Juhi Yadav
Coffman High School
Dublin, OH, United States
Sri Lanka, Water Scarcity
Sri Lanka's Growing Water Crisis

Have you ever wondered what a country surrounded by water suffering from drought looks like? Sri Lanka is an island located south of the Indian subcontinent in the Indian Ocean. Found 5 to 10 degrees north of the equator, Sri Lanka has a tropical climate, being one of the hottest countries in the world, averaging between 80.6-82.4°F. The region's warm climate is ideal for forest growth. At one point, almost all of the nation's land area was covered in forest and rich in biodiversity. Sadly, over the past century, two-thirds of it has been removed due to deforestation. Fortunately, the country remains rich in natural resources such as limestone, graphite, mineral sands, gems, phosphates, and clay. The geography mostly consists of low, flat to rolling hills dominated by a range of mountains in the south-central interior and a coastal plain outlining the nation.

Amid this diverse geography and resource richness, Sri Lanka also faces socio-economic challenges. With a growing population of more than 22.2 million, Sri Lanka has an extensive rural population of 82%, and agriculture continues to be the backbone of the economy (IFAD, 2018). Some of the country's largest exports consist of rice and tea. With such a considerable reliance on agriculture, it would be expected that this country put a greater emphasis on the sustainability of agriculture for its people. However, it's currently experiencing a 34% decline in the productivity of its land, and it's approximated that at least 50% of the land is degraded (Envmin, 2024). With worsening trends, Sri Lankans are suffering, with more than 6 million of the population, nearly 30%, being food insecure and in need of humanitarian assistance (World Food Program USA).

Sri Lanka's cultural framework provides context for understanding its agricultural dependence. The country has a collectivist culture that places great emphasis on family and its interests. Three to four generations often live together, and age resembles a hierarchy within the household. Generally, it's traditional for men to take the breadwinner role and for women to focus on the domestic aspects, but with an impressive literacy rate of 92.5% as of 2022, education plays an important role in the lives of both Sri Lankan men and women (Macrotrends, 2022). Many women participate in the workforce; however, they are usually found in less-valued professions such as tea picking, textile production, and teaching. While cultural traditions shape gender roles and social expectations, Sri Lanka's history reflects a somewhat progressive stance in some areas. For instance, Sri Lanka was the first country in the world to elect a female prime minister in 1960. Women in Sri Lankan society frequently hold higher positions than women in other South Asian countries. Women in higher positions of power is a proud achievement for a developing nation, even as traditional expectations continue to influence daily life. Adding to cultural values in daily life, there are four main recognized religions: Buddhism, Islam, Hinduism, and Christianity. Sri Lanka is known as a multiethnic, multi-religious, and multi-linguistic country. The country is mainly Buddhist, with more than 70.2% affirming this. 13% identify as Hindu, 10% as Muslim, and 7% as Christian. Temples traverse the nation, emphasizing Sri Lanka's cultural and religious diversity (Nathab).

Sri Lanka's climate also profoundly influences its agriculture and way of life. The country only has two major seasons: the Maha season is correlated with the northeast monsoon from September to March, and the Yala season aligns with the southwest monsoon from May to August. These seasons, combined with the country's unique topography, produce distinct rainfall patterns, dividing the country into three main regions based on annual precipitation: the wet, intermediate, and dry zones. The wet zone is found in the southwest of Sri Lanka, where the urban area of Colombo is found and receives a mean annual rainfall of over 2,500 mm annually from the southwest monsoon. The intermediate zone is found in the eastern and central regions, which obtain between 1,750 mm and 2,500 mm of precipitation annually from the northeast monsoon. The dry zone is in the south and northwest regions and receives less than 1,750 mm of rainfall annually (World Bank Group, 2021). Although droughts are frequent in both the wet and dry zones of Sri Lanka, there is a strong correlation between the intensification of drought in the dry regions of the country, and as a result, drought is a major concern for farmers living in the rural dry zone. Historically, drought has been a prevalent issue for centuries, but due to issues like climate change, the situation exacerbates.

