ARGENTINA 2018
THINK 20

FOOD SECURITY AND SUSTAINABLE AGRICULTURE

The role of trade and sustainable intensification to achieve global food security with less carbon emission and more carbon sequestration

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Abstract

According to some estimates food production needs to increase 60% by 2050 to meet the expected demand and assure food security for all. In order to meet this target and simultaneously achieve the carbon emission targets set in the Paris agreement it is necessary to restructure agricultural production in a substantial way.

Lower carbon emissions per unit of product can be achieved by a global initiative to expand sustainable intensification of production especially in the more productive lands of the world. This will require: a) better estimates on carbon emission and sequestration in different agricultural lands, b) a strong international initiative to develop, promote and finance the development and adoption of new technologies that support and make possible a global sustainable intensification strategy and c) an efficient and open agricultural trade system that addresses the growing geographical imbalances between food production and food needs contributing to lower global carbon emission by agriculture.

Challenge

Food security was recognized as a universal right in 1992 during the United Nations Conference on environment and development held in Rio de Janeiro and reaffirmed in the Food Summit organized by FAO in 1996. Since then it has been fully incorporated in the agenda of the United Nations and its decentralized Agencies and also in the Agenda of the G20 meetings. More recently it has been a major item in the globally adopted Sustainable Development Goals (SDGs).

The quantitative and qualitative demand of food is projected to increase quite rapidly during the next two decades as a consequence of population increases, the additional demand from a growing middle class and the need to close the gap of the 815 million people that still remain food insecure (FAO, 2017) According to some estimates in order to meet such demand the agricultural sector should produce 60% more food by 2050.

On the other hand, rural lands, and agricultural and livestock production in particular, are attributed to be responsible for a considerable proportion of total carbon emissions.

Consequently, although the needed increases in production may be technically feasible today, a greater environmental impact in terms of greenhouse gases (GHG) emissions, land degradation, aquifers depletion in certain regions and the loss of eco-systems services is inevitable if food is produced in a “business-as-usual” way.

Moreover, there are no shared global targets in relation to, among others, agriculture, biodiversity, climate, water and energy to address these challenges in an integrated way. Unless those problems are addressed rapidly, the ambitious targets contained in the SDGs and the Paris Climate Agreement (COP21 and 22) will not be met. So, the main challenge for the global community in general, and producing countries in particular, is how to produce more food at the level that is required by an increasing global demand while reducing GHG emissions.

The main element in the strategy that is proposed for increasing global food production with less global carbon emissions is to take into account the large opportunities for carbon sequestration in agricultural and grazing lands, managed forests and the oceans.

Proposal

There are a number of coordinated actions that G20 member countries could initiate to take the newly available information into consideration and thus contribute to the development of world agriculture with lower carbon emissions. However, there are three proposals that we consider of great importance and potential impact in the definition of appropriate pathways and needed policies: a) Improve the estimations of C sequestration in rural lands in order to better define incentives and policies; b) contribute to a world-wide initiative to develop and incorporate sustainable intensification technologies, particularly considering the contribution of the more productive lands of the world. This will require a wider use of knowledge and information-based technologies for minimizing fossil fuel consumption and GHG emissions, especially on lands of high agricultural productivity, thus sparing less productive lands for conservation policies that lead to higher C sequestration; and c) improve and facilitate trade so that land-constrained countries can better access the increased production provided by the high-yielding lands.

The results of these three proposals would contribute to global food security and less global GHG emissions. In addition, it would also contribute with intangible benefits such as virtual water, carbon and nutrients, being transferred from food-exporting countries, which are rich in natural resources, to food-importing countries allowing them to recharge their depleted water aquifers and restore degraded lands.

Proposal 1: Improve estimations on C sequestration in rural lands

A revision of the IPCC recommended methods to estimate carbon (C) budgets that are reported by national GHG inventories seems to be necessary. While IPCC guidelines are very exhaustive and thorough in their approaches to estimate C emissions on most activities, methods to calculate C sequestration by terrestrial lands still remain rudimentary. Inevitably uncertainty arises in countries that have large areas of land covered with vegetation. Using an indirect method to calculate the terrestrial C sink, Le Quéré et al. (2016) provided a valuable historical estimation of the Earth C budget during the period 1880-2015. They show that the amount of C sequestered by terrestrial lands would be growing since 1940 (Figure 1).

