Comparative Analysis of the Water Crisis in Guam and New Delhi: Evaluating Causes and Potential Solutions

Jordina Marshall
Bachelor of Arts in Healthcare Leadership
June 2023

Faculty Adviser: Dr. Christine Stevens

Essay completed in partial fulfillment of the requirements for graduation with Global Honors, University of Washington, Tacoma

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INTRODUCTION

Water covers around 71% of the earth's surface and just 3% is fresh water (Bureau of Reclamation California-Great Basin, 2023). However, there are billions of people who are living with some type of water stress, which puts the wellbeing and expansion of communities all over the world in jeopardy. Water is essential to the continuation of all forms of life, and its availability is an indispensable requirement for their continuing existence. Having an abundance of water is necessary for many activities, including but not limited to the raising of crops, the development of enterprises, and the maintenance of life itself.

Water, on the other hand, is difficult to purify, expensive to transport, and unattainable to replace. Although water is a resource that may be replenished, it is essential to recognize that there is a limit to the amount that can be used at any given time. It is essential for people living in all parts of the world to have a thorough comprehension of the significance of placing a high priority on water and to be aware of the advantages and disadvantages that are associated with the economic, social, and ecological aspects of water.

With the expansion of the world's population, there arises a pressing necessity to equitably manage the various economic needs on water resources, in order to ensure that communities have access to sufficient water for their requirements. It has been shown that water is an essential element required for numerous physiological processes in the human body, such as facilitating blood circulation, regulating body temperature, eliminating waste products through urine, promoting digestion, transporting nutrients and oxygen, and sustaining cellular health (Victoria State Government, 2021). The availability of clean and safe drinking water is of utmost importance due to its potential to cause adverse health effects such as infections, diseases, and impaired physiological functions.

Water scarcity is defined as a water deficiency or a lack of safe water supplies (World Vision Australia, 2023). The recognition of the human right to water and sanitation by the United Nations General Assembly, along with the acknowledgement of the indispensability of clean drinking water and sanitation to the fulfillment of all human rights, holds equal significance. (UNDESA, 2010). This proposition may serve to enhance countries' comprehension of the imperative nature of water education and the significance of raising awareness on the subject.

The core topic of this paper will be an examination of a comparative study of the water issue in India, with a particular emphasis on New Delhi, and the water crisis on the island of Guam, with a large amount of focus being placed on an assessment of the possible causes as well as potential remedies. The first country in the comparison is Guam which is an island located in the North Pacific Ocean, which holds the status of an unincorporated territory under the jurisdiction of the United States. India is an independent country, located in South Asia and is recognized as the 7th largest country globally (Kumar, 2020, p. 189), with a populace of 32,941,000 individuals. "India constitutes 16% of the world's population, but the country has only 4% of the world's freshwater resources" (Nathan, 2023, para. 2). It can be deemed justifiable to assert that the population of India has engendered a precarious predicament concerning the accessibility of potable water within the nation. Guam, on the other hand, has a population of 172,686 people (Guam Population, 2023).

Given that New Delhi has a far higher population than Guam does, the shortage of usable water is nevertheless caused by the same variables in both locations. Guam and New Delhi both face the same challenges. Both of these regions are suffering from a shortage of accessible water at the present time, which poses a significant threat to the survival of each of them individually. Conversely, the population growth of Guam is impacted by the quantity of groundwater due to the

island's limited size. Increased populations put more demand on the water supply and can cause water from wells to get salty and streamflow to be diminished (Pacific Risa: A NOAA RISA team, (2019). According to RISA Team (2019), Guam's tourism industry currently accommodates approximately one million visitors annually. Additionally, there are plans to expand this industry and relocate an additional 4,000 Marines to Guam within the next decade, as Guam serves as a military hub for the United States.

Due to the impact the water problem has on the ecosystem, the welfare of the populace, and the security of their food supply, a solution must be found. It is crucial to identify what modern fundamental factors are causing a shortage of freshwater resources in New Delhi and Guam, as well as what prospective remedies could be available to address this issue. There are rising concerns that endangers the health of both of these nations as well as their capacity to contribute to development.

