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Brazil, Unsustainable Agricultural Practices

Brazil: A Sustainable and Restorative Approach to the Future of Farming

World hunger can be viewed as the root of many of the evils and humanitarian crises in this world. Hunger and the mad scramble for the resources to sustain the increasing populations of the world, are the causes of bloody wars, political battles, environmental damage both in our history and present. Hunger holds humanity back, from peace and the progress that follows. As an attempt to solve world hunger and bring forth a more peaceful, healthier future, governments have gathered and made unified attempts worldwide to send the food and resources needed abroad to the people who need them. Unfortunately, the logistics and funding behind solving world hunger make it seem impossible. People must organize food exports and collections, organize farm education programs, provide the resources for local farmers to become successful, get food aid to people in times of war, and otherwise tackle other insurmountable tasks. Fortunately, there is a light in our future. Humans have made relatively quick work of improving human rights, health, and hunger globally in the 20th and 21st centuries.

Despite our best efforts, another tragedy shook the world at its core: the coronavirus. The pandemic, while currently getting better, weakened economies and cracked the foundations of many political and social systems. As a result, hunger is once again on the rise in every country, including highly industrialized countries that have stayed off the World Hunger Map or climbed out of it in the previous century (*The State of Food Security and Nutrition in the World 2020 Summary*). One of these highly industrialized countries, Brazil, has been put back onto the World Hunger Map, with “more than half its 212 million population is grappling with some level of food insecurity” after coronavirus (Alves). While many blame the virus for the decline of Brazil’s agricultural and trade industries, the pandemic is simply served to expose the flaws in a system destined to fail, slowly, in the approaching future. Not just in Brazil, but in every country, the cracks in policy making and economies have become more obvious. Unsustainable farming practices and lack of nutritious food for Brazilians were already a problem, but now look like a disaster. Since Brazil is one of the world’s largest exporters of food, the decline of agricultural lands and the subsequent starvation of its people will eventually affect the world (Ross).

While it might seem counterintuitive that the fourth largest agricultural economy in the world has over half its population dealing with food insecurity, much of the problem lies in the types of food Brazil grows (Alves, Ross). Most of Brazil’s crops are cash crops and crops meant to become feed for animals, with their biggest agricultural exports being soybeans and corn (The Observatory of Economic Complexity). As a result, when transportation lines and other countries’ exports came crashing down, many Brazilians already in poverty were unable to afford nutrient-rich, healthy foods. This problem had been ongoing, as many rural Brazilians already lacked access to proper nutrition, education, healthcare, and sanitation, all vital ingredients to a high quality of life (de Paula Costa, Lopes, etc.). While these opportunities are provided to urban Brazilians, the millions of Brazilians in urban slums also became more

malnourished due to the higher price of healthier foods and suffered further from the mass spreading of COVID among tightly packed individuals. The reintroduction and intensification of this problem, which had been getting better through the years, begged the question: how can a country like Brazil improve its agricultural economy to feed its own people and still have a high agricultural output?

Brazil already has many of the natural resources needed to feed the entirety of its population plus more. Brazil is a huge and geographically diverse country, but most of the country is covered in rainforest lowlands (46.6% of Brazil's landmass) and fertile highlands, with a mild, humid, tropical climate (*Brazil*). This makes Brazil a great place for agriculture, and 170 million acres of its land (28.34%) is used for farming (*Brazil – Agricultural Land*). One of the biggest concerns about Brazilian farming is about how overharvesting Brazil's natural resources impacts the Amazon River and La Plata River Basins, which cover over three-fifths of Brazil and are incredibly important natural assets, as well as the Amazon Rainforest, the largest tropical rainforest in the world, which covers a huge portion of Brazil as well as the aforementioned river basins (*Brazil Geography*). All Brazilians depend on the Amazon Rainforest for jobs, resources, and natural services, but due to unsustainable agricultural practices, severe deforestation and desertification, Brazil's ecosystems are becoming damaged beyond repair, which is harming the codependent Brazilians, as well as the entire Earth. This problem must be addressed immediately, since even if Brazil turns away from growing cash crops towards more nutritious foods, the environment crops will grow in must be fertile, and sustainable for years to come.

