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保护塞拉多与亚马孙：中巴两国的商业机遇

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亚马孙环境研究所（IPAM）是一家巴西非政府科研机构，成立三十年来始终致力于亚马孙和塞拉多地区的可持续发展。研究所总部位于帕拉州贝伦市，在亚马孙和塞拉多两大生物群落区均设有分支机构，团队160余名成员（其中大多数为女性）正以多元专业背景共同推进生态保护事业。

我们通过三大支柱开展工作：科研成果产出、本地项目落实、公共政策影响，旨在实现经济增长、社会公平与环境保护的协同发展。IPAM在亚马孙和塞拉多生态区的土地利用、森林砍伐、气候变化及可持续农业等领域拥有深厚的研究积淀。

在中巴合作持续升温的同时，双边关系也必须关注气候转型的大背景。包括IPAM在内的多家机构科研成果证实，中巴农产品贸易的长期可行性，取决于能否终结在巴西生物群落区——尤其是亚马孙和塞拉多地区——发生的毁林行为。保护这些生态系统不仅是环境诉求，更是维系这个市场未来竞争力与延续性的战略需求。原生植被的保护，直接关系着降雨模式的稳定性，进而对巴西所出口农产品的产量与品质造成影响。

IPAM将派团于2025年6月访问中国，目的就是评估同中方机构开展技术科研合作的潜力，从而满足中巴这两个大国的共同期待。具体来说，我们的重点是建立合作关系，探讨热带森林砍伐和气候变化的进展同维持当前中巴贸易所需农牧业生产需求之间的关系。我们相信，加强此类合作对促进两国的可持续发展和构建具有韧性的供应链至关重要。

> **基于现有科研成果，我们认为，保护巴西生物群落区将为两国带来重大商业机遇，助力构建互利共赢的可持续大宗商品贸易体系。**

1. 巴西成为全球农业强国的崛起之路

五十年前，巴西曾是一个粮食进口国。然而，自20世纪70年代以来，巴西已跃升为全球最大的农产品生产和出口国之一，尤其在大豆和牛肉方面表现突出。这一转变得益于稳定的气候条件（当前的降雨模式让巴西90%的农业可以依赖自然降水）、战略性补贴和大规模的科技投入。此外，政策推动也发挥了关键作用。1973年成立的巴西农业研究公司（Embrapa）开发了适应热带气候的农业技术。同时，包括《丰收计划》（Plano Safra）在内的信贷和税收优惠措施以及出口补贴机制，则有力推动了农业生产向塞拉多和亚马孙等地区快速扩张。政府还通过分配耕地吸引了大量农业生产者，推动了这些地区农村定居点的增加。

1975年至2010年间，巴西牛肉产量增长了4.05倍（Embrapa，2017）。2024年，巴西牛肉出口达289万吨，创下历史纪录，同比增长26%以上（Abiec，2025）。牛肉生产效率在2021年达到顶峰，平均屠宰体重达每头270.2公斤（Cepea，2024）。1970年至2011年间，

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大豆成为巴西主要作物中增长最为显著的品种，种植面积激增1,762%（从130万公顷增加到2,420万公顷），产量增长了4,907%（从150万吨增加到7,510万吨），单产提升了271%（从每公顷1,144公斤增加到3,106公斤）（Dall'Agnol，2011）。2024年大豆产量为2.927亿吨，同比减少7.2%（2270万吨），种植面积达7900万公顷，同比增加1.6%（增加120万公顷）（IBGE，2025）。

牛肉和大豆产量的增加，主要是由于农牧业区域扩张造成的，而这一扩张导致亚马孙地区损失了15.84%的土地，塞拉多地区损失了47.2%的土地（MapBiomas，2023），这两个生物群落对于区域气候稳定性、生物多样性和河流水质保护以及农业长期可持续性都至关重要。

产量和生产效率方面的这些表现使农业成为巴西经济的主要支柱。2024年，农业行业在巴西GDP中的占比约为25%（Ozbun，2024），在巴西出口中的占比达49%（巴西农业部，2025）。2024年，大豆和牛肉出口占巴西总出口的16.2%（巴西贸工部，2025），创汇超过545亿美元，其中中国是相关产品的主要出口市场（巴西贸工部，2025）。如今，巴西已成为世界最大的大豆出口国和主要的牛肉出口国。这些行业的增长主要集中在亚马孙-塞拉多交界地带，那里的“农牧林一体化”生产体系和热带牧场管理等创新模式，使得适应区域气候的作物大规模生产效率大幅提高。

