"***Koronivia Joint Work on Agriculture***"

Brazilian submission on "2(b) methods and approaches for assessing adaptation, adaptation co-benefits and resilience and 2(c) improved soil carbon, soil health and soil fertility under grassland and cropland integrated systems, including water management"

The Government of Brazil welcomes the opportunity to submit its views regarding the second round of workshops of the Koronivia Joint Work on Agriculture (KJWA) in the context of the joint work between the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI) on issues related to agriculture. In accordance with KJWA's road map, this submission regards (1) methods and approaches for assessing adaptation, adaptation co-benefits and resilience as well as (2) improved soil carbon, soil health and soil fertility under grassland and cropland integrated systems, including water management.

I - Topic 2(b) Methods and approaches for assessing adaptation, adaptation co-benefits and resilience

Brazilian agriculture consists of a large diversity of production systems that play an important role in the country's economy. The agriculture sector contributes with 23% of the GDP and 35% of the jobs generated in the country. Agriculture is an economic activity greatly influenced by environmental conditions and climate and its variability is one of the most important risks to sustainable production.

In this context, Brazil understands that the long-term sustainability of agriculture is dependent on the effective adoption of sustainable practices and the establishment of resilient agroecosystems. These, in turn, are highly dependent on intensive investment on the development of specific scientific knowledge, especially regarding the agronomical aspects of soil, water, climate, crops, livestock and forestry. Nonetheless, sustainability in agriculture is also critically interdependent with the socioeconomic and environmental dimension, needing adequate policy framework and infrastructure to identify and combat the long-term negative impacts of climate change.

Brazil understands that the implementation of a specific adaptation strategy is paramount to handle climatic uncertainty. This strategy is structured on an efficient access to information, technologies and productive processes, paving a way to the establishment of sustainable production systems (BRASIL, 2016). The Brazilian national plan for agriculture and climate change (ABC Plan - BRASIL, 2012), as part of the National Policy for Climate Change, has a strong emphasis on the identification and the proposition of measures for the promotion of resilient production systems, where resilience, adaptative capacity and the reduction of climatic risk are the core priority.

The increasing uncertainty brought up by climate change, especially for a highly climate-dependent and vulnerable sector such as agriculture, requires a robust strategy to assess, organize and integrate data, and produce adequate information to guide the decision-making process in the

implementation of public policies at the national and subnational levels, with the aim of supporting farmers with the reduction of impacts and risks of climate change in productive systems.

While evaluating specific characteristics of resilience and adaptation towards a new and uncertain context, and developing specific measures, Brazil is also evaluating under the lenses of climate change, existing policies and lines of action that can be strengthen and integrated towards a dynamic information system, that could cover the diversity of agricultural systems and regional characteristics. Current national operational policies are useful and should be strengthen to directly or indirectly deliver increased awareness and promote adaptation to the adverse impacts of climate change; some examples are: the Agricultural Climate Risk Zoning (ZARC); the Simulation of the Future Agricultural Scenarios (SCenAgri); the Family Agriculture Insurance, and the Rural Insurance Premium Grant Program. It also refers to other policies as relevant to foster sustainability and adaptation: the National Policy on Agroecology and Organic Production; the Law of Protection of Native Vegetation; the Environmental Regularization Program; the Rural Environmental Registry; the National Policy for Crop-Livestock-Forestry Integration; the Agricultural Policy for Planted Forests; the National Water Resources Policy; and the National Irrigation Policy. (information regarding all of these initiatives can be found through http://www.agricultura.gov.br/).

Amongst these, some already existent information and planning instruments are the Sisdagro – a decision support system for agriculture, from the National Meteorological Institute (http://sisdagro.inmet.gov.br:8080/sisdagro/app/index), the SCenAgri – (simulation of future agricultural scenarios) and the SOMABRASIL – an observation and monitoring system for agriculture in Brazil, both coordinated by Embrapa (http://mapas.cnpm.embrapa.br/somabrasil/webgis.html). These systems are increasingly adjusting their methodologies for an increasing climatic uncertainty, in order to produce information that would enable better decisions by farmers and policy makers.

