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Pathway narratives				
	A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY	JUSTIFICATION
General description	We do not act differently than in the past decade / today	National actions/policies are aligned with national commitments	National actions/policies are aligned with global sustainability targets	
Country Narrative - the main elements that have guided the selection of the assumptions under each pathway	In this pathway we assume a medium population growth, no constraints on agricultural expansion, no afforestation target, no deforestation control, and a BAU scenario regarding biofuel feedstock use for ethanol. The future also leads to a considerable increase with regards to the volume of exports of the main commodities and low agricultural productivity growth.	Compared to the Current Trends Pathway, we assume that this future considers the restoration of 12 Mha of forest by 2030, the expansion of protect areas, and no deforestation beyond 2030, based on the Brazil's commitments. Also we assume that this future would lead to a high livestock productivity growth and a medium crop productivity growth. This future also takes into account food waste and post-harvest loss reductions, and a renewablefuel-oriented scenario when compared to the historical trends.	Assumptions on population growth, diets and reforestation targets are different from the National Commitments pathway. In this pathway, we assume this future would lead to a low population growth, a higher crop productivity growth, and an evolution towards a healthier diet (EAT-Lancet recommended diet). Additionally, we considered a restoration target of approximately 27 Mha by 2050 to go beyond Brazil's NDC commitment of restoring 12 Mha of forests by 2030. This restoration target considers the amount of environmental debt from the Rural Environmental Cadastre (CAR) for all biomes but the Atlantic Forest, where we consider the Atlantic Forest Pact target of restoring 15 Mha.	

Pathway Assumptions					
		A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY	JUSTIFICATION
1. Macroeconomics	1.1) GDP per capita	Total of USD 2,950 billion USD by 2050 (SSP2)	Same as Current Trends	Same as Current Trends	<p>GDP follows the projections given by IIASA for SSP2 (embedded in Calculator). OECD projects USD 5,168 billion by 2050. We need to investigate these values in a future iteration. Source: OECD. (2022). Real GDP long-term forecast (indicator) [Data set]</p> <p>We chose the same SSP for the three pathways since the selection of alternative GDP scenarios will not impact your results for now. In a future iteration, a sustainable scenario is found to be close to SSP1 (OECD, 2016) and we will change the assumption of Global Sustainability to SSP1 if the option is available. Source: OECD. (2016). Alternative Futures for Global Food and Agriculture. Paris, OECD Publishing. Retrieved here</p>
	1.2) Population	230.89 million inhabitants in 2050 (UN-Medium Scenario)	Same as Current Trends	211.75 million inhabitants in 2050 (UN-Low Scenario)	<p>The population will peak 232.93 million by 2050, according to data from IBGE, of which the closest assumptions are the SSP2 and UN_Medium (IBGE, 2020). Source: IBGE. (2020). IBGE - Projeções da população [Data set]. Retrieved here</p> <p>Regarding the Global Sustainability pathway, a sustainable scenario is found to be close to SSP1. We will use the UN-Low assumption instead of SSP1, since the population variation are similar in both assumptions.</p>
	1.3) Inflation	Prices under inflation based on the average change in the 2000-2020	Same as Current Trends	Same as Current Trends	<p>According to IBGE, the index IPCA, used as base to define the inflation rates in Brazil, decreased 24.5% in 2000-2020. During this period, there is significant fluctuation in the index.</p>

