieved through the implementation of crop diversification, climate-smart agriculture, conservation agriculture (great mitigation potential in dry areas), crop-pasture rotation systems, improved crop management, intercropping systems and precision farming.
- Urban farming activities reduce the food carbon footprint by avoiding emissions from long-distance food transports.
- Improving the efficiency of farm machinery in terms of productivity and operating time, and reducing fossil fuel usage, can also reduce GHG emissions.

Measures aimed at reducing dependence on synthetic fertilizer application and measures for improved or integrated crop nutrient management including nutrient use efficiency (e.g. optimized fertilizer application, use of slow or controlled-released fertilizers, intercropping, reduced tillage, use of cover crops and biofertilizer application) significantly reduce N_2O emissions. Biofertilizers and ecological fertilization can also achieve great reductions in CH_4 emissions.

Other environmental benefits

- Cleaner air due to reduced synthetic fertilizer use.
- Improved water quality due to reduced surface run-off and leaching of nutrients into groundwater.
- Reduced soil pollution.
- Contribution to restoration of water cycle.

Adaptation benefits

Implementing measures for nature-positive crop production helps to make agricultural production more resilient to climate change.

- Positive effects for soil: improved nutrient cycling; soil conservation and restoration; reduced soil erosion; enhanced soil fertility, quality, structure, and health; and enhanced soil biodiversity.
- Positive effects for water: efficient water utilization; increased water infiltration and retention into soil; and regeneration of water springs.
- Improved resistance to pests and diseases.
- Increased resilience against extreme weather and climatic conditions, especially heat and drought. Conservation agriculture in particular enhances the resilience of agricultural systems to climate-related stress, notably in dry regions, and improves the resilience of communities to climate-related stress such as drought.
- Increased provision of ecosystem services.
- Urban farming increases climate resilience of urban areas by reducing the so-called urban **heat island effect** (i.e. significantly warmer temperatures in dense urban areas compared to suburban residential or rural areas) and preventing flood through increased water infiltration.

Other sustainable development benefits

- SDG 1 (No poverty) & SDG 2 (Zero hunger): Benefits for livelihoods and food security. Potentially increased agricultural productivity leading to increased (or sustained) crop production; higher household-level incomes; improved food security; equitable access to healthy, nutritious, and diversified foods, and improved rural livelihoods; empowerment of smallholder farmers; increased time availability for additional livestock and vegetable production; and infant and young-child feeding practices.
- SDG 5 (Gender equality) & SDG 10 (Reduced inequalities).
- SDG 6 (Clean water and sanitation): reduced water consumption and contamination; watershed protection; and improved water quality.
- SDG 11 (Sustainable cities and communities): Benefits for cities and communities from urban farming; improved food self-sufficiency of cities;

improved urban food security; and improved urban biodiversity.

- SDG 12 (Responsible consumption and production): Benefits for waste reduction; improved nutrient, water, and other input-use efficiency; reduced loss of production inputs; and promotion of local food systems.
- SDG 15 (Life on land): reduced pollution from fertilizers and pesticides; increased soil microbial activity, soil fertility, and soil quality; enhanced on-farm diversity of genes, species, and ecosystems; improved biodiversity conservation; ecosystem protection (e.g. forests); reduced/prevented land degradation; reduced/prevented desertification; potentially reduced land use; and strengthened ecosystem services.

Main implementation challenges and potential negative externalities and trade-offs

- Implementing sustainable crop production practices may require secure land tenure, equitable access to resources and agricultural advisory services, sufficient public and private financial incentives, knowledge, practical experience, sufficient labour resources and/or high upfront investments.
- Improved crop nutrient management: accessibility of adequate inputs or practices is highly variable depending on region.
- Intercropping requires the appropriate selection of species to avoid competition for resources (e.g. water and nutrients).
- Data intensive to measure progresses towards the desired outcomes.
- Agroecology and climate-smart agriculture: barriers to adoption and use of modern and innovative (bio-)technology.
- Agroforestry: risk of invasive species, allelopathy (i.e. release by one plant of a chemical substance that restricts the germination or growth of another plant), competition for resources, competition between trees and crops or increases in plant diseases. See ***Implementing agroforestry practices*** for more information.
- Crop diversification: increased workload (associated with higher costs and potential difficulties in accessing markets).

Manuel Vidal, captain of the artisanal fishing vessel ‘Cobra’, receives a net full of luga, a leathery seaweed, that a diver collected from the seabed off the coast of Guafo Island

Measures to address challenges and negative externalities and trade-offs

- Support for accessing and using inputs, supplies, technologies or management practices that are necessary for nature-positive production, with particular emphasis on supporting low income and marginalized communities.
- Capacity building on nature-positive production for producers and agricultural extension officers.
- Mainstreaming of nature-positive production systems and techniques in agricultural education.
- Appropriate financial support mechanisms for producers, including dedicated credit lines, with particular emphasis on supporting low income and marginalized communities.
- Payment for ecosystem services (PES) schemes.

- Development platforms to capture the large data required to monitor and assess progresses in nature positive systems.
- Use of appropriate seeds based on traditional knowledge and local conditions.
- Development of strong and compelling transition pathways to minimize losses during the transition.
- Guidance on appropriate selection of crop and livestock species and breed to avoid significant yield reductions.
- Financial mechanisms to compensate for yield reductions and associated income reductions (e.g., subsidies, tax breaks, and payment for ecosystem services (PES)).
- Capacity building and training for producers to maximize knowledge and minimize risk of negative externalities.
- Improved and equitable access to markets for nature-positive products.
- See ***Sequestering carbon in soil and enhancing soil health in crop systems***, ***Implementing integrated crop-livestock systems*** and ***Implementing agroforestry practices*** for more information.

Implementation costs

- According to the **IPCC**, the median upfront investment costs of sustainable land management practices, including sustainable crop production, amount to USD 500 per hectare.

Intervention in practice

- Soybean production in Brazil includes **examples of biofertilizer use in crop production**. Biofertilizer is used on 80% of the land planted with soybeans in Brazil, allowing microorganisms to replace chemical fertilization in the provision of nitrogen to crops. (However, the nutrients phosphorus and potassium are still supplied by chemical fertilizers). Benefits of biofertilizer include increased soybean yields, protection of rivers and freshwater from contamination, reduced GHG emissions (approx. 430 $MtCO_2e$ compared to chemical nitrogen fertilizers) and annual cost reductions of around USD 10 billion, due to reduced imports of synthetic fertilizer. The widespread use of biofertilizers in soybean production has become possible through

collaboration between academia, regulators, industry, extension services and farmer organizations. Scientists provided the necessary technology, regulators created the necessary regulatory framework and the industry took over implementation and commercialization. The use of biofertilizers in soybean production could be used as a model for other crops.

- The Government of India has promoted climate-smart agriculture since 2011 through the initiative "National Innovations in Climate Resilient Agriculture". As part of the initiative, the government tries to increase the number of **climate-resilient villages**. This includes providing training for villagers on in-situ moisture conservation, biomass mulching, residue recycling, water harvesting and recycling for supplementary or life-saving irrigation, conservation tillage, location-specific intercropping and agroforestry, among other things.
- To promote the diversification of crop production, Catholic Relief Services organizes Diversity for Nutrition and Enhanced Resilience agriculture fairs (**DiNERs fairs**). The fairs provide farmers with diverse choices of seeds and other planting materials for nutrient-rich foods (e.g. fruit tree species, indigenous legumes, vegetables and cereal crops) through small samples and vouchers that give decision-making power to farmers.

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