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About this project

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DEEP DECARBONIZATION OF THE AGRICULTURE, FORESTRY AND LAND-USE SECTOR (AFOLU) IN BRAZIL

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SUMMARY

Brazil is a forest country with nearly 500 million hectares (Mha) of forests (about 50% are Protected Areas). Agricultural lands comprise about 263 Mha, including temporary and permanent crops, forest plantations, and pastureland (Maps Bioma, 2021). Agriculture is an essential driver of Brazilian economic growth. Production has grown rapidly over the past decades, driven by rising global demand and technological advances. Changes in crop management practices and expansion in the harvested area have enabled Brazil to become a leading exporter of agricultural products.

Brazil is the world's fourth-largest grain producer and the second-largest grain exporter globally, with 19% of the international market. In the last

20 years, exports reached more than 1.1 billion tons, representing 12.6% of worldwide exports. Soybeans, corn, cotton, and meat are the most dynamic products due to the growing foreign demand. The perspective is that they should continue in the coming years (Embrapa, 2021).

The AFOLU sector represented the main source of emissions in 2019, with about 61% of national net emissions (899MtCO$_2$eq, energy use emissions included), accounting for 574 MtCO$_2$eq of carbon removals (**Figure 1**). The annual deforestation (Land use change) is responsible for most current emissions, while current protected areas and forests play a crucial emission absorption role (removals).

The study simulates two economy-wide GHG emission scenarios for Brazil up to 2050: the current policies scenario (CPS) and the deep decarbonization scenario (DDS) (See the paper "Deep decarbonisation in Brazil"). CPS follows the trend in the AFOLU sector without additional efforts to reduce the deforestation rate. The annual deforestation rate will increase until 2023, and a slight reduction of 10% between 2023- and 2025 is expected. After 2025 it will remain at the same level until 2050. An expansion of protected areas (Conservation Units and Indigenous Lands) is not expected by 2050. Sustainable practices in land management will increase but below the levels seen in recent years.

DDS introduces significant changes in the annual deforestation rate, achieving zero illegal deforestation in the Amazon by 2050, increasing protected areas, and restoring native forests (public and private areas). The adoption of sustainable practices in land management and intensification of livestock systems are expected what will keep livestock and agriculture emissions around the same order of magnitude overtime, allowing deforestation and land use emissions to go down sharply while carbon removals almost double.

FOCUS ON DEFORESTATION AND REMOVALS

The AFOLU sector will provide substantial negative emissions by 2050. The reduction of the annual deforestation rate is the main driver to reduce total Brazilian GHG emissions. Effective compliance with environmental laws and strengthening command and control strategies (surveillance, fines, embargo of areas, seizure of assets and equipment) are essential policies for combating deforestation in Brazil and proved effective ten years ago. Establishing a traceability system over agricultural chains associated with deforestation, such as the soybean and beef chain, will also contribute to curbing deforestation. Expanding protected areas that are important carbon sinks is a crucial mitigation action.

Figure 1. GHG Emissions

| | 2019 | CPS 2050 | DDS 2050 |
| 1479 MtCO$_2$eq | 1889 MtCO$_2$eq | 17 MtCO$_2$eq |

- Power generation
- Cement production
- Livestock
- Rest of the economy
- Agriculture
- Land use change (deforestation)
- AFOLU carbon removals

