Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Report Number 367

October 2026

Land Use, Conservation Policies, and Agricultural Production in Brazil and the United States

Constanza Valdes, Eric C. Davis, Scott Callahan, Kate Binzen Fuller, Trina Weilert, Sara Scott, and Jennifer Bond



Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Service
www.ers.usda.gov

Recommended citation format for this publication:

Valdes, C., Davis, E. C., Callahan, S., Fuller, K. B., Weilert, T., Scott, S., & Bond, J. (2026). *Land use, conservation policies, and agricultural production in Brazil and the United States* (Report No. ERR-367). U.S. Department of Agriculture, Economic Research Service.



Cover images from Adobe Stock.

Use of commercial and trade names does not imply approval or constitute endorsement by USDA.

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the State or local Agency that administers the program or contact USDA through the Telecommunications Relay Service at 711 (voice and TTY). Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Mail Stop 9410, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Report Number 367

October 2026

Land Use, Conservation Policies, and Agricultural Production in Brazil and the United States

Constanza Valdes, Eric C. Davis, Scott Callahan, Kate Binzen Fuller, Trina Weilert, Sara Scott, and Jennifer Bond

Abstract

Over the past 40 years, Brazil's agricultural production has rapidly increased through land expansion and rising yields. This growth has transformed Brazil into the world's second-largest agro-food exporter by value and a major competitor of the United States in global markets for soybeans, grains, cotton, and meats. Since 1985, 253 million acres (103 million hectares) of Brazil's forestland have been converted to pastureland and cropland. To mitigate the loss, the Government of Brazil has recently enhanced conservation policies focused on forest conservation and pasture maintenance. In the United States, over a comparable time, agricultural production has grown steadily, even as the area used for agricultural cultivation has declined and grassland and forestland acreage has risen. The productivity gains in U.S. agriculture are attributable to sustainable intensification facilitated by both technological innovation and enhanced management practices. Longstanding voluntary U.S. conservation programs, including the Conservation Reserve Program (CRP), support the establishment of vegetative cover and other conservation practices on highly erodible lands and other environmentally sensitive acres. This report provides an overview of the land-use changes, productivity gains, and conservation policies in both the United States and Brazil, with particular attention to the drivers and status of deforestation in Brazil.

Keywords: land use, conservation policies, agriculture, United States, Brazil

Acknowledgments

The authors thank Utpal Vasavada, Felix Baquedano, Keithly Jones, Eliana Zeballos, Anil Rupasingha, and Steve Wallander of USDA's Economic Research Service (ERS) for their thoughtful reviews. Special thanks are extended to Justin Baker and Erin Sills of the North Carolina State University Department of Forestry and Environmental Resources, Center for Environmental and Resource Economic Policy; Brent Sohngen of The Ohio State University's Department of Agricultural, Environmental, and Development Economics for their valuable contributions. The authors also appreciate the constructive feedback provided by Joy Harwood, Catherine Feather, Georgi Gabrielyan, and Jamie White in USDA's Farm Production and Conservation Business Center. Additional appreciation is extended to Cynthia Nickerson, Peter Richards, and Jeffrey O'Hara of USDA's Office of the Chief Economist; and to Emily Sandall and anonymous reviewers in USDA's Foreign Agricultural Service for their technical review. The authors extend appreciation to Grant Wall and Christopher Whitney of USDA, ERS for their attentive editorial assistance, Lori Etheredge and Christopher Sanguinett of USDA, ERS for their cartographic output, and to Adele Wilcoxen of USDA, ERS for exceptional design support.

About the Authors

Constanza Valdes and Eric C. Davis are research agricultural economists in the USDA, ERS Market and Trade Economics Division. Scott Callahan and Kate Binzen Fuller are research agricultural economists in the USDA, ERS Resource and Rural Economics Division. Trina Weilert is USDA, ERS's Research Support Branch chief. Sara Scott is the assistant director for outreach and Jennifer Bond is the deputy director for outlook and staff analysis in the USDA, ERS Market and Trade Economics Division.

Contents

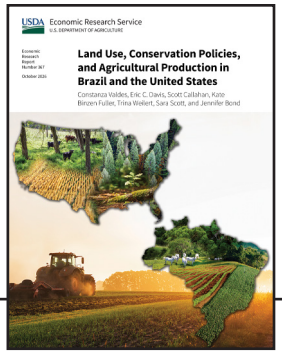
Summary iii
Introduction 1
Land Use 3
The United States: Declining Cropland and Expanding Forest Cover 3
Brazil: Forestland and Pasture Conversion on the Agricultural Frontier 7
Conservation Policy 9
U.S. Conservation Policy Shaping Land Retirement and Working Lands Management 9
Brazilian Conservation Policies 12
Agricultural Productivity and Intensification 17
The United States: Increasing Output Through Yields and Technological Innovation. 17
Brazil: Rising Output Underpinned by Cropland Expansion and Yield Growth 19
Brazil's Agricultural Exports 21
Brazil's Cattle Production and Beef Exports 22
Brazil's Soybean Production and Exports 25
Brazil's Deforestation: Historical Trends and Current Status 27
Protected Lands in Brazil. 28
Conclusion 34
References 36
Appendix A. Brazil's Land Prices: Historical Trends and Current Status 42

USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

A report summary from the Economic Research Service

Land Use, Conservation Policies, and Agricultural Production in Brazil and the United States

Constanza Valdes, Eric C. Davis, Scott Callahan, Kate Binzen Fuller, Trina Weilert, Sara Scott, and Jennifer Bond



Key Points

- Over the past 40 years, agricultural production has increased in both the United States and Brazil. Brazil's production gains are partially attributable to cropland expansion which occurred through the conversion of pastureland and forestland. For the United States, agricultural production has also increased. However, cropland acreage has declined and forestland has modestly expanded.
- Despite differing trends in cropland acreage, crop yields for Brazil and the United States have steadily risen over time, aided by agricultural research and development investments and increased adoption of biotechnology.
- Satellite-based measures indicate that between 2022 and 2024, the majority of States in Brazil experienced a decline in protected forest cover, contributing to widespread net forest loss at the national level.
- U.S. conservation policies include both programs that temporarily retire land and those that incentivize specific conservation practices, such as conservation tillage and cover cropping. The relationship between these policies, the practices they promote, and yields is unclear, as studies have found null, varying, and/or nuanced effects.
- While Brazil's land conservation policies are more limited than for the United States, new conservation policies have been enacted and are aimed at conserving forestland and revitalizing low-productivity pastureland.

Why Does This Matter?

The United States and Brazil are among the largest contributors to global agricultural trade. However, their pathways to becoming leading agricultural producers and exporters over the last quarter century have been markedly different. Brazil, the world's fifth-largest country by area and the largest in terms of arable land, has significantly expanded the area under agricultural cultivation. Between 2000 and 2024, farmers in Brazil converted more than 128 million acres (52 million hectares) of natural vegetation—mainly in the Amazon and Cerrado biomes—into agricultural use (pastureland and cropland). The latest data show 0.5-percent annual deforestation rates for the vast Legal Amazon geographic region from 2020 to 2025. In contrast to the cropland expansion indicated for Brazil, the land used for agricultural cultivation in the United States has declined since the mid-1980s, while grassland and forestland acreage has risen. Between 1987 and 2022, U.S. agricultural output increased 41 percent while cropland acreage fell by 19 percent. During the same period, grassland and forestland in the United States grew 10 percent and 1 percent, respectively. Brazil's agricultural output and cropland acreage increased over 437 percent and nearly 210 percent, respectively, between 1987 and 2022. During the same period, pastureland in Brazil increased 35 percent while forestland decreased 15 percent. As the United States increasingly faces competition from Brazil in international agricultural commodity markets,

particularly for soybeans and corn, interest in Brazil's productivity transformation—and the associated environmental costs—has risen. To aide researchers and policymakers in better understanding the landscape of land-use differences and their links to production outcomes, this study compares land-use trends and related policies in the United States and Brazil.

A Few More Details

Over the study period, 1985 to 2025, increased agricultural production in the United States has occurred concurrently with reductions in agricultural land use and expansions in forestland while increased agricultural production in Brazil has been driven primarily by land conversion through deforestation. Land conservation efforts in the United States are supported by the U.S. Government, which spends an average of nearly $6 billion per year on agricultural conservation programs. Most U.S. conservation programs aim to promote regenerative farming practices, while others are established to retire land from cultivation. For many years, Brazilian Government-supported conservation instruments were limited in scope, but increasingly, they are incorporating sustainability criteria and aim to more effectively slow forestland conversion into agricultural use. Land conservation and reforestation efforts in Brazil are supported by the Brazilian Government which provided an annual average of about $933 million, in subsidized credit for agricultural conservation programs in 2023–25. Given the large agricultural base in both countries, these changes in agricultural production and land use are reshaping international trade.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

Land Use, Conservation Policies, and Agricultural Production in Brazil and the United States

Introduction

The United States and Brazil are two of the most influential players in global agriculture, frequently competing in international markets. For decades, the United States has been a leading agricultural producer and global exporter across a variety of agricultural commodity sectors. Brazil has recently undergone a period of rapid land expansion, technology adoption, and crop intensification that has facilitated significant production gains and expanded their market access. As such, the United States now faces increasing competition for access to export markets that it previously dominated—especially for corn and soybeans. The United States and Brazil accounted for 39 percent and 19 percent of global corn trade, respectively, and 22 percent and 61 percent, respectively, of global soybean trade in marketing year 2025/26 (USDA, Foreign Agricultural Service (FAS), 2026).

While competitiveness is shaped by factors such as natural resource allocations, input-cost structures, and infrastructure quality, land-use and conservation policies and practices have also been shown to affect competitiveness through their impact on land-use decisions, production, and global agricultural trade dynamics (Gutsch et al., 2025; Harding et al., 2021; Spangler et al., 2020; Verburg et al., 2014; Mendonça et al., 2013; Tanaka & Wu, 2004). In recent years, many new conservation policies, such as the European Union's Deforestation Regulation (EUDR), have come into effect. These domestic and international measures, which aim in part to prevent production from shifting from regions with stronger protection to those with weaker safeguards, have been linked with changes in agricultural trade flows in ways that may impact U.S. farmers and ranchers (Al-Riffai et al., 2010; Lu et al., 2026; Zamani & Pelikan, 2026). This report examines the complex interplays among conservation measures, land use, agricultural production, and trade for two major agricultural producers—the United States and Brazil.

In the United States, agriculture has seen declines in cropland acreage and advancements in technology that have enabled large increases in total agricultural production and efficiency, both of which are components of sustainable intensification.[1] The United States also supports a portfolio of conservation programs. Agricultural research and development (R&D) and Federal land management programs, such as the Conservation Reserve Program (CRP), are potential pathways to reducing agricultural land and labor use (Wang et al., 2015). In Brazil, public R&D has also led to rapid agricultural productivity growth.[2] However, the country's rise as a global agro-food exporter has been accompa-

[1] Sustainable intensification, defined here in terms of productivity and outcomes, is a term describing the production of more agricultural goods absent the conversion of non-agricultural land (Pretty et al., 2018). While it can be achieved through the utilization of technology and innovation (Hutchins, 2021), the concept is defined through a focus on outcomes, allowing goals to be achieved through varied means (Pretty & Bharucha, 2014).

[2] Since the 1960s, EMBRAPA, the Brazilian Government's agricultural research institution, has helped farmers adopt new crop varieties suited to the climate and soil conditions of Brazil's tropical Cerrado savannah.

nied by extensive conversion of forestland[3] to agricultural use (Goldman & Weisse, 2026; Sims et al., 2025; Pendrill et al., 2019; Curtis et al., 2018; Arias et al., 2017; Brandão et al., 2006). A landmark 2008 study (Searchinger et al., 2008) modeled the impact of a very large, hypothetical increase in biofuel production on tropical deforestation and detailed how increasing prices generate pressure in Brazil to create new agricultural land and result in indirect land-use change where high-yielding crops displace cattle ranching in forest frontiers. Numerous other empirical and modeling studies also document direct forest to crop conversion and the displacement of cattle ranchers and smallholders into the Amazon and Cerrado biomes[4] (Ribeiro et al., 2025; Miranda et al., 2024; Souza et al., 2020; Richards et al., 2014; Arima et al., 2011; Caldas et al., 2010). It is common for deforested acres in Brazil to be converted first to pastureland before transitioning to crop cultivation. However, Song et al. (2021) provided evidence of soybean expansion driving deforestation in the Cerrado.[5]

To prevent further deforestation while doubling agricultural production and supporting Brazil's growing cattle herd, the Brazilian Government aims to enhance productivity on existing converted acres through intensification efforts (MapBiomas, 2026; Feltran-Barbieri & Féres, 2021). In December 2023, Brazil's Ministry of Agriculture established the National Program for the Conversion of Degraded Pastures (Programa Nacional de Conversão de Pastagens Degradadas, PNCPD), a program[6] [7] to improve the productivity of pastureland that the Government has designated as degraded (Ministério da Agricultura, Pecuária e Abastecimento (MAPA), 2025; Presidência da República Casa Civil (PLANALTO), 2023). It remains to be seen whether the program will be effective in meeting its objectives. Issues include the large capital investments needed and the lack of a complete registry of all rural properties in the country (Rural Environmental Registry (CAR), 2026). Another issue, which has been extensively examined but remains unresolved, involves the debate between Jevon's Paradox and the Borlaug Hypothesis. This centers on whether increasing agricultural efficiency saves forestland or accelerates deforestation (Baldos et al., 2025; Ceddia et al., 2014; Hertel et al., 2014).[8]

The objective of this study is to aid researchers and policymakers in better understanding the landscape of land-use differences and their links to production outcomes and global competitiveness. This report begins by describing historical trends in land use, productivity, and production in both Brazil and the United States. The public policies and conservation programs contributing to those outcomes are also examined. Following a brief introduction of the role of agriculture in Brazil's economy, the policies shaping the sector, and the institutional landscape governing land use; the report uses geospatial land data to describe recent deforestation trends in the Legal Amazon[9] and Cerrado—

[3] Forestland in Brazil consists of native vegetation with dense, tree-covered tropical rainforests; non-forest ecosystems native to Brazil including Cerrado savannas, semi-arid shrublands of the Caatinga; and natural grasslands (Instituto Brasileiro de Geografia e Estatística (IBGE), 2026).

[4] Biome refers to the ecosystem that sustains native plants and animals. Brazil recognizes six biomes—Amazonia, Mata Atlantica, the Caatinga, the Cerrado, the Pantanal, and the Pampa (IBGE, 2026).

[5] Rausch et al. (2026) detail how the dismantling of the Amazon Soy Moratorium will further drive new deforestation.

[6] The PNCPD program was announced in 2023 and re-launched in 2025. About 87.8 million hectares (55 percent of Brazil's total pastureland) have been identified as low or lesser quality, but only 100.6 million acres (40.7 million hectares, which is equivalent to 1.8 million farms) were accepted in the program, having had no deforestation since 2008 (Instituto Clima e Sociedade (ICS), 2026).

[7] Included in the annual Plano Safra and financed via the 2023 RenovAgro Plan (formerly the ABC+ Plan).

[8] The Borlaug Hypothesis proposes that boosting crop yields via technological innovation allows for increased agricultural production on less land while Jevon's Paradox proposes that increasing agricultural efficiency lowers production costs and raises producers' returns, with the financial incentives driving farmers to expand their operations and ultimately accelerating deforestation and land conversion (see Borlaug & Dowswell, 2005; Alcott, 2005).

[9] The Legal Amazon is an administrative region established by Brazilian law for regional planning and land-use management and includes all nine states in the Amazon basin, plus some areas of savannah in Mato Grosso, Maranhao, and Tocantins. It comprises 61 percent of Brazil's territory. For a visual representation of Brazil's biomes, see figure 7.

regions where the interface between agricultural expansion and forest preservation has become a major policy issue in Brazil. This issue is highlighted with the report's use of international trade data from Brazil's Ministry of Trade to trace the path from Legal Amazon municipalities to export destinations for beef and soybean products.

Agriculture is an important sector in Brazil, with agribusiness accounting for half of the country's total exports (Trade Data Monitor (TDM), 2026), and given the country's status as a major agricultural exporter, any increases in production levels in Brazil could result in lower global commodity prices and negative impacts on U.S. agricultural exports to international markets. Conversely, economic or policy changes that result in lower agricultural production levels in Brazil could create opportunities for U.S. agricultural exports to capture market share in key global markets.

Land Use

The United States: Declining Cropland and Expanding Forest Cover

The United States is the fourth-largest country by land mass at 2.3 billion acres (9.5 million square kilometers) (World Country Data, 2026). This study uses land-use data from the 2022 edition of USDA, Economic Research Service's (ERS) Major Land Uses data product.[10] The United States has 377 million acres of cropland, 653 million acres of grassland pasture and range,[11] and 884 million acres of forestland (including rural parks, wildlife preserves, and wilderness areas),[12] accounting for 17 percent, 29 percent, and 39 percent of the total U.S. land mass, respectively (table 1).

While U.S. land use and land cover has changed over time, forestland acreage has remained largely stable since 1920 (Oswalt et al., 2026). Cropland is most prevalent in the Corn Belt (see figure 1 for a map of USDA Farm Production Regions) where 88 million acres (54 percent of the land in the region) are used for cropland, while it is least prevalent in the Mountain region (38 million acres of cropland or 7 percent of the region's total land). Grassland pasture and range is most prevalent in the Mountain region (327 million acres or 60 percent of the region's total land) and least prevalent in the Northeast at 6 million acres (5 percent of the regional total). Forestland is most prevalent in the Northeast (66 percent of the regional total or 74 million acres) and least prevalent in the Northern Plains (4 percent of the regional total or 9 million acres).

To better reflect the land cover of the United States, we have included rural parks, wildlife preserves, and wilderness areas in our tabulation of forestland. This contrasts with the tabulation used for the USDA, ERS Major Land Uses data series, which focuses on forestland used specifically for timber or grazing. The land allocated to rural parks, wildlife preserves, and wilderness areas is typically forested in terms of land cover but is set aside for recreation and habitat preservation and not utilized for other forms of economic activity such as grazing or logging.

[10] See Winters-Michaud et al. (2024) for a detailed explanation of the methodology and sources used to construct the data product.

[11] Grassland pasture and range contains all open land primarily used for grazing, including shrubland and brushland, grasses and legumes, and other forage. This includes private grazing land (excluding cropland and forestland) and Federal grazing lands leased to the public, along with lands managed by the U.S. Department of the Interior, Bureau of Land Management and non-forested lands managed by the USDA, Forest Service.

[12] Forestland is land with forested land cover that serves commercial forest uses (including forestland used for grazing and timber), combined with land used for rural parks, wildlife preserves, and wilderness areas.