然而，近期的挑战给这一发展模式带来了不确定性。亚马孙和塞拉多交界地带的气候不稳定性和森林砍伐正在加剧气候变化，威胁到农牧业生产。巴西是世界第七大温室气体排放国，土地利用、林业和农业的变化占全国排放量的75%左右（SEEG，2023）。

亚马孙是世界上最大的热带森林，60.1%的面积位于巴西境内（IBGE，2022），该地区居住着约4000万人，其中包括众多原住民和传统社区。亚马孙地区的碳储量相当于全球12年的碳排放量（Nobre等，2023），这里还拥有地球20%的淡水资源，对于生物多样性保护、土壤保持和水循环等发挥着重要的生态调节功能。作为世界上生物多样性最丰富的地区，亚马孙是无可替代的自然遗产，为可持续发展提供绝佳机遇（IPAM，2010）。

从历史上看，非法砍伐和土地侵占正吞噬着这片雨林（Azevedo-Ramos等，2020；Moutinho & Azevedo-Ramos，2023），这通常与开辟新的农业生产区有关。该地区每年约有30%的非法森林砍伐发生在非指定用途的公共森林中，这些林地大多被改造成养牛牧场（Moutinho & Azevedo-Ramos，2023）。

然而，情况并非一直如此：2004年至2012年间，巴西在实现减少森林砍伐的同时，增加了粮食产量（Moutinho等，2016；Soares-Filho等，2010）。这一成绩的取得得益于稳健的公共政策和严格的执法行动，在此期间，农产品产量翻了一番，亚马孙地区的森林砍伐则减少了83%（Nepstad等，2014）。

遗憾的是，从2012年开始，巴西亚马孙地区的森林砍伐再度抬头。2019年至2022年间，年均砍伐面积保持在100万公顷左右，这一情况直到2023年才得以扭转，其主要原因是加强了对监管执法的投入，出台了相关公共政策，与私营部门签署了协议，并推出了监测系统。

图1：巴西的亚马逊和塞拉多生物群落

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塞拉多地区则是巴西和南美洲第二大的生物群落，覆盖面积1.98亿公顷，拥有巴西26%的原生植被，被认为是全球生物多样性最丰富的稀树草原。该生物群落对亚马孙河和南美大陆的大部分水循环系统发挥着至关重要的作用，因此该生物群落中植被的丧失会对区域农业生产构成严重威胁。在过去二十年里，这一重要生态系统的森林砍伐率一直保持在高位，同时，塞拉多地区还遭遇了严重的生物多样性丧失和水资源枯竭，这主要是由于畜牧和大豆种植的扩张造成的。过去十年里，塞拉多地区平均每年损失的植被超过92万公顷，在此期间，共有710万公顷的塞拉多地区土地被转化为农业用地。2023年，塞拉多地区有超过110万公顷的原生植被被转化为农业用地，首次超过了亚马孙地区（尽管塞拉多地区的面积仅为亚马孙地区的一半），占全国毁林总量的61%（IPAM，2024）。

与亚马孙地区不同，巴西《森林法》（保护巴西生物群落原生植被的立法）对塞拉多地区的法律保护要求相对较低。例如，在亚马孙地区，法律要求私有农场应将80％的土地保留为法定保护区，即原生植被保护区。而在塞拉多地区，这一比例较低，在20%至35%之间（巴西，2012）。此外，两个地区的土地利用状况差异也很大。亚马孙地区有大片未指定用途的公共森林（Azevedo-Ramos等，2020），而塞拉多地区的特点则是私有农场众多，法律保护力度较低。因此，亚马孙地区所面临的主要挑战是打击非法砍伐森林，而塞拉多地区的核心问题却是需要保护仍然可以合法砍伐的34%残存原生植被（Pinho等，2025），其中62%的面积集中在私有农场上（Bispo等，2023）。

综合考虑上述因素，未来粮食生产形势不容乐观。巴西亚马孙和塞拉多地区森林砍伐率的不断上升，加上全球气候状况的恶化，导致巴西在大豆生产方面的领先地位受到冲击，因为巴西的大豆生产很大程度上依赖于亚马孙-塞拉多农业产区可靠的降雨模式。Rattis等人（2021）预测，到2030年，在目前的气候条件下，该地区51%的农田可能变得不适宜种植，到2060年这一比例将上升到74%。将塞拉多原生栖息地转变为牧场和农业用地的做法，

