Land degradation neutrality: implications for Brazil

Center for Strategic Studies and Management
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Land degradation neutrality: implications for Brazil

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Summary

Introductory Note

A group of experts from various centers of the Brazilian Agricultural Research Corporation (EMBRAPA), of the Center for Strategic Studies and Management (CGEE) and of the Foundation of Meteorology and Water Resources of Ceará (FUNCEME) met in Brasilia, on August 14, 2015, to analyze agricultural production and the problem of land degradation and to discuss the implications for Brazil of the target of achieving a land degradation neutral world, which is inserted in the Sustainable Development Goal (SDG) number 15. This publication summarizes the findings of these experts, who are identified in Annex 1.

1. Background

The heads of State and of government who gathered in New York, from September 25-27, 2015, in a special event of the United Nations General Assembly, adopted the document "Transforming Our World: The Sustainable Development Agenda for 2030". This document defines 17 Sustainable Development Goals (SDG), divided into 169 targets to be achieved by 2030.

The summit in New York was the culmination of a process that began at the Conference of the United Nations on Sustainable Development (Rio + 20), in June 2012, with the document "The Future we want" and continued at the United Nations, leading to the preparation and negotiation of the new post-2015 Development Agenda.

In the context of SDG 15, which is "protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", target 15.3 was approved and stated the following "until 2030, combat desertification, restore degraded land and soils, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world."

2. Objectives of this publication

This document discusses the implications for Brazil of the target of achieving land degradation neutrality by 2030.

The text seeks to answer the following seven questions:

a) What is Land Degradation Neutrality- LDN?

b) Are there degraded lands in Brazil?

c) Is it possible to expand agricultural production based on the recovery of degraded areas?

d) Does Brazil have expertise and technologies to recover and use degraded lands?

e) Are there, in Brazil, policies, programs and experiences regarding the recovery of degraded or desertified areas?

f) What are the advantages and disadvantages for Brazil in relation to the recovery of degraded areas?

g) Can Brazil meet the goal of seeking a land degradation neutral world by 2030?

3. What is Land Degradation Neutrality (LDN)?

For the experts who discussed the topic in the context of this work:

> "Land degradation is understood as the reduction of soil capacity to generate assets and services, in qualitative and quantitative terms, due to the decline of its productive potential and of its environmental regulation capacity" (LAL, 2001, quoted by DONAGEMMA, 2015)[1].

For National Action Program to Combat Desertification [Programa de Ação Nacional de Combate à Desertificação (PAN-Brasil)], land degradation is the loss of productivity due to factors such as soil erosion, reduction of soil fertility and loss

1 The soil has as functions: promote plant growth; receive, store and supply water, store, supply and cycle nutrients; promote gas exchange; and promote biological activity. When their physical attributes, chemical or biological are changed, there is a reduction in the performance of their duties and begins a process of degradation that can reach different degrees.

of natural vegetation, caused by human action and natural phenomena such as climate change (PAN-Brasil 2004).

The United Nations Convention to Combat Desertification (UNCCD) defines LDN as "[...] a state in which the amount of healthy and productive earth resources, necessary to support ecosystem services, remains stable or increases within specific temporal and spatial scales" (UNCCD, 2015)

This means that, in a situation of land degradation neutrality, any degradation that might occur should be, at least, compensated by recovery of already degraded or desertified land.

However, there are practical difficulties in identifying and measuring land degradation. This subject is treated in more detail in the next section.

4. Are there degraded lands in Brazil?

There is consensus among experts that there is a large quantity of degraded land or land in process of degradation or desertification in Brazil. However, there is discrepancy in regard to its quantification, especially in relation to pasture-land. If, on the one side, the land degradation concept is relatively easy to be understood, on the other side, there are difficulties to measure the phenomenon. The following paragraphs show some of these discrepancies, which vary according to the sources used and the definition of what is considered land degradation.

Information coming from the Department of Forestry of the Ministry of the Environment suggests that there are 140 million hectares of degraded land in Brazil. Of these lands, about 30 million hectares are pasture areas under some stage of degradation, with very low productivity for animal feed (IPEVS, 2012).

The Getulio Vargas Foundation (GVF), however, informs that there are 52.3 million hectares of degraded pastures. These are areas with a carrying capacity[2] that is lower or equal to 0,75 Animal Unit per Hectare (UA/ha)[3]. (FGV, 2015).

