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Brazil, Factor 5: Climate Volatility

Transforming Agricultural Practices in Brazil to Adapt to a Changing Climate

Approximately one third of Brazil's population is food insecure (Shapouri, Shahla, and Stacy Rosen). Food insecurity is defined as the lack of access to or the unavailability of, a supply of food with sufficient nutritional value ("Introduction and Basic Concepts of Food Security.") In the northeastern region, the most impoverished part of Brazil, the population exceeds twenty five million, nearly half of which live in extreme poverty ("Brazil." *Country Profile*). In the rural areas of this region most of the adult population are subsistence farmers, usually women, hoping to grow enough annually to feed their families. Climate volatility -the unpredictability of climate change- is a factor that threatens their livelihood. With a changing environment, increased drought frequency and higher temperatures, yields will steadily decrease unless solutions are developed. Agroecology, the use of ecological principles to guide farming practices, may help to build climate resilient farms and a community of social change. In Brazil, several trials of agroecology have empowered women and benefitted them and their families. As the average subsistence farming family in northeastern Brazil is falling into poverty due to climate volatility, agroecology techniques can be implemented to build climate resilience and food security.

The typical rural family in Brazil is a subsistence farming family living in the northeastern region of the country. Not enough data exists to calculate the average subsistence farm size, but the average family farm size, is 18.37 hectares. 24.1% of family farms are run by subsistence farmers. These farms are ninety four percent smaller than the average size of an agri-business sector farm. Subsistence farmers produce maize, coffee, milk, manioc, rice, cassava, and beans (Rocha, Cecilia). They consume enough of their harvest to survive, and they sell any remaining crops at local markets. Typical agricultural practices include collecting water and firewood, raising small animals, and growing grains and vegetables using synthetic pesticides and fertilizers (*Climate Resilient Sustainable Agriculture*).

The average rural household consists of a mother, possibly a father, two children, and occasionally an extended family member (Givisiez and Oliveira.). Women do most of the farming within families while fathers work elsewhere to earn an income. If there are no jobs in their village, they travel as migrant workers, looking for seasonal work on large plantations, or go to urban areas to work as industrial laborers ("Brazil." *Countries and Their Cultures*). Subsistence farming families' diet consists of beans, rice, and cassava dishes and any other crops that they are growing ("Brazil." *Countries and Their Cultures*). Adults rarely receive a formal education. If they do, it likely does not include plant science or farming skill training ("Rural Poverty in Brazil."). Some of the daily activities of mothers include fetching water from wells ("AQUASTAT - FAO's Information System on Water and Agriculture."), cooking, cleaning, and farming. Children are needed for daily household and farm chores, limiting the time they have for an education ("Brazil." *Countries and Their Culture*). Families do not have access to free healthcare. Doctors in the region are less experienced and facilities are lower quality than in southern regions, where the mortality rate is half of that of the northeast. (Khazan).

Land tenure, a lack of healthcare and education, and unsanitary water are barriers to eliminating poverty in subsistence farming communities. The inequality of land distribution forces subsistence farmers to cultivate small plots of land, while still struggling to pay rent. Not only do they become indebted to landlords but the plots are too small on which to grow sufficient amounts of food, especially under harsh conditions ("*Brazil.*" *Country Profile*). It is estimated that food and debt payments account for over 80% of their annual expenditures (Ribot, Jesse C., Antonio Rocha. Magalhães, and Stahis S. Panagides), which is significant considering they must also purchase seeds and equipment. The lack of health services and education further pushes families into the poverty cycle. The knowledge of crop biology and the ecological understanding of the environment is difficult to attain. Farmers are therefore making seed choices and irrigation plans without understanding the environmental changes affecting future farming conditions. They lack education about financial management, which weakens the possibility of escaping from debt. The intensity of labor necessary for crop cultivation is more severe without proper healthcare. The lack of clean water further weakens the health of farmers and increases the spread of diseases.

Climate volatility decreases agricultural productivity and food security. As climate change is occurring, families are increasingly unable to produce enough food due to droughts and extreme temperatures. Drought escalates desertification, creating dry and unusable soil. Brazilian temperatures are expected to increase by 4.5 degrees by the end of the century (Mario) and rainfall is diminishing by forty percent in the northeast region (Rocha, Jan). Poor conditions will lead to lower crop yields and 100,000 Brazilians are expected to soon fall below the poverty line (Ahmed, Diffenbaugh, Hertel). The agriculture business is expected to lose \$3.1 million per year after 2020 due to climate change (Frayssinet). Subsistence farmers are already struggling to produce enough food for survival. It will be even more difficult under extreme and unpredictable conditions.