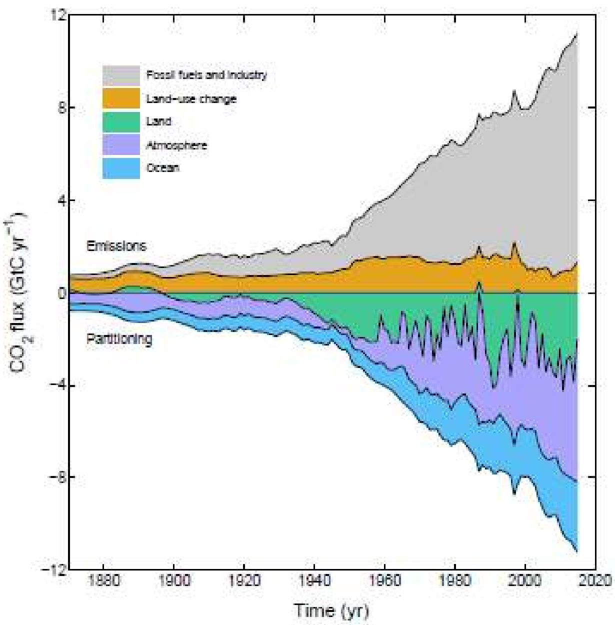

Figure 1. Carbon sequestration capacity of terrestrial lands (area in green) since the mid-20th century until 2015 as reported in a research work by Le Quéré et al. (2016).

Grasslands represent a special biome that deserves reconsideration. National GHG inventories generally show, using current methodologies, that grazing lands behave as great net emitters. But, in our view, they are underestimating the ability of grasslands to capture and store C in soil. Most national reports on GHG inventories have followed the IPCC Guidelines (1996, 2006), which in their Tier 1 method have recommended using a unified default factor of 1 (no change in soil C stock through time) for grasslands ("...after a finite transition period, one can assume a steady state for this stock..."). Such a long-term stability can only be reached under zero-grazing conditions (Keel et al., 2017, Garnett et al., 2017, Schipper & Smith, 2018), but in the real world grasslands were and are still subjected to permanent grazing conditions. Therefore, a default factor of 1 is misleading and represents an oversimplification of reality that inevitably underestimates the C sequestration capacity of grasslands. Considering the large amount of grasslands (mostly grazed) that covers about 25% of planetary ice-free lands (Asner et al., 2004), a C sequestration different from zero can dramatically change the C budget of some countries (which even could show a C neutral condition) and the entire Earth.

By ordering 90 peer-reviewed scientific publications on soil C sequestration in grasslands, in order to confirm this, we depicted data on a frequency distribution graph that is showed in Figure 2. Only two out of 90 grassland cases show a negative capacity for carbon sequestration. The remaining 88 cases show a positive sequestration capacity that varies from one climatic region to another and from one technological level to another.

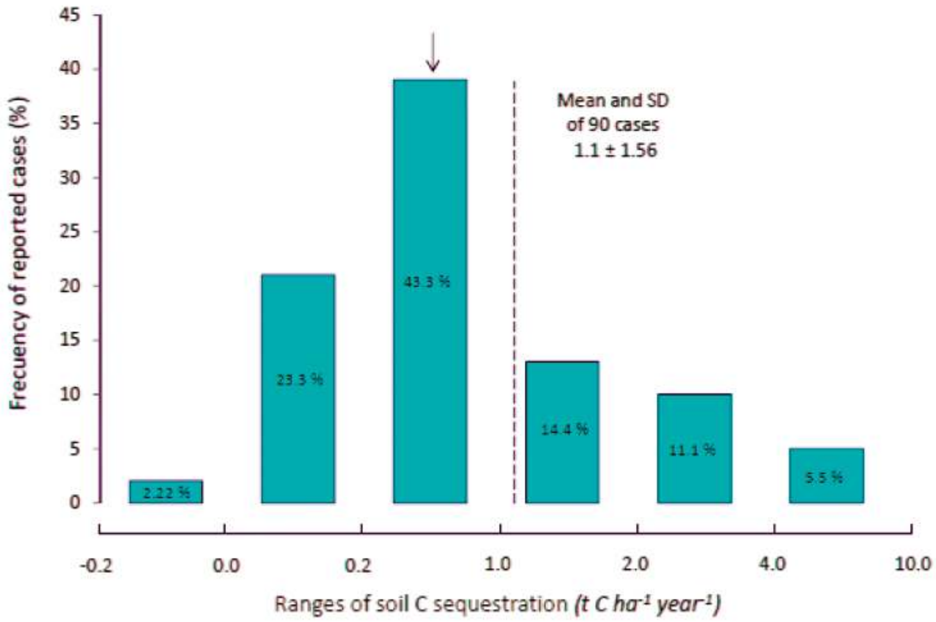

Figure 2. Frequency distribution of C sequestration ranges in BGB in a sample size based on peer-reviewed 90 cases from scientific literature

