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Water Stability Ensuring Food Security in Peru

Peru is a country of vast extremes. From ice-capped Andes mountains to desert coastal regions, Peru is home to numerous and varying landscapes. Yet this beautiful country has a problem that puts urban-dwellers in competition with highland farmers. Originating with the fact that over two thirds of Peruvians reside in a place that receives less than 2% of the country's water flow, cities are requiring increasing amounts of water (Fraser). This is devastating to farmers that have a living dependent on the same water. Every impoverished person in the country is facing water scarcity in their daily life. It is necessary for Peruvians to adapt to these conditions with water conservation methods. In both urban and rural agricultural practices, irrigation can spread what little water there is even further. This directly benefits the environment by making withdrawals from their aquifer sustainable. Rivers that are recharged by the aquifer can continue to flow at steady rates, making ecosystems downstream stable.

The South American countries along the Andes will be facing the effects of climate change, as well. Glacial melt has been spurred on by increasing temperatures. While that means more water for now, glaciers will eventually become an unsustainable water source. Farmers relying on meltwater in the dry season will lose their livelihood unless a way to conserve water is widely introduced. The typical urban family can use these conservative measures in local agricultural. Communal gardens are becoming more commonplace, aiding the incomes of Peruvians already strained for money ("Paradigm Shift Project"). By using new systems of irrigation, these gardens can become more productive, letting the family spend their money on items other than food. While introducing water conservation agricultural techniques will require international support, once they are established, Peru will see increased food security. Farmers in and out of the city will be able to produce more food on less water, developing the economy and making for nutritious meals. By incorporating education and action, Peru will be able to meet Millennium Development Goals by 2015.

The average urban Peruvian family has many qualities that are not altogether unfamiliar. There are approximately 5.1 family members with strict divisions between males and females. Generally, the father is the authoritative figure that provides a main source of income. The wife does maintain a certain level of control over herself and the property, yet she remains second to the husband in terms of control. This type of hierarchical structure is demonstrated in the markets, where a man leads his wife, who are followed by the children (Hudson). Education is widely regarded by the impoverished as the road to riches, and while the government has made progressive efforts to establish more schools, they do not always ensure the quality that Peru's Ministry of Education mandates. There is hope for better education in Peru, considering that they have compulsory and free education with schools available to nearly every resident of the country ("Compassion"). When it comes to a typical diet, potatoes and corn are staple ingredients to any and all meals. Aji (similar to chili peppers, local lemons, and rice are also found in most meals. Along with that, here are three categories of Peruvian cuisine: coastal, highland, jungle. In recent years, there has been a push to add guinea pig (*cuy*) as one of the main meats consumed, alongside pork and chicken, due to its nutrition and low cost ("Economist").

Even though resources can be scarce in the outer regions of major cities, moving to urban areas can provide more prosperous work to a Peruvian family. In fact, Rural Poverty Portal reports that "Urban dwellers can earn 30 times as much as poor farmers." Peru had an unemployment rate of 8.8% and an urban population of 71.6% in 2010 ("International Fund for Agricultural Development"). Many who live

in Lima, the capital, are creating community gardens to supplement their meals and income. This has become a trend due to under- or unemployment and varying prices on staple foods in the city. Beforehand, food could be purchased at the local market or a street vendor; however, both were considered unsanitary due to pesticides ("Paradigm Shift Project"). Living as a poor urban family is far from easy. Shantytowns have popped up all over the country as wayward housing for the poor. In addition to this minimal housing, most urban areas are located where rain is scarce. This creates vulnerability in towns and uncertainty for water supply, which can negatively contribute to a desert garden's sustainability. Upward mobility is also difficult to obtain when millions of men are looking for work in a place where millions of other men are as well. For women, any income they can earn often comes from harvesting the garden. Upper and middle class urban residents will also use low class females as house servants- making up nearly 20% of female employment (Hudson). Any Peruvian family would benefit from an increase in the stability of water to increase the sustainability of food.

Water scarcity has been, and if not changed, will continue to be a detriment to Peruvian society. Not only has it challenged rural farmers with crop productivity, but it has also created barriers for those living in major cities. Currently, communal gardens are becoming a trend in cities like Lima, but they face an unsteady future if enough water cannot be supplied ("Paradigm Shift Project"). Some have resorted to using drip barrels to water the gardens; others simply can't sustain them due to limitations on water usage and minimal rainfall. Without gardens to supplement empty plates and stomachs, healthy meals cannot be made, nor can the family spend the money in areas other than food. Yet, when the farmers are facing the same water deprivation, food becomes more and more rare in the markets of Peru's cities. By ending this vicious cycle, Peru could see better food security in years to come.

