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Brazil, Agroforestry

### **Brazil: Look at the Forest for its Trees**

Deep within the thick forests of the Amazonian jungle, the air is humid and thick. A family joyously converses around their dinner table passing around home-grown beans, rice, yams, and cassava. The clucking of chickens breaks the calm of the peaceful, serene forest surrounding them. Tomorrow, the family will travel to the local farmers market to trade with dozens of other small families that live off the rainforest. Yet the sounds of nature will soon be overwhelmed by the resounding noise of heavy machinery and rich industrialists only miles away, with trees, habitats, and livelihoods falling away in their destructive paths. As bulldozers roll into the area, in just a few years, the family's vast array of fruits and vegetables will transform into a crop of soybeans packaged by agricultural corporations destined for consumers thousands of miles away.

This Brazilian family is just one of many who feed the nation's urban hubs. While over 80% of Brazil's population resides in urban areas, the vast majority of food production comes from rural family farms ("Degree of Urbanization"). As a whole, the story of Brazil is one of a stark divide between the urban and rural populations. While city-living Brazilians are overwhelmingly employed in the service sector, for more decentralized areas, farming is the greatest source of work, employing over 70% of the rural workforce (Gross). As a result of this severe imbalance, the country has also suffered a record bout of food insecurity, with 30% of families having insufficient food as of June of 2022, reaching the same levels seen in 1998 (Vigna).

Contrastingly, Brazil has become increasingly known as a global agricultural powerhouse, and the country is now the largest net exporter in the world (Valdes). Increased agri-business investments into industrial agriculture have turned the farming sector into a key area of the Brazilian economy. Since Brazil has large tracts of arable land and a political base that supports agri-businesses, the agricultural sector has recently skyrocketed. Ironically, even with Brazil's seemingly insurmountable agricultural might, the country regularly struggles to feed its own citizens. The large-scale shift to agri-business food production and export-oriented economics has impeded Brazil's domestic food production and created a real problem of food insecurity within the country.

The heart of this problem lies within the Amazon rainforest, the largest rainforest in the world, which has influenced Brazil's agricultural outcomes for centuries. With the increase of agri-business, the rainforest has begun to perish. Industrialists are responsible for clearing out parcels of land in order to cultivate the cash crops that fuel the Brazilian export industry (Valdes). Indeed, the clearing of the Amazonian rainforest has rapidly accelerated over time, and, during the period from 1985 to 2021, the proportion of Brazilian land that was covered by native vegetation fell from 76% to 66% (Girardi). Industrial farming has been the primary cause of the rapid increase in deforestation as roughly 90% of the lost forest has been converted from land populated by dense nature to that of intensive monoculture farming (Nugent).

Ultimately, sustainable agriculture in Brazil has reached a crossroad. The encroachment of industry has reduced the productivity of Brazilian food yields. Primarily, the shift towards industrial techniques significantly suppresses biodiversity by eliminating important habitats of the native wildlife and promoting monocultures. Overall, crop yields have decreased by around 10% in regions of high deforestation within Brazil as a result of environmental changes and the significant decline of biodiversity (Strickler). Biodiversity is a foundational aspect of sustainable and productive agriculture because it performs a key role in ecological maintenance (Khush). Biodiversity maintains soil fertility and conservation, and it provides the ability for crops to adapt to changing environments. However, Brazil's biodiversity has been limited over the past years, as the cultivation of cash crops like soybeans has supplanted polycultural agriculture that involves different crops, which is a necessary feature of a diverse and resilient agricultural environment.

Moreover, deforestation has also undermined Brazilian environmental sustainability, as well as the effectiveness of agriculture. The rapid disappearance of a large number of carbon sequestering trees is continuously raising Brazil's emissions. Brazilian deforestation was responsible for 70% of all carbon emissions produced by the loss of forests within the region, demonstrating the overwhelming impact of the influx of agri-business (Chaves). Should the wave of deforestation progress further, climate change may accelerate at levels never seen before. Because the Amazon represents one of the largest carbon sinks in the world, sequestering around 5% of global emissions, it is an immensely valuable resource for global climate regulation (Kaiser).