已经导致当地气温上升了近1oC，降雨量减少了10%（Rodrigues等，2022）。研究表明，气温上升导致多种作物产量大幅下降，主要原因是降雨减少和天气模式变化（Rattis等，2021；Leite-Filho等，2021）。例如，气温升高1oC会导致大豆产量下降6%（Silva等，2023）。尽管农艺适应可以部分减轻这些影响，但保护原生植被对于维持区域气候调节仍然至关重要。

在亚马孙和塞拉多生物群落的气候变化和森林砍伐背景下，农产品市场面临着迫在眉睫的气候风险。全球变暖引发的极端事件导致蒸散量减少，森林砍伐扰乱了区域降雨模式，从而危及水资源供应，并导致干旱和极端天气事件发生频率增加。这些气候变化直接威胁农作物产量和牲畜生产力，导致生产成本上升，甚至会出现供应短缺。因此，大宗商品价格可能会变得更加不稳定，在气候异常时期面临上行压力。从长远来看，环境的持续恶化可能引发农业供应链的系统性断裂，对全球粮食安全和贸易稳定产生影响。

简而言之，遏止亚马孙和塞拉多地区的森林砍伐不仅是一项环境责任，也是维持经济和市场稳定以及全球粮食安全的战略重点。

2. 巴西与中国的外交及经贸关系

巴西与中国是历史悠久的合作伙伴。两国在全球南南地缘政治议题上拥有重要共识。自2009年起，中国成为巴西最大的贸易伙伴（巴西出口投资促进局，2011），两国经济的互补性使得双方在从大宗商品到高科技等众多领域建立起紧密的贸易联系。

当前的地缘政治格局正推动这两个大国进一步深化外交与经贸纽带，频繁的高层互访、持续对话、多项双边协议的签署即是明证。尽管当前这一时期对许多国家充满不确定性，但对中巴合作而言却意味着重要机遇，两国可以通过巩固长期贸易机制实现互利共赢。

大豆和牛肉是巴西对华出口的两大核心商品。在大豆方面，中国是全球最大的进口国，高度依赖巴西大豆以满足其不断增长的饲料和食用油用豆需求。近年来，在中国收入增长、饮食结构变化及国内蛋白质需求上升的背景下，巴西也成为中国重要的牛肉供应国。2024年，大豆占巴西对华出口总额的33%，牛肉占比为6.3%（巴西贸工部，2025）。同期，巴西73%的大豆出口和51%的牛肉出口均流向中国市场（巴西贸工部，2025）。

中巴贸易与巴西土地利用变化密切相关。亚马孙和塞拉多生物群落既是农业生产的核心区域，也是气候平衡的关键屏障。2020年，为满足中国牛肉需求导致的森林砍伐面积在塞拉多地区达243,199公顷，在亚马孙地区达152,799公顷；而大豆产业相关的毁林面积在塞拉多地区为90,055公顷，在亚马孙地区为9,041公顷（Trase，2024）。这凸显出调整农产品贸易模式的必要性，以确保生产的可持续性、粮食安全与气候稳定。

中国正展现出日益增强的全球可持续领导力，制定了到2030年实现碳达峰、2060年实现碳中和的宏伟目标。作为国家发展核心战略的“生态文明”理念，为中国与巴西合作提供了战略空间，将粮食安全与关键生物群落的保护结合起来。中巴合作对稳定大宗商品供应、遏制森林砍伐及应对气候变化极其重要。两国协同努力既可扭转农业产量下降的趋势，又能构建更具韧性的生态景观。这一伙伴关系不仅将强化经贸联系，更将为双方带来粮食安全、可持续发展与经济繁荣的多重效益。

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3. 探索中巴绿色韧性贸易合作的新机遇

国际合作与可持续投资对巴西实现制止森林砍伐、应对气候变化、保持农业生产力的目标意义重大，助力巴西确保粮食安全、经济稳定与环境复原力。

要构建长期可持续的贸易伙伴关系，最大机遇在于以可持续发展、创新和生态完整性为基础，打造中巴互利共赢的韧性贸易体系。中粮集团的公开承诺即为例证——该公司计划在2025年前消除大豆和牛肉供应链中的毁林行为，并依据科学碳目标倡议（SBTi）标准实现减排。加速巴西向零毁林低碳供应链转型，既能降低长期贸易风险，也将开启绿色增长与合作的新空间。