It is of major importance that G20 countries agree to promote a significant effort to produce more precise and regionally relevant parameters for estimating C sequestration by grasslands and other agriculture-related biomes. Revisiting current methods and exploring alternative methods to estimate C sequestration by rural lands would greatly improve our view on food production systems and guide the adoption of more sustainable approaches, both in food-exporting and food-importing countries. A global initiative to help developing countries to improve their estimations is crucial. In addition, based on their technical experience and neutrality, some international organizations like CGIAR and FAO could lead, in collaboration with interested countries, studies to produce more precise and regionally relevant parameters for estimating C sequestration by grasslands and other agricultural biomes.

Proposal 2: Contribute to a worldwide initiative to develop and incorporate sustainable intensification approaches

Sustainable intensification (SI) is defined as a process or system where agricultural yields are increased without adverse environmental impact and where new land is spared for carbon sequestration and resource conservation. Beyond controversies, it connotes that desirable outcomes around both, more food and improved provision of ecosystem goods and services, could be achieved by a variety of means (Pretty & Bharucha, 2014).

A sustainable intensification strategy in agriculture should aim to ensure that enough food is provided for a growing population while improving the C balance and enhancing adaptation throughout the food chain. It should be noted, however, that progress will be uneven, and the capacity to increase food production, to reduce the impact on climate and to increase adaptation will vary widely across countries and regions, and at different stages of production and consumption. Available evidence suggests that the largest global impact will be attained on those lands that are more productive and that show low GHG emission per unit of land and per unit of product.

Incentives to address technology-oriented programs will be globally needed to restructure the food production systems, especially in developing countries. They should be stimulated to enter into the digital age, which is boosting the generation of new technology ("precision farming") necessary to support a climate-smart agriculture

The rapid adoption of high-tech strategies into the agri-food sector is mainly confined to developed countries, but the incorporation it is still slow in many well-endowed developing countries that today need the support of the international community. Research and programs financed by the international community will boost the adoption of environmentally-friendly agricultural systems. Examples such as that of the Platform for Big Data in Agriculture from the CGIAR represent a remarkable effort in this regards.

In synthesis, the accelerated worldwide development and dissemination of these technologies will require very active processes of research diffusion of information, capacity building and investments in high-tech resources (e.g., new machinery, information and communication technology, GM seeds). The role of international organizations, like the CGIAR, FAO the WB and many others as well as the participation of bilateral development support programs for promoting a coordinated effort, will be essential.

This new suggested emphasis also implies that the agricultural research and dissemination strategies followed by international organizations that have been mainly aligned with SDGs 1 and 2, related to rural poverty and food security, should, in addition, fully incorporate a stronger alignment with SDGs 1, 2 and 13 related to responsible production and climate change concerns

PROPOSAL 3: Improve and facilitate food trade

A global effort to promote Sustainable Intensification practices at a global level would result in a rapid expansion of production, specially, in the better endowed lands of the world. Thus, production would tend to concentrate on areas and countries that already are better endowed to produce and export food, and those that recently have reached such condition. Improving trade conditions are imperative to globally link sustainable intensification and food security. This will insure that a more internationalized supply of food, at reasonable and stable prices, is available to all importing countries and specially the poorer ones.

It should be stressed that accelerating sustainable intensification in food-exporting countries will increasingly contribute to global food, climate and water security as long as free-trade conditions and logistical infrastructure are enhanced in the world (Aggarval et. al., 2018). The co-benefits of increasing the environmental sustainability in food-supplying countries will result in the rebuilding of sustainability patterns in food-importing countries. Intangible services –not assessed by conventional economic analysis- can benefit food-demanding countries. The transference of "virtual water", carbon and nutrients can allow them a mid- and long-term replenishment of their depleted aquifers and a gradual rehabilitation of their exhausted carbon and nutrients stocks in abandoned and degraded lands.

From this perspective agricultural/food trade will not only contribute to stabilize the market and help meeting the demand of food in resource-scarce countries, but contribute to improve the global carbon balance. The G20 could play an important role in promoting this new perspective and the resulting trade strategies

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