		period (Average scenario)			Source: IBGE (2020). IBGE - Índice Nacional de Preços ao Consumidor Amplo. [Data set]. Retrieved here
	1.4) Inequalities	Inequality based on the difference of the Gini index during 2010-2020.	Same as Current Trends	Same as Current Trends	Between 2011-2020, according to the historical series from World Bank, the Gini index decreased from 52.9 to 48.9. Source: The World Bank (2023). Gini index - Brazil. Retrieved here
2. Land	2.1) Constraints on agricultural expansion / deforestation	Free expansion of productive land under the total land boundary	No deforestation beyond 2030	No deforestation beyond 2030	<p>Current Trends: In the last decade, the low enforcement of environmental protection laws in the last years provides multiple opportunities for infractions to go undetected or unpunished (Carvalho et al., 2019). Source: Carvalho, W. D., Mustin, K., Hilário, R. R., Vasconcelos, I. M., Eilers, V., & Fearnside, P. M. (2019). Deforestation control in the Brazilian Amazon: A conservation struggle being lost as agreements and regulations are subverted and bypassed. <i>Perspectives in Ecology and Conservation</i>, 17(3), 122-130.</p> <p>National Commitments and Global Sustainability: In line with Brazil's NDC (Brazil, 2022) which commits to strengthen its policies and measures with a view to achieve zero illegal deforestation in the Brazilian Amazonia by 2030. Source: Brazil. (2022). Intended Nationally Determined Contribution: towards achieving the objective of the United Nations Framework Convention on Climate Change (p. 10). Retrieved here</p>
	2.2) Afforestation, and forest plantations targets	No afforestation/restoration targets.	Afforestation / reforestation target in line with Bonn Challenge and NDCs commitments - reforestation of 12 Mha by 2030	Afforestation / reforestation target in line with Bonn Challenge and NDCs commitments by 2030 the Atlantic Forest Pact and restoration of environment debts	<p>Current Trends: There is an upward trend in deforestation occurring since 2012 in Brazil (INPE, 2023). Source: INPE (2023). Programa de Monitoramento da Amazônia e demais biomas. Retrieved here</p> <p>National Commitments: The Brazilian government pledged to reforest 12 million hectares by 2030 under Brazil's NDC pledge (Brazil, 2022).</p>

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			per municipality by 2050. We assume a total of 26.84 Mha reforested by 2050	<p>Source: Brazil. (2022). Intended Nationally Determined Contribution: towards achieving the objective of the United Nations Framework Convention on Climate Change (p. 10). Retrieved here</p> <p>Global Sustainability: We assume total afforested/reforested area reaches 26.84 Mha by 2050. In addition to the Brazil's NDC commitment by 2030, we take into account the Atlantic Forest Pact, which aims to restore 15 Mha of degraded/deforest lands in Atlantic Forest by 2050 (Crouzeilles et al., 2019). The assumption also includes to restore by 2050 the environment debts per municipality based on the Rural Environmental Cadastre (CAR) (Guidotti et al., 2017). Sources: Guidotti, V., Freitas, F. L., Sparovek, G., Pinto, L. F. G., Hamamura, C., Carvalho, T., & Cerignoni, F. (2017). Números detalhados do novo código florestal e suas implicações para os PRAs. Sustentabilidade Em Debate, (5), 1–11.</p> <p>Crouzeilles, R., Santiami, E., Rosa, M., Pugliese, L., Brancalion, P. H., Rodrigues, R. R., ... Matsumoto, M. H. (2019). There is hope for achieving ambitious Atlantic Forest restoration commitments. Perspectives in Ecology and Conservation, 17(2), 80–83.</p>
2.3) Urban and settlements area	Increase by 49% between 2020 and 2050 (Current Trend scenario)	Same as Current Trends	Same as Current Trends	<p>The increase was computed based on the urban area growth during 2000–2020 using MapBiomass data (Souza et al., 2020)</p> <p>Source: Souza, C. M., Z. Shimbo, J., Rosa, M. R., Parente, L. L., A. Alencar, A., Rudorff, B. F. T., ... 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).</p>