EXAMINATION OF INDIA'S WATER CRISIS

Agriculture

Agriculture practices that are not responsibly managed is contributing to India's current water crisis. With irrigation management, which involves putting water on the soil through systems like pumping, tubing, or spraying, the water is not used in the most efficient way, which means that too much water is wasted. The Delhi Committee of the Associated Chambers of Commerce and Industry of India conducted a study which revealed that the predominant cause of water loss amounting to 40% in Delhi's water mains is attributed to pipe leakage (Delhi's Water Leakage Problem, 2013). The majority of the water is consumed by agricultural activities and animals. Rivers get polluted with contaminants such as manure from livestock, fertilizers, pesticides, viruses, and bacteria, making the water unsafe to drink. According to the organization World

Wildlife Fund (2023), the agricultural sector is responsible for the consumption of as much as 70% of the freshwater that is freely accessible across the globe. However, an important portion of this resource, approximately 60%, is lost as a result of inefficient irrigation systems, suboptimal application techniques, and the cultivation of crops that require an excessive amount of water in their respective growing environments. This argues that poor water management is one of the primary causes of water waste, and that this particular cause is becoming increasingly vulnerable to water risks.

As explained by Dhawan (2017), agriculture serves as an essential provider of resources that are fundamental to human existence, encompassing vital necessities such as sustenance, shelter, commodities for trade, and the preservation of life itself. India is renowned for its production of highly palatable and nourishing food items, such as fruits, vegetables, dairy products, spices, jute, millets, and castor oil seed. This country ranks second in terms of production for both wheat and rice. These data make it abundantly evident that the agricultural sector has a significant role in determining the destination of the available water supply.

In addition, Dhawan (2017) discovered a large number of studies that have indicated that watershed improvement projects lead to an increase in the amount of accessible water, which is typically channeled towards irrigation. This redistribution frequently comes at the price of meeting the standards for the amount of water that may be used for drinking, particularly during seasons of low precipitation. Because the climate has such a significant impact on crop output, it is essential to pay attention to the temperature, the weather over the course of the year, and the yearly climatic fluctuations in order to determine when the optimal time is to produce crops.

Climate Change

Even if climate change is debatable and its effects impact water supply unpredictability, it should be considered one of the underlying causes. Global climate change will cause alterations in weather and hydrological cycles on a global scale due to the ongoing emission of greenhouse gases by human activities. There is a projected increase in occurrences of both droughts and floods. The melting of certain glaciers and snowpacks may have an impact on the availability of freshwater downstream. The aforementioned alterations are anticipated to result in a decrease in water availability for agricultural purposes, electricity generation, urban settlements, and ecological systems on a global scale (Water Scarcity, 2022). In the article, Emerging Challenges of Water Scarcity in India: The Way Ahead (2019), the global environmental catastrophe impacts India and the world and during a lecture in 2009, Ramanathan issued a warning regarding the Himalayan glaciers, stating that they are highly susceptible to the effects of global warming. For 1.5 billion people, the Himalayan glaciers provide drinking water, irrigation, and hydroelectric power.

India receives its meager annual water supply from the monsoon (July–September), an article claims that this is not the case. As per the findings of a study published in Nature Communications (2017), the precipitation in central India experienced a decline of 10% during the period of 1950 to 2015. During the same time period, there was a 75% increase in heavy rainfall, which exacerbated the degradation. The quantity of rain that falls during the monsoon season is squandered owing to a lack of rainwater gathering infrastructure. India has a major drought problem since it utilizes the most groundwater. “India is the world's largest groundwater consumer, and the government estimates that 21 towns might run out of groundwater by 2020, and by 2030, over 40% of the country's population may not have access to drinking water.” (Roy, 2019, para. 9).

Pumping water from wells is the major method of groundwater exploitation from aquifers. Climate change is expected to aggravate groundwater depletion, making groundwater overexploitation a major problem (Baccar, 2021). An example of overexploitation is the illegal and uncontrolled extraction along with not recharging the resources. This indicates that it does not let water seep through the ground naturally (Ritter, 2019). Because the climate has such a significant impact on crop output, it is essential to keep track of the temperature, the weather over the course of the year, and the yearly climatic fluctuations in order to determine when the optimal time is to produce crops.

Pollution

Water shortage is exacerbated by pollution; therefore, city residents should be conscious that they, together with their government, must work to minimize pollution levels. Staff (2021) claimed unsegregated landfill waste leaches into the earth and contaminates groundwater with harmful minerals and chemicals. The government and the people must work together to reduce pollution. This is not intended to assign blame to the locals, but rather to raise awareness about the environmental factors that contribute to the water crisis. Individuals possess a civic obligation to uphold and preserve their surroundings while actively engaging in their community to promote sustainability. Like New Delhi, the infiltration of pesticides and fertilizers from agricultural activities, untreated wastewater, and industrial waste into the groundwater aquifers results in water pollution on Guam. This is a key contributor to water shortage and climate change, both of which pose a significant threat to individuals and the global community.

