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Potential for Crop Expansion in Brazil Based on Pastureland and Double-Cropping

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The role of land in increasing food production has accounted for over 50% of the increase in crop output in South America since the 2000s (see *farmdoc daily*, [March 6, 2024](#)), with Brazil standing out as a big player. Most of this growth has occurred as a result of the conversion of pastureland, particularly in the Brazilian savanna, the Cerrado. Consequently, Brazil has emerged as a global leader in producing commodity crops, with the potential for further expansion into new areas. But what is the real expansion potential, considering environmental restrictions, logistical challenges and climate?

This article analyzes a recent study published by the Brazilian Agricultural Research Corporation, the Embrapa (see the note), suggesting that Brazil could convert an additional 70 million acres of pastureland to crop production – without deforestation. This number represents a 35% increase in the current production area. Furthermore, we explore the potential for intensifying land use for second-crop corn in Brazil, looking at differences by region and the impact of the growth of corn-ethanol processing plants in the Center-West region.

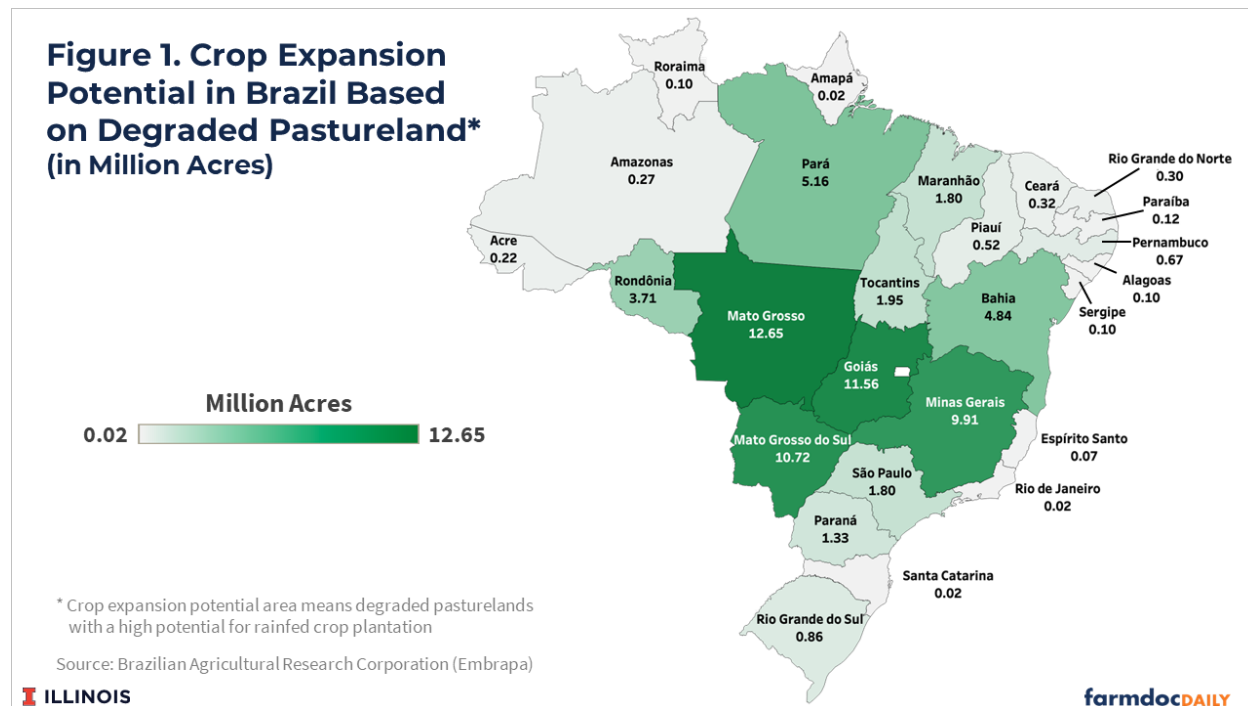
Conversion of Degraded Pasturelands

Based on geospatial databases, a recent study led by Embrapa indicates approximately 70 million acres of planted pastures in Brazil with intermediate and severe levels of degradation that have the potential for conversion into cropland (Bolfe *et al.*, 2024). Pasture degradation does not reflect the productivity of the land but relates to the grasses. Pasture degradation is caused by overgrazing, insufficient weed and pest control, and lack of soil fertilization (Feltran-Barbieri and Féres, 2021) and occurs in practically all regions of Brazil. A conversion of 70 million acres of degraded pasture to cropland would represent nearly a 35%

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increase in Brazil's total planted area compared with the 2023/2024 crop season projection by the National Supply Company (Conab) – Brazil's agency for food supply and statistics.