Table 1

Major uses of land in the United States, 2022 by region (million acres)

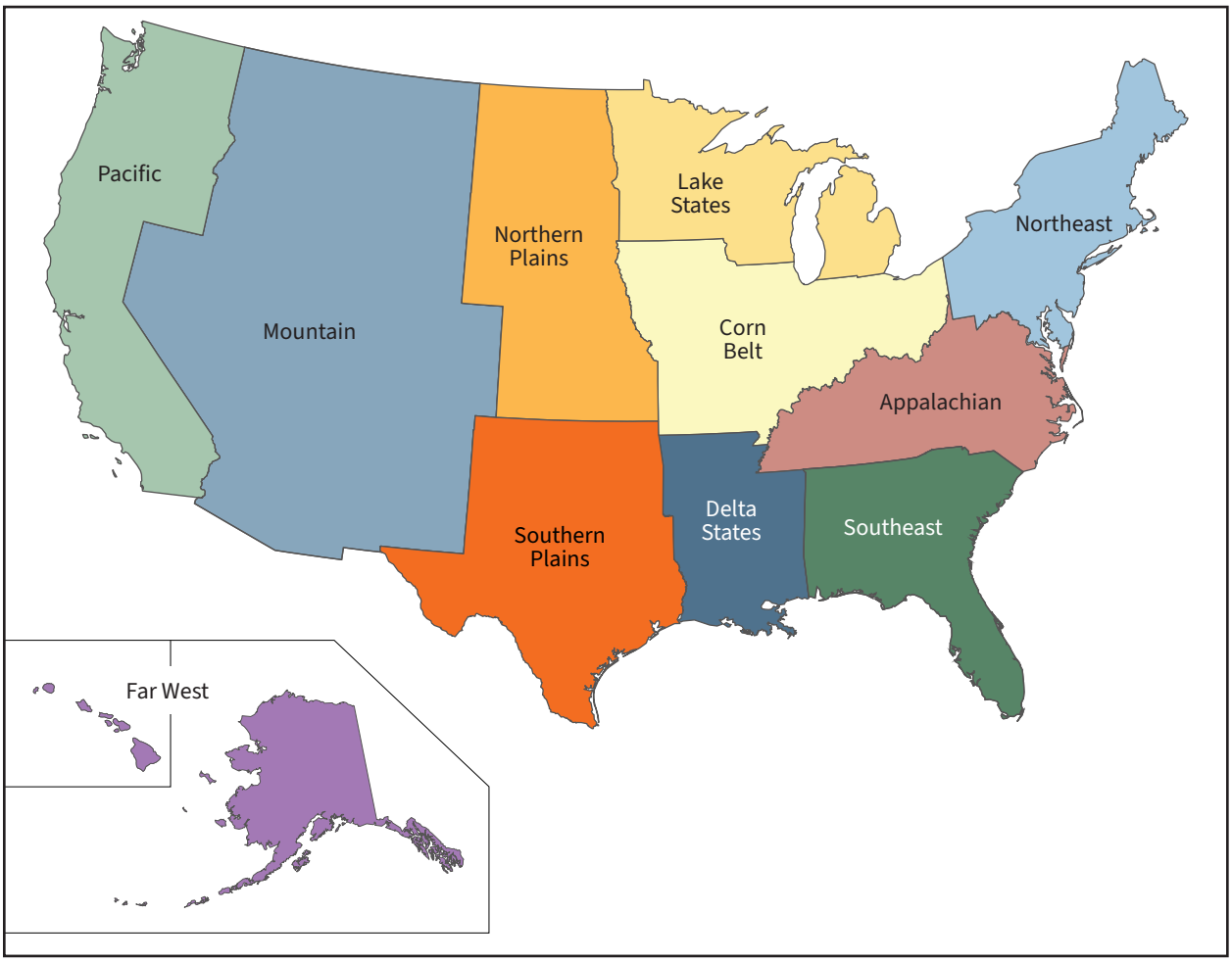
Region	Cropland	Grassland pasture and range	Forestland	Urban land	Other land	Total land
Northeast	11.4	5.5	73.6	12.1	8.5	111.1
Lake States	38.3	8.3	58.3	4.4	12.5	121.9
Corn Belt	88.4	18.4	36.1	8.5	12.9	164.4
Northern Plains	94.9	80.4	8.5	1.3	9.0	194.2
Appalachian	19.6	12.8	74.6	7.6	8.8	123.4
Southeast	11.5	11.5	79.7	11.0	9.1	122.9
Delta States	16.7	9.0	55.1	2.6	7.5	91.0
Southern Plains	37.2	122.1	23.7	6.7	21.4	211.1
Mountain	38.3	326.7	147.0	4.6	31.4	547.9
Pacific	20.8	56.3	88.6	7.1	31.0	203.7
48 States	377.2	651.2	645.3	65.8	152.1	1,891.6
U.S. total	377.4	652.7	883.9	66.2	281.0	2,261.1

Note: Regions correspond with USDA farm production regions (see figure 1 for details). Forestland includes rural parks and wilderness land. Other land includes miscellaneous land and other special uses. Acreage is measured in millions of acres. The U.S. total row includes Alaska and Hawaii, which are not included in the 48 States row.

Source: USDA, Economic Research Service using data from the 2022 edition of the Major Land Uses data product.

Figure 1

USDA, Economic Research Service Farm Production Regions



Note: An additional region known as "Far West" has been added to describe Alaska and Hawaii.

Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service.

Table 2 reports the acreage and the percentage change in land-use categories. Between 1987[13] and 2022, total cropland fell 19 percent. Total cropland is subdivided into three categories: cropland used for crops,[14] cropland pasture,[15] and idle cropland.[16] Each component of total cropland has fallen across this period. While idle cropland and cropland pasture fell significantly, cropland used for crops fell negligibly. Categories that have increased include grassland pasture and range (up 10 percent) and urban land (up 17 percent).

Forestland has increased 1 percent since 1987. Grazed forestland has decreased 24 percent, but accounts for just over 5 percent of total land in the United States. Conversely, rural parks, wildlife preserves, and wilderness areas, which account for almost 12 percent of the total land in the United States, have increased 18 percent during the same time, more than making up for the decrease in grazed forestland. In addition, ungrazed forestland, which accounts for more than 22 percent of total land, has increased by 1.3 percent.

Table 2
Major uses of land in the United States, 2022 by type (million acres)

Land use	Acres (millions)	Percent of total land	Percent change since 1987
Total cropland	377	16.73	-18.66
Cropland used for crops	329	14.58	-0.65
Idle cropland	36	1.58	-47.58
Cropland pasture	13	0.58	-80.04
Grassland pasture and range	653	28.94	10.42
Total forestland	884	39.19	1.24
Grazed forestland	118	5.25	-23.57
Ungrazed forestland	499	22.15	1.28
Rural parks/wildlife preserves/ wilderness areas	266	11.79	18.25
Urban land	66	2.93	16.84
Other land	275	12.20	0.71

Source: USDA, Economic Research Service using data from the 2022 edition of the Major Land Uses data product.

Figure 2 shows how land use has evolved in the United States since 1987. Notably, forestland and grassland pasture and range have increased while cropland has decreased. Cropland has declined year over year, while grassland pasture and range has increased in every year except for 2022. In 2022, private pasture and rangeland increased, so the overall decline stems from a reduction in Federal grazing land (USDA, Natural Resources Conservation Service (NRCS), 2025). Forestland has been relatively constant since 1987. There was a decline in forestland recorded for 2012, but this was the result of a change in how the USDA, Forest Service (USFS) defines timberland rather than a true decline in acreage (Winters-Michaud et al., 2024). Urban land has increased during this period,[17] while miscellaneous other land uses have remained largely constant.

[13] The Major Land Uses data product is published every 5 years, corresponding to the release of the Census of Agriculture. We start our time series in 1987 to match the Brazilian data as closely as possible.

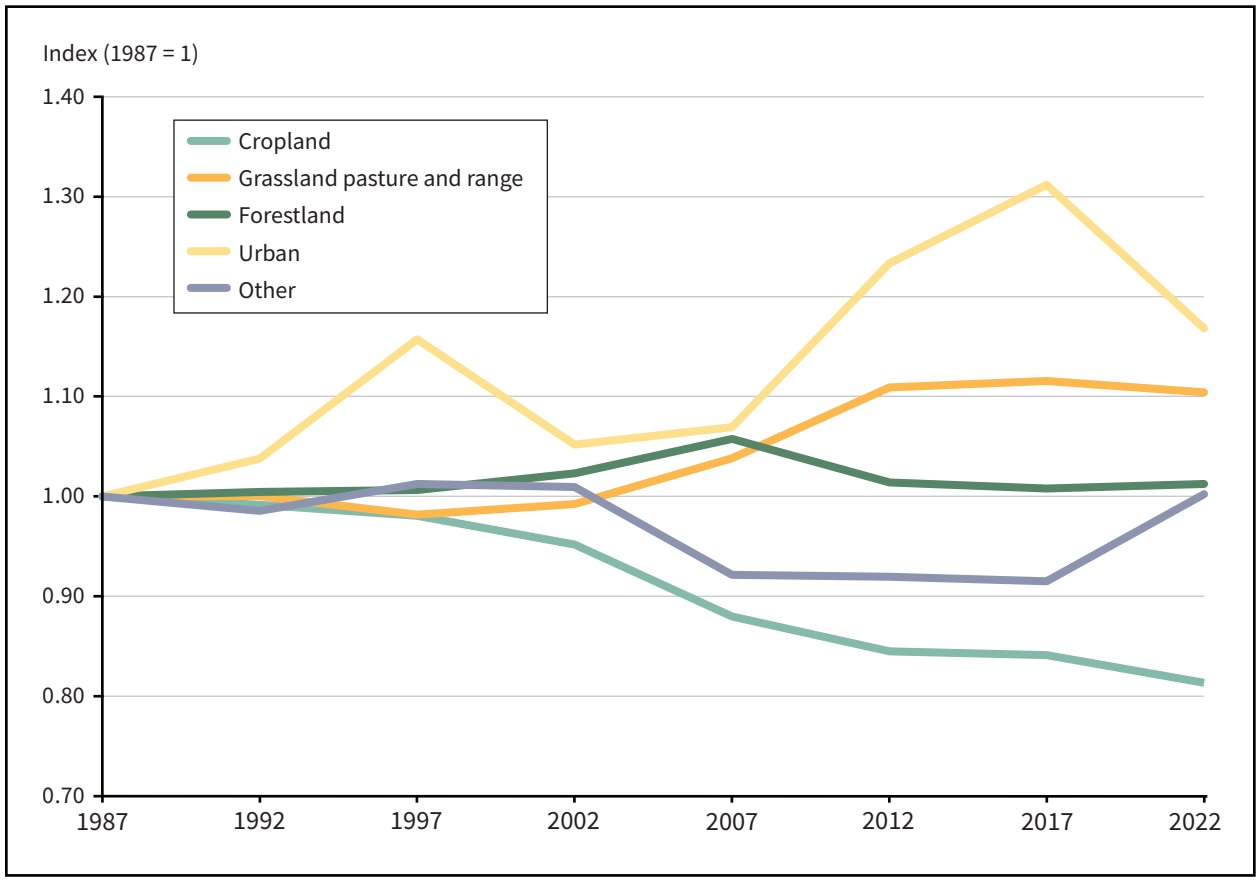
[14] Cropland harvested (net of double cropping) plus crop failure and cultivated summer fallow.

[15] Land used only for pasture that could have been cropped without additional improvements.

[16] Idle land not enrolled in Government programs, plus acreage enrolled in the Conservation Reserve Program (CRP), the Wetlands Reserve Program (WRP), or a Wetland Reserve Easement (WRE) under the Agricultural Conservation Easement Program (ACEP), minus any CRP land that was used for emergency haying or grazing. Land enrolled in CRP represented 61 percent of idle cropland acreage in 2022 and 5.8 percent of total cropland acreage.

[17] Note that figure 2 reports a decline in urban land between 2017 and 2022. This is due to a methodological change in how the 2020 Census of Demographic and Housing Characteristics defines urban land (U.S. Department of Commerce, Bureau of the Census, 2023).

Figure 2
Change in major uses of land in the United States, 1987–2022



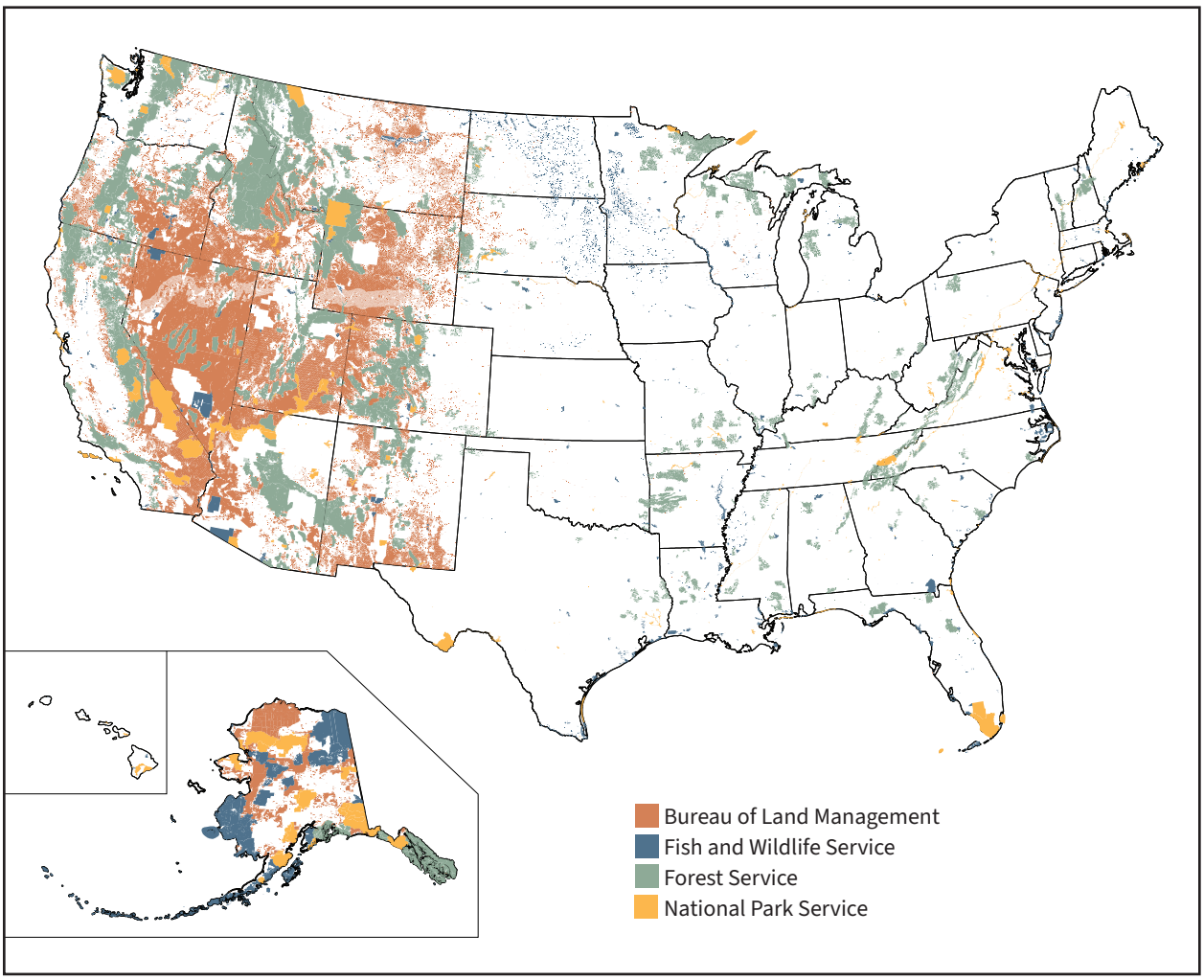
Note: Forestland includes grazed forestland, ungrazed forestland, rural parks, wildlife preserves, and wilderness areas. Urban land declined due to a methodological change in how urban land is defined in the 2020 Census.

Source: USDA, Economic Research Service using data from the 2022 edition of the Major Land Uses data product.

To provide further context and help visualize U.S. Government-owned land, figure 3 provides a map of federally managed land by ownership type. This chart depicts all land owned by four U.S. Federal agencies: USFS; the U.S. Department of the Interior, Bureau of Land Management (BLM); the U.S. Department of the Interior, National Park Service (NPS); and the U.S. Department of the Interior, Fish and Wildlife Service (USFWS). Most federally owned and protected lands are located in the western part of the country, roughly corresponding to the Pacific and Mountain farm production regions, along with Alaska. BLM and USFS manage the bulk of federally owned land in the western United States.[18] These lands are not an exhaustive list of protected lands, as State, local, and city governments manage parks, recreation areas, and other land resources. Additionally, Federal and State governments operate programs to assist and facilitate conservation on privately owned lands, including some through the USDA. The USDA programs are discussed in detail in the U.S. Conservation Policy section of this report. The patterns observed within the programs serve as a benchmark for understanding how land-use dynamics and interventions unfold in other major agricultural economies.

[18] It should be noted that we are unable to parse out the subset of BLM and USFS land utilized for wildlife refuges and wilderness areas. As such, figure 3 instead displays all land owned by BLM and USFS and is not an accurate reflection of the specific acreage represented by wildlife refuges and wilderness areas in the USDA, ERS Major Land Uses data product.

Figure 3
Federally protected lands in the United States

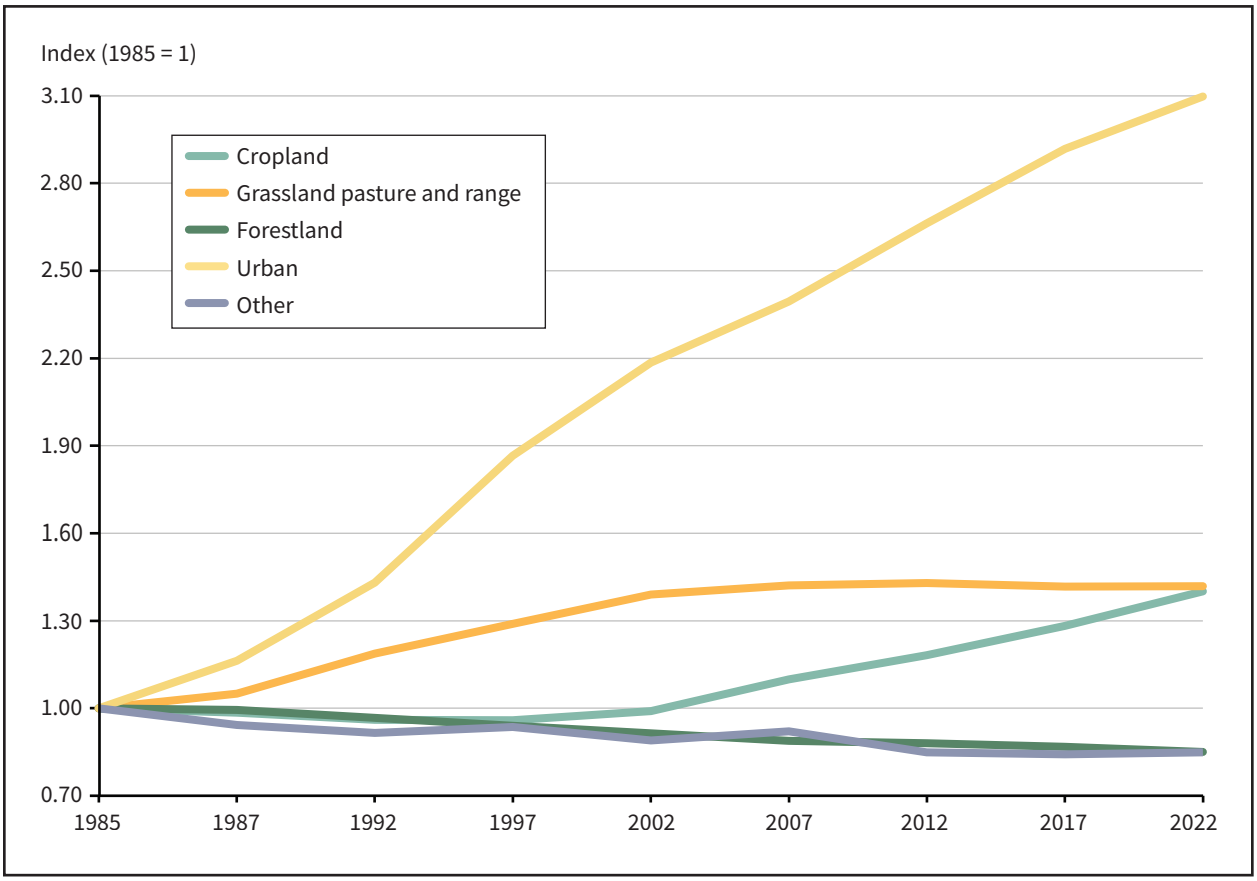


Source: USDA, Economic Research Service using data from Esri, 2026.

Brazil: Forestland and Pasture Conversion on the Agricultural Frontier

Using satellite-based measures of land use as reported in the MapBiomas data series, we examine land-use changes in Brazil from 1985 to 2022, mirroring the preceding U.S. analysis. Brazil is the world's fifth-largest country in terms of area, with 2.1 billion acres (8.5 million square kilometers) (Instituto Brasileiro de Geografia e Estatística (IBGE), 2026). Brazil has undergone a profound transformation in land use since 1985, driven by agricultural expansion at the expense of forestland (figure 4). Forestland declined from 68 percent of the country's territory in 1985 to 58 percent in 2022. Pasture and rangeland remain the largest land-use category in Brazil, growing nearly 42 percent and adding 143.5 million acres since 1985. Cropland increased 40 percent from 1985 to 2022, adding 83.5 million acres (MapBiomas, 2026). Urban land, which accounts for 0.5 percent of Brazil's land area, also increased during this period, while other uses of land have remained largely constant (figure 4).