	2.4) Protected areas	254 Mha of protected areas by 2050	266 Mha of protected areas by 2050	Same as National Commitments	<p>Current Trends: Brazilian protected areas were computed using the 2010 data from World Database on Protected Areas (WDPA, 2020).</p> <p>National Commitments and Global Sustainability: an expansion of protected areas is expected if policies are put in practice, such as an effective implementation of Brazil's Forest Code.</p>
3. Productivity and management	3.1) Crop productivity for the key crops	<p>Between 2020 and 2050, crop productivity increases:</p> <ul style="list-style-type: none"> -from 3.22 t/ha to 3.37 t/ha for soybeans -from 5.6 t/ha to 5.84 t/ha for corn 	<p>Between 2020 and 2050, crop productivity increases:</p> <ul style="list-style-type: none"> -from 3.22 t/ha to 3.88 t/ha for soybeans -from 5.7 t/ha to 7.5 t/ha for maize 	<p>Between 2020 and 2050, crop productivity increases:</p> <ul style="list-style-type: none"> -from 3.22 t/ha to 4.13 t/ha for soybeans -from 5.7 t/ha to 8.61 t/ha for maize 	<p>Current Trends: The crop productivity values are based on a low growth scenario.</p> <p>National Commitments and Global Sustainability: The ABC Plan (MAPA, 2012) focuses on the nationwide adoption of technologies such Crop-Livestock-Forestry, No-Till, and Double Cropping. Based on these policies, we assume a medium and higher productivity growth in National Commitments and Global Sustainability pathways, respectively.</p> <p>Source: MAPA. (2012). Plano setorial de mitigação e de adaptação às mudanças climáticas para a consolidação de uma economia de baixa emissão de carbono na agricultura: Plano ABC (Agricultura de Baixa Emissão de Carbono) (p. 173). Retrieved from here</p>
	3.2) Cropland under agroecological practices	35 Mha of total cropland under agroecological practices by 2030 (agroforestry)	Same as Current Trends	Same as Current Trends	<p>In the 2020/2021 crop season, Brazil increased the agroforestry area to 17.4 Mha (Polidoro et al., 2020). The ICLF Network has set a goal to double this amount by 2030 and reach 35 million hectares of ILPF (REDE ILPF, 2023).</p> <p>Sources: Polidoro J. C., De Freitas, P. L., Hernani, L. C., Dos Anjos, L. H. C., Rodrigues, R. D. A. R., Cesário, F. V., ... & Ribeiro, J. L. (2020). The impact of plans, policies, practices and technologies based on the principles of conservation agriculture in the control of soil erosion in Brazil. Authorea Preprints.</p> <p>REDE ILPF (2023). ICLF in numbers. Retrieved here</p>

<p>3.3) Livestock productivity for the key livestock products</p>	<p>Between 2020 and 2050, the productivity per head increases: -from 66kg/TLU to 75 kg/TLU for cattle beef -from 2285L/TLU to 2455 L/TLU for cattle milk</p>	<p>Between 2020 and 2050, the productivity per head increases: -from 66 kg/TLU to 84 kg/head for cattle beef -from 2281L/TLU to 2579 L/TLU for cattle milk</p>	<p>Same as National Commitments</p>	<p>Current trends: Most of the Brazilian pasturelands still maintain an extensive system that depends basically on the nutrient supply of the pastures (Barbosa et al., 2015). Source: Barbosa, F. A., Soares Filho, B. S., Merry, F. D., de Oliveira Azevedo, H., Costa, W. L. S., Coe, M. T., ... de Oliveira, A. R. (2015). Cenários para a pecuária de corte amazônica (p. 154). Retrieved from Universidade Federal de Minas Gerais website</p> <p>National Commitments and Global Sustainability: The use of sustainable technologies can contribute to the increase in animal yield and welfare due to thermal comfort, mitigation of the effects of greenhouse gases, and the recovery of degraded areas (Pereira, 2019). We assume a higher productivity growth than 2000–2020. Source: Pereira, M. de A. (2019). Avaliação econômica de sistemas de Integração Lavoura-Pecuária-Floresta: As experiências da Embrapa. Embrapa Gado de Corte- Documentos (INFOTECA-E). Retrieved here</p>
<p>3.4) Pasture stocking rate</p>	<p>Increase from 0.90 TLU per ha to 1.31 TLU per ha pasture between 2020 and 2050.</p>	<p>Increase from 0.90 TLU per ha to 1.46 TLU per ha pasture between 2020 and 2050.</p>	<p>Same as National Commitments</p>	<p>Current Trends: Despite recent advances, the productivity of Brazilian pasturelands is still below its potential (Strassburg et al., 2014), we keep the BAU scenario for this pathway. Source: Strassburg, B. B. N., Latawiec, A. E., Barioni, L. G., Nobre, C. A., Silva, V. P. da, Valentim, J. F., ... Assad, E. D. (2014). When enough should be enough: Improving the use of current agricultural lands could meet production demands and spare natural habitats in Brazil. Global Environmental Change, 28, 84–97.</p> <p>National Commitments and Global Sustainability: Source: The ABC Plan (MAPA, 2012) focuses on the adoption of sustainable technologies such as Crop-Livestock-Forestry. We assume a higher productivity growth.</p>