According to Moacyr Bernardino Dias-Filho, a researcher at Embrapa, who has studied the issue extensively, pasture degradation is present in all regions of Brazil. However, it tends to be higher in places where livestock is showing the highest growth rates, ie, in the areas of agricultural frontier (DIAS-FILHO, M. B., 2014).

Taking AU/ha as an indicator of the degree of degradation of pastures, it is possible to assume that around 50% of Brazilian pastures were heavily degraded, and that in regions where is the agricultural frontier (North, Northeast and Midwest) the problem would be greater. The same problem would be intermediary in the Southeast region and lowest in the South. Within the same line of reasoning, it can be inferred that another 25% of total Brazilian pastures would be moderately degraded. Thus, only about 20% to 25% of pastures in Brazil would not be degraded or only slightly degraded (DIAS-FILHO M. B., 2014).

The Cerrados, the Caatinga biome (in the Northeast semi-arid region) and the Amazon are critical areas when it comes to recovery of degraded lands (Figure 1).

2 Carrying capacity: a function of forage availability in the pasture and of its consumption by animals.

3 Unit of animal per Hectare (UA/Ha) is the measure that is used to standardize the weight of animals in a herd. It is equivalent to one animal of 450 kg in one hectare.

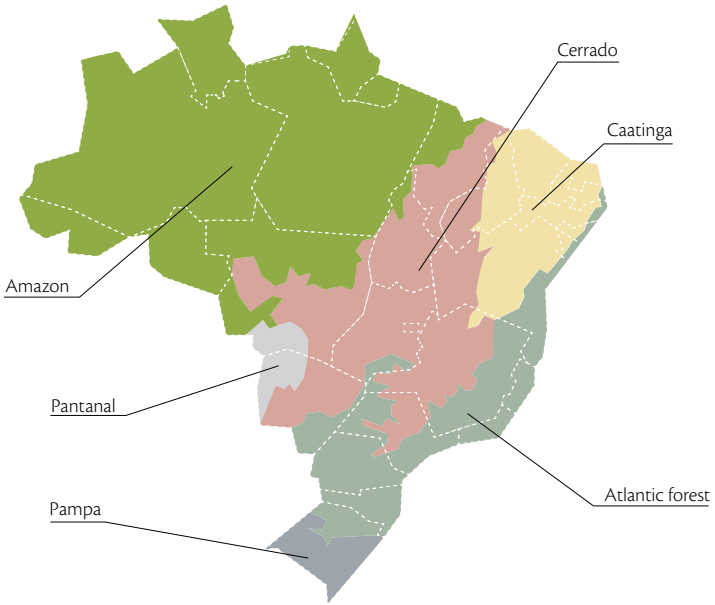

Figure 1: Brazilian biomes

Source: Ministry of Environment (MMA).

4.1 The Cerrados

The Cerrado biome, which is located mainly in the Midwest region, but also in parts of North and Northeast, is home to the most dynamic area of the Brazilian production of food and raw materials, such as soybean, corn, animal proteins and cotton.

In the Cerrado área, there are one-third of Brazil's biodiversity and about 5% of the world's flora and fauna. This region is considered the most biologically diverse savanna in the world (SANTOS, BARBIERI, CARVALHO & MACHADO, 2010). It is estimated that there are 11,046 species of plants, 212 of mammals, 837 of birds,

1,200 of fish, 184 of reptiles and 113 of amphibians. Regarding insects, it is estimated that there are about 90,000 species.

In the Cerrados are located the headwaters of some of the main Brazilian river basins. Thus, the Cerrados are important for supplying water to several regions of the country.