Figure 4
Change in major uses of land in Brazil, 1985–2022



Source: USDA, Economic Research Service calculations based on MapBiomas dataset, 2026.

More recent data provide additional detail on the current distribution of Brazil's forest, pasture, and agricultural land. In 2025, about 60.9 percent of total land was covered by forests, including 1.03 billion acres of non-farm natural forests, 185 million acres of permanent forest conservation on farms, and 65 million acres of other forests on farms (table 3). Nearly 23 percent of total land was dedicated to pastureland—including 394.1 million acres of pasture area[19] (cultivated and natural) spread across the country—plus 32.1 million acres of pastureland on farms defined by the Brazilian Government as degraded,[20] 34.3 million acres dedicated to forest-pasture cattle systems, and 12.4 million acres for temporary meadows and pastures (table 3). By comparison, U.S. grazing lands totaled 652.7 million acres in 2022 (USDA, ERS, 2026). About 7.2 percent of total Brazilian land is dedicated to production, including 112.2 million acres for temporary crops, 19.3 million acres for permanent crops, and 21 million acres of fallow land (table 3). These distributions help frame the conservation approaches employed in each country.

[19] Including 322.2 million acres of improved and natural pastureland available for agriculture (IBGE, 2026).

[20] The Brazilian Government defines pasture degradation by a combination of factors, but it can be proxied by normalized difference vegetation indices (NDVI) that provide percentages of seasonal greenness and landcover on a sliding scale. An "A" rating, using the sliding normalized difference vegetation index (NDVI) scale, is viewed as indicating healthy pastureland and is associated with high levels of greenness and ground-cover, as well as, limited to zero evidence of invasive foliage (Tucker, 1979). A "C" or "D" rating indicates pastureland that is severely degraded and is associated with limited vegetative ground cover, low seasonal greenness, and often-invasive foliage and pest-damage (do Valle Júnior et al., 2019).

Table 3
Brazil's forest, pasture, and agricultural land utilization and conservation programs, 2025

	Million acres	Percent of total area
Forestland	1,280.4	60.9
Forest area	1,029.9	49.0
Permanent forest conservation on farms	185.3	8.8
Other forests on farms	65.2	3.1
Pastureland	473.0	22.5
Cultivated pasture	277.3	13.2
Natural pasture	116.9	5.6
Degraded pasture area	32.1	1.5
Forest-cattle system	34.3	1.6
Temporary meadows and pastures	12.4	0.6
Cropland	152.5	7.2
Temporary crops	112.2	5.3
Permanent cropland	19.3	0.9
Fallow area	21.0	1.0
Other land	196.2	9.4
Other area	151.0	7.3
Non-arable land on farms	32.1	1.5
Long-term fallow area	13.1	0.6
Total land area	**2,102.1**	**100.0**

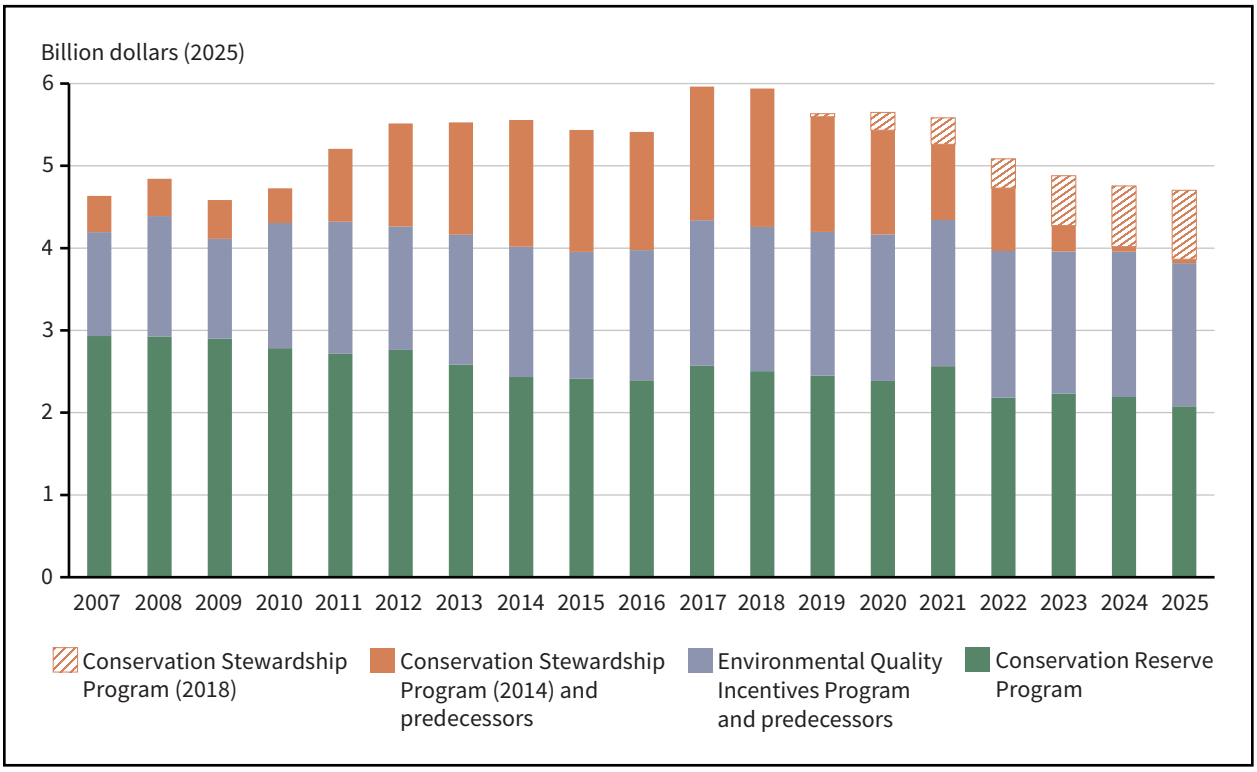
Source: USDA, Economic Research Service using data from the Brazilian Institute of Geography and Statistics, Agricultural Census.

Conservation Policy

U.S. Conservation Policy Shaping Land Retirement and Working Lands Management

Conservation policy can influence the amount of land used for agriculture as well as the productive intensity of that land. The United States invests substantially in conservation (figure 5), and USDA has long maintained a suite of programs that incentivize producers to improve or maintain soil health, wildlife habitat, and water and air quality. These goals are served through various mechanisms, including removing land from production, easements that ensure land stays in agricultural production, and financial incentives and cost shares for specific practices (Fuller et al., 2026). In terms of funding, the top three programs are the Conservation Reserve Program (CRP, $2.1 billion in estimated 2025 outlays), the Environmental Quality Incentives Program (EQIP, $1.7 billion in estimated 2025 outlays), and the Conservation Stewardship Program (CSP, $0.9 billion in estimated 2025 outlays). These programs collectively made up nearly 90 percent of total USDA conservation spending in fiscal year 2025 (Congressional Budget Office (CBO), 2026).

Figure 5
Estimated outlays for major USDA conservation programs, fiscal years 2007–25



Note: Values are adjusted to 2025 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator. Chart does not include supplemental funding provided under the Inflation Reduction Act. All programs (and categories) include predecessor programs. The Conservation Stewardship Program (2014) predecessor is the Conservation Security Program. The Wildlife Habitat Incentives Program is the predecessor to the Environmental Quality Incentives Program. The Emergency Forestry Conservation Reserve Program and 40 percent of the Grassland Reserve Program are counted as predecessors to Conservation Reserve Program (CRP) funding, which also includes CRP technical assistance. Years covered reflect data availability.

Source: USDA, Economic Research Service analysis of Congressional Budget Office Baseline Projections using estimated outlays from the prior fiscal year.

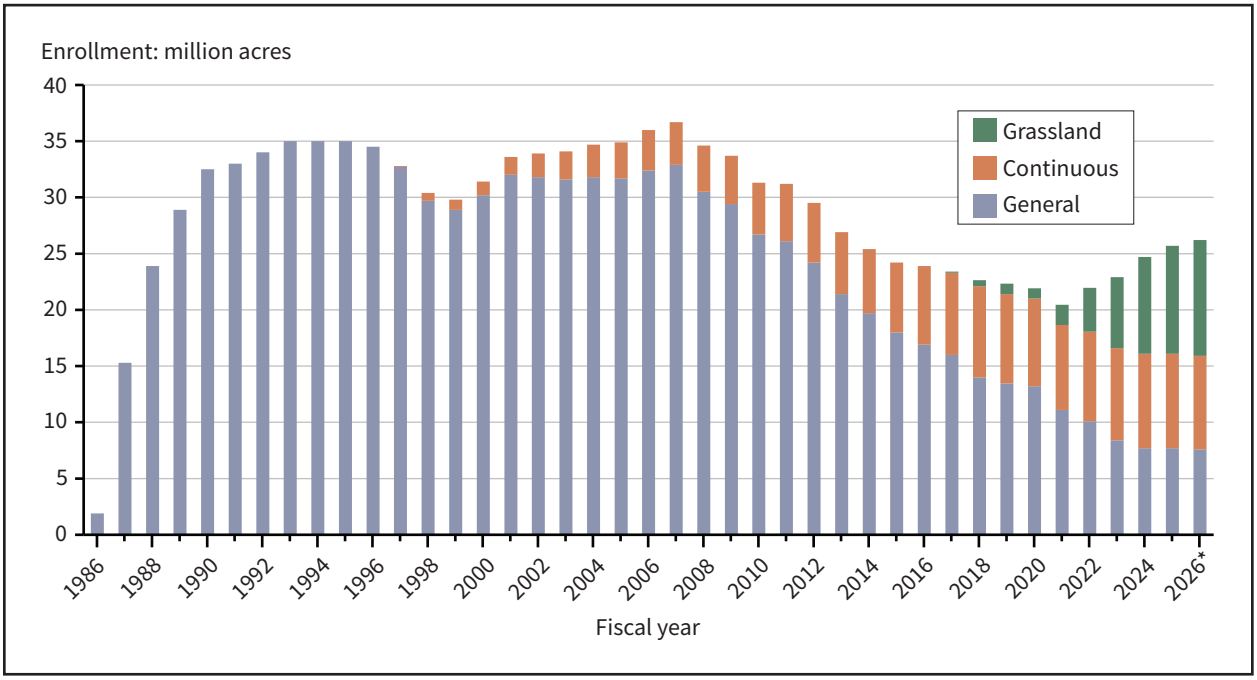
Conservation Reserve Program

In terms of acreage and funding, voluntary CRP is the largest USDA conservation program (figure 6), with over 25 million acres enrolled as of 2025 (USDA, Farm Service Agency (FSA), 2026b) and an estimated $2.1 billion in estimated spending (CBO, 2026). CRP was established by the Food Security Act of 1985, with program implementation beginning in 1986. CRP provides 10- or 15-year contracts in which producers voluntarily submit offers and, if accepted, receive an annual rental payment in return for specific activities.

Historically, CRP was considered a temporary land-retirement program. Today, the program is made up of three related but differing components: General, Continuous, and Grassland CRP. General CRP is the oldest component and temporarily removes land from production, instead installing some type of vegetative "cover" (e.g., native grasses) (USDA, FSA, n.d.). Continuous CRP began in 1996 and targets land that is especially environmentally sensitive. Many Continuous CRP contracts, such as those for riparian buffers, involve practices that are employed on only part of the field, allowing farming to continue on the remainder.

The largest change to CRP, however, was the addition of the Grasslands program. Grassland CRP was established by the Agricultural Improvement Act of 2018 and has rapidly grown to 39 percent of CRP acreage as of February 2026. Grassland CRP is explicitly a working-lands program, offering a rental rate in exchange for activities intended to preserve grassland and rangeland for livestock forage uses (USDA, FSA, 2026a).

Figure 6
U.S. National Conservation Reserve Program acreage, 1986–2026



* 2026 acreage is as of the March monthly summary.

Note: CRP implementation began in 1986.

Source: USDA, Economic Research Service using data from USDA, Farm Service Agency.

CRP enrollment peaked at 36.8 million acres in 2007. The Food, Conservation, and Energy Act of 2008 reduced the acreage cap for CRP enrollment from 39.2 million acres to 32 million acres in 2009, and the Agricultural Act of 2014 further reduced the cap to 24 million acres beginning in 2016. The Agricultural Improvement Act of 2018 increased the enrollment cap incrementally from 24 to 27 million acres by 2023 (Barbarika, 2021), and the cap in 2026, after several extensions of the 2018 bill, remains at 27 million acres. Despite the 8-million-acre reduction in the enrollment cap between 2009 and 2017, idle cropland fell by less than 1 million acres between 2012 and 2017 and fell by 3 million acres between 2017 and 2022 (USDA, ERS, 2026b) as both the cap and CRP enrollment grew, driven by expansion of Grassland CRP acres.[21]

[21] The 1985 Farm Bill directed the USDA to enroll between 40 and 45 million acres by 1990. The CRP acreage cap was then set at 36.4 million acres under the 1990 Farm Bill and increased to 39.2 million acres in the 2002 Farm Bill (Barbarika, 2021).

Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP)

EQIP and CSP are the other two major programs that support conservation practices on working agricultural land and follow CRP in USDA conservation spending. EQIP was established by the 1996 Farm Bill and received $1.7 billion in fiscal year 2025 (CBO, 2026). CSP evolved from the Conservation Security Program established in the 2002 Farm Bill and took its current form in the 2008 Farm Bill, receiving $887 million in funding in fiscal year 2025 (CBO, 2026).

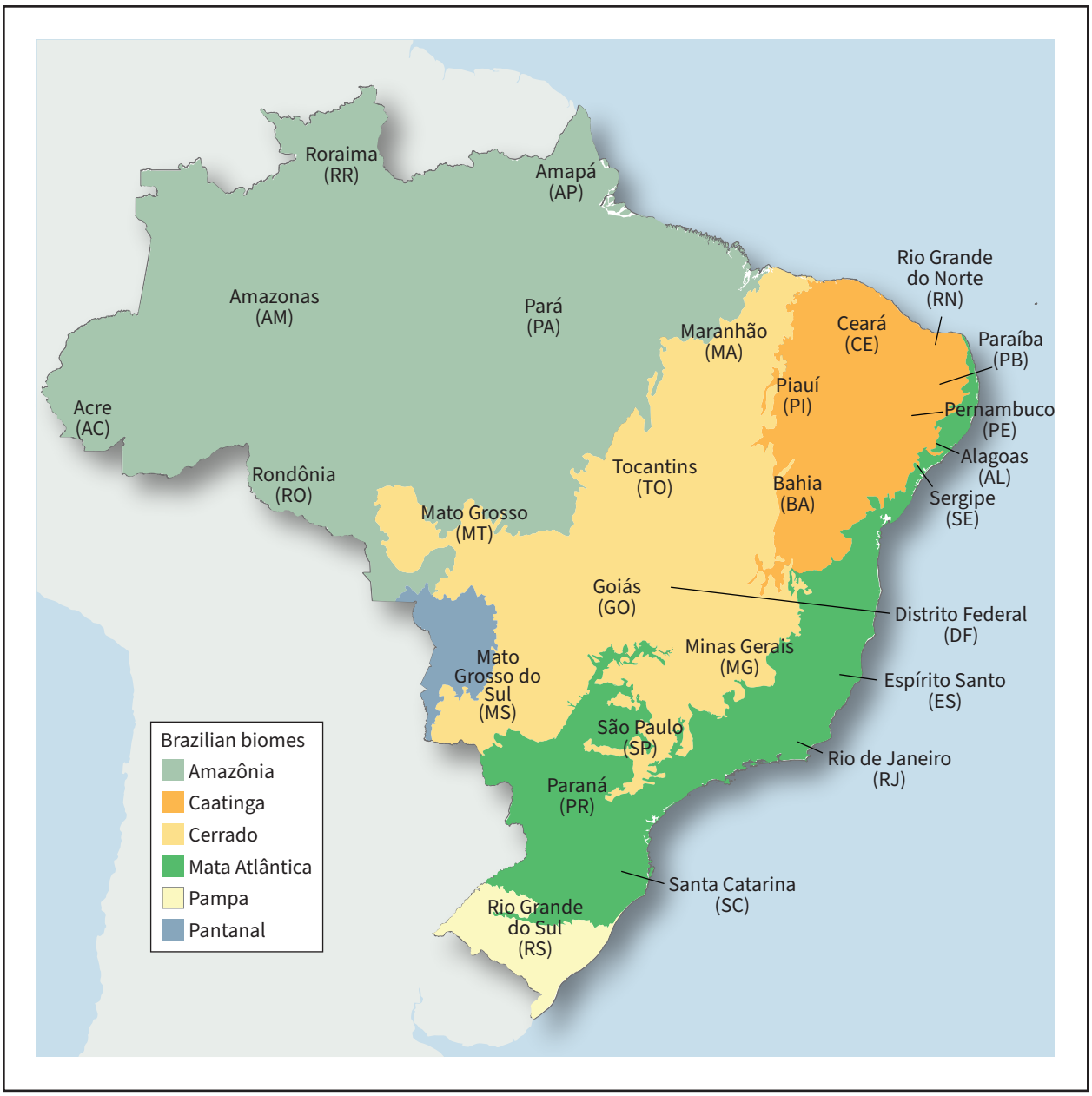
Both EQIP and CSP incentivize practices such as reduced tillage, cover cropping, and the installation of efficient sprinkler systems, but they serve different purposes. The goal of EQIP is for producers to address individual resource concerns on their operations through specific conservation practices, while CSP offers payments for expanded, overall land stewardship and builds on existing conservation activities (Fuller et al., 2026).[22] Taken together, these different programs show how conservation policy can affect both the amount of land used for agriculture and in some cases, the intensity of its use, providing a basis for comparing land-use outcomes across countries.

Brazilian Conservation Policies

Brazil manages various agricultural conservation policies that include legal mandates, subsidized credit, and technology-driven practices, and nearly one-third of Brazil's land is formally designated as protected forest or conservation territory (MapBiomas, 2026). These protected areas span several diverse biomes, most notably the Amazon rainforest, the Atlantic Forest (Mata Atlântica), and the Cerrado savanna (figure 7).

[22] Land is considered to have a resource concern when management practices degrade a resource used in farming, such as soil, to the point that the sustained productive use of the land is impaired.

Figure 7
Brazilian biomes



Source: USDA, Economic Research Service using information from the Brazilian Institute of Geography and Statistics.

The framework of Brazilian agricultural conservation includes three categories:

(1) Regulatory mandates:

- The Forest Code (Law Number 12.651/2012) is the foundational law dictating conservation on farms. It requires landowners to maintain two main types of protected areas:
  - Legal Reserves (Reserva Legal): This was set up in 1965 to prevent deforestation associated with the expansion of cattle grazing and crop cultivation (MAPA, 2025). The Forest Code requires the maintenance of minimum levels of native vegetation in protected Legal Reserve

lands, with the size depending on the biome[23] in which the private land is located. Farms within the Amazon biome must retain 80 percent of the native vegetation, farms in Cerrado must maintain 35 percent, and all other properties must retain 20 percent (MAPA, 2025).

  - Areas of Permanent Preservation (APP): These are farm areas—such as riverbanks, steep slopes, and wetlands—that must be left untouched to protect water resources and prevent soil erosion.

- The Rural Environmental Registry (CAR) is a mandatory electronic registration system used by the Government to monitor environmental compliance via satellite imagery.