Population growth and the growing energy demand are factors which also escalate climate volatility. The human carbon footprint will steadily increase with the population. Brazil is the eighth highest emitter of greenhouse gases in the world and the third of developing countries. Furthermore they are the largest producer and consumer of ethanol in the world. Despite its association with sustainability, ethanol actually leads to severe ozone pollution according to a 2014 study in Sao Paulo (Salvo, Alberto, and Franz M. Geiger). This directly damages the ozone layer and decreases protection from ultraviolet rays. The atmosphere's ability to stabilize temperature fluctuation is reduced ("*FACT SHEET: Ozone and Air Pollution.*"). , increasing unpredictable temperatures which causes leading to more severe weather disturbances. Oil drilling accidents further damage the environment and water resources, increasing the possibility of drought. Land-based oil rigs require clearing of land, leading to deforestation and higher levels of carbon dioxide in the atmosphere. Climate volatility is on the rise. Without a solution, feeding twenty five million people in northeast Brazil will be a challenge.

Agroecology is one answer to the problem of climate-induced food insecurity. It is the use of ecological principles to enhance the habitat on small scale farms, creating self-sufficient ecosystems. Agroecology methods include soil enhancement, reduction in the use of non-renewable fuels and pesticides, crop rotation, and polycultures. Soil enhancement includes mulching, minimized tiller use to avoid erosion, compost systems, and the use of microbes in the soil to

enhance fertility (Gliessman, Dr. Stephen R.). Renewable energy options such as solar and wind energy are ecofriendly and allow farms to be energy independent as fossil fuels sources are diminishing while prices are increasing. Pesticides are expensive, unhealthy, and not sustainable. Moreover, they're becoming ineffective. Already five hundred and forty arthropods have demonstrated resistance to over one thousand pesticides (Altieri, Miguel A., and C. I. Nicholls). Crop rotation uses different crops on the same plot to increase diversity and healthy soil. Polycultures utilize complementary biological characteristics of two or more crops to improve pest regulation and nutritional value of crops. This increases the stability of yields (Altieri, Miguel A., and C. I. Nicholls). As water scarcity is common, agroecology uses irrigation techniques suitable for each farm. Cultivation methods also include dry farming and the use of seeds requiring less water (Gliessman, Dr. Stephen R.) These techniques will halt direct pollution to the habitat, conserve resources, and produce higher yields with less labor under imperfect conditions.

Community outreach cooperatives promote agroecology by creating a system for research, education and support in the adoption of new methods. They build an environment for the whole village to discuss and overcome the cultural barriers to new techniques. If the majority of the village is excited to adopt new techniques and driven to study their results, working through the challenges will be a community effort and implementation will be easier. To spread agroecology to other villages, it is best for motivated farmers to become method trainers, sharing their new knowledge with nearby villages. Other farmers will be more likely to listen to someone who lives thirty miles away than someone who lives three thousand miles away. Moreover, within cooperatives, financial management, ecology and renewable energy is discussed and taught. This also benefits the economic stability of villages (*Climate Resilient Sustainable Agriculture EXPERIENCES*). A support and education network is important for a village of subsistence farmers. For a state or even a country though, it is especially vital to agricultural success, political change, and socioeconomic equality.

As most subsistence farmers in this region are women, agroecology programs focus on them. Worldwide, women account for 75% of agricultural work completed. In Brazil, they are considered experts in seeding and cultivation. Their productivity is expected to increase by approximately thirty percent with new agroecology methods (Edith van Walsum). They not only are the main farm laborers but also the cooks and caretakers of their families, The less field labor necessary, the more time they have to care for themselves and their relatives. As women work together in cooperatives to learn the most effective techniques, the stronger villages become which increases resilience to climate change. In Paraiba, a state in southern Brazil, a farmer spoke to this saying, "Today I am a different woman. Before, when I saw people I never felt like talking, being open. I just listened to them speak. Today no! Today I speak with the whole world. I became stronger, as a woman, as a mother. When I and other women started participating, something men were already doing, many things changed in my community. Especially for me. I feel fulfilled and will continue to participate!" (Freire, Adriana Galvão).