It is reasonable to state that the more people who reside in a nation, the greater the likelihood that there will be pollution. Delhi has one of the greatest population densities in the world, making it one of the highest in the world. More than half of India's rivers are considered to

have significant levels of pollution, which not only endangers the country's population but will also have a detrimental effect on the economic well-being of the nation. Ahmed (2019) found that 70% of India’s surface water is unfit for human consumption due to pollution. The precarious nature of the situation lies in the fact that the provision of potable water is a crucial factor in disease prevention and a fundamental component of human physiological processes.

Lack of Management/Corruption

Due to severe lack of control, excessive privatization, general irresponsibility, and pervasive government corruption, Kumar (2019) says multiple generations have grown progressively eager for more than a few drops of safe water. Unfortunately, the government has an exclusive monopoly on water management. As explained by Chakraborti (2019), the high level of nonrevenue water can be attributed to various factors, such as advanced system age, inadequate maintenance, illicit connections, leakage, and insufficient mapping. The water supply situation in various regions of India exhibits variability, and it is noteworthy that India, as a nation, does not suffer from a dearth of water resources. However, due to either negligence or insufficient infrastructure, certain areas within the nation encounter periods of water scarcity.

Sudarshan Pandey (2022) declares that the water predicament in India can be attributed to inadequate governmental planning and corruption. He further contends that the current water scarcity crisis could have been mitigated through the implementation of improved water management practices (S. Pandey, personal communication, November 27, 2022). There has been a distinct lack of attention to water legislation, water conservation, efficiency in water use, water recycling, and infrastructure.

Augustin Maria (2008) argues that Delhi's water supply and management are the government's responsibility. This involves poor water infrastructure and management. The

government appears to be neglectful in providing clean water. Water utilities are underperforming in India despite investments to improve infrastructure and capacity; India lags in water governance for a variety of reasons such as the poor capacity of Indian states, the complexity of the Indian decision-making system (which has a number of veto players), conflicts between states over water rights, and most importantly, the lack of water-related expertise among Indian political leaders and policymakers (Ahmed, 2019). Power and influence make these people social elites. Additionally, the government must promote good administration, sustainable development, and education to help reduce wastewater.

EXAMINATION OF GUAM'S WATER CRISIS

Agriculture

The groundwater aquifer that is found in the northern part of Guam is the primary source of water that is utilized for agricultural purposes on the island of Guam. The limestone Northern Guam Lens Aquifer is the primary source of freshwater on the island, and the amount of water extracted from it each day has more than tripled, moving from around 15 million gallons to 45 million gallons (Gingerich, 2013). 80% of Guam's drinking water originates from the Northern Guam's Lens Aquifer.

In the context of commercial agriculture production, varying water requirements are observed across different months. Typically, the period spanning from April to June necessitates the highest amount of rainwater on average (Hollyer, 2016). Guam's 130 wells produce around 40 million gallons of water every day. In 1937, the United States Navy was the first organization to use groundwater. (Jocson, 2002). The Census of Agriculture in Guam has indicated that the quantity of farms has increased by over two-fold since 2007, and there has been a rise in the value of agricultural production. Consequently, an increased demand for water supply is necessitated to

cater to the irrigation needs of crops. The proliferation of algal blooms can be attributed to the influx of nutrients, primarily originating from agricultural discharge and septic and cesspool effluent. Algal blooms refer to an increase of algae in a given environment. Because of a significant increase in the accumulation of algae, this has an impact on the quality of the water. (Water and Environmental Research Institute of the Western Pacific, 2022).

The island of Guam relies on local production and imported resources for its agriculture, but the climate causes a decline in the quality of the soil available for agricultural cultivation, which in turn impacts the food available to the local population. The majority of the supermarkets in Guam lacked an average of five of twelve categories of nutritious foods, according to the Thrifty Food Plan published by the United States Department of Agriculture. Because of this, it is essential to highlight the fact that Guam farmlands cultivate healthy fruits such as mango, banana, avocados, and watermelons (Nicoson, 2016). One notable discovery is that the agricultural sector is experiencing a gradual decline, attributed to the aging of farmers and the younger generation's disinterest in inheriting farmland. Additionally, the availability of job opportunities in the military further exacerbates the challenge of existing farmers in sourcing sufficient quality labor to support their agricultural operations.