Many people have heard that the agricultural industry brings ruin to the natural environment. This is not necessarily true for all type of agricultural models, but we can definitely see it in the Amazon Rainforest. The largest rainforest in the world used to function as a massive carbon sink, since it absorbed billions of tons of carbon dioxide, a major greenhouse gas, per year. Unfortunately, unsustainable agricultural activity has reversed this trend, and the Amazon has started emitting more carbon than it absorbs due to fires set in order to clear land for pastures and farms (Carrington). The growing demand for new farmland is caused both by economic growth and the desertification of the Amazonian soil. Since the soil after deforestation no longer has native fauna and flora to keep the soil from eroding and add new nutrients (humus) to it, heavy rains cause the loose soil on farms to wash away and leave barren, infertile lands behind. This forces farmers to strip away more forest for new farmland and creates a positive feedback loop leading to the desertification of Brazil. This is amplified even more by droughts caused by the removal of plants. Evapotranspiration is a major contributor to rains in the Amazon rainforest, but without the flora needed to absorb and release water back into the atmosphere, some of these rains have disappeared and left Brazilian farms struggling even more (Worth, Afissar). This trend means that not only will the rainforest and weather patterns suffer, but also that farmable land will become scarcer for Brazilians and the Brazilian economy will suffer because of the dwindling crop exports available. Since Brazil is one of the world's largest exporters of food, it can be expected that parts of the world will also suffer from this food shortage and be forced to adapt, or even go without. Farms, along with many Brazilians working in the service industry, depend on the vitality of the Brazilian ecosystem.

The main problems causing the desertification of the Amazon includes the clear-cutting and burning of native flora in the rainforest, the huge monoculture efforts used to produce Brazil's cash crops, and overuse of toxic chemicals (Horton). Planting more native vegetation in smaller amounts, with field rotations and less pesticide and herbicide use would be one of the best ways to produce healthier food for the populace, increase the resilience and fertility of the soil, and help save the rainforest, although it would be at the sacrifice of Brazilian agricultural exports. Money and aid cannot fully solve Brazilians' struggles with hunger; rather, access to the resources and how the country produces its food sustainably is the ultimate way to solve Brazil's hunger. In order to keep up with the demand for food across the world (as well as in Brazil) without compromising the rainforest and waterways of Brazil, farmers must start reusing old and overused fields. These fields must first be restored, and then be taken care of so that they don't deteriorate again. How are deteriorated farm fields restored? Usually, old farm fields are abandoned and may take decades to reach a state in which they can be farmed again. However, through clever use of restoration techniques and environmental monitoring, fields can be restored much quicker.

In an article published by the Journal of Environmental and Health Science, "Restoration of Degraded Agricultural Land: A Review", there are four key aspects to a successful field restoration project. First, the cause of the deterioration must be identified. While deforestation and overuse are the root cause behind many of these field's deterioration, tests must be run in order to determine if the soil has an appropriate pH, salinity, amount of water, and possible harmful pests or chemicals remaining. After the causes of deterioration are determined, stabilizing the farmland starts with removing degrading influences from the area, such as preventing any dumping waste on or excessive farming of the land (Saturday). It includes making sure the surrounding location will also have no negative influence on the land, since a piece of land cannot simply be blocked off from the area; factors and influences from the area will always leak through.

Next, the actual restoration of the site may start. There are two types of restoration. Passive restoration through secondary succession, and active restoration, through the anthropogenic changing of the farmland (Saturday). Active restoration is far faster and more efficient for our purposes. This type of restoration is achieved through several agronomic and biological techniques. Planting native species is one of the best ways to improve the health of the farmland and even the ecosystem in general. Brazil has over 46,000 registered species of fungi and plants, so additional research is needed to know which species are necessary for improving the health of the degraded farmland (Zappi). Plants and fungi add nutrients to soil through decomposition, protect the soil from erosion, increase the amount of rain in the area through increased evapotranspiration and increase the biological productivity of the soil. Finally, the presence native flora will attract and allow the breeding of native fauna and bacteria, which are also necessary for the health of an ecosystem and recovery of agricultural lands. Animals can naturally help increase the biological productivity, diversity, and health of an area through pollination, decomposition, defecation, and other functions. This a bonus to this solution, since Brazilian farmers and scientists can work together to plant beneficial flora and introduce native fauna, but also potentially harvest and eat some of those native plants and animals. The land doesn't have to be fully unused to restore but can be harnessed for agricultural uses that are less invasive to it.