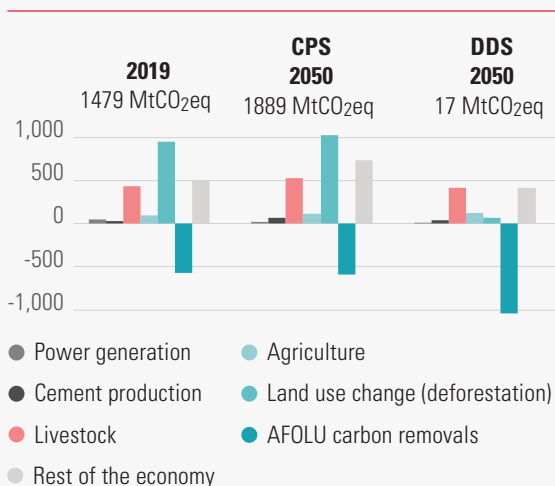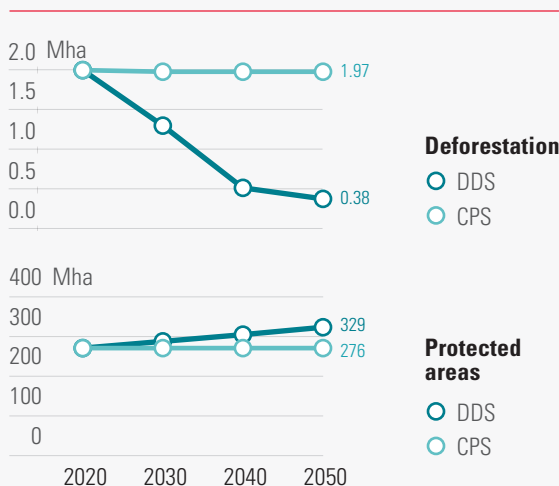**Figure 2.** Deforestation and protected areas

Deforestation
- DDS
- CPS

Protected areas
- DDS
- CPS

The restoration of native forests, the expansion of forest plantation and agroforestry, and the recovery of pastureland are also important carbon sinks along with no-tillage systems in cropping. In addition, the expansion of nitrogen biological fixation replacing the use of synthetic fertilizers is also a relevant mitigation measure.

FOCUS ON LIVESTOCK

The cattle herd is the main animal production category in Brazil. About 97% of the cattle herd is managed in extensive systems (natural pasture), and the trend is that this mode of production remains predominant. Studies show that there is a huge area of degraded pastures in Brazil. Taking the stocking rate (in adult animal units - UA / ha) as an indicator for the degree of pasture degradation, it is estimated that about 50% of Brazilian pastures are heavily degraded, and mainly in the regions (North, Northeast, and Midwest) where the agricultural frontier is threatening the natural vegetation coverage. The same problem occurs in the Southeast region, but moderately, and in the South, at a lower level.

Livestock is an important emission source in Brazil. Its share is currently 28% of the country's net emissions and is estimated at 433 Mt CO_2eq in 2019. In CPS, it grows 22% reaching 529 Mt CO_2eq in 2050. In DDS, emissions are slightly lower than in 2019, getting to 413 Mt CO_2eq, a decrease of 4%. Lower emissions do not jeopardise meat production. On the contrary, emissions reduction is driven by productivity gains.

In the CPS, livestock productivity gains are expected to increase through restoring up to 30 million hectares of degraded pastures by 2050. This mitigation action is part of the government's commitments to the UNFCCC (NAMAs and NDC) adopted in 2010, aiming to reduce emissions in the agricultural sector. The recovered pastureland area was 10.5 Mha between 2010 and 2018. By 2050, the restored pasture is expected to more than double. In addition, there would be a 12% increase in the carcass weight by 2050 compared to 2019. Higher exports and an expansion in the domestic demand for meat support the projected growth of beef production in CPS, reaching 18.5 million tons of CWE (carcass weight equivalent) by 2050.