Climate Change

Guam lies within one of the most active tropical storm regions in the world. In the future, typhoons will be less frequent, but stronger (Pacific RISA, 2019). The quality and quantity of drinking water is impacted by a variety of weather patterns, including but not limited to rising temperatures, drought, the frequency of storms and typhoons, land use, and the percentage of area covered in forests. Temperatures in Guam range from the low 70s to the middle 80s Fahrenheit throughout the year. The average annual rainfall on Guam ranges from 85-115 inches during the

wet season (July through October). The phenomenon of climate change has been a matter of concern for the inhabitants of Guam since a specific point in time. The high temperatures encountered on Guam can potentially pose a threat to human health due to the increased likelihood of heat stroke and dehydration, which can have adverse effects on the cardiovascular and nervous systems. Despite the uncontrollable nature of climate change, it is imperative to comprehend its implications and devise strategies or provisions to alleviate its adverse effects. As a direct result of this, the saltwater, which is rising, is getting closer and closer to the wells, which are the principal supply of freshwater for the island. This leads to the deterioration of the quality of the surface water, particularly in river deltas, where it has an effect on agriculture as a result of the incursion of saltwater into the soils of river deltas.

Climate change poses a range of challenges, including potential harm to human health, uncertainties to freshwater resources, heightened incidence of wildfires (December to May), and the possibility of infrastructure damage resulting from future sea level rise and more intense typhoons. Guam has a climate that is generally warm and humid throughout the year; nevertheless, rainfall patterns differ around the island, which contributes to an increase in the available water supply. Freshwater management is still essential for Guam since half of the total rainfall is lost to the sky via processes such as evaporation and transpiration and does not contribute to the replenishment of the aquifer (Pacific RISA, 2019).

In spite of this, precipitation is still quite effective in penetrating the ground and recharging the aquifer. The water demand on the island is being impacted by population growth, considering efforts to recharge the aquifer. Indeed, a considerable number of Pacific Island Nations exhibit a high degree of susceptibility to the potential of calamitous events. The coral surrounding the islands may experience a decline as a result of natural disasters, leading to a potential disruption

in the food chain for marine life as well as the coral reefs ecosystem which is responsible for providing food.

The results of this research show that Guam's ability to maintain its water supply is in jeopardy as a result of the changes brought about by climate change. The majority of Guam's challenges are the result of natural catastrophes that are linked to the island's water supply. This is due to the fact that Guam is situated in the center of the typhoon belt. The geographical position of Guam plays a direct role in the occurrence of these natural disasters. For instance, when a typhoon hits the island, Guam's plight is exacerbated by issues with storm water management. These issues include inadequate or non-existent storm water infrastructure, which leads to flooding and pollution (Water and Environmental Research Institute of the Western Pacific, 2022). The watershed systems of the region have been impacted as a result of Guam's climate change and the natural catastrophes that have taken place on the island. Not just in Guam but all over the world, greenhouse gases are changing the oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic (What climate change means for Guam, 2016).

Moreover, within the Pacific region, the aforementioned fluctuations in climate change have a significant impact on the indigenous population's food production, import transportation to the islands, and the destruction of infrastructure leading to power outages, water pressure loss, and displacement of homes. Additionally, typhoons or rainy storms can result in food loss for affected individuals. According to COP27, between 2001 and 2018, UN Water reported that 74% of all natural disasters are water-related (i.e. flood and droughts) (COP27, 2022). Due to the fact that Guam is such a tiny island, the people who live there are extremely vulnerable to the repercussions

of incidents such as this one. It is essential for the population to make preparations and guarantee that they will have sufficient water supply to survive through the climate changes.

Pollution

The urban runoff, chemical spills, effluents from septic tanks, and sewage overflows that are being caused by human-induced activities are the primary contributors to water pollution. This causes the water quality to be unreliable as a result of the high levels of contamination (Wen, 2020). It is a formidable challenge to completely circumvent human activities; however, through monitoring and potentially restricting specific activities, a discernible impact can be achieved. Human activities, such as improper disposal of wastewater and solid waste, agricultural products, and pesticides related to agricultural production, are the primary sources of drinking water contamination and are regarded to fall under the category of "human activities." Because of this, the runoffs and pollutants that seep into the groundwater will have an effect on the ecosystem of the islands. The growth of industrial output is another factor that leads to environmental degradation. The island is threatened by a variety of harmful pollutants, some of which include sediment, microbiological organisms, and hydrocarbons originating from petroleum, to mention a few. There are findings of pollution near water supply wells such as illegal dumping and siting of hazardous land use (Water and Environmental Research Institute of the Western Pacific, 2022).