Embrapa mapped approximately 26 million acres of pastureland with severe degradation and 43 million acres with intermediate degradation with either good or very good potential for conversion to agriculture. At the state level, the largest quantities of degraded pastureland with potential for conversion are in the states of Mato Grosso (+12.65 million acres), Goiás (+11.56 million acres), Mato Grosso do Sul (+10.72 million acres), Minas Gerais (+9.91 million acres), Pará (+5.16 million acres), and Bahia (+4.84 million acres) (see Figure 1). Those states, and in particular Mato Grosso, are where large increases in cropland have already occurred.



In Brazil, degraded pastures have been seen as potential areas for cropland expansion because of the relatively high costs of fertilizers compared with the average price of cattle beef in the domestic market (Bragança *et al.*, 2022). This makes conversion to cropland a more attractive alternative than recovery of the pasture for livestock grazing. In other words, rather than improve the pasture, it is often more profitable to convert it into cropland. Over the last two decades, from 2000 to 2021, Brazil recovered 52 million acres of degraded pastures, according to data from the Federal University of Goiás.

It is important to note that Embrapa's analysis of the potential for agricultural expansion excluded areas that are deemed exceptional, such as indigenous lands, conservation units, rural settlements, and Afro-Brazilian settlements, as well as Legal Reserves – private areas protected by federal legislation. This law requires landowners to maintain a fixed amount of area as native vegetation within their properties to preserve biodiversity. The proportions of land required to be held as Legal Reserves vary by regional biome: 80% in the Amazon, 35% in transition zones between the Amazon and Cerrado, and 20% in the Cerrado, Atlantic Forest, Caatinga, Pantanal and Pampa biomes. The potential for conversion of 70 million acres of degraded pasture to cropland would continue to include these Legal Reserves in natural vegetation.

In Mato Grosso, Brazil's largest agricultural state, the planted area could increase 25% compared to the 2023/2024 season by converting degraded pastureland into cropland. Currently, soybeans and corn occupy more than 90% of the crop-planted area in Mato Grosso in the double-cropping system (see more in the next section). Additionally, in the Center-West states, the potential for agricultural expansion is notably higher in Mato Grosso do Sul and Goiás, reaching 69% and 67%, respectively, compared to the acreage in the current crop season.