Integrated crop-livestock-forest systems (ICLF) is an agricultural production strategy that integrates different production systems — crops, livestock, and forestry within the same area. It can be implemented using mixed, rotating, or succession crops so that there is an interaction between each component, thus generating mutual benefits, such as: optimization and intensification of soil nutrient cycling; biodiversity conservation and sustainable agriculture; increased production of grains, meat, milk, timber, and non-timber, GHG emission reductions, etc. The goal set by the Low-Carbon
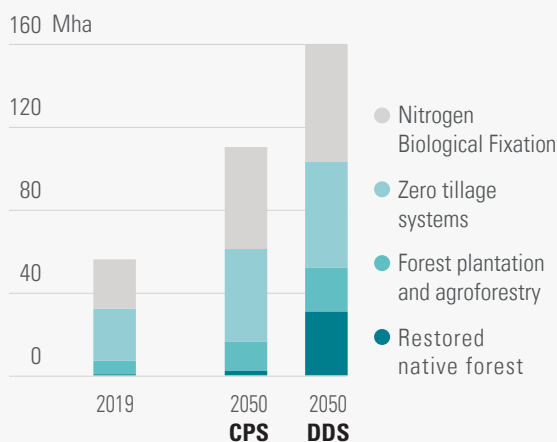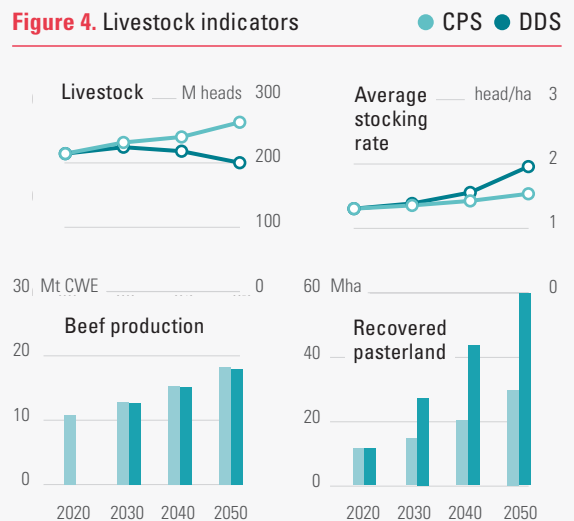

Figure 3. Carbon sinks

Figure 4. Livestock indicators   ● CPS ● DDS

Agriculture Plan (ABC Plan) in 2009 was to increase the land area using ICLF in Brazil by four million hectares by 2020. The ratification of the Paris Agreement by the Brazilian government in 2016 added another five million hectares of farmland using ICLF systems to the goal set by the ABC Plan, totaling nine million hectares by 2030. Data shows an increase of 10 Mha in the area under integrated systems in the period 2010-2018, reaching 15 Mha, with 17% hosting the tree component of the system. In the CPS, the trend is to expand the area with integrated systems by 2050. However, this is expected to occur at a lower growth rate than in the last 10 years, reaching 25 Mha by 2050.

In the DDS, livestock productivity gains are expected to increase through restoring 60 Mha (million hectares) of degraded pastures, herd genetic improvement, and slaughter age reduction (from a current average of 37 to 27 months by 2050). By 2050, there would also be an increase of 30% in the carcass weight, compared to the CPS, which enables to reduce the

size of the livestock and still produce about 18.3 million tons of CWE. An increase in the area under Integrated crop-livestock-forest systems (ICLF) in the DDS is expected to occur at a slightly higher growth rate than the CPS, reaching 30 Mha by 2050. Higher exports and an expansion in the domestic demand for meat explain this projection of beef production. The determinants of demand for agricultural products by 2050 are the global population and the growth of Brazilian income. The agricultural sector is considered capable of meeting the world's growing demand for food and inputs, given the favorable conditions concerning climate, land availability, and technology. It is worth mentioning that significant yield increases are projected for the main agricultural activities, including livestock. As a result, agricultural production grows while the agricultural area expands moderately in 2020-2050. Experience within Brazil shows that agriculture productivity can continue to grow without depleting natural capital or increasing GHG emissions.

OPPORTUNITIES TO DECARBONIZE THE MEAT INDUSTRY

- Adoption of cattle origin monitoring systems to ensure compliance with environmental regulations.

- Proposition of new arrangements to encourage traceability throughout the production chain.

- Vertical integration of chains (producers, slaughterhouses, and retailers).

- Creation of new sectorial commitments and increased adherence to the meat TAC (Conduct Adjustment Terms).

- Greater transparency in the data necessary for the control of the production chain by government agencies, such as improvements in the

CAR (Rural Environmental Registry[1]) validation process and GTA (Animal Transit Guide) inspection.

- Engagement: inclusion of all primary and secondary suppliers along the chain.

- Increased pressure from consumers and importers.

- Development of technology for better management of production systems at the farm gate, post-farmgate and at all stages until meat consumption.

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[1]   Georeferenced record of environmental information on farms established by law (2012 Forest Code).