(2) Subsidized credit mechanisms:

- Plano Safra (Brazil's annual agricultural plan): The Government's large annual credit assignment conditions a portion of its lower-interest loans on conservation practices.
- RenovAgro Program: Formerly known as the ABC+ Plan, it provides subsidized credit lines[24] for actions to improve the productivity of pastureland. To ensure compliance with Brazil's Forest Code, farmers must register in CAR. To discourage deforestation, participating producers receive lower interest rates, higher credit limits, and extended repayment and grace periods.
- National Program for Converting Degraded Pastures (PNCPD): Launched by MAPA, this program has two stated aims: (1) restoring 30 million hectares of what the Brazilian Government has designated as degraded pastureland into high-yield, sustainable agricultural areas and (2) converting 10 million hectares for integrated crop-livestock systems. This program positions itself as a sustainable-intensification strategy that would allow Brazil to increase food production without clearing new forests. Financing for Brazil's PNCPD plan is included in the annual Plano Safra and financed via the RenovAgro Plan. Some challenges to the implementation of the PNCPD program have been identified, including the large scale of land and the high cost of implementation (USDA, FAS, 2024). The program estimates that $320 billion U.S. dollars would be needed to recover the 40 million hectares over the next decade (MAPA, 2025).

(3) Supply chain agreements and initiatives:

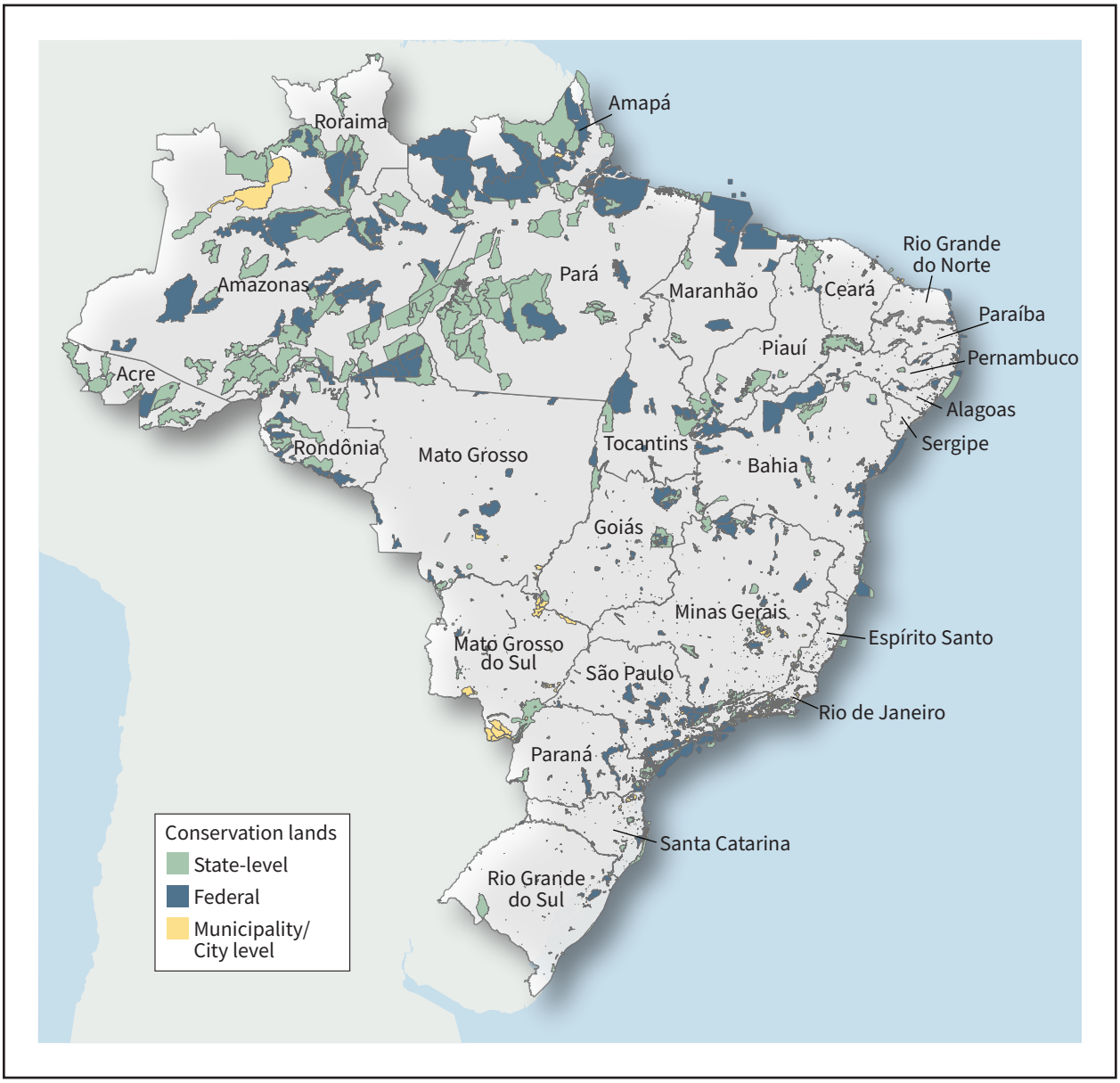
- Brazil has voluntary and government-led agreements that restrict market access for non-compliant agricultural farms.
- Examples include the Soy Moratorium (voluntary agreement; currently paused), Cattle Agreements (government-led), and a sugarcane zoning law agreement (government-led).

See figure 8 for a map depicting the locations of protected lands in Brazil which shows how policy requirements are applied differently across the country's biomes. It also highlights how Brazil's national conservation efforts are shaped by the forest law and Legal Reserves (private land reserves, where private landowners are required to maintain native forest in their properties) and result in a patchwork of small forest lots where extensive forestland (or other native biomes) used to be, as it is legal to deforest land as long as a defined percent of pre-existing forestland remains. For example, in the Cerrado, the condition is that 35 percent of pre-existing forestland must remain (figure 8).

[23] The Amazonia biome covers 420.8 million hectares (49.5 percent of Brazil's territory) and accounts for 67 percent of total forestland and 23 percent of farm production, while the Cerrado covers 198 million hectares (23.3 percent of Brazil's territory) and accounts for 16 percent of the forestland and 35 percent of farming (MAPA, 2025).

[24] Loans are provided on an annual basis through the Harvest Plan (Plano Safra) and the interest rate on these loans is 7 percent, which is lower than the official SELIC (Sistema Especial de Liquidação e de Custódia) interest rate of 14.5 percent and the much higher 22.4 percent market interest rate (Banco Central do Brasil (BCB), 2025).

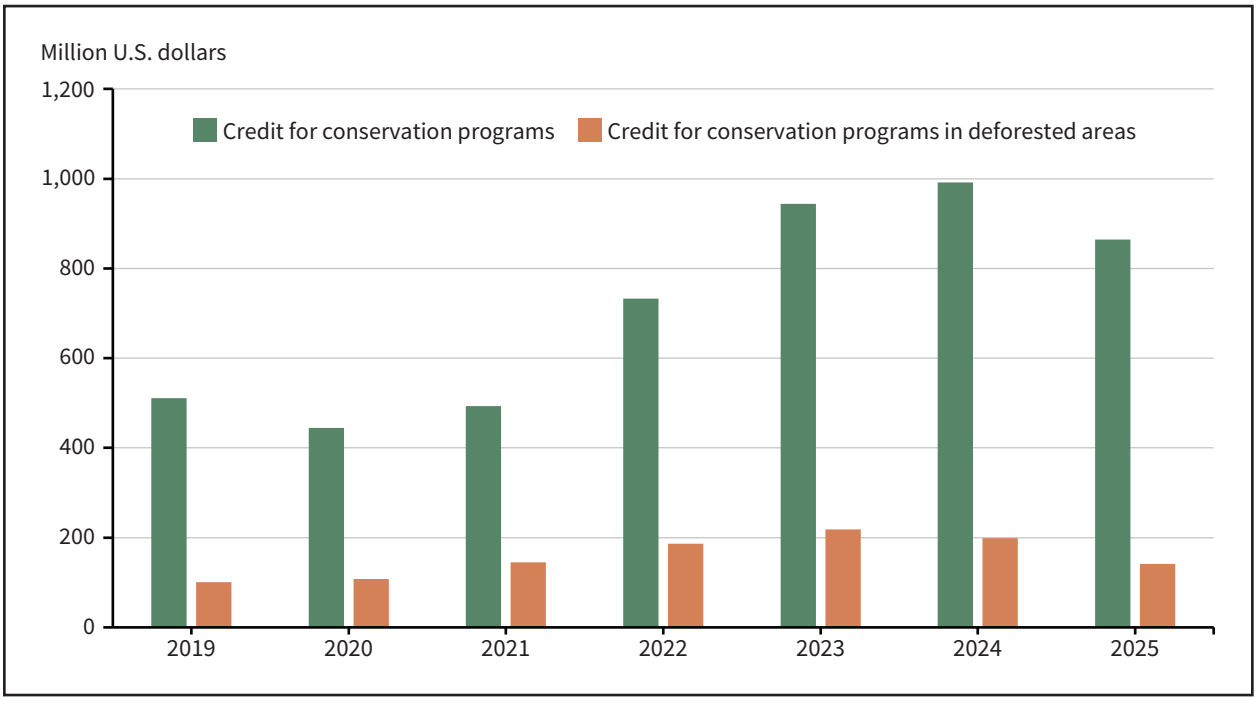
Figure 8
Conservation lands in Brazil



Source: USDA, Economic Research Service using data from MapBiomas, 2026.

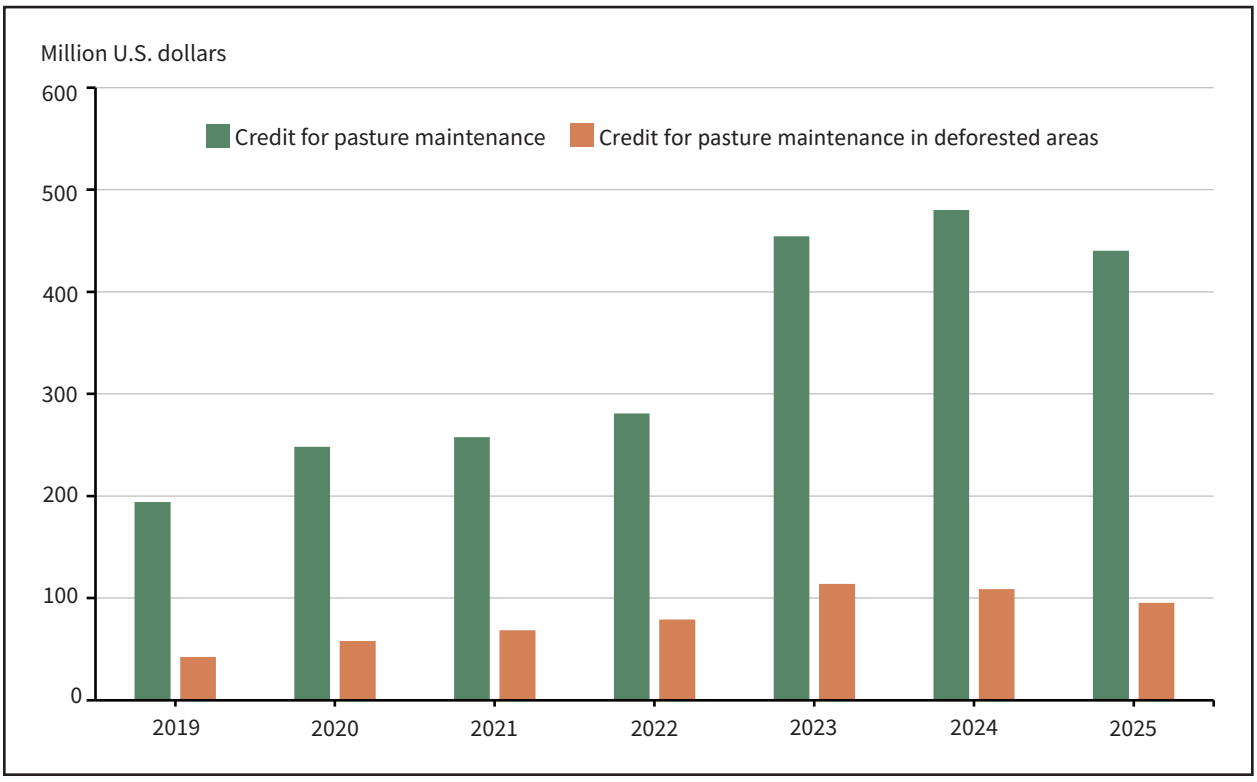
Land conservation and reforestation efforts in Brazil are supported by the Brazilian Government which provided about $933 million in subsidized credit for agricultural conservation programs (figure 9). Between 2010 and 2020, the ABC Plan disbursed $37 billion Brazilian real ($10.5 billion U.S. dollars) in subsidized credit for the purchase of inputs (limestone and fertilizers) for pasture maintenance (Banco Central do Brasil (BCB), 2025). In 2022, the ABC Plan was replaced by the ABC+ Plan (Plano de Adaptação e Baixa Emissão de Carbono na Agricultura), the Brazilian Agricultural Policy for Climate Adaptation and Low-Carbon Emission. Under this plan, the Brazilian Government, across 2022–25, provided $1.7 billion U.S. dollars in subsidized credit for pastureland maintenance via fertilization (figure 10; BCB, 2025). According to MapBiomas (2026) data, about 24 percent of the credit granted for pastureland maintenance benefited deforested areas.

Figure 9
Subsidized credit for agricultural conservation programs in Brazil, 2019–25



Source: USDA, Economic Research Service calculations using data from MapBiomas, 2026.

Figure 10
Subsidized credit for pasture maintenance in Brazil, 2019–25



Source: USDA, Economic Research Service calculations using data from MapBiomas, 2026.

The most common land-use change in the Cerrado and Legal Amazon is the clearing and conversion of forestland to pastureland for beef cattle and crop production, while the sequence of activities following deforestation varies across biomes (Instituto Nacional de Pesquisas Espaciais (INPE), 2026; Silveira et al., 2022; Tyukavina et al., 2018). Over the past four decades, pasture and crop lands have replaced 111.7 million hectares of forestland in Brazil (MapBiomas, 2026). These expansion efforts set the stage for understanding how production gains have been achieved in Brazil.

Agricultural Productivity and Intensification

Understanding productivity patterns requires distinguishing changes driven by land expansion from those arising through technological and management improvements. Brazil's increases in agricultural output were achieved largely through the expansion of cultivated area. From 1961 to 1985, Brazil experienced rapid extensification of agriculture, with cropland growing at an average rate of 3.3 percent annually. The rate of extensification has slowed more recently though, with gains coming more from increases in productivity. In the United States, production gains have been driven by rising yields, with relatively little addition of new agricultural land. In fact, agricultural land acreage is smaller in 2023 than it was in 1961.

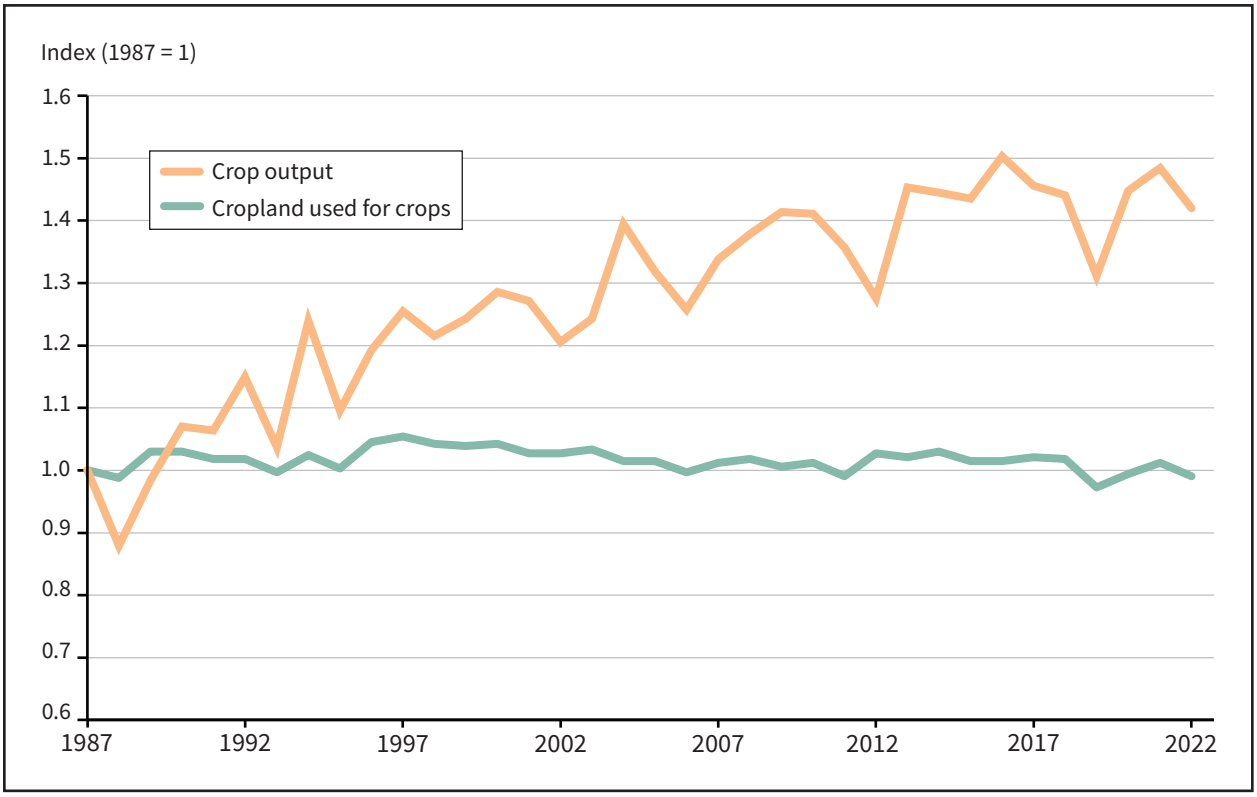
The United States: Increasing Output Through Yields and Technological Innovation

Total cropland declined in the United States from 1987 to 2022, with every category declining except cropland used for crops. During this period, land used for crops (which excludes pastureland and idle cropland) declined 1 percent. Despite this decline, the production of most major commodities has increased year over year for decades, with aggregate crop output increasing 42 percent from 1987 to 2022.[25] Figure 11 shows cropland used for crops and crop output from 1987 to 2022. The continued productivity gains on a reduced land base are what is often referred to as sustainable intensification and have been driven by technological innovation and enhanced management practices. While the total amount of cropland is modestly declining in the United States, these reductions have been more than offset by an increase in grassland and forestland. Land allocated to rural recreation and habitat preservation has increased 18 percent since 1987, reaching 226 million acres in 2022.[26] These sustained yield gains provide a basis for examining how specific conservation practices and research investments affect underlying production dynamics.

[25] Crop output is calculated by multiplying the individual crop's (such as wheat) output quantity by a price derived from a Törnqvist price index and then aggregated over commodities. See Wang et al. (2024) for more detailed information on how U.S. aggregate crop output is calculated.

[26] This estimate comes from the rural parks, wildlife refuges, and wilderness areas category from the Major Land Uses data product (USDA, ERS, 2026).

Figure 11
U.S. cropland used for crops and crop output, 1987–2022



Note: Both crop output and cropland used for crops have been normalized relative to their 1987 values.

Source: USDA, Economic Research Service using data from the Major Land Uses and Agricultural Productivity in the United States data products.

Impacts of U.S. Conservation Policy and R&D on Land Use and Yields

Conservation programs like CRP, EQIP, and CSP fund many different practices, each potentially having differing effects on production. Both the EQIP and CRP programs have been linked to small increases in county-level corn and soybean yields (Zhang et al., 2025). While the estimated effect varies over model specification and crop, Zhang et al. (2025) estimated that a hypothetical 10-percent increase in aggregate EQIP payments to the county in the previous 5 years would increase corn yields by 0.085 bushels per acre. They also estimated that a 10-percent increase in aggregate CRP payments to the county in the previous 5 years would increase soybean yields by at least 0.040 bushels per acre.[27] Although Zhang et al. (2025) were unable to establish the mechanism behind these improvements due to data constraints, they postulated that the positive correlation between CRP payments and yields reflected a composition effect as farmers selectively removed less productive land from production. Given program eligibility and ranking rules, farmers have greater incentive to enroll less productive lands in CRP relative to more productive lands that could remain in farming. This is especially true for General CRP, in which fields are taken out of production for the 10–15 years of their contract. If CRP temporarily removes lands with lower yields from production, the average yield of the lands remaining in production would be higher, even without any change in the productivity of the remaining land.