While climate change threatens millions of lives around the world with rising sea levels, global warming, and increasingly frequent natural disasters, it also poses a unique challenge to Brazilian agriculture. About 90% of Brazilian agriculture relies on rain. Therefore, droughts, heatwaves, and other climatic anomalies caused by climate change can severely disturb Brazilian farming (Ruiz). Moreover, deforestation and over-cultivation of crops associated with unsustainable industrial practices reduces the ability of soils to properly absorb rainfall. Unfortunately, this change spells the beginning of a disastrous cycle of more climatic disturbances that will force Brazil to deforest more land to increase crop production resulting in a dangerous cycle that ruins the environment. The increase in arid environments within the region will drastically affect food security in the Pan-Amazonian region. By 2060, the percent of agricultural land that is suboptimal for farming under these climatic conditions will be 74% (Ruiz).

Large agribusinesses in Brazil have centered crop production on exports and cash crops that are not designed to directly support the Brazilian people. The country's domestic population has had to rely more on smallholder subsistence agriculture for food production. Even though smallholder agriculture only occupies around 30% of Brazil's agricultural land area, it provides over 70% of the food consumed by Brazilians (Nolasco). Unfortunately, smallholders have frequently been forced to compete with agri-business interests for land and resources, and they have disproportionately suffered from the negative effects associated with industrial agriculture.

Luckily, agroforestry presents a new opportunity for smallholders to maximize yields while farming sustainably, which can help ensure the long term success and stability of Brazilian agriculture. The technique of agroforestry, a branch of sustainable agriculture, involves the intentional and large-scale integration of forest and shrub systems into subsistence farming ("Agroforestry"). For Brazilian

smallholders, a transition from conventional monoculture farming towards agroforestry could not only improve yields for the farmers that are struggling to feed the nation, but also help them adapt to the long-term challenges presented by climate change.

Agroforestry represents a unique solution to the environmental problems created by agri-businesses due to its potential to revitalize farming yields. Indeed, agroforestry systems are twice as productive as monoculture systems, even those farmed by the most efficient “conventional” standards (Rosati). Doubling the yield of a plot is an incredible feat, and agroforestry does so by simulating the natural environment of wild plants. Brazilian farmers could dramatically improve yields by integrating crops into agroforestry systems, such as by planting crops in between rows of trees. The environment of trees and shrubbery accompanying crops increases the amount of organic matter stored within the soil and conserves water and nutrients more effectively, thus serving to maintain sustainable agriculture. Moreover, since Brazilian agriculture is so reliant on rainfall, planting more trees serves as a perfect opportunity for farmers to rely less on expensive irrigation and to let tree roots capture water for their crops. Agroforestry essentially lets farmers “plant water”.

Another notable benefit of agroforestry is the farming technique’s adaptability. Agroforestry does not rely on cutting down trees, but it reverses the trend of deforestation by planting new ones instead. Many agroforestry plots have combined reforestation projects with farming, which, when implemented across millions of farms, can help repopulate the broken Amazonian rainforest. The effects of preserving forestland have been remarkable as drops in deforestation levels have also coincided with sharp rises in the growth of food production and agricultural efficiency (Butler). Moreover, agroforestry provides an intuitive solution to the problems of climate change, as a decrease in deforestation by 70% in Brazil in 2014 dropped global emissions by 1.5% (Radford). Reforestation combined with a decrease in deforestation proves to be the most efficient way to reduce carbon emissions. For instance, in Canada, a large-scale reforestation project successfully sequestered 20% of carbon emissions (Geiling).