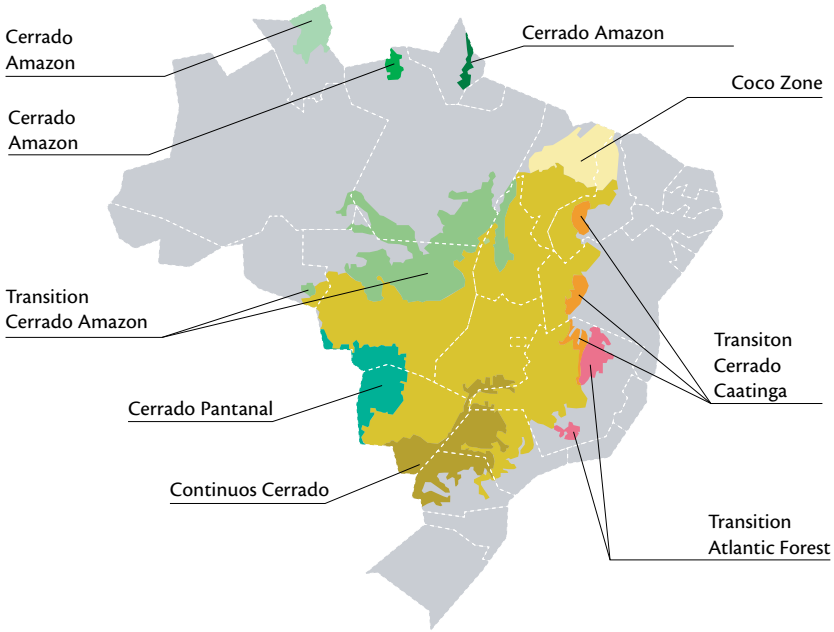

Figure 2: The Cerrados area and transitions

In the Cerrado areas, many of the 53 million hectares of cultivated pastures have some degree of degradation. The degradation of pastures is an evolutionary process of losing vigor, productivity and capacity of natural recovery. This process makes the grasslands susceptible to the harmful effects of pests, diseases and invasive plants (MACEDO et al., 1993).

According to assessments made by Andrade et al. (2015), using satellite imagery Spot Vegetation, It was observed that 12.5 million hectares (24%) of planted pastures in the Cerrados show some indication of degradation. Considering also as degraded pastures with mild elevation of the vegetation index only after rains, the area of planted pasture with indicatives of degradation goes up to about 18.4 million hectares (35%). The states of Mato Grosso, Minas Gerais, Mato Grosso do Sul and Goiás stand out with about 80% of the planted pasture areas with some indication of degradation in the Cerrado biome.

The opening of new areas for agricultural production without conservation practices and the accelerated loss of biodiversity and of native areas of the Cerrado have been identified as critical to agricultural research (EMBRAPA CERRADOS, 2007). One strategy that has been sought for reduction of degradation in cultivated pasture in the Cerrados is to increase carbon (C) in the soil (SANO, 2015).

4.2 The Caatinga biome and the Semi-arid

The Caatinga biome is typical of the Brazilian semi-arid, which is located mainly in the Northeast region (Figure 3). This biome is characterized by xerophilous formations, woody, deciduous and thorny with about 1,500 plant species, and great climatic variation with large areas susceptible to desertification.

The Semi-Arid plays an important role in food production, especially in family farms. The region presents a water deficit, is subject to periodic droughts and already has the presence of land at an advanced stage of degradation and desertification (CGEE, 2016).

The extension considered as area susceptible to desertification (ASD) in the Northeast covers 1,323,975.4 km² and comprises parts of the states of Alagoas, Bahia, Espírito Santo, Maranhão, Minas Gerais, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe and all the state of Ceara. Much of the ASD is in

various stages of degradation, and 70,522.75 km2, or 7.05 million ha, are in advanced stage of degradation and desertification (SA, 2015; CGEE, 2016).

