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India: A Lasting Solution For Weather-Dependent Farming

India, a country in Southeast Asia, has a population of roughly 1.36 billion people and makes up almost 1/6 of the population of the world (Data Commons, 2019). India shares borders with a range of countries, such as China, Bhutan, Nepal, Afghanistan, Pakistan, Bangladesh, and Myanmar. Although India has a population that is about 100x more than the United States, India is only a third of the size of the U.S., at roughly 1,269,000mi²(Worldometer, 2018). Of that land space, about 65.5% is rural and 34.5% is urban, and 159.65 million hectares of the land are currently cultivated (Statista, 2019). India follows a Parliamentary System, and the Prime Minister is currently Narendra Modi. The major exports in India are petroleum products, gems, spices, tea, coffee, a variety of metals, medications, and machinery. The exportation of these goods is what makes India such a valuable country.

Some of the major crops in India are millets, wheat, rice, coffee, tea, sugarcane, and cotton. Growing these crops makes up the income for many all over the country. The average farm size is about 1.08 hectares, which could be compared to about 2 full-sized football fields. While the land is looked at in terms of acres in the United States, in India, the size of land is primarily measured in hectares. 1 hectare of land is equal to 2.47 acres. The climate in India stays hot all year, and the heat peaks in the summer. Summer starts in late June and ends in late September. Cropping seasons typically start around this time each year in India to ensure the best growth. On top of having heat all year round, India has very humid rainy seasons. Unlike some of the countries in the Northern hemisphere, India has mild winters, where there is no snow or temperatures below 60°F.

While there is an expansive range of family types and sizes in India, going from extremely poor to extremely rich, for this research, the families that will be researched are typical farmers' families in Southern India. An average family is made up of two adults and two to three children (PRB, 2020). Previously, farmers with 1-2 hectares of land used to live in semi-permanent houses, or houses that weren't made for a long-term stay, but now, because the government stepped in to aid, most farmers are able to afford a permanent house, or a brick house. In some of the more developed rural areas, a typical farmer's house consists of a kitchen, a center room, and one or two bedrooms, but the features of each house change greatly between the area the house is in and the amount the farmer makes.

A typical diet for a farmer's family is vegetarian and is made up of millets, rice, lentils, and a variety of different vegetables. Some diets also include dishes with meat, such as chicken, lamb, or fish. Most families get food through local farmer's markets where people come to a central point for vegetables and food. There are also some vendors that go door to door each morning selling things like fruits, vegetables, and milk. Farmers' markets are mostly used by the villagers, as the owners of farms can use the food they

grow each year rather than buying it from a vendor. Once each family obtains their food, they use firewood to cook it so that it is safe to eat.

One of the main jobs in rural areas of India is to work in agriculture. It is incredibly important as that is how many people get food. The average wage is barely enough to get the bare necessities each household needs, and most families cannot afford anything extra. Everyone in farmers' families work, including the children between their studies and activities. 80% of rural areas have access to education up to middle school. Children will have to travel out of town in most places to obtain a secondary education. In the past, many children that were from rural areas did not receive any sort of education at all, but the government has worked to improve those circumstances, so now many children all over India have the ability to receive at least a basic education.

On top of education, the government provides safe drinking water in all urban areas and about 50% of rural areas (JMP, 2017). 71% of rural areas have toilets now (BBC, 2019), and 100% of villages also have access to some sort of electricity (BBC, 2018). While urban areas have full access to all of these things, rural areas did not have access to them in the past, and the numbers are rising more and more each year. 60% of rural areas have access to telephones, and villagers that can afford smartphones are able to have those as well. Many of the rural areas are starting to have wifi towers, which offers many more opportunities for the villagers in those areas. The typical roads in villages are made up of gravel, also known as metalled roads.

The major barrier that a farmer's family faces when it comes to earning a living and having access to nutritious foods is the weather. All farmers are very dependent on the weather as they need rain to yield each year's crops. If there is a failure of seasonal rains or there are insufficient rains, sometimes crops will not grow. Over 70% of farmers are incredibly dependent on the seasonal rainfalls as when there is no rain, there is no yield (SMW, 2017). When there are droughts, where the land gets very dry, crops are unable to grow, and when there is too much rainfall, where flooding happens, the crops that have grown get damaged. Farmers are very weather-dependent, and that is one of the most important factors to have nutritious food and being able to sustain their families.

