FACT SHEETS:
BEST PRACTICES FOR A CLIMATE SMART AGRICULTURE

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Manuel Otero, Director General of the Inter-American Institute for Cooperation on Agriculture

"The Americas play a critical role in maintaining global food security while helping to maintain the maximum levels of greenhouse gas concentrations established by global climate conferences. This document prepared by the Living Soils of the Americas initiative presents technologies developed and implemented in the region that can help in this huge global challenge that is the preservation of food production and create favorable conditions for the adaptation and mitigation of climate change through the adoption of best agricultural practices."

Rattan Lal, Director, Carbon Management and Sequestration Center (C-MASC), College of Food, Agricultural, and Environmental Sciences, The Ohio State University.

"Soils are the main terrestrial component for carbon storage and extremely important for advancing greenhouse gas mitigation policies and thus mitigating the effects of climate change. We need to increase cultivated areas with best agriculture practices considering physical, chemical and biological soil components, keeping them alive and healthy. The practices presented in this collection represent technologies capable of being implemented in more than 90% of the cultivated areas throughout the hemisphere and based on scientific knowledge. They are essential to guide actions in countries to advance the agenda established by the Living Soils of the Americas initiative."

CONSERVATION AGRICULTURE

Conservation agriculture is based on the three principles: no soil disturbance by tillage, permanent soil cover and crop rotation.

Croplands cover 340 million ha in the Americas, ensuring the production of food, feed, fiber and biofuel. Conservation agriculture is the most widespread sustainable management practice to improve soil health and sequester C adopted in several American countries (USA, Brazil, Argentina, Paraguay); however, conventional tillage is still the predominant system adopted in the American croplands. Therefore, the adoption of conservation agriculture must be promoted to deliver multiple benefits, such as:

- Preventing soil disturbance, mitigating soil CO_2 emissions to the atmosphere;
- Protecting soil surface with crop residues, reducing soil erosion and enhancing soil health and soil C sequestration;
- Introducing cover crops to improve soil biodiversity, soil health and increase soil C stocks by 15%;
- Reducing applications of fertilizer and pesticides and greenhouse gas emissions;
- Expanding conservation agriculture to 50% of the current area cultivated with the main annual crops (corn, soybean, wheat, rice), the American continent has the potential to sequester 888 Tg C, ranging from 529 to 1,247 Tg C for the 0-0.60 m depth over 20 years.

5 Principles worth spreading

1. Managing More by Disturbing Less Soil
2. Diversifying Soil Biota with Plant Diversity
3. Keeping Live Roots Growing Throughout the Year
4. Keeping the Soil Covered as Much as Possible
5. Producing more from less

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NATURAL FOREST RESTORATION

Natural forest restoration is a most important strategy to remove CO_2 from atmosphere, restore biodiversity, enhance soil health and carbon sequestration, and strengthen multiple ecosystem services.

Natural vegetation covers most of the American continent, in which evergreen forests alone account for about 15 billion ha. International initiatives on forest restoration are being promoted around the world. An important initiative is the Boon Challenge, involving 61 countries (29 located in the Americas) and has the goal of restoring 150 Mha of degraded and deforested landscapes by 2020 and 350 Mha by 2030. The UN Decade on Ecosystem Restoration (2021-2030) has a target to build a broad-based global movement to upscale restoration and put the world on track for a sustainable future.

- Land use change and deforestation are two of the major causes of greenhouse gas emissions in the Americas;
- Natural forest restoration transforms degraded ecosystem into multifunctional and biodiverse landscapes;
- Soil carbon sequestration is higher with natural forest restoration than with plantation of commercial trees;
- A mature forest, such as Amazon Forest, can store about 275 Mg of C (tree, dead wood, litter and soil pools);
- Natural forest restoration is much more than planting trees, it requires a careful socioecological planning to define what and where to plant, and how to protect and manage those landscape on the long-term basis;
- Globally, adding up to 24 Mha of forest every year from now until 2030 could store one-quarter of the atmospheric CO_2 needed to limit global warming to 1.5 Cº.

Natural forest restoration can transform degraded ecosystems (source of CO_2 and disservices) into multifunctional ecosystems (sink of CO_2 and providers of key ecosystem services)

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PASTURE RECLAMATION

Pasture is the major land use in the word, covering 905 million ha in the American continent. Moreover, the adoption of sustainable practices to restore poorly-managed and/or degraded pastures can have a large impact on the global soil carbon stocks and greenhouse gas mitigation.

Global estimates indicate that the livestock sector may be responsible for 8–18% of greenhouse gas emissions. This fact sheet presents the main alternatives to reduce the greenhouse gas emissions in pasturelands. In addition to reducing greenhouse gas emissions, carbon sequestration improves soil health in pasturelands. Thus, healthy soils are more resilient and can benefit pasture quality.

- The overall potential of soil C sequestration by pasture reclamation in the American continent is 1,792 Tg C (1.782 Pg C), ranging from 717 to 2,868 Tg (0.717 to 2.868 Pg C) for the top 0.3 m soil;
- Important alternatives to reduce the greenhouse gas emissions include adoption of integrated systems, leading to soil carbon sequestration and offsetting CH_4 and N_2O emissions from cattle production;
- Improved grazing management can mitigate the greenhouse gas emissions mainly due the reduction of CH_4 emission per kg of animal product.
- Adjusting grazing intensity (more forage production), by seeding legumes with grasses and fertilization, can also increase soil carbon sequestration;
- Improving feed digestibility, when used together with the previous strategies, improves feed digestibility and has technical mitigation potential of 0.68 $GtCO_2e\ yr^{-1}$.

3 Main alternatives to reducing the GHG emissions and increasing soil C stock and soil health in pasturelands are:

1. Pasture reclamation
2. Improved grazing management
3. Improved feed digestibility

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SUSTAINABLE COFFEE PRODUCTION

Coffee is a key crop in sustaining millions of livelihoods around the world, including the American continent. Sustainable management of coffee, and boosting production has important social, economic and environmental benefits.

Coffee is a globally traded commodity where smallholder coffee farming households are responsible for 90% of the world's coffee. Coffee is grown over 5 million ha in the American continent. Given its social and economic importance, sustainable production is the key to develop farming systems which produce more but without associated increase in greenhouse gas emissions yet maintaining soil carbon stocks and sustaining soil health.

- In Brazil, coffee under organic management (green manures) reduces soil carbon stock only by 10% compared with that of the native vegetation, but the use of synthetic fertilizers reduces 20% of the original soil carbon stock;
- In Costa Rica and Nicaragua, the carbon footprints for 1 kg of fresh coffee cherries range between 0.26 and 0.67 kg CO_2e for conventional and 0.12 and 0.52 kg CO_2e for organic management systems (agroforest systems);
- In Mexico, Guatemala, Nicaragua, El Salvador and Colombia, coffee cultivated in polycultures have lower carbon footprint (6.2–7.3 kg CO_2e kg^{-1} of parchment coffee) than monocultures (9.0–10.8 kg^{-1}).
- Agroforest systems are sustainable practices for coffee productions in the American continent, but future studies are needed to document potential for soil C sequestration and greenhouse gas mitigation.

Despite the economic and social importance of the coffee production in American countries, research information is missing about the adoption of sustainable practices and theirs effects on soil C sequestration, greenhouse gas mitigation and soil health.

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