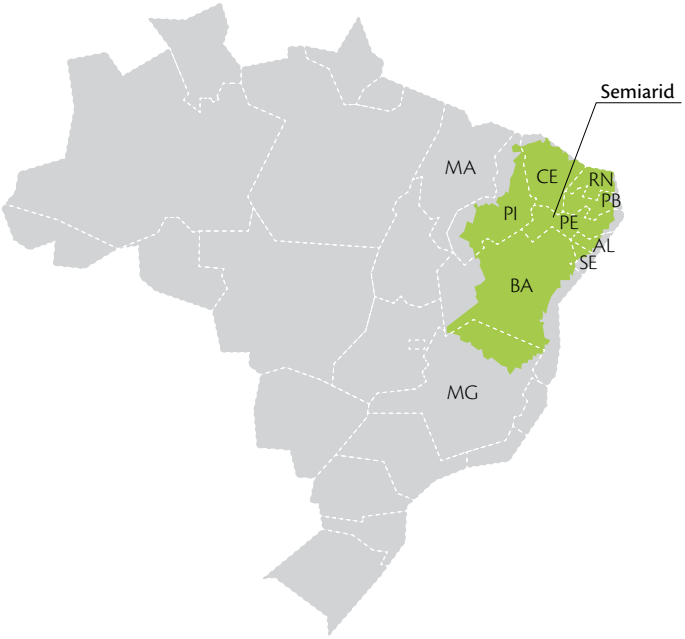

Figure 3: Brazilian Semi-Arid

Source: New Definition of the Semi-arid, MI, 2003.

Generally, areas affected by land degradation and desertification in the Northeast, to varying degrees, can be recovered with proper soil management, water and vegetation cover (PEREZ-MARIN & MEDEIROS, 2015).

4.3 The Amazon

The Amazon covers all states of the Brazilian North (Acre, Rondônia, Amazonas, Roraima, Amapá and Pará), as well as virtually all of Mato Grosso and western

Maranhão (Figure 4), an area of approximately 5.1 million square kilometers (about 60% of the country's territory).

The relief of the region is, in general, of low altitude, due to the river plains of the Amazon and Araguaia rivers and depressions. In the east, beyond the Araguaia depression, are the highlands and plateaus of the Parnaíba Basin.

The hydrography is the most striking feature of the region, which has the largest river basin in the world, covering more than 7 million km2 (4 million only in Brazil). This vast network depends on two factors: the Amazon forest (and its evapotranspiration) and the equatorial climate with rainfall on almost every day of the year.

The vegetation is diverse and strongly influenced by the equatorial climate and hydrography, which together led to the formation of the Amazon rainforest.

The Amazon region contributes to Brazilian food production, and in it the natural regeneration of pastures is a strong component in the recovery of degraded areas.

Figure 4: Brazilian Amazon region

Deforested areas in the Amazon (Figure 5) reach 68 million hectares, ie 680 thousand km². Of these areas, 25% are abandoned or underutilized, often in a state of degradation, with great possibility of recovery for agricultural use, especially with perennial crops.

According to Embrapa, to meet the demand of agribusiness development all that is needed it to recover some of these areas (EMBRAPA AMAZONIA OCIDENTAL, 2005).

An assessment of the evolution of pasture areas in the Amazon, between 1975 and 2006, shows that there has been sharp slowdown in recent decades. Such behavior suggests substantial increase in pasture productivity and trend of increasing reuse of cleared areas, through the recovery of degraded pastures.

Indeed, in the decade 1975-1985 the herd grew 150%, according to IBGE data, while

areas of planted pasture increased 480%. In the decade 1996-2006, this trend is reversed at the same rate: the herd grew 128%, while planted pastures areas grew only 40%.

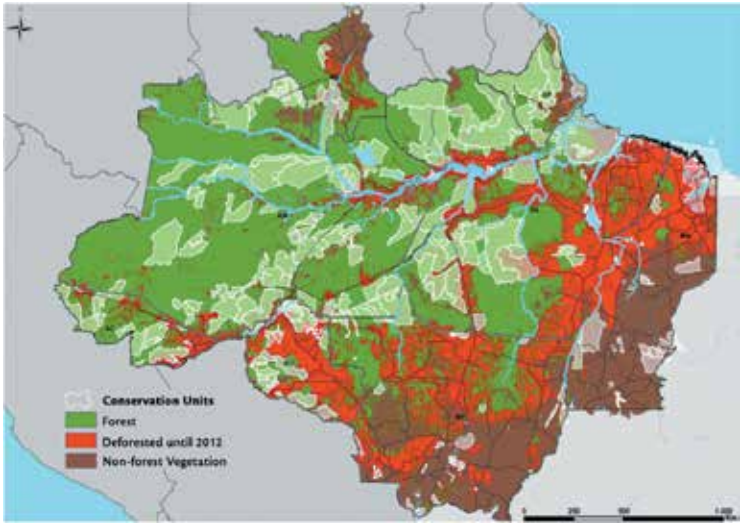

Figure 5: Map of the Amazon region showing deforested areas by 2012.

Source: National Institute for Space Research-INPE, Forest Satellite Monitoring-Prodes, 2012.