The impact of climate change on Sri Lanka cannot be overstated. Warmer temperatures and changing weather patterns frequently arise due to the immense amounts of fossil fuel emissions in our atmosphere. Sri Lanka has been subject to significant threats from extreme heat, with maximum temperatures reaching 95°F. Extreme heat is a major threat to human health and will have terrible consequences for outdoor laborers. Two primary types of drought occur in Sri Lanka: meteorological, which correlates to the degree of dryness, and hydrological, which is associated with a deficit in surface water flow. Hydrological drought can often occur many months after a meteorological drought. The other extremity relates to the encroachment of seas onto land as well as flooding. An island like Sri Lanka is especially vulnerable to sea level rise, shifts in rainfall, and flooding. Currently, Sri Lankans along the coast are impacted by the salinization of soils and groundwater because of rising sea levels causing harm to their drinking water. In the past 30 years, floods have affected more than 10 million people in Sri Lanka (UN Sri Lanka). River flooding, flash flooding, and coastal flooding have contributed to significant loss. Life, livelihoods, and infrastructure are all detrimentally afflicted by natural disasters like the ones above. Not to mention, the agricultural sector will take enormous hits from low yields, including key staples such as rice. It’s the staple food of 18.6 million Sri Lankans and is the livelihood of more than 1.8 million farmers (Food and Agriculture Organization). Changes such as precipitation and temperature are expected to affect crop growth processes negatively. Unfortunately, Sri Lanka is one of the many countries that have fallen victim to climate injustice; its carbon emissions are far below that of other nations, but it is among the ten countries at-risk of extreme weather events according to the Global Climate Risk Index (Envmin, 2024). Natural disasters are vigorously destroying the livelihoods of farming communities from widespread crop failures, and additional economic losses arise that worsen the pressure on farmers already challenged by a growing population.

Despite these challenges, Sri Lanka has a history of climate-related discrepancies. Over 2,000 years ago, Sri Lankan Kings built networks of tank cascades as a solution to water scarcity. A tank cascade system is a series of tanks interconnected by streams and waterways in a dry zone region made to recycle and reuse water from previous rainfalls. The tank's main functions consist of capturing rainwater for flood control, storing rainwater, recycling used water, and minimizing drought impact. By releasing water into irrigation canals, the water can flow to crop fields, sharing water from the top to the bottom of fields in which the same water travels to the next tank, continuing this pattern.   These tanks can harvest and store rainwater, capturing runoff so water can slowly be released during dry seasons. These tank cascades are critical to farmers living in dry regions as they help conserve soil moisture for an extended period, improving soil fertility so crops can be grown throughout the year. At one point, there were between 18,000 and 30,000 small tanks in Sri Lanka. Now, there are only 14,421 active tanks and 1,661 small cascades (BBC, 2023). Sri Lankans, particularly in rural areas, are reliant on these systems for their livelihoods, but due to misuse and improper maintenance, these vital systems are not functioning in the way they were originally designed. Attributable to urban sprawl and expanding agriculture, many negative effects have impacted the tank’s capacity to support local ecosystems and withstand drought. Furthermore, there’s a heavy reliance on chemical fertilizers that have affected the soil biodiversity that the tank systems depend on. Unfortunately, village tank systems are unable to sustain large-scale cultivation to meet the demands of a growing population. To combat all these issues, there have been projects to support the former tanks, such as the Mahaweli Development Project, which is the largest irrigation-based agricultural development project in Sri Lanka. However, due to underdevelopment, lack of knowledge, and little concern for the environment, this project has caused soil to be washed out from farms and end up in reservoirs. It's clear that solving the water scarcity problem involves the redevelopment and construction of these ancient cascade tanks that not only have the potential to strongly support people in times of drought, but also to provide aid for flood mitigation.

To further refine traditional agriculture, the use of modern solutions such as precision agriculture offers hope. The University of Missouri defines it as an integrated crop management system that matches input and output values with crop needs for a small area on a field (University of Missouri, 1998). There are a multitude of different types of precision agriculture techniques suitable for each farm. Remote sensing utilizes satellites to gather information on soil moisture, crop health, and other factors. Soil sensors are also used by satellites to monitor soil, nitrogen levels, and other elements. Drones are equipped with camera sensors and GPS, which also collect similar information to the ones above, with the addition of creating detailed maps and identifying crop damage from pests or diseases. Most importantly, advanced sprinkler and drip irrigation technologies enable efficient water and fertilizer application, reducing water consumption. The research conducted from these shows inconsistencies within fields and grants efficient management to gain the most productivity and profitability while ensuring the sustainability of land resources attributed to a piece of land. This procedure aims to produce less runoff into waterways and reduce the use of fertilizers, herbicides, fuel, and water. The prevention of excessive chemicals in waterways results in better water quality for the community and ecosystem. The food insecurity crisis is compounded by limited access to knowledge of modern farming techniques. Farmers, who make up a significant portion of Sri Lanka's agricultural workforce, often lack the resources and knowledge to adapt to sustainable practices. However, there are some challenges considering the implementation of this technology, such as its high up-front costs. Efforts to address a challenge as big as this one require more than just short-term solutions. Long-term investments ranging from 5 to 10 years from an organization such as the World Bank Group (WBG) can provide financial assistance for such a transformational project. They have the capability of providing knowledge, advice, and financial resources critical for a developing country like Sri Lanka. WBG aims to transform food systems, reduce poverty, and achieve green which aligns perfectly with a project like this. With their help, hiring expert engineers and designers to inspect the original tank systems and work to create designs with maximum efficiency as well as perform the execution of precision agriculture technology in villages is a key principle for producing higher yields for farmers and reducing the major water scarcity problem. It's pivotal that assistance is provided to farmers on how to fix low yields given the new technology brought to them.