值此巴西持续发挥环境领导作用与中巴建交50周年之际，我们提出一系列潜在的合作举措，旨在促进两国建立可持续、有韧性和长期的贸易伙伴关系：

- 气候韧性科研合作：投资科学研究对评估气候变化风险及其对农业和生态系统的影响十分重要。双方可联合开发具有成本效益的适应战略（包括基于自然的解决方案），并设计适合热带农业的气候变化应对技术。
- 以追溯体系强化透明度：建立覆盖农产品全供应链的追溯系统，是确保可持续性、监控食品质量和化解检验检疫风险的核心。针对输华大豆和牛肉进行追溯合作，是降低整个价值链违法风险的有力途径。
- 气候适应融资动员：识别并拓展融资渠道，对支持热带农业气候适应项目具有重要意义。
- 生态修复作为战略路径：在亚马孙和塞拉多生物群落开展退化土地修复，可实现在不新增开垦面积的前提下，提升农业产能的目标。通过农林牧一体化生产、混农林业及生态修复等系统，巴西能在恢复景观的同时保护农村生计与生物多样性。
- 以经济激励遏制合法毁林：原生植被保护必须在经济上具有可行性，这点在塞拉多地区尤为重要。通过对环境服务付费、参与碳市场、可持续信贷额度和零毁林产品溢价等金融机制有助于扭转土地合法转化的趋势。
- 可持续集约化生产：通过气候智能型和低排放的种植方式提高单产，这是既满足农业生产需求，又保护生态系统的关键。基于科学的农业技术援助，可以在农村地区落实集约化和多样化生产等更可持续、更高效的生产实践。
- 释放生物燃料潜力：生物能源为交通和工业领域提供了一条低碳脱碳路径，符合两国的气候目标。技术与投资合作有助于扩大农林废弃物衍生的可持续生物燃料的生产和出口规模。
- 退化牧场修复与开发：恢复退化牧场是巴西提高生产力和减少排放的最大机遇之一。中巴可联合投资相关技术与实践，将利用效率低下的土地转化为可持续生产系统，从而减轻毁林压力。
- 巴西对华出口多元化：在2024年6月举行的中巴高层协调与合作委员会第七次全体会议上，双方同意深化贸易多元化并扩大巴西出口。借助2024年巴西担任G20轮值主席国推动全球可持续生物经济讨论的契机，我们将迎来一个独特的机会，在现有森林经济和社会生物多样性的基础上开辟新的具有韧性的市场。

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4. 结论

总之，巴西与中国的伙伴关系在协调农业生产、环境可持续性和全球贸易往来的复杂互动方面具有巨大潜力。通过整合两国在农业、科技和可持续发展方面的互补优势，双方可共同开辟更绿色、更具韧性的贸易实践路径。气候变化不仅给农业生产力和供应链带来实质性风险，更给未来发展注入了深层不确定性。包括预计的作物减产、气候波动加剧及潜在的价格震荡等在内的风险，将长期威胁两国的粮食安全和市场稳定，尤其对中国这个农产品进口大国而言更是如此。

鉴于中巴贸易关系的规模与相互依存度，两国应作为战略盟友共同开发应对气候挑战的解决方案。这包括联合对科技创新与公共政策进行投入，构建具有气候适应性的农业体系和供应链。通过协同行动，巴中两国可以为世界树立典范，证明环境保护和经济发展并非对立的目标，而是可持续繁荣未来的重要支柱。

在两国各级政府推动下，民间社会通过与第三部门及私营领域的对话，可以进一步挖掘双方可持续发展的潜力。巴西和中国之间正在架起一座真正的桥梁，强化引领全球生态转型的力量。

在此，我们重申：保护亚马孙与塞拉多生物群落应被视为双方共同的战略机遇，这是一项对两国中长期发展均有利的明智投资。

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The Conservation of the Cerrado and the Amazon: A Business Opportunity for Brazil and China

Olivia Zerbini Benin & André Guimarães

May 2025

IPAM (Amazon Environmental Research Institute) is a Brazilian non-governmental scientific organization that has been working for 30 years toward the sustainable development of the Amazon and the Cerrado. Headquartered in Belém, Pará, with offices distributed across both biomes, our efforts involve more than 160 staff members—most of them women—bringing together diverse expertise in support of conservation.