[27] In each case, Zhang et al. (2025) model a change to the total payments made to all farmers in the county, which could change due to entry/exit into/from the program, changes to payment rates or contract types, or other reasons. They did not explicitly model changes to CRP rental rates or EQIP financial assistance payment rates.

Working-lands conservation programs may also impact production through the practices they incentivize. Literature on the effects of some of the conservation practices supported by EQIP and CSP—namely conservation tillage (both no-till and reduced tillage) and cover cropping—is summarized in Bowman et al. (2025), along with analysis using USDA Agricultural Resource Management Survey (ARMS) data. The yield effects of cover cropping are particularly complex, since returns to cover cropping can accrue over long periods of time.

Findings on how these practices influence crop yields are mixed. Zhang et al. (2025) found a modest positive relationship between EQIP payments and yields, and while they did not provide a specific explanation for this, they did mention that conservation programs, generally, can increase yields through practice-induced improvements in soil health. Bowman et al. (2025) did not find a statistically significant difference when comparing yields between adopters and non-adopters of conservation tillage or cover cropping for corn and soybean fields. However, they did find a positive, significant correlation between conservation tillage and corn yields when using a matching analysis.[28] In their summary of the literature, they found that the estimated yield effects of no-till and reduced tillage are variable as well. For example, Al-Kaisi (2016) found that conservation tillage did not influence corn and soybean yields across seven locations in Iowa in 2003–13, but Deines et al. (2019) found small positive corn and soybean yield increases from conservation tillage along the U.S. Corn Belt. Taken together, these results imply nuanced, variable impacts from policies that incentivize conservation practices on sustainable intensification goals. U.S. conservation policy has been focused on outcomes or "resource concerns," such as water quality and wildlife habitat, that directly relate to sustainability but not to intensification or productivity directly.

Outside of conservation policy, U.S. agricultural research and development has resulted in substantial gains in productivity (Evenson, 2001; Alston et al., 2009; Huffman & Evenson, 2006; Fuglie & Heisey, 2007; Alston et al., 2009). Some of the improved crop varieties resulting from that research also have implications for conservation-practice adoption—such as those that allow for decreased pesticide use in the case of insect-resistant (Bt) crops, or decreased tillage, in the case of herbicide-resistant (HT) varieties. Adoption of HT, Bt, and stacked (HT+Bt) crop varieties has increased substantially in the past 25 years, with these varieties now planted on a combined total of more than 90 percent of corn, soybean, and cotton acres (USDA, ERS, 2025). Use of HT varieties is directly tied to producers' ability to adopt no- or reduced-tillage systems, since herbicides can replace tillage-based weed control in some cases (Sutherland et al., 2021). Improved varieties and the results of other agricultural research, such as animal nutrition, food manufacturing, and agricultural chemicals, have been important sources of productivity gains in U.S. agriculture over the past 40 years (Wang, et al., 2015).

Brazil: Rising Output Underpinned by Cropland Expansion and Yield Growth

Brazil has seen substantial shifts in its agricultural land use for crops and grazing and movement of its agricultural frontier (IBGE, 2026). Increases in productivity have resulted in rising agricultural production, especially in the tropical savannah of the Cerrado (IBGE, 2026). Over the past three decades, 18 percent of the country's forestland has been cleared, including 157.7 million acres of the Cerrado and 50.4 million acres of Legal Amazon territories (MapBiomas, 2026). According to MapBiomas, Brazil cleared more than 1.8 million hectares (4.4 million acres) of forest in 2023, with the Cerrado accounting for 61 percent of the deforestation while the Amazon accounted for 25 percent (MapBiomas, 2024).

[28] Neither method of comparison indicates causality.

Brazil's agricultural transformation can be divided into several periods, each characterized by different combinations of land expansion, productivity growth, policy changes, and export demand. From 1961 to 1985, Brazil's Government enacted policies, such as the Superintendência de Desenvolvimento da Amazônia (SUDAM) Plan in the 1960s and the National Integration Program (PIN) in the 1970s, to "colonize" the forest, by redistributing land and expanding settlements, infrastructure, and industries into the Legal Amazon (Joanoni Neto & Guimarães Neto, 2021). The Government also provided agricultural subsidies for agricultural and cattle production and invested in agricultural R&D through the Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), 2024; Correa & Schmidt, 2014).

Exports were a focus of policies enacted during this time period (MAPA, 2025). For example, PIN decreed the construction of several interstate roads, including the BR-163, connecting the south to the north of the country (from Cuiabá in Mato Grosso to Santarém in the Center-West region). Another road was built that runs from east to west, connecting the Legal Amazon with the Northeast. The Cuiabá-Santarém Road integrated Brazil's interior states with the rest of the country and notably, the Amazon River, home to several major river ports (Joanoni Neto & Guimarães Neto, 2021). Import-substitution industrialization also took place in Brazil in the 1980s, which emphasized Brazil's self-sufficiency and protections for domestic industrial production. During this period, improvements in yields coincided with credit constraints (Barros, 2009).

Between 1986 and 1995, cropland use declined 2.3 percent per year and total factor productivity (TFP) growth slowed (1.8 percent annual growth) compared to the previous decade (2.6 percent annual growth). In the 1985 crop year, a second corn crop was introduced on a small scale in southern Brazil (Ramalho et al., 2021), where the poultry and pork industries were located (Valdes et al., 2023). The 1986–95 period was also characterized by agricultural trade liberalization (World Trade Organization (WTO), 2026).[29] This was a period of hyperinflation, low growth, and decreased Government support (subsidized credit) to agriculture (Barros, 2009).

The period from 1996 to 2003 saw Brazil's second corn crop become firmly established, and the practice rapidly expanded in the Center-West region of the country. The large 1994 devaluation of Brazil's currency favored exports, debt forgiveness, and agricultural production and led to privatization and lower Government support to agriculture. During 1994–2004, global trade in soybeans doubled, and about 70 percent of the global increase in exports went to China (TDM, 2026). In Brazil, seeds smuggled from Argentina led to the first plantings of genetically engineered (GE) soybeans in the 1990s and their eventual legalization in 2003 (Daroit & Nascimento, 2009). Since 2004–05, sustained growth and investments in agriculture, expansion of the second corn crop, and rapid export demand from China (principally for soybeans and beef) have led to rapid growth in Mato Grosso and the expansion of the agricultural frontier to northern export ports to reduce transportation costs (Valdes et al., 2023).

Brazil has substantially expanded its agri-food sector through both land expansion and yield growth. The adoption of improved corn varieties and double cropping soybeans with corn have contributed to rapid production growth in the past three decades. However, at 6 tons per hectare, corn yields in Brazil represent less than half the corn yields obtained in the United States. Average soybean yields also differ, with U.S. soybean yields 7 percent higher than Brazil's yields (EMBRAPA, 2024).

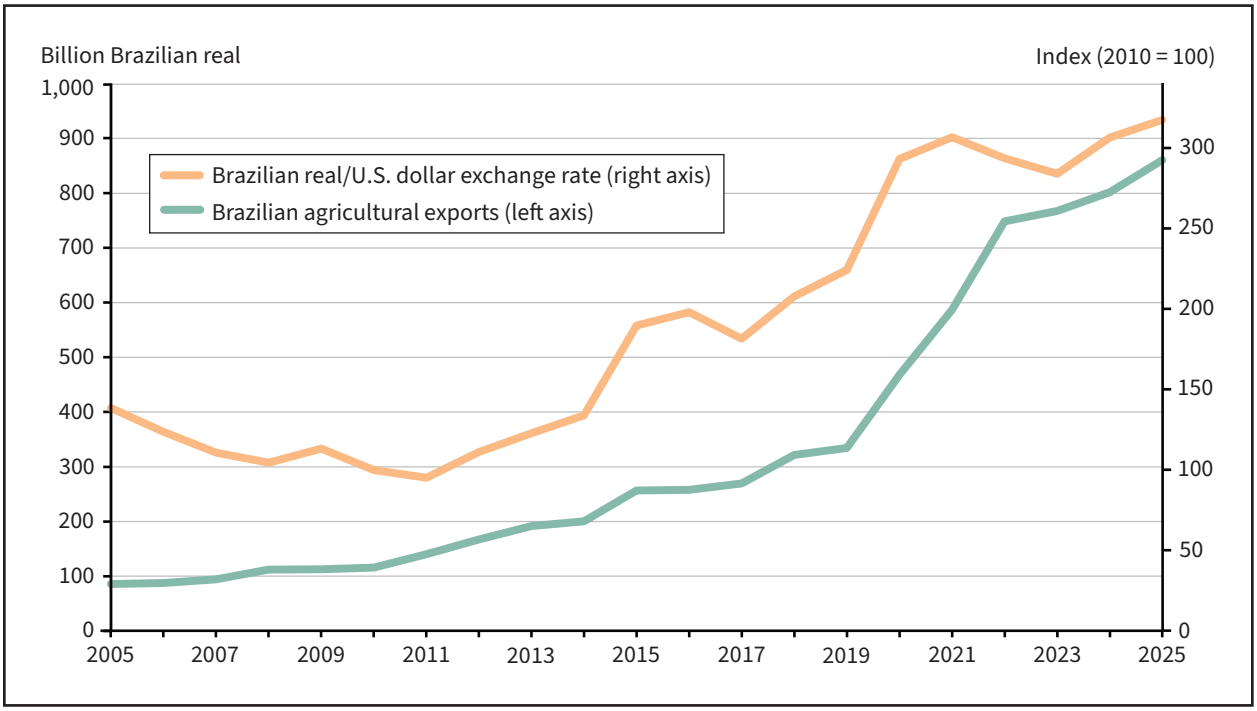
[29] From 1986, the Uruguay Round of negotiations under the General Agreement on Tariffs and Trade (GATT) commenced. This eighth round of negotiations was concluded in 1994, creating the World Trade Organization (WTO) and increasing international trade by reducing protective measures in sectors such as agriculture (WTO, 2026).

Brazil's Agricultural Exports

Changes in production and land use are reflected in Brazil's export profile, with shifts in competitiveness corresponding with developments in key commodity sectors. Brazil's agricultural exports, including processed products, have grown, on average, 12 percent per year since 2000 and accounted for 37 percent of Brazil's total exports in 2025. Brazil is now the world's largest global exporter of soybeans, poultry meat, beef, coffee, sugar, and orange juice (TDM, 2026).

Fluctuations in Brazil's exchange rate have also played a role in the increased competitiveness of Brazilian agricultural exports. Depreciation of the Brazilian real relative to the U.S. dollar reduces the dollar price of Brazilian products sold in foreign markets, thus promoting export sales. A devaluation in 1999 benefited Brazil's export sector by lowering the price of its export products and boosting producers' domestic-currency revenues (Langley, 2000). During this period, the area planted to soybeans expanded rapidly. Following the global financial crisis, there was another recession and devaluation in 2009, and during subsequent years Brazil's soybean production and exports increased significantly (USDA, FAS, n.d.). All in all, Brazil's devaluations in 2001, 2009, 2015, and 2021 had a positive effect on its agricultural trade, contributing to Brazilian agriculture's increasing export orientation with each recession (Valdes et al., 2020; figure 12).

Figure 12
Export value of all agricultural products from Brazil and the Brazilian real-U.S. dollar exchange rate



Source: USDA, Economic Research Service using data from Banco Central do Brasil, 2025.

Brazil's Cattle Production and Beef Exports

Brazil is the third-largest cattle producer in the world, behind China and India, with the world's biggest commercial herd at 234.4 million head. From 2000 to 2022, the beef-cattle herd in the Legal Amazon region grew at an average annual rate of 2.6 percent, which was faster than the national average of 0.9 percent. Its herd grew from 47.5 million to 104.3 million head (IBGE, 2026). While cattle ranching occurs in all Brazilian regions, the Legal Amazon accounts for 35 percent of national production. Ranches with more than 500 head of cattle are principally located in the Legal Amazon and contain 44 percent of all animals, with 60 percent of these ranches containing more than 1,000 animals.[30]

About 84 percent of cattle in Brazil consume grass on free-range production pastureland throughout their lives, with 9.6 percent of the fattening occurring in feedlots and 6.4 percent occurring through supplemental feeding on pastureland for the final phase before slaughter. The average slaughter age is 36 months (down from 48 months a decade earlier), and the slaughter rate is 33 percent (up from 21 percent in 2014) (MAPA, 2025).

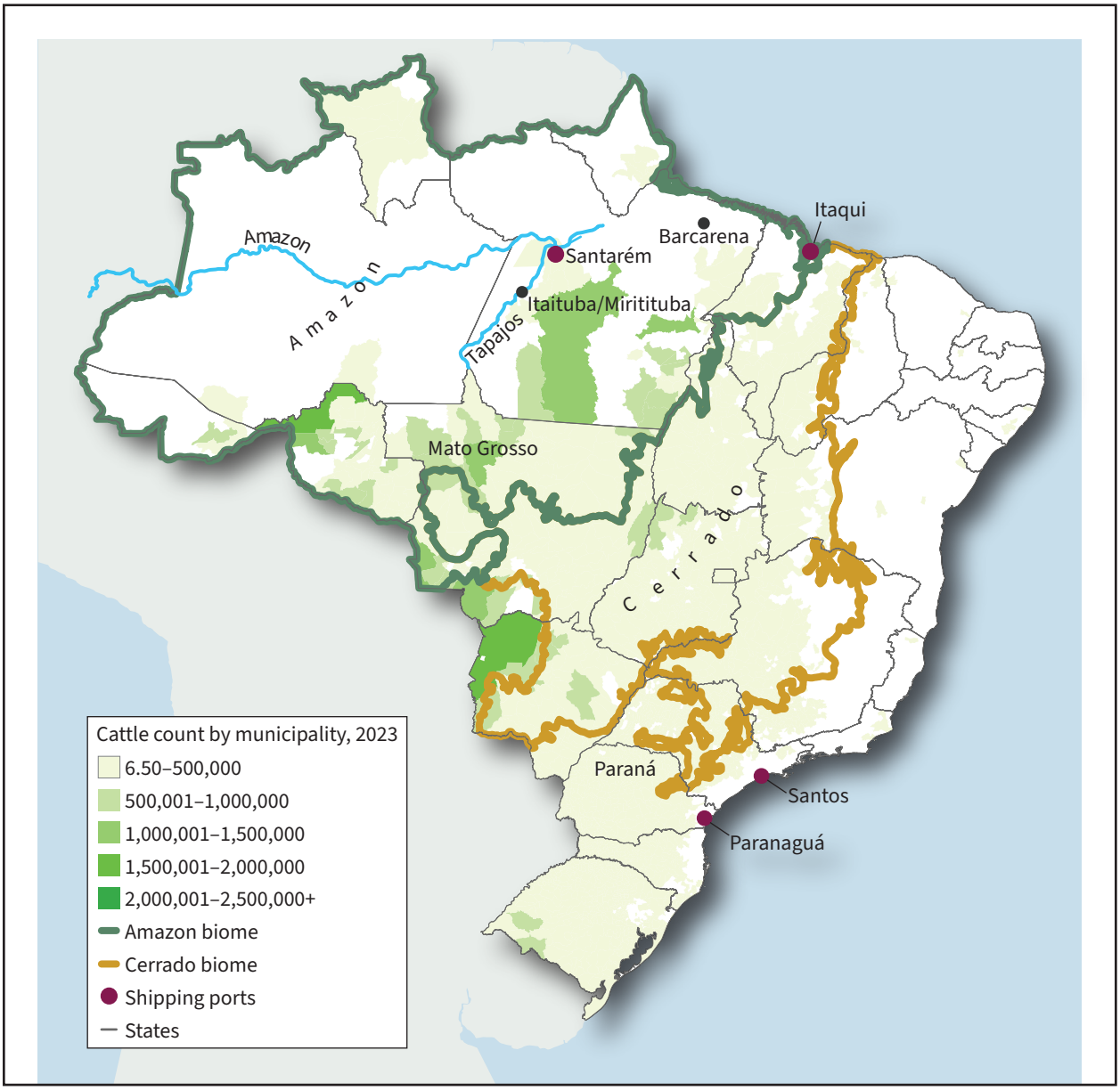
Technological advancements, low labor costs, a large domestic market, and beef demand from China have encouraged the development of beef-processing operations in Brazil (Center for Advanced Studies on Applied Economics (CEPEA), 2023). Between 2005 and 2025, the national average cattle stocking rate in Brazil increased from approximately 0.91 to 1.19 head per hectare (head/ha) in 2005 to 1.25 to 1.35 head/ha by 2025. Feedlot operations continue to gain market share for cattle finishing. The number of fed (confined and semi-confined) cattle has increased from an average of 2 million head to more than 9 million head in 2025 (IBGE, 2026). This increased cattle productivity (breeding and nutrition) is tied with increased demand for land resources for crops. The growth in beef-cattle farming has been driven mainly by an increase in domestic consumption and, in recent years, by exports to Asian countries, particularly to China (TDM, 2026).

Brazil's gains in per-capita income have resulted in higher income levels, a growing middle class, and the diversification of diets, leading to stronger demand for meat by Brazilian consumers. Brazil is the world's largest exporter of beef, by volume, with exports accounting for 21 percent of global exports, ahead of India, Australia, and the United States (USDA, FAS, 2025b). China's demand for beef has played a key role in stimulating Brazilian beef exports, which increased from just 1,000 metric tons in 2004 to more than 1.7 million metric tons in 2025 (TDM, 2026). China accounts for 53.4 percent of Legal Amazon beef exports (figure 14). In 2025, Legal Amazon beef exports reached 1.0 million metric tons (about 37 percent of Brazil's beef exports to China). In 2025, beef exports from Mato Grosso[31] totaled 532.6 million tons, with 53 percent of those exports shipped to China (figure 14). Given the projected increase in cattle availability and strong external beef demand, exports are projected to rise 31 percent, from 2.9 million tons in 2024 to 3.8 million tons in 2035 (MAPA, 2025).

[30] In Brazil, 40 percent of cattle herds consist of fewer than 10 animals.

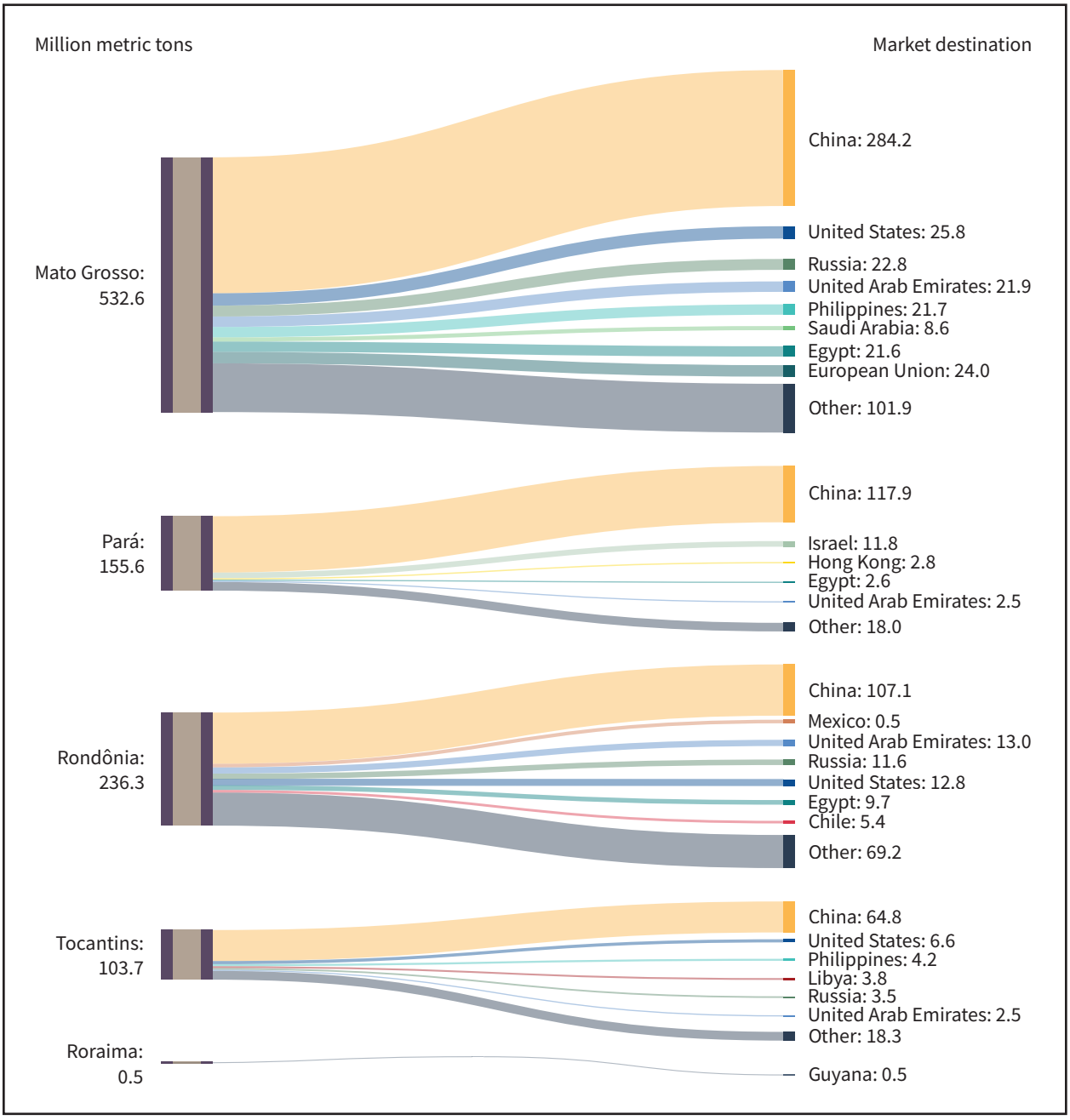
[31] The State of Mato Grosso, Brazil's leading agricultural producer and exporter (both by volume and value), has land that is part of both the Amazon (57 percent) and Cerrado (37 percent) biomes (IBGE, 2026).

