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India, Factor 5: Climate Volatility

### **The Effects of Climate Volatility on Food Security in India**

The typical farmer in India is faced with a variety of challenges brought about by factors such as demographics, customs, illiteracy, government policy, weather conditions, and now, climate change. Though climate change affects all areas of the globe, it is predicted that India will face the most challenges due to their large, growing population and reliance on agriculture. These challenges include increased heat waves and droughts, water stress, severe storms and flooding, and increased temperatures. (Battelle Memorial Institute) With these challenges progressing, it is becoming increasingly difficult for a farmer in India to simply mind a plot of land, use it to sustain employment and provide food for family sustenance, and pass it to the next generation. With the cooperation and education of local communities, the government, and farmers, changes can be implemented to combat climate change. Without these changes, the adversity Indian farmers face will only continue to grow.

According to the Food and Agriculture Organization of the United Nations, 66.5 percent of India's population lives in rural areas, as family farms and subsistence agriculture in India are very common. Families in India (averaging 4.9 per family) tend to be larger than the average family size in other countries, primarily driven by India's lack of an adequate healthcare system for elders and because gender roles encourage them to continue having children until they have a boy. Unfortunately, when land is divided among these children, it is in smaller fragments, which reduces agricultural productivity. A typical farm in India is smaller than the average farm in other countries: 67 percent of India's farmland is held by farmers with less than one hectare (Ians). Crops are the predominant focus of agriculture in India. Because of its diverse climate and topography, a variety of crops can be grown on the typical family farm; however, the most common crops include staples such as wheat, rice, pulses, sugarcane, vegetables, fruit and cotton. Family farms might raise cows for dairy and buffaloes for slaughtering, as India is the world's largest producer for milk and has the world's largest amount of buffaloes. The average farmer in India will make only Rs 6,426 a month, which is about 90 US dollars (Rukmini). It is estimated that the family consumes half their wheat and rice and sells the rest to private traders at minimum price. The majority of farms in India operate on a rainfed agricultural system, and groundwater is their most dominant source of water for farming. Farmers also rely on seasonal flooding during monsoon to provide water for their crops. (Rada, "India's Agricultural Growth Propellers") Other common agricultural practices on family farms include extensive use of fertilizer due to India's depleted soil. Because farmers are faced with the expensive upkeep of their farms, including the cost of fertilizer, and they do not have enough land, many farmers in India are in debt. This debt prevents them from investing in new agricultural technology, putting them at another disadvantage and creating a cycle of debt.

Approximately half of India's population is vegetarian because the primary religions - Hindu, Buddhist, and Jain - restrict or forbid certain meats. Legumes such as lentils and chickpeas are an important part of the Indian diet, and rice (usually topped with an array of spices) is a staple food throughout the country. The types of fruits and vegetables available in India depend on the region since climates throughout the large country can vary. India has nearly 195 million undernourished people, a tragic situation that is especially apparent in children, 4 in 10 of whom suffer from undernutrition or stunted growth. To compound the issue, this problem is multigenerational, as malnourished women give birth to low-weight infants. Nutritional problems in India cause their people more susceptible to diseases and cause diminished learning capacity in children. The large number of malnourished Indians is attributed to agricultural productivity barriers in India caused by climate change, lack of education, and cycles of poverty. In addition, the government does not provide Indian farmers with adequate resources and

markets to produce and sell enough low-priced, nutritional food to sustain their population, as only 3.8 percent of the country's Net National Product is given to rural development. (Upadhyay, "Challenges in Achieving Food Security in India"). Because there is a lack of an adequate healthcare system in India, many urban Indians turn to private healthcare systems; however, this option is generally inaccessible to poor, rural Indians. In fact, the quality of healthcare in rural systems, if any, is considered extremely inferior to that of urban systems. ("Healthcare System in India")

Though the illiteracy rate has decreased in India in the past few years, India still has one of the highest adult illiteracy rates in the world. Not surprisingly, there is a large literacy gap between Indians in rural areas and Indians in urban areas, which is largely due to the financial situation of many farmers. Rural farmers cannot afford to get educated because of financial burdens. Without education and literacy, it is more difficult for farmers to keep up with the recent unpredictable monsoons and irrigation levels (driven by climate change) as well as new agricultural technology, which causes them to lose money and fall into a vicious cycle of poverty. Traditional knowledge derived from agricultural customs and practices passed down from generation to generation is simply not enough anymore to prevent their crops from failing. Thus, illiteracy is considered a large barrier for small farmers in India.