We operate through the production of scientific knowledge, implementation of local initiatives, and influence on public policies, with the goal of promoting economic development, social equality, and environmental preservation. IPAM has extensive expertise in research on land use, deforestation, climate change, and sustainable agriculture in the Amazon and the Cerrado.

Despite the growing enthusiasm around Brazil-China cooperation, it is essential that this relationship takes into account the context of climate transformation. Scientific evidence, including that produced by IPAM, shows that the long-term viability of agricultural commodity trade between Brazil and China depends on ending deforestation in Brazil's biomes—particularly the Amazon and the Cerrado. Protecting these ecosystems is not only an environmental necessity but also a strategic requirement to ensure the continuity and future competitiveness of this market. The stability of rainfall regimes—and consequently the production and productivity of the commodities exported by Brazil—is intrinsically linked to the conservation of native vegetation.

In June 2025, IPAM will visit China to explore the potential for technical and scientific cooperation with local organizations, aiming to address the shared aspirations of these two major nations: Brazil and China. More specifically, our focus is on establishing partnerships that allow a deeper understanding of the connections between tropical deforestation, climate change, and the need to sustain the agricultural and livestock production that currently supports Brazil-China trade. We believe that fostering such cooperation is essential for promoting sustainable development and resilient supply chains in both countries.

> **Given the current wealth of scientific knowledge, we understand that conserving Brazil's biomes represents a business opportunity for both nations, paving the way for a sustainable and mutually beneficial commodity trade.**

1. The Brazilian Context: How Brazil Became an Agricultural Powerhouse

Fifty years ago, Brazil was a food importer. However, since the 1970s, the country has transformed into one of the world's leading producers and exporters of agricultural commodities, especially soy and beef. This transformation was driven by a combination of stable climatic conditions (Brazil's

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current rainfall regime supports 90% of its agriculture without irrigation), strategic subsidies, and significant investments in science and technology. Public policies also played a central role in this shift. The creation of Embrapa (Brazilian Agricultural Research Corporation) in 1973 brought technological innovations adapted to Brazil's tropical conditions, while credit programs and tax incentives—such as the Plano Safra (2003) and subsidized export schemes—supported rapid expansion into regions like the Cerrado and the Amazon. Government programs offering arable land also attracted a wave of producers and encouraged the growth of rural settlements in these areas.

Between 1975 and 2010, beef production increased 4.05 times (Embrapa, 2017). The year 2024 marked a historic peak in Brazilian beef exports, reaching a total of 2.89 million tons—an increase of over 26% compared to the previous year (Abiec, 2025). Beef productivity peaked in 2021, when the average carcass weight (including all slaughtered cattle) reached 270.2 kg per animal (equivalent to 18 arrobas) (Cepea, 2024). In the soybean sector, between 1970 and 2011, soy cultivation recorded the highest growth among Brazil's major crops: the planted area expanded by 1,762% (from 1.3 to 24.2 million hectares), production increased by 4,907% (from 1.5 to 75.1 million tons), and productivity grew by 271% (from 1,144 kg/ha to 3,106 kg/ha) (Dall'Agnol, 2011). The 2024 soybean harvest reached 292.7 million tons, representing a 7.2% decrease (22.7 million tons) compared to 2023, while the cultivated area totaled 79 million hectares—an increase of 1.6% (or 1.2 million hectares) compared to 2023 (IBGE, 2025). This expansion has been largely driven by the dynamics of agricultural growth, which led to the loss of 15.84% of the Amazon and 47.2% of the Cerrado (MapBiomas, 2023)—two critical biomes for regional climate stability, biodiversity and freshwater conservation, and consequently, the long-term sustainability of agriculture.

This performance in production and productivity has turned agribusiness into the main pillar of Brazil's economy. In 2024, the sector accounted for approximately 25% of GDP (Ozbun, 2024) and 49% of the country's exports (Ministry of Agriculture and Livestock, 2025). In the same year, soybean and beef exports alone represented 16.2% of Brazil's total exports (Ministry of Development, Industry, Trade and Services – MDIC, 2025), generating over USD 54.5 billion, with China as the main destination market (MDIC, 2025). Today, Brazil is the world's largest soybean exporter and one of the top beef exporters. Growth in these sectors has been concentrated in the Amazon-Cerrado frontier, where innovations such as crop-livestock-forest integration systems (ILPF) and tropical pasture management have enabled large-scale productivity gains in crops adapted to the regional climate.