Figure 13
Geographical distribution of Brazil's cattle in 2023



Source: USDA, Economic Research Service using data from the Brazilian Institute of Geography and Statistics, 2023.

Figure 14
Legal Amazon beef-exporting States and destination markets, average 2023–25



Source: USDA, Economic Research Service using data from the Brazilian Foreign Trade Secretariat, 2026.

U.S. competition with Brazil in the beef sector remains limited because each country exports to a different market segment, with the exception of China (USDA, FAS, 2025b). U.S. beef is recognized as a premium product (with a premium price) in the global market. The United States supplies its grain-fed beef to markets in Japan, South Korea, Mexico, China, Canada, and the European Union (listed in order of trade importance), which together account for more than three-fourths of global U.S. beef exports. In the international marketplace, there are distinct differences between U.S. and Brazilian exports with respect to key characteristics of beef quality. U.S. beef is grain-fed and known for its distinctive marbling, however, Brazilian beef does not have that same trait. Brazil supplies grass-fed beef to other markets, including China and Russia, for use in processed products (TDM, 2026). Brazil

also supplies beef to the United States, with the United States the second-largest destination for Brazilian beef. In the first 7 months of 2025, close to 13 percent of all Brazilian beef exports were sent to the United States. Most Brazilian exports to the United States are beef trimmings that are processed with U.S. beef and turned into burger patties. Brazilian beef is also used for ground beef in the United States (USDA, FAS, 2025a).

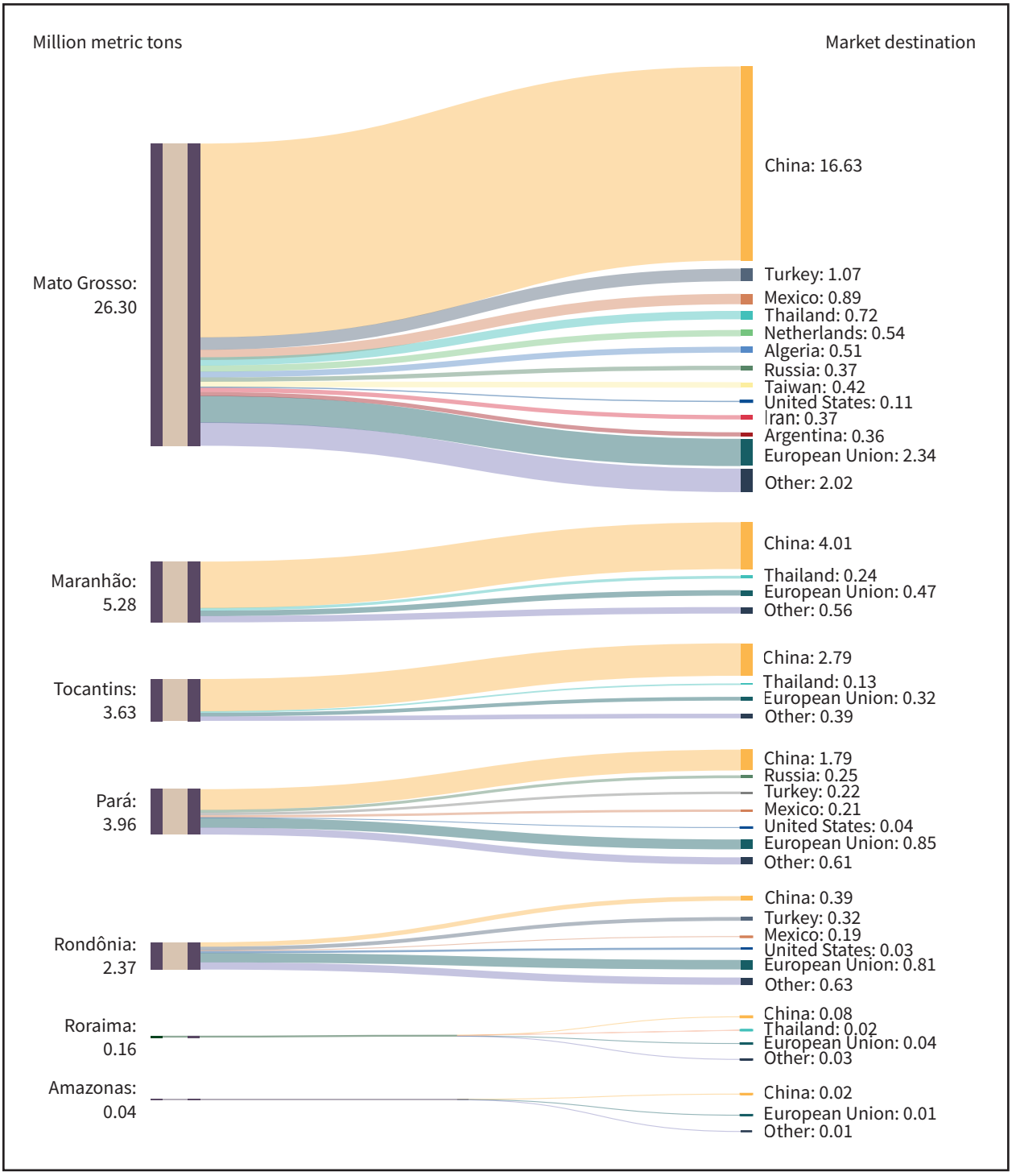
Brazil's Soybean Production and Exports

Soybean production in Brazil stands out at the center of the country's farm-sector expansion and its ascent as a top global supplier of agricultural products. Brazil is the world's leader in soybean production and exports. Companhia Nacional de Abastecimento (CONAB) projects soybean farmers will produce 180.6 million metric tons (equivalent to 6.62 billion bushels) in marketing year 2025/26, harvested on a record 48.6 million hectares (120.1 million acres) (CONAB, 2025). Beginning in 2000, the number of acres in soybean production has increased by an average of 2.3 percent per year.

Song et al. (2021) found substantial forest loss due to soybean expansion occurred in the Cerrado. They also found that the Pampas, Cerrado, and Atlantic Forest nearly doubled the area under soybean cultivation between 2001 and 2019. The introduction of financial reforms, deregulation, privatization, and trade liberalization led to the opening of the soybean sector to traders and processors (Cardoso, 2011). The growth in the soybean sector accelerated after 2008, and soybeans accounted for 50 percent of total Brazilian field-crop output by volume in 2025/26. A significant share of this agricultural production expansion has been destined for exports (CONAB, 2025), with China being the largest export destination (figure 15).

Figure 15

Legal Amazon soybean-exporting States and destination markets, 2023–25

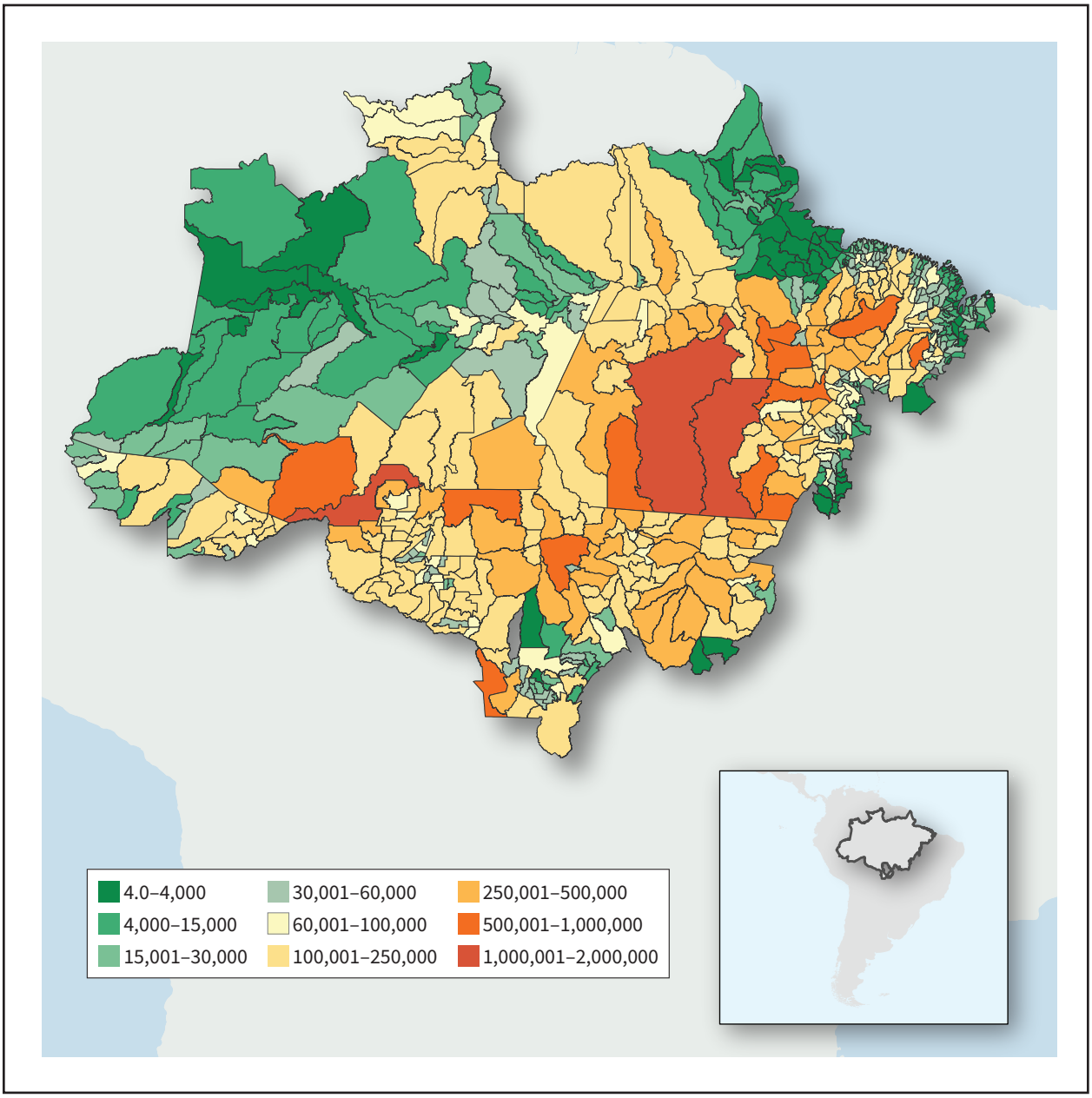


Source: USDA, Economic Research Service using data from the Brazilian Foreign Trade Secretariat, 2026.

Brazil's Deforestation: Historical Trends and Current Status

Land-use shifts linked to pasture and crop land expansion have had measurable effects on forest cover, making deforestation a central characteristic of Brazil's recent agricultural landscape. As one of the world's largest cattle producers, increased domestic and international demand for beef has driven the expansion of Brazil's pastureland into the agricultural frontier and resulted in the conversion of forestland to pastureland (Silveira et al., 2022). Bowman et al. (2012) found that extensive cattle ranching remained the dominant land use in the Brazilian Amazon despite its low productivity. Figure 16 illustrates the transition from forestland to pastureland from 1985 to 2022 in the Legal Amazon region and the resulting expansion of the agricultural frontier. Estimates of deforestation indicate that over that period, 63.8 million hectares (14 percent of the forest) in the Legal Amazon and 20.4 million hectares (4 percent of the forest) in the Cerrado have been cleared (MapBiomas, 2026; IBGE, 2025).

Figure 16
Transition from forestland to pastureland in the Legal Amazon (hectares), 1985–2022



Source: USDA, Economic Research Service using data from MapBiomas, 2026.

Studies have analyzed or modeled the economic effects of biofuel policies on grain-producing regions of the world and on world food production, using agricultural sector or multisector economy-wide models to assess policy and trade implications of increased ethanol production (Richards et al., 2026; Elobeid et al., 2011). Others have examined price shocks in global crop prices, their transmission to domestic prices, and the effect on deforestation (Berman et al., 2023; Harding et al., 2021). For the case of Brazil, still other studies have confirmed that crop, pasture, and forestland prices are closely connected through land-use conversion and speculative spillover effects, where rising profits from soybean production drive up the opportunity cost and price of land (Richards & Arima, 2026; Richards et al., 2014; appendix A).

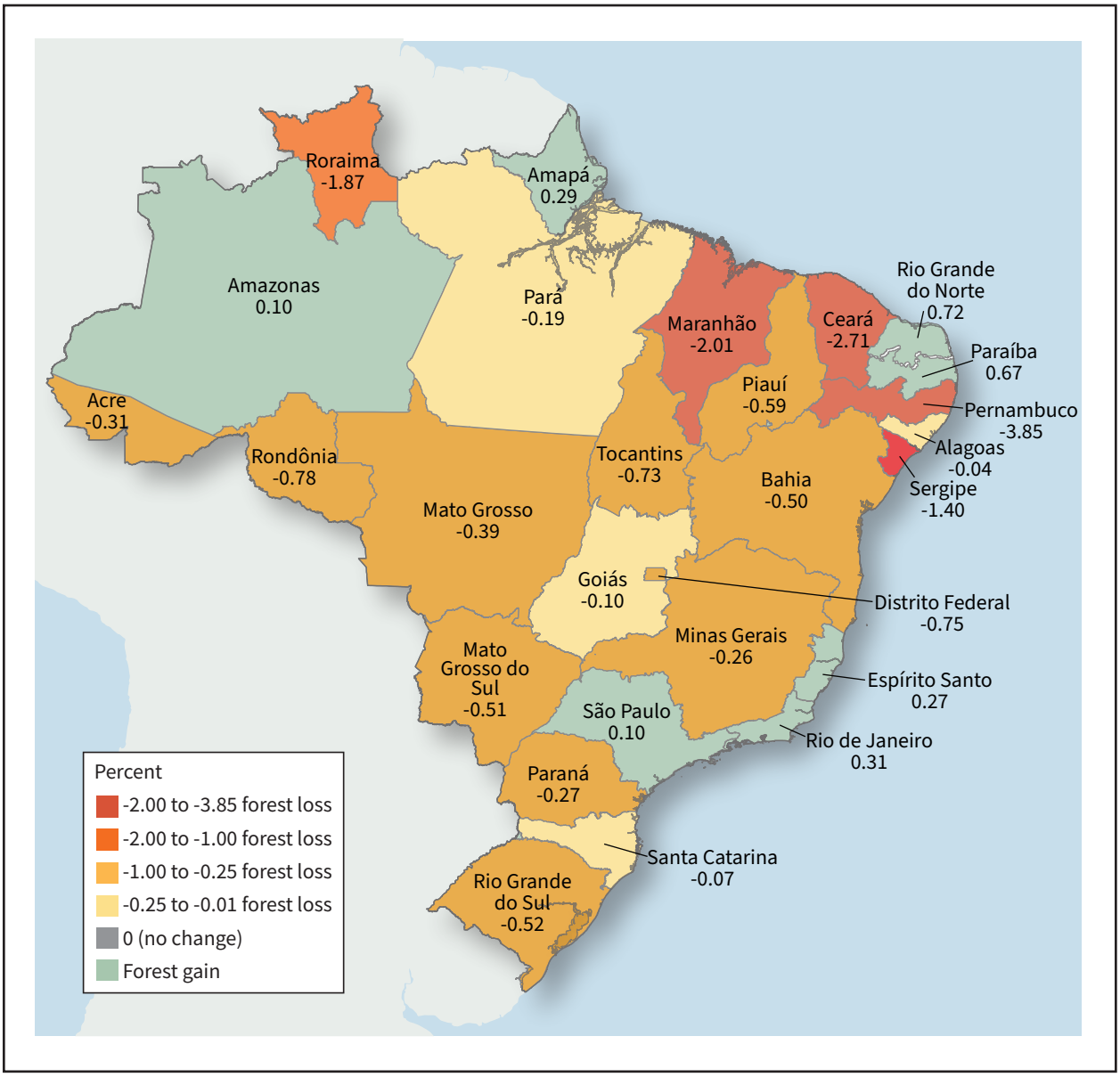
Protected Lands in Brazil

Brazil encompasses approximately 850.7 million hectares of land, providing essential context for interpreting national-scale, forest-cover dynamics. Protected forest areas were quantified at the State level from 2022 to 2024 using MapBiomas land-cover and land-use tabular data (figure 17). For each year, forest-classified, land-cover values located within legally protected areas were extracted and aggregated by State. These aggregated, forest-area totals were then spatially joined to the official Brazilian State boundaries to support consistent State-level comparisons. Short-term changes were evaluated using the 2022–2024 period, while long-term trends were assessed by using the time series spanning 1985–2024.

The short-term analysis identified forest-area losses in 20 States and gains in 7 States between 2022 and 2024, providing an indication of recent forest-cover dynamics within legally protected areas. In contrast, the 1985–2024 time series provide broader historical context for evaluating changes in forest and non-forestland cover.

Figure 17

Percent change in protected land area in Brazil, 2022–2024



Source: USDA, Economic Research Service using data from MapBiomas, 2026.