The issue of being weather-dependent is staying the same for most farmers. There is still no backup plan for when extreme weather happens. Where there are fertile lands, farmers don't face the issue of worrying about the weather, but in the uplands, the land is much drier and foods like millets or other rain-fed crops cannot get cultivated. For every fertile farm, there are about 10 farms with dry land, making it that much more important to find a solution to the dependency on weather. Urban populations do not depend on farming for their sustenance, but, rural populations depend greatly on farming and need the crops to yield each year as farming makes up the livelihood of many villagers.

A solution that could greatly improve and solve this problem would be to have drip irrigation in the upland fields, or the drier fields. Drip irrigation is when water and fertilizer are delivered throughout a field through underground pipes. The nutrients from the water and fertilizer go straight to the roots of each plant, allowing each field to have an even distribution of water. If there is a limited source of groundwater, the land could be irrigated using drip irrigation to optimize the water usage. Drip irrigation would also help prevent runoff and thereby soil erosion. Soil erosion is bad for farming because it allows

some of the good soil to go to waste, which results in less soil to use for growing crops. One of the biggest benefits of drip irrigation is that it prevents water wastage, which is extremely important in rural areas of India as that extra water could be used for so many other things.

In order for drip irrigation to be implemented into fields, the central and state governments would have to lead the project. It would take some time for the process to be completed, but it would be difficult to start using drip irrigation without government aid. In addition to financial aid or incentives, the government has to raise awareness about the benefits of this project. And although there are a few field officers to spread the word and help with inquiries, a lot more are needed to reach the majority of the rural areas.

The most ideal source of funding for both of these solutions would be trying to raise money for farmers through nonprofits. Unfortunately, this funding source has already been tried. There are quite a few nonprofits that are trying to raise money for this exact problem, but, because of the lack of advertising for this situation, the money that has been raised still isn't enough to fix the issue at hand. Because of how accessible donating to a nonprofit is, this source of funding would work the best, as it could cater to all over the world and allow people from different countries or even continents to donate. So, while nonprofits for this cause are already a thing, awareness for these nonprofits is something that is lacking. Something that could be done to bring people's attention to these nonprofits is by making flyers or posters and putting them up in popular places in the cities, or even by making social media accounts to tell people about the issue at hand.

The only downfalls to using drip irrigation are the initial funding and expenditure, as well as the maintenance throughout the years. The pipes will have to be replaced every 5 years, and if the pipes are not installed correctly, they will have to be completely replaced. But, even with the costs of drip irrigation, in the end, the farmers would profit off of it much more as there could be more crop rotations in a year due to the limited water usage. Without soil erosion, there will be more good soil for farmers to use to plant crops, and without water wastage, there will be more water to grow those crops.

Another solution to solve the weather-dependency farmers face is groundwater recharging through the construction of artificial dams in ponds and streams. Groundwater recharging is a process where water is redirected through land, or in this case fields, through ponds, canals, or infiltration basins. Much like drip irrigation, it is used to manage water loss and make sure that all the crops in a field are getting water and there will be a yield. Through groundwater recharging, the groundwater levels are maintained, pumping costs for water are reduced, waterlogging in fields is minimized, and farmers' annual yields are increased.

Every acre-foot costs an average of \$390.00 USD, which would be about 0.4 hectares (Water In The West, 2014). This method is a bit cheaper than drip irrigation and could be funded through the central and state government, or even through a non-profit organization. Much like drip irrigation, a few non-profits have been made to raise money for this method, although it is much more scarce and isn't as widely seen as drip irrigation. Unfortunately, these non-profits also lack advertising, so in order to raise money for this project for farmers, awareness would have to be made for this solution and steps would have to be taken to spread the word about this solution. Because of the lower cost, this option would take less funding to install, unlike drip irrigation. To make this project work, farmers would have to learn how to properly use

artificial groundwater recharging. This is a common process in the United States, but it is not very common in India, so many people would have to learn about the way it works.