The end goal of a restoration project is to increase the biological productivity of degraded agricultural lands, promote the health of the ecosystem, and allow for further (and hopefully more sustainable) use of the land for farming. Of course, time is a necessary component in restoring agricultural lands, as time will be needed to see any substantial effects on the land and soil quality. The restoring fields will need to be monitored often to make sure that restoration efforts are not in vain, and that adjustments can be made when the ecosystem needs them (Saturday). It is also vital to create a sustainable agricultural industry in order to keep the farmland viable. Implementing crop rotations, using cover crops, and vegetative filter strips are examples of important tools used to protect and heal the farmland after the restoration project is finished and can be used after restoration to prevent the land from becoming degraded again (Lamb, Erskine, & Parrotta). Crop rotations, a great practice already implemented in many American farms. In a rotation, crops are switched between fields, and legumes will often be planted in one field to restore nitrogen levels to the soil. During the Florida Youth Institute, students were showed this process, and observed the nodules on legume roots, which work in partnership with rhizobia bacteria to restore the soil. Cover crops can also be planted to prevent soil erosion, smother weeds, and even increase crop yields (Clark). Vegetative filter strips are strips of vegetative land that act as a filter or barrier between nutrient-rich agricultural lands and water bodies. A filter strip can prevent runoff from entering the water, which protects people from the harmful algal blooms that have ravaged places such as Florida in the past. All of these practices can increase the number of native fruits and vegetables in addition to being beneficial to farmland and water quality, and as a result can increase the amount of nutrients Brazilians eat in their diets. Furthermore, improving the conditions of these fields will allow for more food to be grown in the future (without compromising the Earth), which is essential for providing enough food for Earth's growing population.

These practices can easily be implemented by local farmers or companies in tandem with environmental scientists (to monitor the ecosystem), but the proper training must be provided by institutions with the technology, information, and experience needed to help Brazilians. The Institute for Sustainable Agriculture and World Food Bank are examples of organizations equipped to help Brazilian farmers tackle the environmental and agricultural problems Brazil has that created additional hunger issues in the country. These organizations already have educational opportunities (such as the Global Youth Institute) and well as connections to scientific and agricultural communities around the world, so helping Brazilian farmers learn about and develop solution to these issues is right up their alley. Brazilian farmers, with this help, will easily be able to change their lives and the lives of everyone reliant on Brazilian food exports.

While change always brings some form of upheaval, this solution will in the long run benefit Brazilian farmers and may even help them escape poverty since they will be able to eat and sell the food that they grow, rather than selling cash crops that ultimately profit other people, since cash crops are sold for very little and aren't nutritious as a full meal in themselves. Brazil might be able to diversify its agricultural market, and jobs will definitely open up with an increase in the type of products available. It is important to help people to help themselves, rather than throwing money at an issue without any sustainable long-term solution. While many people across the world are aware of the issues concerning and tying together world hunger and the

environment, awareness does nothing if people are not willing to act! This type of action is absolutely vital to our future!