A particularly important factor for increasing livestock productivity in recent decades has been the increasing substitution of rangeland by planted pastures. By the late 1960s, the creation of cattle was predominantly concentrated in natural pastures of low productivity, like those found in the archipelago of Marajó, with average annual carrying capacity of around two ha per animal (DIAS-FILHO, 2011).

In case of grassland productivity (in terms of carrying capacity) had been maintained at the level of the 1970s, itsr area would have to be substantially larger to accommodate the current herd. According to Valentine and Andrade (2009), such productivity gains, between 1975 and 2006, prevented the incorporation of 147.5 million hectares of the Amazon and Cerrados for the formation of new pastures. This trend has been confirmed by the decrease in deforestation rates in the Amazon (DIAS-FILHO M. B., 2014).

5. Is it possible to expand agricultural production based on the recovery of degraded areas?

The general conclusion reached by the experts that participated in the event on Neutral Land degradation is that Brazil can expand its agricultural production, to meet the needs of the domestic market and for export, without the need to open up new areas. The wide availability of today's degraded or in degradation process areas is an important asset for the country, so any expansion needed in the primary activities, related to agriculture and livestock, can be met with the adoption of technologies already available, which allow for the recovery of these areas and their reincorporation to the productive process.

The reasons for this conclusion are set out in the following items.

6. Does Brazil have knowledge and technology to recover degraded lands?

Brazil has expertise and technologies on recovering of degraded lands that can be applied, both for agricultural and livestock production and for ecosystem restoration. These knowledge and technologies are available in research and development institutions, such as Embrapa and universities, and are already used on a large scale. They include, among other things:

- Platforms of sustainable practices, as, for example, production systems integration-Crop-Livestock (ICL) and Integration-Crop-Livestock-Forest (ICLF). ICL and ICLF production systems are recovering and incorporating

degraded pastures in a sustainable intensification of production process. These production systems, along with Direct Planting (DP), are considered as part of the new agricultural revolution and will allow the incorporation of millions of hectares of degraded areas in the production process, with zero deforestation. Brazil is becoming a global player in the use and improvement of these sets of technology and knowledge;

- New forms of land management, for example, the Direct Planting, have strongly affected Brazilian agriculture for the transformation of production from the traditional way of soil preparation, with plowing and harrowing, for systems where planting is done directly, with minimal disturbance, preventing erosion and soil degradation;

- New tools to facilitate interaction with the soil, for example, the development of a robot, by Embrapa, which raises the level of detail of information for precision agriculture and the establishment of soil quality bio-indicators and benchmarks for each of these indicators. Using biological indicators of soil quality in areas that are in tillage (direct planting) and in systems of livestock farming integration, it was observed that these systems favor the quality of tropical soils, reversing the environmental liabilities (MENDES, I, 2015);

- Methodologies that use images from sensors aboard orbiting platforms to characterize the vegetation, soil and relief (essential information for land management). These methodologies allow the application of large scale remote sensing techniques for aiding, dynamically, in the diagnosis of, and acquirement of the status of vegetation cover of pastures (NOGUEIRA, 2015).

There are also new approaches to communication between academia, the productive sector and boards (public and private sector). These new approaches facilitate dialogue and the exchange of information, provide environment conducive to the emergence of new ideas and contribute to the improvement of sector policies and of the legal apparatus.

In all regions and biomes there are examples of knowledge and technologies that

strengthen tropicalization of the sustainable intensification of production, toward a neutral world in land degradation.

In the case of the Cerrados, for example, which is important breadbasket of the Brazilian agricultural production, it is observed that agricultural production systems are evolving to sustainable production, especially with the large-scale adoption of the new technologies referred to above, as Direct Planting, Integration Crop-Livestock and Integration Crop, Livestock and Forest.

7. Are there, in Brazil, policies, programs and experiences of the recovery of degraded or desertified areas?

Brazil has several successful initiatives of sustainable land use and of recovery of degraded areas (TCU 2015). With respect to sustainable land use, stand out the ecological-economic zoning (ZEE), the agro-ecological zoning (ZAE), both coordinated by the Ministry of Environment, and zoning of climate risk (ZARC), coordinated by the Ministry of Agriculture. Other initiatives are the land planning, certification and registration of rural properties and rural environmental cadaster, coordinated by the Ministries of Agriculture and of Environment, respectively.