Although India recently achieved national food self-sufficiency, new challenges have emerged, such as slowing agricultural growth, land degradation, and shrinking biodiversity. Soil degradation and nutrient depletion has occurred due to the farming of the same crops over and over again; this causes farmers to have lower crop yields, which makes them lose money and decreases the amount of people they can feed. This causes farmers to have to use more fertilizers, which not only adds another expense to their farm, but is harmful to the surrounding environment, causing eutrophication in nearby bodies of water. These costly inputs- fertilizer, pesticides, and insecticides- cause farmers to lose money, putting them in a cycle of debt. Not only is soil in India being degraded, but their supply of groundwater is being used up. Groundwater is used to supply dry areas with water through irrigation, but due to the over pumping of this water for farming, the groundwater supply is being depleted. ("Agriculture in India")

In addition to these issues, a pressing factor that affects agricultural productivity in India is climate change. Climate change causes a number of agricultural issues, such as extreme droughts, floods, and temperatures. These effects of climate change can already be seen in India and will only continue to worsen. In addition, these effects are predicted to hit small, poor family farms the hardest. Not only will climate change cause extreme amounts of rainfall that damage crops, but droughts will become more frequent as well. Many regions in India already face issues regarding water scarcity, and farmers in India particularly rely on seasonal monsoons to supply their crops with water. Because of these factors, the climatic effects of climate change will cause increased crop failure. Tragically, the effects of droughts has been so costly to farmers that it is believed to have contributed to higher suicide rates among farmers in recent years. With climate change, temperatures in India will begin to warm. If this warming is outside the tolerable range for plants, it can cause them to perish, resulting in a reduction in crop yields for major staple crops such as wheat and rice. This is especially detrimental to India because their food security is dependent upon these staple crops. Lower crop yields will render farmers unable to pay for new technology or the tools to keep their farm running. In this scenario, farms will struggle and, with a decrease in the amount of food available, prices will rise and food will be less accessible for Indian families.

Any lowering of agricultural productivity in India severely affects their food security, trade policy, and livelihood. If the effects of climate change were to be combated properly, India would be able to achieve better food security. In addition, the lives of many farmers and their families would be improved, India

would see economic improvement, and India would be armed with the right structure, tools, practices, and plans to stay ahead of climate change as it worsens with time. There are solutions and ways to adapt agricultural practices in response to climate change. Educating farmers on these techniques and the changing environment is critical to the long-term productivity and viability of farming.

One idea that can be implemented in response to extreme weather events, such as droughts and floods, caused by climate change is the creation of a watershed plan. This watershed management plan would bring rural communities together to engage in land planning and agricultural practices that will regulate water sources. First, Indian farmers and others should be educated that water is a finite source and made aware of their water-shortage situation, including how it will become increasingly more drastic due to climate change. Second, new water-saving agricultural practices can be implemented, including drip irrigation instead of the more common flood irrigation because it uses less water. A less costly practice in the plan could be harvesting the rainwater from floods and using it on farms during droughts or dry periods. Since the supply of groundwater has become depleted with more droughts, collecting rainwater can decrease the usage of groundwater. In addition, focusing on allowing groundwater to recharge is important. (“A Watershed Plan”)