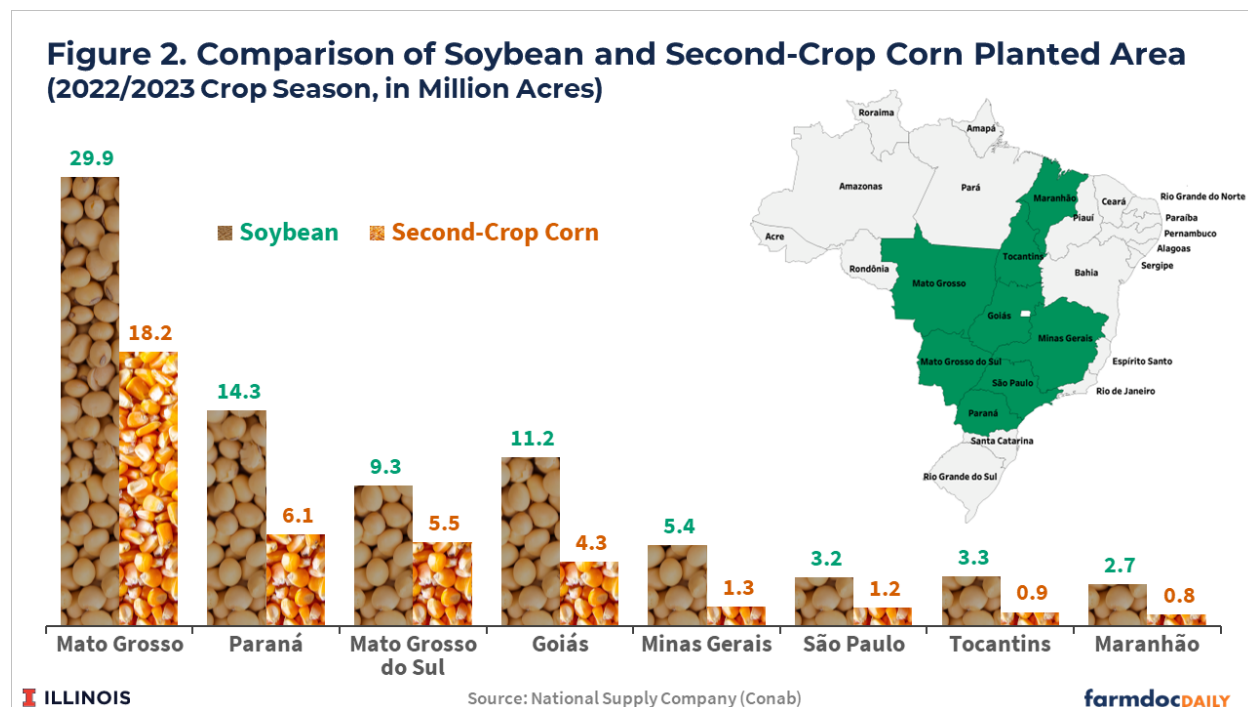
Moreover, the state of Bahia, located in the Northeast region, can potentially increase its agricultural areas by 52% by converting degraded pasturelands. In the Northern states, Pará stands out with the highest amount of degraded pastureland suitable for conversion into cropland. Pará could see as much as 130% growth compared to the 2023/2024 crop season. The expansion of crop production into Brazil's northern states is primarily driven by the relatively lower land costs compared to the Center-West and South regions, along with numerous favorable qualities for modern agriculture (see *farmdoc daily*, July 12, 2021).

In addition to showing the potential for converting pastures to agriculture, Embrapa's study integrated data on existing rural infrastructure, including the availability of warehouses and proximity to state and federal highways. The analyses reveal that 54% of pasture areas are within a 12-mile radius of warehouses, while 89% have access to highways within the same distance. Furthermore, Embrapa's study incorporated data from the Agricultural Climate Risk Zoning program, a risk management tool that provides planting guidance and soil-specific information for more than 40 crops in Brazil.

Intensified Land Use for Second-Crop Corn

Brazil can further expand its currently cultivated area by intensifying land use for second-crop corn (known as safrinha), which is planted immediately after the soybean harvest in January-February each year. In the 2022/2023 crop season, approximately 40% of the soybean area in Brazil was dedicated to cultivating second-crop corn, according to Conab. The tropical climate prevalent in the Center-West states allows for planting soybeans in the spring, followed by corn in the fall, within the same area. However, that planting schedule is not viable in the extreme southern regions of Brazil because of lower temperatures during the winter months.