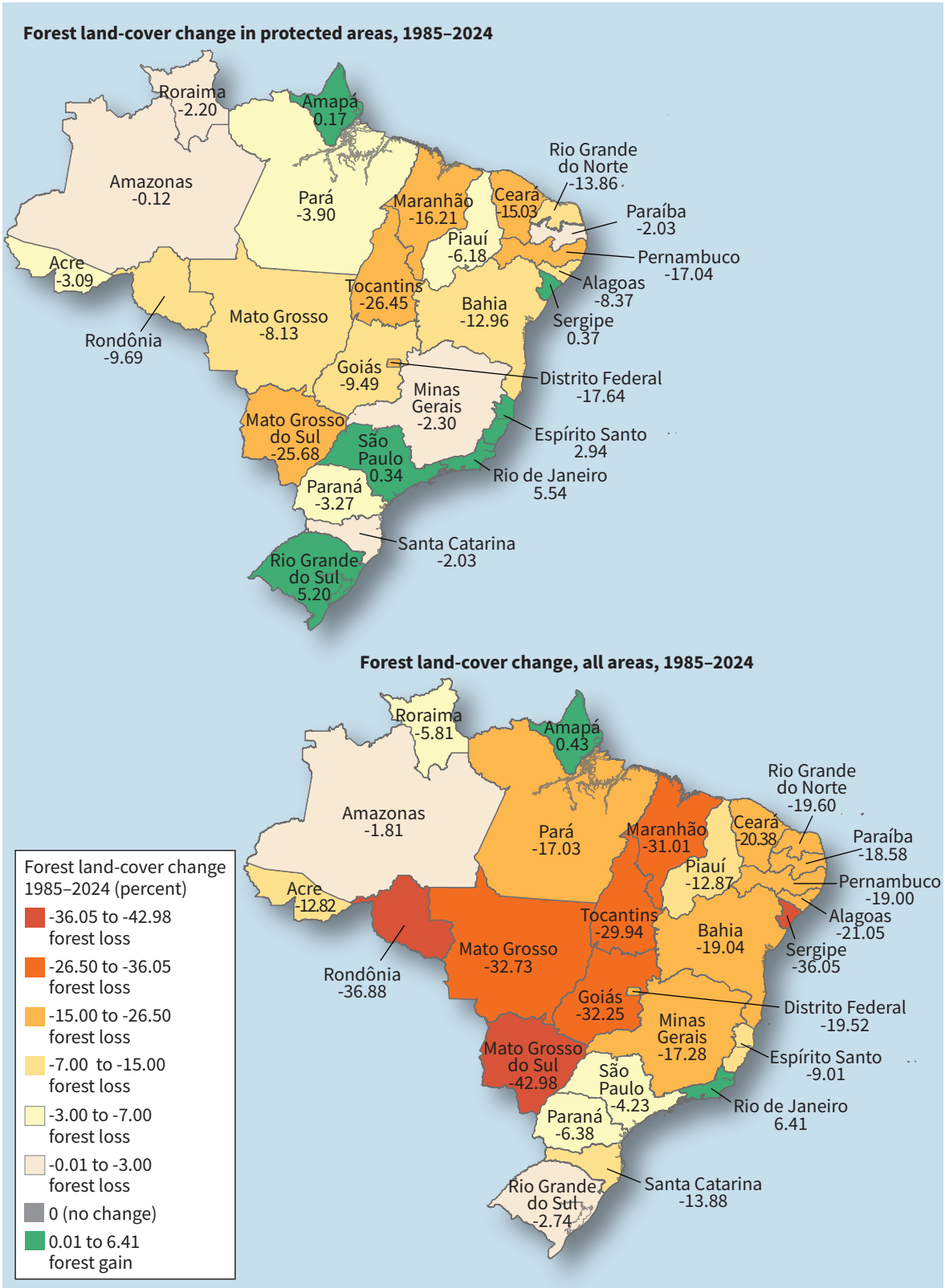
To assess long-term forest dynamics both inside and outside conservation-protected zones, forest-cover change within protected areas was evaluated from 1985 to 2024 using MapBiomas land-cover and land-use data. Forest-cover change within protected areas was summarized at the State level to quantify temporal trends across the study period. These State-level results were then integrated with Brazil's administrative boundaries and mapped to illustrate the spatial distribution of aggregated forest-cover change within protected areas. This spatial assessment provides insight into how forest-cover trajectories differ between lands inside conservation zones and those outside them.

The rate of forest change for each State was calculated as the percentage difference in protected forest area between 1985 and 2024, using 1985 as the baseline. Negative percentage values indicate reductions in protected forestland (forest loss), while positive values indicate increases (forest gain). Over this period, aggregated forest-cover change within protected areas ranged from –26.45 percent to 5.54 percent, compared with a wider range of –42.98 percent to 6.41 percent in non-protected areas (figure 18).

Figure 18 also shows that during the 1985–2024 period, 6 States experienced increases in protected forest cover, while 21 States exhibited declines. When the analysis is expanded to full land-use and land-cover changes, the data indicate widespread forest loss at the national scale. Of the 27 Brazilian States analyzed, 25 experienced a net loss in forest area between 1985 and 2024, while only 2 States experienced gains. This distribution underscores the extensive nature of recent deforestation, with gains occurring in only a small minority of States. Across the 2-year comparison period, protected areas collectively lost more than 300,000 hectares of forestland, while non-protected areas experienced even greater losses, totaling approximately 5.4 million hectares. Taken together, these differences show how conservation designations reduce but do not eliminate the pressures shaping forest-cover outcomes across Brazil.

Figure 18

Forest land-cover change in Brazil, 1985–2024



Source: USDA, Economic Research Service using data from MapBiomas, 2026.

The Legal Amazon experienced considerable fluctuations in deforestation levels between 2015 and 2025, with periods of activity followed by notable reductions (INPE, 2026). Deforestation has concentrated principally in Mato Grosso and Rondônia, where more than 16 percent and 31 percent of the forests, respectively, have already been cleared. This contrasts with the situation in Amapá and Amazonas, where smaller areas of land have been deforested (table 4; figures 19 and 20).

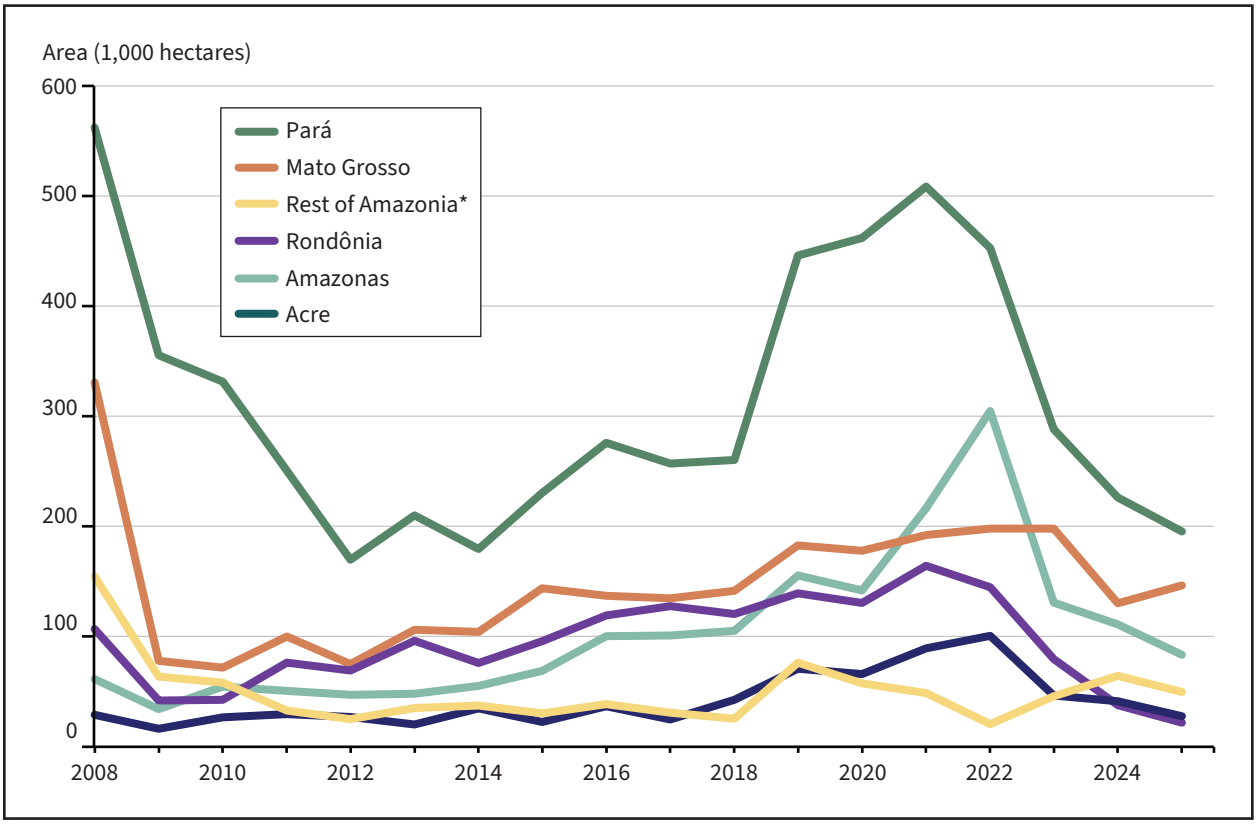
Since the mid-1980s, deforestation in Rondônia has been very rapid: 2 million hectares had been cleared by 1995, 5.2 million hectares by 2005, and 6.2 million hectares by 2015. By 2025, nearly 7.5 million hectares—an area larger than the State of West Virginia—had been cleared (MapBiomas, 2026). During the 1990s, the inland development in Mato Grosso and Rondônia for soybean cultivation further contributed to deforestation, as did the infrastructure developed to transport bulk grains for export (INPE, 2026). By 1997, Brazil had developed a soybean transportation route using the Amazon River and tributary rivers in Rondônia (Madeira River) and Mato Grosso (Tapajós River) to reach the export terminal port in Santarém. Soybeans shipments could also reach the port via the BR-163 road.

Table 4
Historical forest clearing in the Legal Amazon

	Area of State	Forest area in 2025	Percent of State classified as forest-cleared			
	1,000 hectares	1,000 hectares	By 1995	By 2005	By 2015	By 2025
Acre	16,417	13,919	2.5	6.4	8.7	11.9
Amazonas	155,926	132,809	0.3	0.6	1.0	1.7
Amapá	14,247	10,908	0.1	0.3	0.3	0.4
Maranhão	32,965	3,953	3.8	7.2	9.2	10.1
Mato Grosso	90,321	29,798	4.7	12.7	14.4	16.1
Pará	124,587	88,771	3.5	9.2	11.8	14.5
Rondônia	23,775	12,859	8.5	21.7	26.0	31.4
Roraima	22,364	14,659	0.8	2.1	2.9	3.9
Tocantins	27,742	479	2.1	3.1	2.9	3.2
Legal Amazon	**508,345**	**308,157**	**2.7**	**6.7**	**8.1**	**9.8**

Source: USDA, Economic Research Service calculations using data from MapBiomas, 2026. State area data are from the Brazilian Institute of Geography and Statistics, Malha Municipal Digital e Áreas Territoriais, 2025.

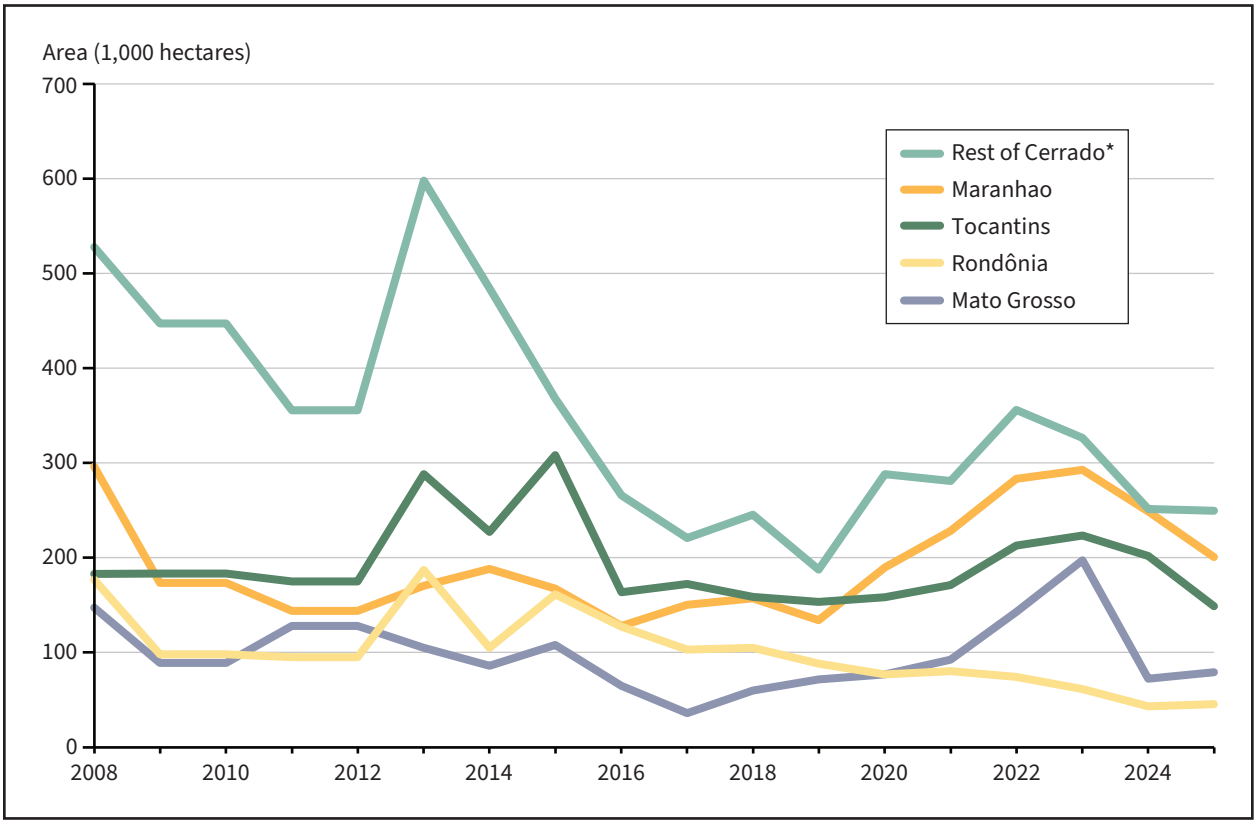
Figure 19
Annual deforestation in the Legal Amazon, 2008–25



* Includes Amapá, Maranhão, Roraima, and Tocantins.

Source: USDA, Economic Research Service calculations using data from Instituto Nacional de Pesquisas Espaciais (INPE), 2026.

Figure 20
Annual deforestation in the Cerrado, 2008–25



* Includes Distrito 22, Goias, Mato Grosso do Sul, Minas Gerais, Paraná, Pará, Piauí, Rondônia, and São Paulo.

Source: USDA, Economic Research Service calculations using data from Instituto Nacional de Pesquisas Espaciais (INPE), 2026.

Conclusion

Since the early 2000s, global economic conditions and population growth have led to rising demand for diversified diets and increased protein consumption (USDA, Office of the Chief Economist (OCE), 2025). Both Brazil and the United States have increased agricultural production in response to the growing demand. Brazil has increased crop and livestock production through land expansion and higher yields. This growth has altered the competitive landscape in global agricultural markets, contributing to declining U.S. market shares in third-country markets for oilseeds, grains, meats, and other agricultural products (USDA, OCE, 2025). To ensure the long-term viability of its agricultural system, Brazil aims to implement policies and farming practices that will improve yields and lower costs.

In the United States, agricultural production has increased since the early 2000s, even as farmland acreage has declined slightly. Many of the productivity gains realized in the United States have been attributed to R&D, particularly from improved crop varieties (Alston et al., 2009; Wang et al., 2015). As agricultural acreage has decreased, U.S. forestland has modestly increased, with the largest component of forest growth consisting of land set aside for protection in parks, wildlife refuges, and wilderness areas. The United States also invests an average of approximately $6 billion per year in various conservation programs, such as CRP and EQIP, which have been tied to small but statistically signifi-

cant yield increases (Zhang et al., 2025). However, the mechanisms behind yield impacts from conservation programs are unclear, as the practices these programs support have generally been found to have variable effects on yields (Bowman et al., 2025).

Our analysis comparing agricultural land-use trends and related policies in the United States and Brazil is limited by the complexities of shifting, interacting policies. One limitation is derived from the difficulties estimating the impact of recent changes to Brazilian land use and conservation policies. For example, the outcome of new policies meant to improve 40 million hectares of pastureland under PNCPD remains uncertain, both because it is a new policy and because of its scale and high estimated costs. Additionally, determining how these policies may interact with evolving international agreements and policies adds another layer of complexity. The European Union's 2023 Deforestation Regulation and the 2026 pause of the Soy Moratorium may send differing signals to Brazil's crop markets and drive antithetical land-use decisions. Lastly, while agricultural land use in the United States and Brazil has trended in opposing directions, both countries have seen increases in production and productivity. While uncertainty surrounding how increasing agricultural efficiency affects agricultural land use persists, the United States and Brazil provide two differing examples of land-use outcomes related to increases in productivity.

References

Alcott, B. (2005). Jevon's paradox. *Ecological Economics, 54,* 9–21.

Al-Kaisi, M. M., Archontoulis, S., & Kwaw-Mensah, D. (2016). Soybean spatiotemporal yield and economic variability as affected by tillage and crop rotation. *Agronomy Journal, 108***,** 1267–1280. https://doi.org/10.2134/agronj2015.0363.

Al-Riffai, P., Dimaranan, B., & Laborde, D. (2010). *Global trade and environmental impact study of the EU biofuels mandate*. Report for the European Commission.

Alston, J. M., Beddow, J. M., & Pardey, P. G. (2009). Agricultural research, productivity, and food prices in the long run. *Science, 325*(5945), 1209–1210.

Arias, D., Vieira, P. A., Contini, E., Farinelli, B., & Morris, M. (2017). *Agriculture productivity growth in Brazil: Recent trends and future prospects*. World Bank.

Arima, E., Richards, P. D., Walker, R., & Caldas, M. (2011). Statistical confirmation of indirect land use change in the Amazon. *Environmental Research Letters***,** *6*(2), 024010.

Baldos, U. L., Cisneros-Pineda, A., Fuglie, K. O., & Hertel, T. W. (2025). Adoption of improved crop varieties limited biodiversity losses, terrestrial carbon emissions, and cropland expansion in the tropics. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)***,** *122*(6), e2404839122.

Banco Central do Brasil (BCB). (2025). *Sistema Gerenciador de Séries Temporais.*

Barbarika, A. (2021). *The Conservation Reserve Program: A 35-year history*. U.S. Department of Agriculture, Farm Service Agency.

Barros, G. (2009). Brazil: The challenges in becoming an agricultural superpower. In L. Brainard & L. Martinez-Diaz (Eds.), *Brazil as an economic superpower?* Brookings Institution Press.

Berman, N., Couttenier, M., Leblois, A., & Soubeyran, R. (2023). Crop prices and deforestation in the tropics. *Journal of Environmental Economics and Management***,** *119,* 102819.

Bolfe, E. L., Victoria, D., Sano, E. E., Bayma, G., Massruhá, S. M., & de Oliveira, A. F. (2024). Potential for agricultural expansion in degraded lands in Brazil Based on Geospatial Databases. *Land, 13*, 200.

Borlaug, N. E., & Dowswell, C. R. (2005). Feeding a world of 10 billion people: A 21st century challenge. In R. Tuberosa, R. L. Phillips, & M. Gale (Eds.), *Proceedings of the international congress in the wake of the double helix: From the green revolution to the gene revolution*, Bologna, May 27–31, 2003, 3–23.

Bowman, M. S., Soares-Filho, B. S., Merry, F. D., Nepstad, D. C., Oriana, H. R., & Almeida, T. (2012). Persistence of cattle ranching in the Brazilian Amazon: A spatial analysis of the rationale for beef production. *Land Use Policy***,** *29*(3), 558–568.

Bowman, M., Ferraro, P., Fuller, K. B., Gramig, B. M., Mosheim, R., Njuki, E., Pratt, B., Rejesus, R., & Rosenberg, A. B. (2025). *Economic outcomes of soil health and conservation practices on U.S. cropland* (Report No. ERR-353). U.S. Department of Agriculture, Economic Research Service.

Brandão, A. S. P., de Rezende, G. C., & da Costa Marques, R. W. (2006). *Crescimento agrícola no Brasil no período, 1999–2004*. Texto para Discussão, 1103. Instituto de Pesquisa Econômica Aplicada.

Brazilian Confederation of Agriculture and Livestock (CNA). (2025). *Rural Landscapes Project***.**

Cadastro Ambiental Rural (CAR). (2026). *Ministério da Gestão e da Inovação em Serviços Públicos***.**

Caldas, M. M., Simmons, C., Walker, R., Perz, S., Aldrich, S., Pereira, R., Leite, F., & Arima, E. (2010). Settlement formation and land cover: A case study in the Brazilian Amazon. *Journal of Latin American Geography, 9*(1), 125–144.

Cardoso Jr., J. C. (2011). *A reinvenção do planejamento governamental no Brasil. Organizador, 4. Diálogos para o Desenvolvimento*. Institute of Applied Economic Research.