Existing sustainability indicators for agroecosystems are being tested in all projects implemented by the ABC Plan, in order to evaluate their usefulness towards the evaluation of resilience and adaptive capacity. The ABC Platform, a multi-institutional strategy developed to support the monitoring and the evaluation of the ABC Plan, finally started its activities in 2018, and has, among its other objectives, the evaluation of studies and indicators regarding the resilience of agricultural systems, in Brazil, and what constitutes the adaptive capacity of such systems.

Further, evaluating the institutional capacity to both support farmers in their decision making, with the adequate information, as well as actively support their recovery in the aftermath of negative climatic impacts, is also essential. The ABC Plan is advancing in the development of a Climate Intelligence Program, where an information Center – CIClAg – will be responsible for integrating indicators and building scenarios, which can then be prioritized and pursued as a long-term vision or used to steer the implementation of current public policies. The ability to have an operational intelligence center as part of an adaptation strategy will provide tools to break down technical-scientific and political-institutional knowledge barriers providing decision makers a more palatable set of parameters among which to decide.

Agriculture is a climate dependent sector, and the increasing uncertainty brought by climate change is a further challenge to guarantee its sustainability and especially, its capacity to promote food security. It is a complex challenge, but Brazil is committed to increase and strengthen the sustainability of its agricultural systems, promoting resilient and productive production areas. Reliable and available information is at the center of this challenge and it is the government's

responsibility the implementation of an information system that can assure farmers the access to the best information available.

To achieve that, Brazil still has challenges, such as establish a universal connectivity; develop, establish and implement reliable information systems; strengthen its institutional capacity, in national and subnational levels, in order to promote effective support to farmers in all its vast territory.

II - Topic 2(c) Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management

Tropical agriculture has great potential to contribute to local and global food security. Management of soil carbon, soil health, soil fertility and water are indispensable for the sustainable use of natural resources (Obalum et al., 2017). While soil fertility in regions under temperate climate mainly depends on the mineral soil component, in highly weathered soils of the tropics the ability of soils to provide plants with available nutrients greatly depends on soil organic carbon (SOC). Besides soil fertility, SOC management in tropical and subtropical ecosystems is of utmost importance due to the relevance of this soil component for soil water holding capacity, biodiversity, soil quality, soil health, and eventually, the resilience of the soil-plant system. Due to specific soil and climate - naturally low soil fertility, low SOC, but high net primary productivity of biomass and high turnover rates, as well as, generally high mean annual temperatures and precipitation - sustainable intensification, using best soil management practices and agriculture systems specifically developed or adapted for tropical and sub-tropical agriculture for variable scales, is a viable option in the agriculture sector for economically, socially and environmentally sustainable development.

In general, the objectives of sustainable intensification are 1) prevention of further loss of native vegetation; 2) prevention of degradation of lands of high environmental vulnerability; 3) conservation of soil and land, including prevention of soil erosion and SOC loss, to promote productivity and sustainability of agroecosystems; 4) recovery of degraded lands, including pastures, to increase sustainable agricultural production and the provision of ecosystem services.

Brazil currently encourages, through its national plan for agriculture and climate change (ABC Plan - BRASIL, 2012) within the National Policy for Climate Change, the implementation and use of agricultural practices and technologies that promote the efficiency of the production systems and at the same time delivers the co-benefits of controlling greenhouse gas (GHG) emissions through the capture of atmospheric carbon dioxide and SOC accumulation.

The ABC Plan's technologies that contribute to SOC preservation or enhancement are 1) recuperation of degraded pastures; 2) zero-tillage with crop rotation; and 3) integrated crop-livestock-forestry systems, including agroforestry. Other technologies in the Plan that promote systems efficiency and avoid GHG emissions are 1) biological nitrogen fixation; 2) planted forests; and 3) manure management.

Strategically important activities to achieve the objectives of sustainable intensification are:

1. Improving soil knowledge at appropriate geographical scales for adequate land use planning in rural settings, identifying areas of major potential for production, limitations in terms of soil carbon (standing stocks and sequestration potential), soil fertility and availability of water, and expected productivity for different crops to achieve sustainability and food security;