Education and change go hand and hand: teaching community members how the climate is changing and how it's affecting them with the help of an organization such as Project WET, is a great way to involve the localities in ensuring they are a part of such a drastic project that is bound to change to their way of life. Water conservation education contributes to a low water footprint which can be beneficial in times of water crisis. Through water education, Project WET provides resources and educators to cover topics from water's chemistry to climate change, sanitation, and hygiene to all ages. They will engage in activities to promote water conservation such as calculating personal water footprints to see how much they use throughout their everyday lives and more. This will lead to further engagement to meet the community's needs and advance the project. It's crucial that community members such as villagers support these projects by providing insight into terrain, climate, and additional information beneficial to it considering that utilizing the natural landscape can enhance the ability of these technologies; primarily the tank cascades. When communities feel heard, they are more likely to show more support for their local project. To tie together organizations that can aid and educate people regarding this project, Integrated Water Resources Management (IWRM) is an operation guided on the principles of sustainable water development by focussing on the the key factors catalyzing this project: ensuring stakeholders play their respective roles, participation of institutions and people, considering socio-hydrological challenges (human-water interactions), and financing strategies. Among countries that have utilized this resource--Somalia, Panama, and Vietnam--show successful development in aiding countries with their tribulations against climate change and water scarcity. Vietnam is showing advancements by utilizing IWRM more and more in the legal and governmental aspects. For example, IWRM is working to reshape water policy such as revising the landmark Law on Water resources of 1998 revised in 2012 and again more recently in 2023 to incorporate more congruent IWRM principles. Additionally, in March of 2025, The Ministry of Natural Resources and Environment (MONRE) and The Ministry of Agriculture and Rural Development (MARD) were merged to form the Ministry of Agriculture and Environment. There's many more successful ways in which IWRM has made improvements in Vietnam and is why it is exemplary that they can add a necessary approach to this project in Sri Lanka.

It must be stated that the agricultural department of Sri Lanka should oversee a part of this massive long-term 5-10 year project and take part in managing its development. Additionally, WBG will send financial management and procurement specialists to ensure the project funds will go where they're intended. The implementing agency, a part of WBG, frequently reports project progress and results, along with meetings twice a year with the agriculture department of Sri Lanka. Visiting rural villages and observing tank conditions and farms can guarantee that this project is up and running in no time. When a project is completed and approaching the end of the loan, WBG will evaluate the project and determine what further measures are needed to sustain the benefits from it. The agricultural department will continue making sure tanks are up to par with proposed standards from WBG as well as the newly available precision agriculture techniques available to farmers. With the help of the Sri Lankan government, the WBG, Project WET, IWRM, and individuals from communities, hopefully, progress in the growth of crop yields and water scarcity will decrease the number of Sri Lankans suffering from insufficient needs.

Sri Lanka is a nation of unique landscapes, rich culture, and resilient people. To preserve this beautiful country, there must be a broader focus on the country's agricultural aspects. By enhancing agricultural production through the rehabilitation of the country's ancient cascade systems, the adoption of precision agriculture, and ways to educate and advocate for community participation, these actions will not only address the immediate challenges of food security and water scarcity but also set an example for how traditional knowledge and modern technology can be combined to create sustainable development. The country is capable of improving the livelihoods of millions in Sri Lanka and ensuring a stronger resilience to climate change for future generations to come. In addition to addressing Sri Lanka's agricultural challenges, Sri Lanka must take the opportunity to inspire other countries vulnerable to climate change and encourage others to invest in sustainable agriculture practices and create a brighter future for citizens across the globe.

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