The current status of the problem is turning dire. "More than two-thirds of the country's 29 million people live on the dry western side of the Andes, where less than 2 percent of the country's water flows," according to the Scientific American. "Water wars" that were seen in Bolivia are becoming prevalent in Peru, where urban dwellers demand more from the same water sources farmers are using. The current aquifer that is used for most urban cities is being drained at a rate faster than it can replenish itself (Fraser). Although there are no exact estimates on when this aquifer will run out, plans for a large tunnel rerouting water from melting glaciers have taken root. If this plan were to follow through, farmers would lose much of their water source. Thus, their livelihoods would be down the drain. On the other hand, if the current situation is not altered, those living in the city could see extreme rationing in water usage, especially when it comes to low socioeconomic classes. Over two-thirds of the water being used in Lima goes to wealthier districts, yet those who are poorest pay four to five times as much for their water. The issue of water usage is further exacerbated by the fact that only eight percent of farmers are using water-conservation techniques, even though they use eighty percent of Peru's water (Fraser). It is obvious that in order to satisfy all Peruvians, radical reforms will be required.

Climate change will be a double-edged sword for Peru. In the dry season, farmers require meltwater from the Ande's glaciers to water their crops. With a temperature increase, there will be more water; however, the supply from glaciers will run out sooner. This could potentially lead to a boom in agriculture and speculation, that will come plummeting down with a decrease in water after a few decades. Farmers who had once expanded will have to dramatically draw back, decreasing the food supply for urban-dwellers. Urban-dwellers would be hit twice as hard. Only shriveled up food would be available at the market, and they would be unable to help themselves because there is no extra water for gardening in the city ("Paradigm Shift Project"). Rapid urbanization would occur from farmers put out of a job and searching for a new one. This urbanization would put a greater strain on those who remained in the agricultural business, because cities and towns would require even more water. Poverty and food instability would skyrocket. Couple the effects of climate change with a natural growth in population, and the outcomes would be devastating. The typical family would be without sufficient nutrients and battling for a source

of steady income.

For Peru to obtain food security by 2015, a plan must be implemented to address both rural and urban problems. By doing so, each will become more stable, and the interrelated problems will be straightened out. A two fold agenda, concerning both education and conservation, should be implemented throughout the whole country of Peru. While Peru has education available to nearly every person in the country, it is necessary that education on water conservation be implemented. In rural areas, this education will supplement the actions mandated by the second step- irrigation and other water conservation practices. Children who are helping in the field will gain a deeper understanding of the importance of their actions. It will also cement a productive cycle of learning while doing and doing while learning. When passed on from generation to generation, water conservation will become an integral part of everyday life. Furthermore, education will provide a greater understanding of Earth and the relationship between people and resources. Children could get to see the big picture of where they fit in to the big issue of water scarcity. Education in non-agricultural sectors will also have benefits. By learning daily means of water conservation, those living in cities can spread the water they already have a little further. Along with that, city-goers will reap the fruits of new water conservation practices, such as drip irrigation, in their communal gardens. This knowledge will also be passed down from increasingly healthier generation to healthier generation when Peruvians realize the effectiveness of conservation efforts through education and practice.

Several water conservation methods can be implemented both in rural and urban agriculture. Currently, The Paradigm Shift Project has been working with women in Lima, Peru to establish water conservation efforts in communal gardens. This includes drip irrigation, which Wasatch Community Gardens identifies as the most efficient irrigation system. It is 90% more efficient than sprinklers, and has several other benefits: decreased topsoil erosion, gives water directly to base of plant, waters plants and not weeds, preferred in desert regions. Irrigation that has already been implemented can be improved with pressurized systems, which require less water ("Wasatch Community Gardens"). Also, using tailwater return systems uses runoff from the field and returns it to the top of the field, essentially recycling what water there is ("LSU AgCenter"). These methods, along with any other future advancements that will be taught by education programs, will help decrease excess water and maximize the usage of water.