2. Understanding soil processes, as affected by soil management, regarding SOC dynamics and stabilization, and its interdependence with nutrient (N, P, S, etc.) dynamics;
3. Improving soil fertility management through promoting efficient fertilizer use to reduce nutrient loss, leaching and GHG emissions; the use of green manures in plant rotations, especially leguminous species to promote biological nitrogen fixation and enhanced nutrient cycling; the use of biofertilizers and inoculants; phosphate solubilizing microorganisms; and plant growth promoting rhizobacteria, among others;
4. Promoting increased above and belowground (root system) biomass input in the topsoil and lower soil depth (> 30 cm) along with improved soil fertility management;
5. Promoting the use and maintenance of mechanical soil erosion control (contour planting, terracing) concomitant to zero-tillage;
6. Developing or adapting analytical methods and protocols for monitoring soil organic carbon (SOC) stock change in tropical soils. A slight increase in SOC can have important impact on soil fertility and soil health but assessing this difference may be prone to errors due to insufficient accuracy of existing assessment tools. Additionally, currently used methods are labor and cost intensive that may hamper the viability of SOC stock change assessment projects;
7. Creating specific or adapted metric system for vulnerability and sustainability assessment of natural ecosystems and agroecosystems and for soil health and quality is necessary;
8. Improving monitoring of land use and management, including remote sensing technologies;
9. Improving and implementing precision agriculture technologies for soil fertility and SOC management;
10. Analyzing sustainable production, SOC sequestration potential and water resources management in the wider context of production and the social, economic and political systems (credit systems and subsidies, market, policies and incentives);
11. Promoting technology and knowledge transfer as well as scientific research regarding soil and water conservation and recuperation of degraded lands.

To support these goals Brazil developed a National Program for Soil Survey and Interpretation (PRONASOLOS, https://www.embrapa.br/pronasolos; http://www.in.gov.br/web/guest/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/26572788/do1-2018-06-20-decreto-n-9-414-de-19-de-junho-de-2018-26572694). In the next three decades, this national effort will improve available information on soil and water resources and help strategic planning for use and management. The National Plan for Soil and Water Use, Management and Conservation has been articulated by the government and private sectors. The aim of this plan is to establish a set of actions, to support the implementation of public policies oriented to soil and water conservation, as well as, for the recuperation of degraded lands. GEOPORTAL, provided by MAPA, is an advanced tool for metadata analyses to support decision making (https://www.geoportal.seduh.df.gov.br/mapa/).

III - Conclusion

Finally, it is important to recall that the Brazilian NDC stresses that Brazil considers adaptation to be a fundamental element of the global effort to tackle climate change and its effects. The implementation of policies and measures to adapt to climate change, with mitigation co-benefits, contributes to building resilience of populations, ecosystems, infrastructure and production systems, by reducing vulnerability and through the provision of ecosystem services. Thus, the three pillars of sustainable development (environmental, economic and social) are considered by Brazil. The social dimension is at the core of its adaptation strategy, bearing in mind the need to protect

vulnerable populations from the negative effects of climate change and enhance resilience. The agricultural sector plays a key role in establishing secure livelihoods and strengthening social resilience, while providing food security and economic development.

Brazil advocates that while a continued action on enabling climate change mitigation is a crucial objective of the Convention, efforts to foster sustainable development have also to prioritize adaptation to the adverse impacts of climate change, and resilience of food systems. Brazil also understands that a specific adaptation program for the agriculture sector is imperative to create a safe environment for both the rural producer's as well as the public policy manager's decision-making process.

IV - References:

BRASIL, 2012. Plano setorial de Mitigação e de Adaptação às Mudanças Climáticas para a Consolidação de uma Economia de Baixa Emissão de Carbono na Agricultura: Plano ABC / Ministério da Agricultura, Pecuária e Abastecimento, Ministério do Desenvolvimento Agrário, coordenação da Casa Civil da Presidência da República. – Brasília: MAPA/ACS

BRASIL, 2016. *Plano Nacional de Adaptação à Mudança do Clima*: volume 2: estratégias setoriais e temáticas: portaria MMA nº 150 de 10 de maio de 2016/Ministério do Meio Ambiente. Brasília: MMA. 2 v.

BRASIL, 2015. *Intended Nationally Determined Contribution*. Towards achieving the objective of the United Nations Framework Convention on Climate Change. Available at: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Brazil%20First/BRAZIL%20iNDC%20english%20FINAL.pdf>. Accessed on 7 Mar 2019.

OBALUM et al. 2017. Soil organic matter as sole indicator of soil degradation. *Environmental Monitoring and Assessment*, 189:176.