However, recent challenges cast uncertainty over this trajectory. Climate instability and increasing deforestation in the Amazon-Cerrado frontier are threatening agricultural productivity and exacerbating climate change. Brazil is the seventh-largest greenhouse gas emitter in the world, with land use change, forestry, and agriculture accounting for about 75% of national emissions (SEEG, 2023).

Figure 1. Amazon and Cerrado Biomes in Brazil

In the case of the Amazon, it is the largest tropical forest in the world, home to approximately 40 million people, including many traditional and Indigenous communities, with 60.1% of its territory located in Brazil (IBGE, 2022). It stores a carbon stock equivalent to 12 years of global emissions (Nobre et al. 2023) and holds 20% of the planet's freshwater, playing a vital role in ecosystem services such as biodiversity protection, soil conservation, and water regulation. As home to the world's greatest biodiversity, the Amazon represents an irreplaceable natural heritage and a significant opportunity for sustainable development (IPAM, 2010).

Historically, the Amazon has been threatened by illegal deforestation and land grabbing (Azevedo-Ramos et al. 2020; Moutinho & Azevedo-Ramos, 2023), often linked to the expansion of agricultural production. Around 30% of annual illegal deforestation in the region occurs in undesignated public forests—areas that are mostly converted into pastures for beef production (Moutinho & Azevedo-Ramos, 2023). However, this has not always been the case. Between 2004 and 2012, Brazil proved that it is possible to reduce deforestation while simultaneously increasing food production (Moutinho et al. 2016; Soares-Filho et al. 2010). This achievement was made possible through the implementation of robust public policies and effective enforcement of command-and-control legislation—during that period, commodity production doubled while deforestation in the Amazon was reduced by 83% (Nepstad et al. 2014).

Unfortunately, since 2012, deforestation in the Brazilian Amazon has been on the rise again. Between 2019 and 2022, annual deforestation rates hovered around one million hectares. However, in 2023, deforestation in the Amazon began to decline once more. This progress was achieved through renewed investments in enforcement, public policies, private sector agreements, and monitoring systems.

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As for the Cerrado—the second largest biome in Brazil and South America, covering 198 million hectares and accounting for 26% of Brazil's native vegetation—it is considered the most biodiverse savanna in the world. This biome plays a crucial role in supporting the water systems that feed the Amazon and much of the continent, making vegetation loss here a serious threat to regional agricultural productivity. Over the past two decades, native vegetation conversion in this essential ecosystem has remained high, resulting in significant biodiversity loss and water depletion—primarily due to the expansion of beef and soybean production. In the last 10 years, the Cerrado has lost an average of over 920,000 hectares of native vegetation annually, with rural properties converting 7.1 million hectares during this period. In 2023, over 1.1 million hectares of native vegetation were cleared in the Cerrado—surpassing the Amazon for the first time despite being half its size—and accounting for about 61% of all deforestation in the country (IPAM, 2024).

Unlike the Amazon, the legal protection of the Cerrado under the Brazilian Forest Code—the legislation that protects the native vegetation of Brazil's biomes—is less stringent. For example, in the Amazon, private landowners are legally required to preserve 80% of their land as Legal Reserve (native vegetation). In the Cerrado, this percentage is lower, ranging between 20% and 35% (Brazil, 2012). Moreover, land use dynamics differ significantly between the two regions. The Amazon contains vast areas of undesignated public forests (Azevedo-Ramos et al. 2020), while the Cerrado is dominated by numerous private properties and has fewer legal protections. As a result, while the key challenge in the Amazon is tackling illegal deforestation, the main issue in the Cerrado is the urgent need to protect the remaining 34% of native vegetation that can still legally be cleared—62% of which lies within private rural properties (Bispo et al. 2023; Pinho et al., 2025).