As for sustainability, there are initiatives such as the ABC Plan (Low Carbon Agriculture)[4] and the Water Producer Program, among others. The ABC Plan, for example, aims to recover 15 million hectares of degraded areas.

4 The ABC Plan – Sector Plan for Mitigation and Adaptation to Climate Change for the Consolidation of a Low Carbon Emission Agriculture, also called Low Carbon Agriculture Plan, is coordinated by the Civil House of the Presidency of the Republic, the Ministry of Agriculture and the Ministry of Agrarian Development (Source: <http://www.agricultura.gov.br/arq_editor/download.pdf>, access on September 15, 2015)

Another important action is the GeoABC Project[5], which includes methodologies and technological innovations for monitoring and planning of a low carbon agriculture in Support of the ABC Governance Plan, which subsidizes initiatives on the sustainability of water and soil. At the local scale, the project assesses innovative methods and techniques in the area of remote sensing and integration of spatial data for the detection of cultivation practices and farming systems aligned with low carbon emission policies. At the subregional in scale, the project develops integrated methods to monitor the evolution and transformation of landscapes due to the adoption of sustainable systems (SIMÕES et al, 2015).

There are also regional initiatives and programs, at the state and municipal levels, which help recover degraded or desertified areas. Some examples are:

- The Ecological - Economic Zoning (ZEE) of thE Area of Influence of the Highway BR – 163 (Cuiabá- Santarém), in the Amazon Region:
- The Standardization of Ecological - Economic Zoning of the Legal Amazon (UZEE) and its Integration with the Agro-ecological Zoning (ZAE) of the Region:
- The development of geotechnologies for the identification and monitoring of degradation levels in pastures (GeoDegrade Project)[6];
- The Hydroenvironmental Development Project (Prodham)–developed by the Secretariat of Water Resources of Ceará (SRH) and the Foundation of Meteorology and Water Resources of Ceará (FUNCEME);
- The Project for Recovery of Degraded Areas and Areas on Desertification

5 Coordinated by Embrapa Soils, the GeoABC Project gathers brazilian and french scientists in order to assess how satellite images can be used in the monitoring of production systems involved in the ABC Plan. Source: https://www.embrapa.br/busca-de-noticias/-/noticia/6809145/projeto-vai-subsidiar-o--plano-abc, access on September 15, 2015.

6 The GeoDegrade Project aims to develop tools based on geo-spatial technologies that, through mapping and technical development, allow for the identification of areas with degraded pastures and hence areas with a potential for production increase. The project team is coordinated by Embrapa Monitoring by Satellite and includes experts from several areas and institutions. Source: http://www.geodegrade.cnpm.embrapa.br/apresentacao, access on September 15, 2015.

Process in the Hydrographic Sub-Basin do Riacho Brum in the city Jaguaribe – CE (Project BRUM) also developed by SRH and FUNCEME; and

- The Caatinga protected areas program (UCCA) developed by the Environmental Municipal Agency of the municipality of Petrolina (PE).

Also worth quoting is the PAN-Brasil, which includes actions to reclaim desertified areas and prevent further desertification in Brazil.

8. What are the advantages and disadvantages for Brazil in relation to the recovery of degraded areas?

Considering the large size of Brazil´s territory, it is an enormous challenge for the country to achieve what determines target 15.3, which is, "until 2030, combat desertification and restore degraded lands and soils, including areas affected by desertification, drought and floods, and implement efforts to achieve a neutral world in terms of land degradation".

However, given the importance of our ecosystems and Brazil's role in the world food and raw materials production, this is a necessary goal for the country.

Brazil has a set of technologies and knowledge, as well as initiatives and programs, as seen previously, that can provide the basis for a plan for the management of Brazilian lands. Another promising set of technologies and expertise is being developed by universities and research Institutions. There is a flow of training of technicians and specialists who can meet the likely increase in demand in this area.