	3.5) Forest management	TBA	TBA	TBA	The assumptions will be quantified after the implementation of the forestry module.
4. Trade	4.1) Share of consumption which is imported for key imported products (%)	The share of total consumption that is imported remains constant at the 2020 level (I2 scenario)	Same as Current Trends	Same as Current Trends	Brazilian imports will be almost stable for 2030 for the main imported agricultural products (MAPA, 2023). Source: MAPA. (2023). Projeções do Agronegócio: Brasil 2022/23 a 2032/33 [Report]. Retrieved here
	4.2) Evolution of exports for key exported products (1000 tons)	The exported quantity: -increases from 81.8 Mt in 2020 to 161.9 Mt in 2050 for soybeans -increases from 33.1 Mt in 2020 to 66.6 Mt in 2050 for maize -increases from 2.5 Mt in 2020 to 5.1 Mt in 2050 for beef	Same as Current Trends	Same as Current Trends	We assume the scenario in which the evolution of exports is multiplied by 2 by 2050. The three pathways use the E2 scenario. This scenario is found to be close to the projections from MAPA for the main commodities (MAPA, 2023). We will investigate the exports for soybeans, maize, and beef in more detail, and we will make the necessary adjustments before the final submission in October. Source: MAPA. (2023). Projeções do Agronegócio: Brasil 2022/23 a 2032/33 [Report]. Retrieved here
5. Food	5.1) Average dietary composition	By 2050, the average daily calorie consumption is based on projections given in FAO (2018) for a Business-as-Usual scenario	Same as Current Trends	By 2050, average daily calorie consumption is based on the EAT-Lancet recommendations for a healthy diet (EAT-Lancet scenario)	Current trends and National Commitments: the diet assumption is based on historical trends from FAO (FAOSTAT, 2023) and projections of food consumption in 2050 given in FAO (2018), adjusted to reproduce national statistics values in 2015 and 2020. The national food intake data was retrieved from the Brazilian Household Budget Survey (POF) conducted by the Brazilian Institute of Geography and Statistics (IBGE), surveyed in 2017-2018 (IBGE, 2021). Sources: FAOSTAT. (2023). FAOSTAT database. Retrieved from here .

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	5.2) Share of food consumption which is wasted at household level	Same share as in 2020	The share of final household consumption which is wasted at the household level is reduced by 5%.	Same as National Commitments	<p>National Commitments and Global Sustainability: The Brazilian government committed to the United Nations (SDG 12.3.1br) to reduce per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains by 2030 (IPEA, 2016). Source: IPEA. (2016). ODS 12—Consumo e Produção Sustentáveis. Retrieved May 21, 2020, from here</p>
6. Biofuels	6.1) Targets on biofuel and/or other bioenergy use	Following the projections from OECD-FAO Agricultural outlook for 2019-2028. Also, the data used for the biofuel feedstock use for	Increasing the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030	Increasing the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030	Current Trends: In addition to using the OECD-FAO Agricultural outlook for 2019-2028, the biofuel feedstock use for sugarcane was replaced by the data computed in de Andrade Junior et al. (2019). We used the data related to the BAU scenario, mapped with the macroeconomic elements of the SSP2.

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		sugarcane were replaced by the ones computed for the BAU scenario in de Andrade Junior et al. (2019).			National Commitments and Global Sustainability: In Brazil's NDC (Brazil, 2022), the government pledges to increase the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030. For these scenarios, we used for the biofuel feedstock used for sugarcane was replaced by the ones computed for the RFO (Renewable Fuels Oriented) scenario in de Andrade Junior et al. (2019). Source: de Andrade Junior, M. A. U., Valin, H., Soterroni, A. C., Ramos, F. M., & Halog, A. (2019) Exploring future scenarios of ethanol demand in Brazil and their land-use implications. <i>Energy Policy</i> , 134, 110958. Retrieved from here
	6.2) Targets on other non-food use	-	-	-	-
7. Water	7.1) Irrigated crop area	No growth scenario	High growth scenario	Same as National Commitments	The assumptions for National Commitments and Global Sustainability are based on projections provided by the National Water Agency (ANA). According to the data provided by the agency, it is estimated an increase of 4.2 million hectares of irrigated crop area (+76%) by 2040, with a smaller impact on the expansion of use of water (+66%) (ANA, 2021). Source: ANA. (2021). Atlas Irrigação. Uso da Água na Agricultura Irrigada. 2a. Edição. Brasília. Retrieved from here