Transitioning to agroforestry, however, is not easy for smallholder Brazilian farmers who generally lack productive capital to invest into their farming resources. Planting an agroforestry system within the Amazon rainforest generally costs two to three times the amount of a plot consisting of soybean monoculture (Nugent). But smallholder farmers lack capital to invest in farming resources needed for the transition. Thus, for family farmers to effectively switch to agroforestry, it is imperative for farmers to learn about the benefits of these new agro-ecological techniques. Increased productivity of agroforestry systems results in a return of around twice the initial investment and farmers break even within two years (Nugent). Moreover, agroforestry does not require repeated purchases of expensive fertilizers, chemicals, and pesticides, making them much cheaper over time. Because of the increased yields and lack of inputs necessary, farmers can achieve eight times the profit in agroforestry systems when compared to conventional agriculture (Hanes).

According to Brazilian farmers, lack of government support is the most significant factor that hinders the adoption of agroforestry techniques (Shennan-Farþón). Indeed, the Brazilian government has always prioritized the agri-businesses over smallholders. While the Brazilian government has invested \$8 billion USD into family farming initiatives over the past couple of years, the investments made towards industrial agriculture topped six times that amount (Gross).

A reconstruction of agricultural policy is clearly needed. First, the Brazilian government must shift support away from the industrialists deforesting the lifeblood of Brazilian diversity that is necessary to maintain a stable agricultural sector, but instead shift towards promoting agroforestry among smallholders in order to reduce food insecurity and promote sustainability. Investing more into sustainable agricultural techniques like agroforestry can help smallholders persist through the difficult transition from conventional farming to agroforestry, through the couple of years of elevated investment before the farmers are able to achieve total self-sufficiency.

Second, promoting agroforestry should also focus on providing the knowledge and technology that enable smallholder farmers to make the transition. Agroforestry represents a new farming practice that is foreign to many farmers. Inevitably, many smallholders will be reluctant to forgo customary conventional farming practices that they have been used for years or even decades. While non-governmental organizations have independently provided knowledge and technology to smallholders about agroforestry, their coverage is patchwork and unlikely to spur a country-wide movement. Therefore, to encourage and facilitate a widespread transition towards agroforestry the Brazilian government should initiate an education campaign and provide adequate technical assistance and investments so that rural farmers are willing and able to take a leap of faith away from traditional means. One policy success to model after is the Cistern Program, which has a track record of success working through a network of partnerships between NGOs and governmental organizations. The program has facilitated rural development and greater access to water by training community members to build cisterns and subsidize the construction of new rainwater collection tools to improve access to water for small farmers. A similar nationwide agroforestry initiative for rural farmers across Brazil could mirror the Cistern Program to partner with NGOs to systematically improve farming techniques across the country, not just in specific areas.

Finally, the Brazilian government must realize that the country would benefit significantly from increased adoption of agroforestry in the face of economic and political pressure. Already, other nations under similar environmental conditions as Brazil, like India and Nigeria, have pursued larger agroforestry usage in order to adapt to decreasing yields and climatic issues. As climate change inflates temperatures within Brazil, the yields of industrial agriculture will progressively decrease, while those of sustainable smallholders will increase. Thus, the Brazilian government will likely be pressured into supporting agroforestry as a sustainable alternative. Moreover, sustainable agriculture presents Brazil with a way to meet global climate initiatives and preserve their image as the home to the wondrous Amazon rainforest, while also reducing domestic food insecurity. And, as agroforestry improves the profits of smallholders, sustainable farming techniques will gain more political influence within Brazilian politics due to an increase in economic leverage for smaller farmers.

With these concrete steps, Brazil can transition its focus away from agri-businesses towards smallholder agriculture, using agroforestry as a regenerative technique. Agroforestry can help Brazil solve the issue of food insecurity that plagues over a third of the Brazilian people and can revitalize the Amazon rainforest to combat climate change. The Brazilian government can ensure that their people eat their fill and that their cropland does not shrivel up, but they must take actions and aid the smallholder farmers that feed the country. While the rural farming family cultivating a myriad of different crops may not be the first image that comes to mind when picturing Brazilian agriculture, it may soon be the dominant form of farming in a new sustainable world involving agroforestry.

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