Given this context, the future of food production is not promising. The progressive increase in deforestation rates in the Amazon and Cerrado, combined with worsening global climate conditions, has led to a gradual decline in Brazil's leadership in soybean production, which heavily depends on stable rainfall patterns in the Amazon-Cerrado agricultural frontier. Rattis et al. (2021) project that by 2030, 51% of farms in this frontier may become unviable under current climate conditions, rising to 74% by 2060. The conversion of native Cerrado habitats into pasture and cropland has already raised local temperatures by nearly 1°C and reduced rainfall by 10% (Rodrigues et al. 2022). Research shows that rising temperatures are leading to significant yield losses across multiple crops, primarily due to declining rainfall and shifting climate patterns (Rattis et al. 2021; Leite-Filho et al. 2021). For instance, a 1°C increase in temperature could lead to a 6% reduction in soybean productivity (Silva et al. 2023). Although agronomic adaptations may partially mitigate these impacts, conserving native vegetation remains essential to sustaining regional climate regulation.

Against this backdrop of deforestation and climate pressure in the Amazon and Cerrado, there is an imminent climate risk for agricultural commodity markets. By disrupting regional rainfall patterns through reduced evapotranspiration, deforestation—exacerbated by extreme weather events linked to global warming—compromises water availability and fuels more frequent droughts and climate extremes. These climate changes directly threaten crop yields and livestock productivity, resulting in higher production costs and potential supply shortages. As a result, commodity prices may become more volatile, with upward pressure during climate stress periods. In the long term,

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continued environmental degradation could trigger systemic disruptions in agricultural supply chains, with global implications for food security and trade stability.

In summary, halting deforestation in the Amazon and Cerrado is not only an environmental imperative but also a strategic priority for economic and market stability, as well as for global food security.

2. Brazil–China Diplomatic and Trade Partnership

Brazil and China are long-standing partners with significant alignment on geopolitical issues within the Global South. Since 2009, China has been Brazil's largest trading partner (APEX-Brasil, 2011), and the two countries' complementary economies have established strong commercial ties across various sectors, from commodities to advanced technology.

The current geopolitical moment has brought these two major nations even closer, fostering stronger diplomatic and trade relations through frequent visits, ongoing dialogue, and the announcement of several bilateral agreements. Although this is a period marked by uncertainty for many countries, it presents a major opportunity to deepen Brazil–China cooperation, further strengthening the longevity of their trade relationship and ensuring mutual benefit.

Two of the main products exported from Brazil to China are soybeans and beef. In the soybean sector, China is the world's largest importer and depends heavily on Brazilian soy to meet its growing demand for animal feed and cooking oil. In recent years, Brazil has also become an important supplier of beef to China, driven by rising incomes, changing dietary preferences, and domestic protein needs. In 2024, soybeans accounted for 33% of Brazil's exports to China, while beef represented 6.3% (MDIC, 2025). Additionally, that same year, 73% of Brazil's soybean exports and 51% of its beef exports were destined for China (MDIC, 2025).

Trade between China and Brazil is closely tied to land use and land cover change in Brazil. The Amazon and Cerrado biomes are critical to agricultural production and climate balance. In 2020, deforestation linked to beef production exported to China resulted in approximately 243,199 hectares of deforestation in the Cerrado and 152,799 hectares in the Amazon. In the soybean sector, exposure to deforestation was about 90,055 hectares in the Cerrado and 9,041 hectares in the Amazon (Trase, 2024). This underscores the urgent need for action in the trade dynamics of these agricultural commodities to ensure production sustainability, food security, and climate stability.

China has shown growing global leadership in sustainability, with ambitious targets such as peaking emissions by 2030 and achieving carbon neutrality by 2060. The concept of "ecological civilization," central to the country's development plan, offers a strategic space for partnerships with Brazil—aligning food security with the conservation of critical biomes. Sino-Brazilian cooperation is essential to ensure a stable supply of commodities while avoiding deforestation and combating climate change. Together, Brazil and China can work to reverse the decline in agricultural productivity and build a more resilient landscape. This partnership will not only strengthen trade relations but also promote food security, sustainable development, and economic prosperity for both nations.

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3. Exploring Opportunities for Sino-Brazilian Cooperation Toward a Green and Resilient Trade

International cooperation and sustainable investments are essential to support Brazil's efforts to halt deforestation and address climate change while maintaining agricultural productivity—ensuring food security, economic stability, and environmental resilience.