Ceddia, M. G., Bardsley, N. O., Gomez-y-Paloma, S., & Sedlacek, S. (2014). Governance, agricultural intensification, and land sparing in tropical South America. *Proceedings of the National Academy of Sciences, 111*(20), 7242–7247.

Center for Advanced Studies on Applied Economics (CEPEA). (2023). *Beef production.*

Companhia Nacional de Abastecimento (CONAB), National Supply Company. (2025). *Indicadores***.**

Congressional Budget Office (CBO). (2026). *Baseline projections: USDA farm programs.*

Correa, P., & Schmidt, C. (2014). *Public research organizations and agricultural development in Brazil: How did Embrapa get it right?* (Economic Premise Number 145). World Bank.

Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A., & Hansen, M. C. (2018). Classifying drivers of global forest loss. *Science, 361*, 1108−1111.

Daroit, D., & Nascimento, L. F. (2009). The influence of the actor network on the innovative process of transgenic soybean in Rio Grande Do Sul, Brazil. *Journal of Technology Management and Innovation***,** *4*(4), 150–160.

Deines, J. M., Wang, S., & Lobell, D. B. (2019). Satellites reveal a small positive yield effect from conservation tillage across the U.S. Corn Belt. *Environmental Research Letters***,** *14*(12), 124038.

do Valle Júnior, R. F., Siqueira, H. E., Valera, C. A., Oliveira, C. F., Fernandes, L. F. S., Moura, J. P., & Pacheco, F. A. L. (2019). Diagnosis of degraded pastures using an improved NDVI-based remote sensing approach: An application to the Environmental Protection Area of Uberaba River Basin (Minas Gerais, Brazil). *Remote Sensing Applications: Society and Environment, 14*, 20–33.

Elobeid, A., Carriquiry, M., & Fabiosa, J. (2011). *Global biofuel expansion and the demand for Brazilian land: Intensification versus expansion*. Iowa State University Center for Agricultural and Rural Development.

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA). (2024). *Brazil has 28 million hectares of degraded pastures with potential for agricultural expansion*. (Research, Development, and Innovation News Report).

Esri (2026). *USA Federal lands [ArcGIS layer]. ArcGIS Living Atlas of the World***.**

Evenson, R. E. (2001). Economic impacts of agricultural research and extension. In B. L. Gardner, & G. C. Rausser (Eds.), *Handbook of agricultural economics***,** *Volume 1A: Agricultural Production***.** Amsterdam: Elsevier Science.

Feltran-Barbieri, R., & Féres, J. G. (2021). Degraded pastures in Brazil: Improving livestock production and forest restoration. *Royal Society Open Science, 8*, 201854.

Food and Agriculture Organization of the United Nations (FAO). (2025). *FAOSTAT database.*

Fuglie, K. O, & Heisey, P. (2007). *Economic returns to public agricultural research* (Report No. EB-10). U.S. Department of Agriculture, Economic Research Service.

Goldman, E., & Weisse, M. (2026). *Deforestation linked to agriculture. Indicators of forest extent*. World Resources Institute, Global Forest Review.

Gutsch, M., Mai, J., Ukhova, N., & Dijkstra-Silva, S. (2025). Effects of environmental provisions in international trade agreements on business and economies–A systematic review. *Sustainability Accounting, Management and Policy Journal, 16*(7), 1–27.

Harding, T., Herzberg, J., & Kuralbayeva, K. (2021). Commodity prices and robust environmental regulation: Evidence from deforestation in Brazil. *Journal of Environmental Economics and Management***,** *108*, 102452.

Hertel, T. W., Ramankutty, N., & Baldos, U. L. C. (2014). Global market integration increases likelihood that a future African Green Revolution could increase crop land use and CO2 emissions. *Proceedings of the National Academy of Sciences***,** *111*(38), 13799–13804.

Huffman, W. E., & Evenson, R. E. (2006). *Science for agriculture: A long-term perspective* (second edition). Blackwell Publishing.

Hutchins, S. H. (2021). Sustainable agriculture in the U.S. vs. the EU. *CSA News***,** *66*, 24–34.

Instituto Nacional de Pesquisas Espaciais (INPE). (2026). *Dados abertos.*

Instituto Brasileiro de Geografia e Estatística (IBGE). (2026). *Macrocaraterização dos recursos naturais do Brasil: Potencialidade agrícola natural das terras.*

Instituto Clima e Sociedade (ICS). (2026). *New parameters for agricultural and livestock production in Brazil***.**

Langley, S. (2000). *International financial crisis and agriculture* (Report No. WRS-99-3). U.S. Department of Agriculture, Economic Research Service.

Lu, X., Li, H., Cheng, Y., Liu, X., Wang, S., & Wang, Z. (2026). Reassessing global trade and welfare impacts of EU's carbon border adjustment mechanism in developing countries: A structural quantitative model. *Humanities and Social Sciences Communications*. https://doi.org/10.1057/s41599-026-08941-y.

Maia, S. M. F., Canuto dos Santos, C., Greschuk, L. T., Cavalcante, M., Cherubin, M. R., Bayer, C., & Cerri, C. E. P. (2026). Sustainable intensification of Brazilian pastures reconciles food security with large-scale soil carbon sequestration. *Journal of Environmental Management, 413*, 130346.

MapBiomas (2024). *Collection [9] of the annual land use and land cover maps of Brazil.*

MapBiomas (2026). *Collection [10] of the annual land use and land cover maps of Brazil.*

Mendonça, M. J., Loureiro, P. R. A., & Sachsida, A. (2013). The dynamics of land-use in Brazilian Amazon. *Ecological Economics*, *84*, 23–36.

Ministério da Agricultura, Pecuária e Abastecimento (MAPA). (2025). *Informativo de economia agrícola.*

Miranda, J., Britz, W., & Börner, J. (2024). Impacts of commodity prices and governance on the expansion of tropical agricultural frontiers. *Scientific Reports, 14*(1), 9209.

Joanoni Neto, V., & Guimarães Neto, R. B. (2021). Brazilian national integration policies and the Amazon: Discourses of modernisation between the past and the present. In *Environment and development: Challenges, policies, and practices* (pp. 363–385). Cham: Springer International Publishing.

Oswalt, S. N., Bush, R., Murray, L. T., & Walker, D. (2026). *Forest resources of the United States, 2022: A technical document supporting the Forest Service 2020 RPA assessment* (General Technical Report WO-107). U.S. Department of Agriculture, Forest Service.

Pendrill, F., Persson, U. M., Godar, J., Kastner, T., Moran, D., Schmidt, S., & Wood, R. (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Global Environmental Change, 56*, 1–10.

Presidência da República Casa Civil (PLANALTO). (2023). *Decreto Nº 11.815, December 2023: Institui o Programa Nacional de Conversão de Pastagens Degradadas em Sistemas de Produção Agropecuários e Florestais Sustentáveis.*

Pretty, J., Benton, T. G., Bharucha, Z. P., Dicks, L. V., Flora, C. B., Godfray, H. C. J., Goulson, D., Hartley, S., Lampkin, N., Morris, C., Pierzynski, G., Prasad, P. W., Reganold, J., Rockstrom, J., Smith, P., Thorne, P., & Wratten, S. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nature Sustainability, 1*(8), 441–446.

Pretty, J., & Bharucha, Z. P. (2014). Sustainable intensification in agricultural systems. *Annals of Botany, 114*(8), 1571–1596.

Ramalho, M. A. P., Marques, T. L., & Lemos, R. D. C. (2021). Plant breeding in Brazil: Retrospective of the past 50 years. *Crop Breeding and Applied Biotechnology*, 21(spe), e383021S3.

Rausch, L., Reis, T. N. P., Mazzetti, C., Barrozo, M., Skidmore, M., & Gibbs, H. K. (2026). The rise and fall of the Amazon Soy Moratorium. *Science*, July 2026, 249–251.

Ribeiro, J. M. P., Maculan, G., de Ávila, B. O., Morais, V. A., Hoeckesfeld, L., Secchi, L., & de Andrade Guerra, J. B. S. O. (2025). Deforestation by production displacement: Expansion of cropland and cattle ranching on Amazon Forest. *Environment, Development and Sustainability*, 1–32.

Richards, P., Arima, E., Arita, S., & O'Hara, J. (2026). An ethanol boom and booming corn prices in Brazil's Amazon and Cerrado Regions. *Energy Policy, 217*, 115389.

Richards, P., & Arima, E. Y. (2026). High profits from soybean-corn agriculture are associated with increased land prices and deforestation rates in Mato Grosso's Amazon forests. *Communications Earth and Environment, 7*(1), 222.

Richards, P. D., Walker, R. T., & Arima, E. (2014). Spatially complex land change: The indirect effect of Brazil's agricultural sector on land use in Amazonia. *Global Environmental Change, 29,* 1–9.

Searchinger, T., Heimlich, R., Houghton, R. A., Dong, F., Elobeid, A., Fabiosa, J., Tokgoz, S., Hayes, D., & Yu, T. H. (2008). Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land-use change. *Science, 319*(5867), 1238–1240.

Silveira, M. V., Silva-Junior, C. H., Anderson, L. O., & Aragão, L. E. (2022). Amazon fires in the 21st century: The year of 2020 in evidence. *Global Ecology and Biogeography, 31*(10), 2026–2040.

Sims, M. J., Stanimirova, R., Raichuk, A., Neumann, M., Richter, J., Follett, F., MacCarthy, J., Lister, K., Randle, C., Sloat, L., Esipova, E., Jupiter, J., Stanton, C., Morris, D., Melhart, C., Drew, S., Harris, P., Harris, N. (2025). Global drivers of forest loss at 1 km resolution. *Environmental Research Letters, 20*(7), 074027.

Song, X., Hansen, M. C., Potapov, P., Adusei, B., Pickering, J., Adami, M., Lima, A., Zalles, V., Stehman, S. V., Di Bella, C. M., Conde, M. C., Copati, E. J., Fernandes, L. B., Hernandez-Serna, A., Jantz, S. M., Pickens, A. H., Turubanova, S., & Tyukavina, A. (2021). Massive soybean expansion in South America since 2000 and implications for conservation. *Nature Sustainability, 4*, 784–792.

Souza Jr., C. M., Shimbo, J. Z., Rosa, M. R., Parente, L. L., Alencar, A. A., Rudorff, B. F. T., Hasenack, H., Matsumoto, M., Ferreira, L. G., Souza-Filho, P. W. M., de Oliveira, S. W., Rocha, W. F., Fonseca, A. V., Marques, C. B., Diniz, C. G., Costa, D., Monteiro, D., Rosa, E. R., Velez-Martin, E....Azevedo, T. (2020). Reconstructing three decades of land use and land cover changes in Brazilian biomes with landsat archive and earth engine. *Remote Sensing, 12*(17), 2735.

Spangler, K., Burchfield, E. K., & Schumacher, B. (2020). Past and current dynamics of U.S. agricultural land use and policy. *Frontiers in Sustainable Food Systems. Agroecology and Ecosystem Services, 4*, 98.

Sutherland, C., Gleim, S., & Smyth, S. J. (2021). Correlating genetically modified crops, glyphosate use and increased carbon sequestration. *Sustainability*, *13*(21), 11679.

Tanaka, K. & Wu, J. (2004). Evaluating the effect of conservation policies on agricultural land use: a site-specific modeling approach. *Canadian Journal of Agricultural Economics***,** *52*(3), 217-235.

Trade Data Monitor (TDM). (2026). *Trade data monitor***.**

Tyner, W. E. & Taheripour, F. (2008). Biofuels, policy options, and their implications: Analyses using partial and general equilibrium approaches. *Journal of Agricultural and Food Industrial Organization, 6*(2),1–19.

Tyukavina, A., Hansen, M. C., Potapov, P. V., Stehman, S. V., Smith-Rodrigues, K., Okpa, C., & Aguilar, R. (2018). Types and rates of forest disturbance in Brazilian legal Amazon, 2000–2013. *Science Advances, 3*(4), e1601047.

U.S. Department of Agriculture, Economic Research Service (ERS). (2025). *Adoption of genetically engineered crops in the United States* (data product).

U.S. Department of Agriculture, Economic Research Service (ERS). (2026). *Major land uses***.**

U.S. Department of Agriculture, Farm Service Agency (FSA). (n.d.). *Conservation Reserve Program***.**

U.S. Department of Agriculture, Farm Service Agency (FSA). (2026a). *CRP enrollment and rental payments by State, 1986–2025***.**

U.S. Department of Agriculture, Farm Service Agency (FSA). (2026b). *Conservation Reserve Program monthly summary—March 2026.*

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). (2024). *Sustainable agriculture programs in Brazil—Past, present, and future* (Report No. BR2024-0006). Global Agricultural Information Network.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). (2025a). *Livestock and products* (Report No. BR2025-0024). Global Agricultural Information Network.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS). (2025b). *Livestock and poultry: World markets and trade*.

U.S. Department of Agriculture, Foreign Agricultural Service (FAS) (2026). *Production, Supply, and Distribution (PS&D) database*.

U.S. Department of Agriculture, National Resources Conservation Service (NRCS). (2025). *2022 National resources inventory summary report*.

U.S. Department of Agriculture, Office of the Chief Economist (OCE). (2025). *USDA agricultural projections to 2034* (Report No. OCE-2025-1). Prepared by the Interagency Agricultural Projections Committee.

Valdes, C., Hjort, K. & Seeley, R. (2020). *Brazil's agricultural competitiveness: Recent growth and future impacts under currency depreciation and changing macroeconomic conditions* (Report No ERR-276). U.S. Department of Agriculture, Economic Research Service.

Valdes, C., Gillespie, J., & Dohlman, E. (2023). *Soybean production, marketing costs, and export competitiveness in Brazil and the United States* (Report No. EIB-262). U.S. Department of Agriculture, Economic Research Service.

Verburg, R., Rodrigues Filho, S., Lindoso, D., Debortoli, N., Litre, G., & Bursztyn, M. (2014). The impact of commodity price and conservation policy scenarios on deforestation and agricultural land use in a frontier area within the Amazon. *Land Use Policy*, *37*, 14–26.

Wang, S. L., Heisey, P., Schimmelpfennig, D., & Ball, E. (2015). *Agricultural productivity growth in the United States: Measurement, trends, and drivers* (Report No. ERR-189). U.S. Department of Agriculture, Economic Research Service.

Winters-Michaud, C. P., Haro, A., Callahan, S., & Bigelow, D. (2024). *Major uses of land in the United States, 2017 (Report No. EIB-275). U.S. Department of Agriculture, Economic Research Service.*

World Country Data. (2026). *World population data, country facts and rankings 2026*.

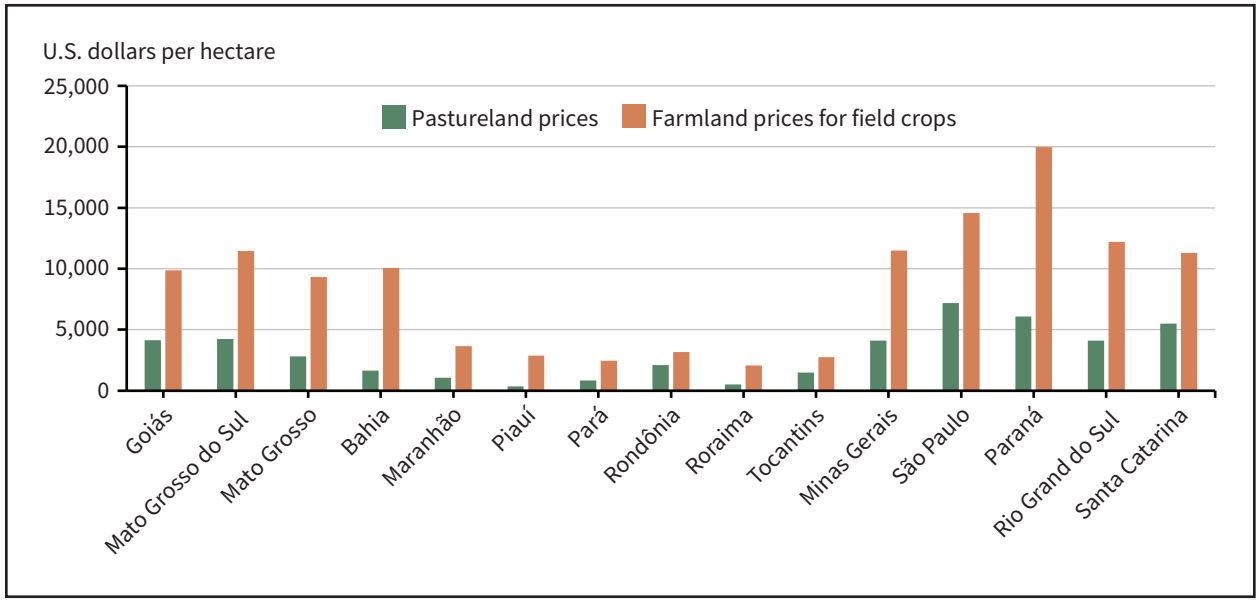
World Trade Organization (WTO). (2026). *The Uruguay Round*.

Zamani, O., & Pelikan, J. (2026). Deforestation-free trade: the impact of border regulations on trade, production and land use in the forestry and agricultural sectors. *Environmental Research Letters*, *21*(2), 024009.

Zhang, W, Li, Y., & Bovay, J. (2025). Yield impacts of agricultural conservation programs. *Choices, 40*(4), 1.

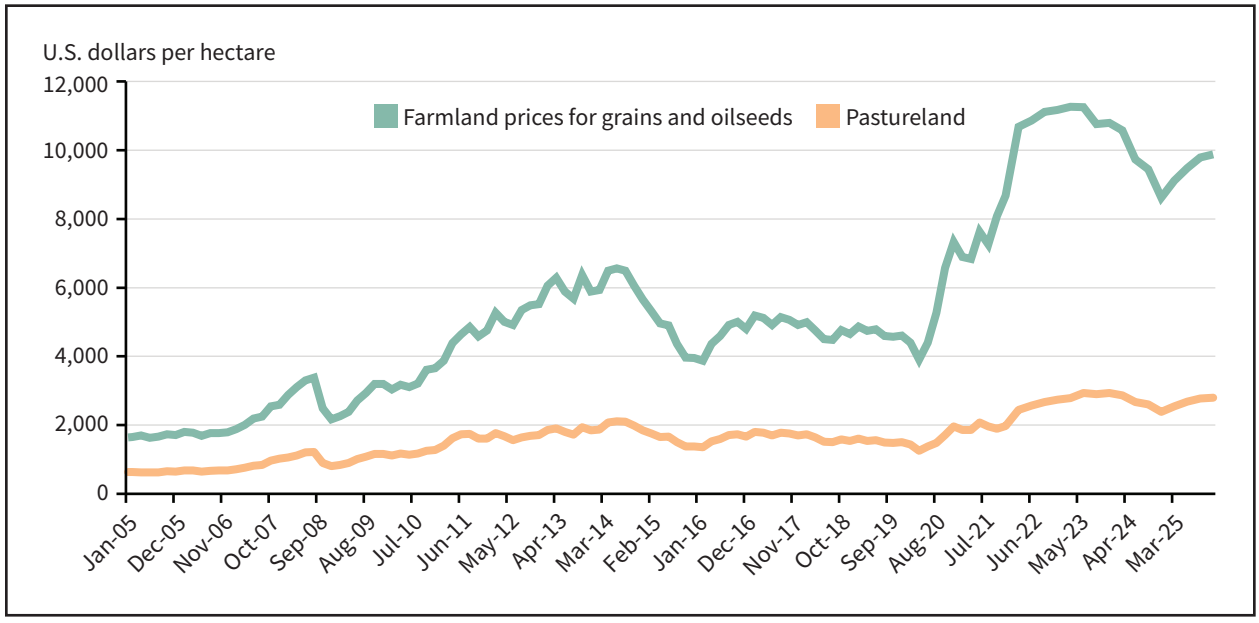
Appendix A. Brazil's Land Prices: Historical Trends and Current Status

Figure A.1
Crop and pasture land prices by Brazilian State in 2024–25



Source: USDA, Economic Research Service calculations using data from S&P Global.

Figure A.2
Crop and pasture land prices in Mato Grosso, 2005–25



Source: USDA, Economic Research Service calculations using data from S&P Global.