Many of these Brazilian initiatives contribute positively to the achievement of the target 15.3 of the New Agenda for Sustainable Development after 2015. The ABC

Plan, for example, as shown above, has seven programs and they all contribute to the recovery of degraded lands or to sustainable land use. They are:

a) Recovery of Degraded Pastures (15 million hectares);
b) Integration Crop-Livestock-Forest (ICLF)) and Agroforestry Systems (AFS);
c) Direct Planting (No-Till) Systems (DPS);
d) Biological Nitrogen Fixation (BNF);
e) Planted Forests;
f) Treatment of Animal Waste;
g) Mitigation and Adaptation to Climate Change.

Other initiatives for the recovery of degraded areas have shown positive results. For example, the recovery of lands in the Amazon region, where data of the Project Mapping the Use and Land Cover of Deforested Areas in the Legal Amazon (TerraClass) show that in the period between 2008 and 2012, the regeneration of areas (secondary vegetation = 113 000 km2) has grown and is 2.5 times greater than what was deforested (44,000 km2) in the same period (VENTURIERI, 2015).

Noteworthy is the implementation of Direct Planting (No-Till) production system in areas such as the Cerrado biome, where the adoption of sustainable management practices has helped to prevent soil degradation and to restore degraded areas.

In the dry semi-arid Northeast, several initiatives have helped to recover degraded areas and reverse the degradation of land with the implementation of conservation practices appropriate to physical, environmental and socioeconomic local conditons. One example is the Technique of the Inoculum that seeks to restore the biological life through re-inoculation of microorganisms and seeds (MARTINS, 2015).

The benefits which should result, for Brazil, of the adoption of the target 15.3, to achieve a neutral land degradation world, are evident and strategic, especially in regard to:

- Promoting the sustainable use of terrestrial ecosystems;
- The positive impact of the image of Brazil as a producer of food;
- The opportunity to strengthen the generation of employment and income in a sustainable production matrix;
- The emission reduction of greenhouse gases;
- The role that Brazil has as a partner in South-South cooperation.

Among the challenges, there is a need to standardize the information, considering the diversity of biomes and taking into account the extent of land degradation in each place.

9. Can Brazil meet the goal of seeking a neutral world in land degradation by 2030?

For the experts who participated in the preparation of this work, the answer is yes: Brazil can meet that goal well before the year 2030. The country has a significant amount of degraded areas that, if they were recovered and incorporated into the production system, would waive the clearing of new land to support increased agricultural and livestock production.

Over the past 50 years, the changes in the framework of support for Brazilian agricultural production led to an increase in production and export of food, placing the country as a key actor for the nutritional security of the population (CGEE, 2014). Brazil can expand agricultural production without incorporating new areas into the production system, using areas that are in the process of degradation, and based on existing knowledge and technologies that enable a sustainable intensification of production.

Throughout these years, Brazil has developed an advanced tropical agriculture grounded on science. The country has created an extensive research and education system for agriculture, which includes specialists and a useful intellectual capital. It has also improved the private sector, which has innovative entrepreneurs, motivated networks of technology sources and of technical assistance, and various types of active associations and collective decision making bodies.

There are also today in Brazil a long list of successful experiences of programs and projects, large and small, that demonstrate the feasibility of degraded land restoration.

The country can, without much effort, consolidate a system for the management of soil and water and for sustainability of agricultural production, based on the recovery of degraded areas. With that it can meet the commitments stemming from the goal 15.3 of the New Agenda for Sustainable Development and, above all, it can benefit in terms of greater sustainability of its development.

In order to accomplish the target, the country needs to consolidate its policy on land use sustainability, including soil, water and biodiversity resources. This will require legal and programmatic improvements, such as in the case of the agricultural and the water resources policy (CGEE/FGV SP, 2014), taking into account existing assessments such as the Operational Audit Report on Soil Governance in Urban Areas (TCU, 2015).

Brazil can take a proactive stance in meeting target 15.3, having as a pillar its privileged position in terms of knowledge and technology to recover degraded tropical and subtropical lands. With this, the country reaffirms its leading role on the international stage (CGEE/FGV SP, 2014), both in promoting and certifying the quality of its food production (CGEE, 2014), and in the transfer of knowledge and technologies on land degradation recovery in the context of South - South Cooperation.

Thus, for Brazil, the expected benefits of achieving land degradation neutrality are evident and strategic. This will result in the promotion of sustainable use of terrestrial ecosystems, in the positive impact to the image of Brazil as a producer of food and in the opportunity to strengthen the generation of employment and income in a sustainable production matrix.

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