When focusing on the eight states that account for nearly all of the safrinha planted areas in Brazil, approximately 50% of the soybean area was dedicated to cultivating second-crop corn (see Figure 2). This indicates a substantial potential for the corn-planted area to double in Brazil, with an additional 40 million acres, depending on regional climate differences, soil characteristics, livestock production, and domestic and international market dynamics. Just in Mato Grosso, Brazil's largest corn and soybean producing area, the area occupied by second-crop corn could increase by an additional 11 million acres based on the total acreage occupied by soybeans in the first season (see Figure 2).



The state of Goiás, in the Center-West region, also has a high potential to intensify corn production as a second crop depending on market conditions, such as prices and cost of production. In the 2022/2023

crop season, 38% of the soybean areas were dedicated to cultivating second-crop corn in Goiás. In Mato Grosso do Sul, also in the Center-West region, almost 60% of the soybean areas were planted to second-crop corn. Areas not planted to second-crop corn are typically used as pasture for cattle.

The safrinha planted area could triple in the northern states of Maranhão and Tocantins (see Figure 2). Those states are part of the Matopiba region, considered the new agricultural frontier in Brazil. Matopiba is formed by the Brazilian state of Tocantins and parts of Maranhão, Piauí, and Bahia (see *farmdoc daily*, [July 12, 2021](#)). Usually, investors buy cheaper degraded pastureland in Matopiba to improve it and then convert it to grain crops. The terrain there is flat, with productive soil, a favorable climate, and plenty of water for irrigation. However, the biggest challenge is logistical, which in part is being attenuated with the development of ports in the north.

The intensified land use for second-crop corn has also been pushed by the dramatic increase in the growth of ethanol processing plants in Brazil's Center-West. In contrast to the United States where most ethanol is corn-based, most Brazilian ethanol is made from sugarcane. Over the last decade, corn ethanol plants have been built throughout the Brazilian states of Mato Grosso, Mato Grosso do Sul, and Goiás – where the volume of the second crop of corn has also grown rapidly. In the 2023/24 season, corn ethanol is expected to account for almost 20% of all ethanol consumed in Brazil (see *farmdoc daily*, [June 30, 2023](#)). Brazilian consumption of ethanol is supported by the country's carbon credits program, called *RenovaBio*, created in 2016 to support Brazil's 21st Conference of the Parties (COP21) goals.

Less than half of soybean acreage in Paraná, a state in southern Brazil, is planted to second-crop corn due to climatic constraints limiting the potential for further expansion. In almost half of Paraná, as in the southernmost state of Rio Grande do Sul, double cropping typically happens with soybeans and wheat or another winter crop.

Final Considerations

The potential for Brazil to expand its agricultural output through converting degraded pastureland into cropland is large. With approximately 70 million acres identified as suitable for conversion, Brazil could increase its total planted area by 35% compared to the current crop season. The largest quantities of degraded pastureland with potential for conversion are found in the Center-West and Northern states. However, several factors are at play in determining the demand and viability for this increase, such as commodity prices, international market, logistics, exchange rate, etc.

Furthermore, the intensification of existing cropland through double-cropping of soybeans with second-crop corn presents another avenue for Brazil to bolster its agricultural production. With approximately 50% of the soybean area already dedicated to cultivating safrinha in the 2022/2023 crop season, there's ample room for further expansion, particularly in the states of Mato Grosso, Goiás, and Mato Grosso do Sul. These states have accounted for 99% of corn ethanol production in Brazil, a growing industry in the last decade pushed by renewable fuel policy.

Note

The Brazilian Agricultural Research Corporation (Embrapa), under the umbrella of the Brazilian Ministry of Agriculture and Livestock, is a technological innovation company focused on generating knowledge and technology for Brazilian agriculture. It was established in 1973 to develop the technological foundation for a genuinely tropical agriculture and animal farming model. The initiative has been tasked with providing Brazil with food security and a leading position in the international market. Embrapa's headquarters is located in Brasília, DF. It has 43 research units and seven administrative units around the country. It carries out technical and scientific projects with 27 countries and 62 foreign institutions.

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