A possible solution to fund either of these projects is to charge a tax on water and use that money to obtain the materials needed for this technology. This would help raise the money needed without going through a non-profit or looking for donations, although if the tax is placed on people that already have limited water, it could decrease the amount of water they are able to afford. That could potentially lead to serious health problems or even death. Although many people in India are able to have enough water, there are still some that do not have the resources to get the water they need on a daily basis. Placing a tax on the already limited amount of water they have could end up doing more damage than good. But, if the tax was only placed on people that had more than a certain amount of water, then it could benefit many as it would help farmers get the money they would need and everyone would be able to get the food they need for the year. This solution to raise money could easily work, but it would have to be very detailed and would need to be put in place properly so it does not take away water from people in need.

Both drip irrigation and artificial groundwater recharging can work hand-in-hand, or they can work as stand-alone. The reason why these solutions are the best to help fix weather-dependent farming in India is because of the accessibility of the materials and the easy installation process for both. While they aren't incredibly cheap or super simple, they are known to work very well and have proved to be the most efficient solutions to guarantee water in fields. Drip irrigation has proved to be more efficient in many places, though it costs more and has higher maintenance. Artificial groundwater recharging costs less to run, but it takes more time than drip irrigation to work. The most important thing ordinary people can do to help develop and spread these technologies is aid in spreading awareness for these solutions. Overall, with either of these processes, farmers would no longer have to worry about needing rain during their farming seasons. They could grow more crops yearly and have long-term solutions for their fields.

Works Cited

Ahrendsen, M. (2017). Groundwater: Principles of artificial recharge. Retrieved March 29, 2021, from <https://www.ngwa.org/what-is-groundwater/About-groundwater/principles-of-induced-infiltration-and-artificial-recharge>

Check, R. (2019, November 27). India's toilets: Report QUESTIONS claims that rural areas are free from open defecation. Retrieved March 29, 2021, from <https://www.bbc.com/news/world-asia-india-46400678#:~:text=The%20results%20appear%20at%20odds,households%20had%20access%20to%20toilets.>

Clean drinking water. (2021, March 24). Retrieved March 29, 2021, from <https://www.unicef.org/india/what-we-do/clean-drinking-water>

Countries compared by agriculture arable land hectares. international statistics. (n.d.). Retrieved March 29, 2021, from <https://www.nationmaster.com/country-info/stats/Agriculture/Arable-land/Hectares>

Data center: International Indicators. (n.d.). Retrieved March 29, 2021, from <https://www.prb.org/international/indicator/hh-size-av/map/country/>

Friar, M. (n.d.). Artificial groundwater recharge. Retrieved March 29, 2021, from https://www.usgs.gov/mission-areas/water-resources/science/artificial-groundwater-recharge?qt-science_center_objects=0#qt-science_center_objects

German, A. (n.d.). What is Drip irrigation? Retrieved March 29, 2021, from <http://www.eco-drip.com/why-drip-irrigation/what-is-drip-irrigation/>

India says all villages have electricity. (2018, April 30). Retrieved March 29, 2021, from <https://www.bbc.com/news/world-asia-india-43946049>

India. (n.d.). Retrieved March 29, 2021, from https://datacommons.org/place/country/IND?utm_medium=explore&mprop=count&popt=Person&hl=en

Largest countries in the world (by area). (n.d.). Retrieved March 29, 2021, from <https://www.worldometers.info/geography/largest-countries-in-the-world/>

Research by Melissa Rohde By Janny Choy, G. (2014). Understanding California's Groundwater. Retrieved March 29, 2021, from <https://waterinthewest.stanford.edu/groundwater/recharge/#:~:text=In%20fact%2C%20researchers%20found%20that,broadly%20agrees%20with%20published%20values.>

Subudhi, Suresh. "It's Time India Sets up a National Infrastructure Bank." *Mint*, 4 Feb. 2021, www.livemint.com/opinion/online-views/its-time-india-sets-up-a-national-infrastructure-bank-11612446340164.html.

Team, S. (2017, March 27). Here's why India needs Monsoon badly. Retrieved March 29, 2021, from <https://www.skymetweather.com/content/agriculture-and-economy/dependency-of-indian-agriculture-on-monsoon/>

U.S. census Bureau current population. (n.d.). Retrieved March 29, 2021, from <https://www.census.gov/popclock/print.php?component=counter>