Crop rotation or intercropping, rather than the more common mono-cropping, can help reduce pesticide use as most pests are specialized to a single crop. It can also keep the soil fertile without using as much fertilizer (reducing costs for farmers) and prevent erosion. With increased floods due to climate change, erosion will become more and more of a problem. Crop rotation, intercropping, and the practice of windbreak farming can help prevent erosion. Intercropping and crop rotation will also increase the diversity of crops, allowing farmers to expand their markets and allowing Indian families access to a variety of foods. This diversity of crops is also important to combat climate change because it decreases the reliance a farmer would have on one crop. During climate change, more crops are likely to fail due to rising temperatures. It is becoming increasingly important for farmers to not rely on one and be able to farm multiple crops if one fails. The most important aspect of this idea is the education of small farmers on the positive effects of crop rotation and intercropping, allowing them to implement these practices on their own farms, combat climate change, become more financially independent, and provide a diverse amount of food to Indians.

Another solution suggested by many scientists is the use of genetically engineered (GMO) crops. These crops could be made flood or drought resistant, which would help fight the effects of climate change. They could also be engineered to require less fertilizer and less pesticides, which eliminates an economic burden for farmers, or to include more nutrition. The Indian government would play a big role in making GMOs legal and readily available for farmers. GMOs, however, are not currently considered a viable option for India because farmers, already poor, would suffer economic consequences because the GMO seeds are costly. This could be a solution in the future if India provided more money to their farmers, but would only add to a farmer’s cycle of poverty if they tried it right now. (Bagla)

An additional way to ameliorate the effects of climate change would be to control India’s fast-growing population. With less people, less food would be needed, decreasing pressure on farmers to produce high yields which is becoming increasingly harder due to climate change. Lowering the population also means that less water would be used. The reason why India has one of the largest populations is due to social factors and limitations. If women were educated on birth control and family planning, this could lower the population. One program called “CycleBeads” is already doing this. This program created a necklace with beads representing days in a calendar, red ones for a menstrual cycle, which is the Standard Days Method of contraception, tracking fertility. This does not require expensive pills or medical devices. If it were

scaled up, it could make positive changes in India. (Green) Empowering women and giving them more opportunities to work and earn money can also help lower the population. Many families keep having children until they have a boy because a boy is the only one who can earn money, but through giving women more opportunities, this can be eradicated. Families also have many children because they want to be taken care of when they are old, so implementing a health care system is a change that could be implemented by the government to alleviate this aspect of population growth. Efforts in doing so have already been implemented, such as the government's launch of the National Rural Health Mission in 2005 ("Healthcare System in India"). If similar efforts were to be successfully scaled up, they could not only provide a better quality of life for rural farmers and populations, but they could also help control India's population, which in turn would allow India to have a greater resistance to climate change.

There are other roles the Indian government can play in helping India combat climate change and agricultural barriers. If the government were to supply more money to agriculture, improvements such as the expansion of irrigation facilities can be made. As for small farmers, they would be able to invest in new agricultural technology, such as drip irrigation or GMOs, increasing their food output, and potentially alleviating them from their cycle of debt. This could allow them to become literate and invest in their own agricultural education, learning and teaching others new techniques that can be used to tackle the issues created from climate change. In addition, it is the government's responsibility to encourage and invest in the work of scientists who could potentially help combat climate change. This was already seen when President Kovind addressed recently graduated scientists, urging them to put their efforts towards developing new technology to combat climate change and help the small farmers in their country ("India: President Kovind Asks Scientists to Find Solutions for Challenges Like Climate Change, Water Scarcity") More of this encouragement of scientists can help India progress towards fighting climate change.

The agricultural situation in India is dire, but not irreversible. Many of the problems may be addressed through a concerted effort to improve the plight of the Indian farmer through policy change and thoughtful and sustained action. These changes include a watershed management plan, intercropping and crop rotation, and population control. Ultimately, educating India about climate change and increasing awareness of these new policies is the most important part. Without that, the situation will only get worse for the Indian farmer and for the nation as a whole. Resisting the effects of climate change would allow India to have a steady, reliable food supply and water supply, and it would allow their farmers to prosper economically, in the fields, and in their education; all of these factors making India become one step closer to achieving food security.

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