Agricultural reforms promoted by international aid workers are often unwelcome, especially when traditional techniques are culturally tied. Introduction of agroecology programs must be done a few villages at a time, working personally with farmers to teach agroecology methods while also learning from farmer's traditional knowledge. Because traditional gender roles are

strongly connected to the culture, working with women to encourage larger roles for them in the private and public sector will be difficult and should be done slowly, step by step. For each crop, the most sustainable cultivation technique is different. For this project, a set protocol for each staple crop should be prepared in advance of field work. But workers should be ready to tweak conditions to fit farmers' equipment and cultural traditions. In addition, financial management training sessions should be available if desired and taught in groups to encourage the creation of cooperatives. If possible, farmers who have adopted agroecology techniques should be hired as project managers to help implement method adoption in the region. Creating a community driven, self-help support network is key to overcoming cultural and economic barriers to agroecology methods.

A successful agroecology project called ActionAid Brazil was done in Pajeu, Pernambuco, in northeast Brazil. It shifted the traditional division of crops and livestock between women and men. Participants built cisterns, fences, chicken coops, local seeds, and compost fertilizer for the crops. It built eco-systems within each small farm so they could function even when droughts were prolonged and soil was infertile. It also educated women and men to manage their finances better, supporting women to have a larger role in crop planning. The result of the project was higher crop yields, less energy dependency, more nutritious crops, and educated farmers who could successfully manage their finances (*Climate Resilient Sustainable Agriculture*). Similar projects have been successful in southern Brazil (Freire, Adriana Galvão). Now the techniques need to be widely adopted throughout the country.

Cooperative agroecology networks alone will not eliminate poverty in the region. Land tenure, access to health care, education and clean water are issues that affect subsistence farmers and need to be addressed by the government. The debate over land distribution has been occurring for years. Politicians continually promise to address the issue but never do once they're elected. The political crisis in Brazil is preventing land reform currently, but grassroots organizations must continue to lobby for change. Social media outreach programs should inform first world citizens of the numerous injustices occurring and the need for help. People can donate to non-governmental and grassroots organizations, such as Water for Life and Grassroots International, that are working towards clean water and land reform.

Non-governmental organizations in the region must communicate. So often, NGOs focus on their own path and do not allocate time or funding for collaboration with other organizations. As many groups are working for similar causes in the same region, collaboration is important. Without it, counterproductive efforts prevent the efficient use of time and resources. If too many aid workers are assigned to the same region with different instructions, community members will resist help. Furthermore, discussing goals and distinguishing unique ideas and interests will strengthen mission statements and decrease grant competition between organizations.

Agroecology collectives are beginning to speak out. Women who are farming, raising children, cooking, cleaning, and surviving through the poverty cycle, have a story to tell. In Paraiba, five thousand female smallholder farmers marched through Lagoa Seca chanting "I am not a slave, nor an object - I have no owner, I am not a piece of property - I want freedom to be a woman..." (Freire, Adriana Galvão). They were not speaking directly to land inequality or lack of education but more broadly to women's health and social inequality. They are raising awareness for the

lack of support from the government. Their movement started as a farming cooperative, learning about agroecology (Freire, Adriana Galvão). Awareness leads to change because collectives can use their networks, stories, and shared motivation to pass life-changing policies for all Brazilians.

The average subsistence farming family in rural Brazil is falling into extreme poverty due to climate volatility. Subsistence farms are usually small, cultivated by women, and threatened by drought and extreme temperatures. As climate change is becoming more pronounced, it is clear that farms must be stable and resilient in order to produce ample yields. Agroecology is a working solution that creates self-sufficient eco-systems on farms to grow more food and use less resources. Agroecology especially benefits women, who do most of the farming. Not only do they learn financial management and new cultivation strategies, but they gain collective organizing skills, individual health, and personal empowerment. These networks of farmers use agroecology methods and demonstrate the capacity to farm in a changing climate. Systems have been successfully tested in small villages by organizations such as ActionAid Brazil. Land tenure, healthcare, and education barriers can keep subsistence farmers trapped in poverty. With the collaboration of local agroecology collectives, non-governmental organizations, and ordinary people across the globe, policy changes are possible. The average subsistence farming family can live on climate crisis resistant farms, ensuring their own survival and aiding the food staple sources in Brazil to help feed the rest of the country.

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