For a long-term and sustainable trade partnership, the greatest opportunity lies in consolidating a resilient and mutually beneficial trade relationship between Brazil and China, grounded in sustainability, innovation, and environmental integrity. COFCO's public commitment to eliminating deforestation from its soybean and beef supply chains by 2025—and reducing emissions in line with SBTi criteria—is a good example. Accelerating Brazil's transition to deforestation-free and low-carbon supply chains will reduce long-term trade risks and open new opportunities for green growth and collaboration.

In light of Brazil's ongoing environmental leadership and the recent celebration of the 50th anniversary of Brazil–China diplomatic relations, we present a series of potential cooperative initiatives aimed at fostering a sustainable, resilient, and long-term trade partnership between the two countries:

- **Scientific cooperation for climate resilience:** Investing in scientific research is critical to assessing climate risks and their impacts on agriculture and ecosystems. Joint efforts can focus on developing cost-effective adaptation strategies, including nature-based solutions, and designing technologies tailored to tropical agriculture in a changing climate.
- **Strengthening transparency through traceability:** Traceability systems across agricultural commodity supply chains are essential to ensure sustainability, monitor food quality, and address sanitary risks. Cooperation on traceability for soy and beef imported by China is a powerful tool to reduce the risk of illegality in supply chains.
- **Mobilizing finance for adaptation:** Identifying and scaling up sources of financing to support climate adaptation in tropical agriculture is essential.
- **Restoration as a strategic pathway:** Restoring degraded areas in the Amazon and Cerrado biomes represents an opportunity to increase productivity without expanding into new areas. Through systems such as crop-livestock-forest integration, agroforestry, and ecological restoration, Brazil can regenerate landscapes while supporting rural livelihoods and biodiversity.
- **Addressing legal deforestation through economic incentives:** Making native vegetation conservation economically viable—especially in the Cerrado—is essential. Financial mechanisms such as Payments for Environmental Services (PES), participation in carbon markets, sustainable credit lines, and premium prices for deforestation-free products can help reverse legal land conversion trends.
- **Sustainable intensification of production:** Joint efforts to increase productivity per hectare through climate-smart and low-emission practices are vital to meeting demand while conserving ecosystems. With science-based technical assistance, more sustainable and

efficient production practices—such as intensified and diversified farming—can be implemented on rural properties.

- **Unlocking the potential of biofuels:** bioenergy offers a low-carbon pathway to decarbonize transport and industry, aligning with both countries' climate goals. Technological and investment cooperation can help scale the production and export of sustainable biofuels derived from agricultural and forestry residues.
- **Development and restoration of degraded pastures:** rehabilitating degraded pastures is one of Brazil's greatest opportunities to increase productivity and reduce emissions. China and Brazil can jointly invest in technologies and practices that convert underutilized land into productive and sustainable systems, reducing pressure on forests.
- **Diversifying Brazilian exports to China:** at the 7th Plenary Session of COSBAN in June 2024, Brazil and China agreed to deepen trade diversification and expand Brazilian exports. With Brazil's G20 presidency driving global discussions on sustainable bioeconomy in 2024, there is a unique opportunity to create new resilient markets based on standing forest economies and socio-biodiversity.

4. Conclusion

In conclusion, the partnership between Brazil and China holds immense potential to address the complex interplay between agricultural productivity, environmental sustainability, and global trade dynamics. By leveraging their complementary strengths in agriculture, technology, and sustainable development, both nations can chart a path toward greener and more resilient trade practices. Climate change not only poses tangible risks to agricultural productivity and supply chains—it also introduces deep uncertainties about the future. These risks, including projected crop yield losses, increased climate volatility, and potential price instabilities, represent long-term threats to food security and market stability in both countries, especially for China as a major importer of agricultural commodities.

Given the scale and interdependence of the Brazil–China trade relationship, the two countries should act as strategic allies in developing joint solutions to climate challenges. This includes co-investing in innovation, science, and public policy to build climate-resilient agricultural systems and supply chains. Through collaborative action, Brazil and China can lead by example—demonstrating that environmental conservation and economic development are not opposing goals, but essential pillars of a sustainable and prosperous future.

Civil society, echoed by national and subnational efforts, can further unlock promising opportunities for sustainable development in dialogue with the third sector and the private sector in both countries. In this way, a true bridge is strengthened between Brazil and China, with the power to guide global ecological transformation.

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That said, we reaffirm: the conservation of the Amazon and the Cerrado must be framed as a shared strategic opportunity—a smart investment for both nations, especially in the medium and long term.

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