Felipe-Morales has stated that the government doesn't have enough water management policies (Rosales). With more effective water management policies in place, both urban and agricultural sectors will benefit. Farmers will be able to produce more crops of a higher quality. By being able to sell more crops, poverty in rural areas will be reduced. Currently, Peru is importing more food than it exports, creating a viable market for food grown in the country (Rosales). Farmers will also have more water in their daily life by using resources efficiently. Urban agriculture will see the same kind of efficiency in their daily life. Water used wisely would lead to more productive gardens. This means more of a family's income could go to costs other than food ("Paradigm Shift Project"). Women would benefit from the increase in importance on the communal gardens which they dedicate so much time to. Overall, extreme poverty would be reduced in accordance with widespread water availability caused by conservative measures. The environment would become more sustainable once policy makers are making decisions that they had received education on at a young age. Glaciers, rivers, and lakes will be used at practical rates, sustaining urban development and economic development caused by increased food production.

Local projects, such as The Paradigm Shift Project mentioned above could be scaled up successfully. They provide education and resources for communal gardens. Engineers Without Borders is another program that has addressed poverty in rural areas. By increasing funding to this program, plumbing, electricity, and hygienic measures will all be improved. Engineers Without Borders focuses on water conservation and has seen sustainability in rural areas with only a few hundred dollars invested. Nearly

every Millennium Development Goal will become achievable by 2015 with these changes. Extreme hunger and poverty will be eradicated by better food production. Universal primary education will receive emphasis through new curriculum on water conservation. Women will be empowered through work in communal gardens, which is viewed as a source of income ("Paradigm Shift Project"). Money that has been spared through home-grown fruits and vegetables can be used for the next two goals, maternal care and reducing child mortality by ensuring nutritious meals. While food stability will only slightly affect resistance and treatment of drugs through healthy immune systems, governmental policies on water conservation will have profound effects for the seventh goal, environmental stability. Finally, the last goal, global partnership for development, will see a boost through predictability and steady levels of exports.

At the national level, new policies will have to be created to ensure the follow through on this plan. Mandates on levels of water conservation efforts, such as minimal water lost in irrigation, will be effective both on the corporate and smallholder farming levels. Although the Peruvian government already has laws on education availability, curriculum programs should be created and required at all schools. Communities should stand behind their government in these acts, considering that it will bring the most prosperity at that level. It will be necessary for corporations to comply with water conservation standards because it will help the environment directly and indirectly through employees picking up techniques. On the international level, many organizations could play an immensely influential role for agricultural advancements. The World Bank has dedicated investments to agriculture. These investments will be essential to farmers who don't have an irrigation system in place. In India, there was a 66% increase in income once the World Bank implemented a watershed conservation project ("Millennium Development Goals"). This type of project would be synonymous with other efforts made by Peruvians. The International Union for Conservation of Nature has a focus on climate change. Climate change has had a direct impact on glacial melting, and the IUCN could enhance programs that monitor the usage of meltwater. Together, these programs could help Peru reach its Millennium Development Goals by laying the foundation for research and helping Peru get its footing in surveying farmers.

Ranging from coastal deserts to flat highlands to peaking mountains, Peru is a place of very different landscapes. However, the entire country is facing the dire effects of water scarcity. Rural farmers are trying to fend off thirsty cities that are using the same water sources. For all poor Peruvians, measures need to be taken in conserving water. Creating, replacing, and improving irrigation systems will benefit everyone in the country by using every drop of water efficiently. Doing so helps the people and the environment. Farms in the highlands will be able to produce more crops without using as much water. For communal gardens in highly populated cities, women will be able to provide more for the family, supplementing the income with nutritious fruits and vegetables. The increase in production at all levels will help Peru export more goods and decrease imports. Along with a steady market, watershed management will lead to better income, as it did in India. Incorporating irrigation systems into agriculture has direct financial and economic advantages.

Not only will Peruvians experience a monetary boost, they will also be well on their way to meeting Millennium Development Goals. First and foremost, poverty and hunger will be remedied. Through an increase in food and income, Peruvians in poverty may be able to escape its grasp. Healthier meals and improved living conditions would be seen from the mountains to the Pacific Ocean. Dealing with the effects of climate change on glaciers will have to be addressed by international programs, such as the World Bank and IUCN. They can subsidize farmers hoping to improve their irrigation systems and water efficiency. Local projects can also be scaled up to help agricultural practices. The Paradigm Shift Projects has worked to establish communal gardens in urban areas. By also mandating education on water conservation, children will be more likely to use those methods. Creating a cycle of awareness in Peruvians will decrease the effects of water scarcity, making the best of the situation.

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