References

- Alves, L. (2021, July 19). *The New Humanitarian* | *Pandemic puts Brazil back on the world hunger map*. The New Humanitarian; The New Humanitarian. <https://www.thenewhumanitarian.org/news-feature/2021/7/19/pandemic-puts-brazil-back-on-the-world-hunger-map>
- Andrade, G. (2018, February 16). *Out-of-Home Food Consumers in Brazil: What do They Eat?* - *PubMed*. PubMed; PubMed. <https://pubmed.ncbi.nlm.nih.gov/29462918/>
- Average Household Size in Brazil*. (2021, May 5). Arcgis.Com; Arcgis. <https://www.arcgis.com/home/item.html?id=38dcd2e938094c5090e0cb1bebf9c997#:~:text=Description,household%20population%20by%20total%20households>.
- Brazil*. (n.d.). Rainforestfoundation.Org; rainforestfoundation. Retrieved May 23, 2022, from <https://rainforestfoundation.org/our-work/geographies/brazil/#:~:text=of%20indigenous%20territories,Rainforests,biodiverse%20country%20in%20the%20world>.
- BRAZIL | Summary | Columbia Public Health*. (2022, May 6). Columbia Public Health |; Columbia Public Health. <https://www.publichealth.columbia.edu/research/comparative-health-policy-library/brazil-summary>
- Brazil - Agricultural Land (% Of Land Area) - 2022 Data 2023 Forecast 1961-2018 Historical*. (2022). TRADING ECONOMICS | 20 Million INDICATORS FROM 196 COUNTRIES; Trading Economics. [https://tradingeconomics.com/brazil/agricultural-land-percent-of-land-area-wb-data.html#:~:text=Agricultural%20land%20\(%25%20of%20land%20area\)%20in%20Brazil%20was%20reported,compiled%20from%20officially%20recognized%20sources](https://tradingeconomics.com/brazil/agricultural-land-percent-of-land-area-wb-data.html#:~:text=Agricultural%20land%20(%25%20of%20land%20area)%20in%20Brazil%20was%20reported,compiled%20from%20officially%20recognized%20sources).
- Brazil (BRA) Exports, Imports, and Trade Partners | OEC - The Observatory of Economic Complexity*. (2020). OEC - The Observatory of Economic Complexity; OEC World. [https://oec.world/en/profile/country/bra#:~:text=Exports%20The%20top%20exports%20of,and%20Canada%20\(%244.39B\)](https://oec.world/en/profile/country/bra#:~:text=Exports%20The%20top%20exports%20of,and%20Canada%20(%244.39B)).
- Brazil geography, maps, climate, environment and terrain from Brazil | - CountryReports*. (n.d.). Countries of the World - CountryReports; CountryReports. Retrieved May 23, 2022, from <https://www.countryreports.org/country/Brazil/geography.htm>
- Brazil Rural Population 1960-2022 | MacroTrends*. (2022). Macrotrends | The Long Term Perspective on Markets; Macrotrends. <https://www.macrotrends.net/countries/BRA/brazil/rural-population#:~:text=Aggregation%20of%20urban%20and%20rural,a%201.16%25%20decline%20from%202018>
- Brazil's Water Crisis - Water In Brazil 2022 | Water.org*. (n.d.). Water.Org; Water.org. Retrieved May 23, 2022, from <https://water.org/our-impact/where-we-work/brazil/#:~:text=Currently%20there%20are%20more%20than,without%20access%20to%20improved%20sanitation>.
- Carrington, D. (2021, July 14). *Amazon rainforest now emitting more CO2 than it absorbs | Amazon rainforest* | *The Guardian*. The Guardian; The Guardian.

<https://www.theguardian.com/environment/2021/jul/14/amazon-rainforest-now-emitting-more-co2-than-it-absorbs#:~:text=Most%20of%20the%20emissions%20are,CO2%2C%20rather%20than%20a%20sink.>

Clark, A. (2015). *Cover Crops for Sustainable Crop Rotations - SARE*. SARE; Sustainable Agriculture Research and Education. <https://www.sare.org/resources/cover-crops/>

de M Souza, A. (2013, February). *Most consumed foods in Brazil: National Dietary Survey 2008-2009 - PubMed*. PubMed; PubMed. <https://pubmed.ncbi.nlm.nih.gov/23703263/>

Deforestation And Climate Change. (2017). The Nature Conservancy; The Nature Conservancy. <https://www.nature.org/en-us/about-us/where-we-work/latin-america/brazil/stories-in-brazil/deforestation-and-climate-change/>

Educational Quality in Brazil. (2019, October 15). UNESCO; <https://www.facebook.com/unesco>. <https://en.unesco.org/fieldoffice/brasil/expertise/education-quality>

Effects of Deforestation. (n.d.). Pachamama.Org; Pachamama. Retrieved May 23, 2022, from <https://www.pachamama.org/effects-of-deforestation#:~:text=The%20loss%20of%20trees%20and,of%20problems%20for%20indigenous%20people.>

Horton, H. (2022, February 23). *UK trade could promote use of banned pesticides in Brazil, new report warns | Pesticides | The Guardian*. The Guardian; The Guardian. <https://www.theguardian.com/environment/2022/feb/23/uk-trade-could-promote-use-of-banned-pesticides-in-brazil-new-report-warns#:~:text=Meanwhile%2C%20Brazil's%20overuse%20of%20highly,and%20poisoning%20farmworkers%20and%20communities.>

Institute for Sustainable Agriculture - Instituto de Agricultura Sostenible. (n.d.). Instituto de Agricultura Sostenible; ISA. Retrieved May 23, 2022, from <https://www.ias.csic.es/en/>

20. Lamb, D., Erskine, P.D., Parrotta, J.A. Restoration of degraded tropical forest landscapes. (2005) *Science* 310(5754): 1628–1632.

Lopez, M. (2021, April 13). *Charting new 'sustainable agricultural pathways' in Brazil | CoSAI*. CoSAI. <https://wle.cgiar.org/cosai/news/charting-new-%E2%80%98sustainable-agricultural-pathways%E2%80%99-brazil>

Maia, A. (2021, May 21). *Improving production and quality of life for smallholder farmers through a climate resilience program: An experience in the Brazilian Sertão | PLOS ONE*. Home - PLOS; PLOS One. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0251531>

Ross, S. (2015, October 6). *4 Countries That Produce the Most Food Worldwide*. Investopedia; Investopedia. <https://www.investopedia.com/articles/investing/100615/4-countries-produce-most-food.asp>

Sanders TG. The problems of nutrition in Brazil. *Am Univ Field Staff Rep South Am*. 1982;(16):1-19. PMID: 12338491.

Saturday, A. (2018, September 26). *Restoration of Degraded Agricultural Land: A Review*. Ommega Online Publishers; Journal of Environmental Health and Medicine. <https://www.omegaonline.org/article-details/Restoration-of-Degraded-Agricultural-Land-A-Review/1928>

Stuart, P. (2021, April 20). *What's Happening to the Cerrado: the Detrimental Effects of Industrialized Agriculture | Panoramas*. Panoramas; Panoramas. <https://www.panoramas.pitt.edu/economy-and-development/whats-happening-cerrado-detrimental-effects-industrialized-agriculture>

Taylor, C. (2021, November 19). *Deforestation in Brazil's Amazon rainforest hits 15-year high*. CNBC; CNBC. <https://www.cnbc.com/2021/11/19/deforestation-in-brazils-amazon-rainforest-hits-15-year-high.html>

The State of Food Security and Nutrition in the World 2020 | FAO | Food and Agriculture Organization of the United Nations. (2020). Home | Food and Agriculture Organization of the United Nations; FAO. <https://www.fao.org/publications/sofi/2020/en/>

UNICEF. (2020). *Out-of-School Children in Brazil*. Unicef.Org; UNICEF. https://www.unicef.org/brazil/media/14881/file/out-of-school-children-in-brazil_a-warning-about-the-impacts-of-the-covid-19-pandemic-on-education.pdf

Werth, D., & Avissar, R. (2004, February 1). *The Regional Evapotranspiration of the Amazon in: Journal of Hydrometeorology Volume 5 Issue 1 (2004)*. AMETSOC; Journal of Hydrometeorology. https://journals.ametsoc.org/view/journals/hydr/5/1/1525-7541_2004_005_0100_treota_2_0_co_2.xml

What is Environmental Education? | US EPA. (2012, December 13). US EPA; US EPA. <https://www.epa.gov/education/what-environmental-education#:~:text=Environmental%20education%20is%20a%20process,make%20informed%20and%20responsible%20decisions.>

Zappi, D. (n.d.). *Growing knowledge: the Brazilian List of plants and fungi | Kew*. Royal Botanic Gardens, Kew | Kew; Royal Botanic Gardens, Kew. Retrieved May 23, 2022, from <https://www.kew.org/read-and-watch/brazilian-list>