The storm water that flows across Guam is another component that adds to pollution because it accumulates and brings the pollutants to the shore of Guam, where the contaminated waters mix untreated with the coastal waters. This is an additional factor that contributes to the island's overall level of pollution. The result leads to the formation of a thick layer of silt that covers the reefs, which blocks out sunlight and limits the production of oxygen. This suffocates the coral and other marine organisms, which in turn reduces food supplies and fish populations

(Summary of the Guam Nonpoint Source Pollution Management, 2023). Coral reefs on Guam are still being harmed by the buildup of waste products that have accumulated in the ocean. This accumulation, which is induced by a number of stressors including fluctuations in the environment, turns the corals white.

According to the Guam Coastal Management Program, the spread of waste materials such as cigarette filters, plastic bags, cups, plates, food wrappers, vehicle batteries, tires, and other automotive components from the mainland poses a significant threat to the natural ecosystem of the marine environment. (Burdick, 2008). The management of storm water that is the consequence of natural causes is difficult; nevertheless, this difficulty may be possibly overcome by reducing the amount of chemicals that are used, limiting the amount of fuel that is used, managing water systems, and engaging in other activities that are analogous to these. As a direct result of this, the people who live on Guam are far more worried about the potential damage that pollution might cause to the reefs that are located in the waters around the island.

Military & Increasing Population

The U.S. military has occupied large tracts of land in this region for the past 60 years (Denton, 2010). As such, it is logical to assume that the United States makes the effort and invests the money necessary to ensure that the water supply on Guam is effectively maintained given that Guam is a territory of the United States and serves as the home base for a military installation. The demand for freshwater has grown in recent years and is projected to continue to do so in the years to come as a result of population expansion. Because of proposed military relocation to Guam and expected population growth, freshwater demand on Guam is projected to increase further. The expected increased demand for groundwater has led to concern over the long-term sustainability of withdrawals from existing and proposed wells.

The United States military is in the process of constructing a vast shooting range complex over the Northern Guam Lens Aquifer. It is projected that up to 6.7 million lead bullets will be fired during this project, which poses a risk to the major water source for the local community as well as the ocean regions that are nearby (Protect Guam's primary water source from contamination, 2023). The occupants of the island as well as the generations to come will have their health and wellbeing put in jeopardy as a result of this. The current endeavor of the residents of Guam involves seeking to override military activities. However, due to Guam's status as a U.S. territory, it is subject to the jurisdiction of the U.S. Navy, thereby limiting the agency of its inhabitants in this regard. Guam is the primary transportation and shipping hub to greater Micronesia and is expected to import large amounts of materials to accommodate the military buildup phase.

While the military has agreed to help monitor the water supply, the shooting range is located right adjacent to Guam's National Wildlife Refuge. This poses a potential threat to the animals that live there. The National Wildlife Refuge not only offers vital habitat to a number of flora and animals that are in risk of extinction, but also preserves a number of locations that hold great cultural meaning for the Chamorros, the native people who call this place home. It would appear that the U.S. military and government are only interested in controlling Guam, while the people who live there are gradually losing their authority over the island. Because of this, Guam is considered a military asset by the United States, and the military should consider the possible threats that they represent to the people and wildlife who live on the island.

SOLUTIONS

The water scarcity issue in India is further compounded by inadequate agricultural management techniques, the impact of climate change, inadequate governance, and environmental pollution. The implementation of rainwater collection systems has the potential to yield advantages for urban populations; however, the construction of necessary infrastructure incurs significant expenses. It is my contention that the government's provision of resources is insufficient and that their allocation of resources towards the pursuit of ensuring access to clean water for the populace is not prioritized. It is comprehensible that monetary considerations serve as the foundation for various endeavors, however, pursuing access to clean water for the population may prove to be highly advantageous. It appears that the government continues to delay and postpone developing infrastructure. If they improve the infrastructure, they can conserve cleaner water and use it more efficiently. It is possible for human activities, such as the emission of greenhouse gases, traveling by train or bus, or possibly switching to an electric automobile, can be reduced in order to mitigate the effects of climate change, even if this change will inevitably occur. In order to make the most of the resources that are already available, the government of India has to increase the amount of money it spends on technology and involve all relevant parties in the planning process.

The fact that we live in a modern period and are dependent on technology and machine industries to manufacture food makes it difficult to put restrictions on these activities. Improving the infrastructure will cut down on waste as well as the number of individuals who are constantly looking for clean water. For the purpose of monitoring and regulating agricultural irrigation, standardization is required. It is possible that the government, which manages the water supply, will initiate this. Residents of New Delhi ought to have a global imaginary in order to unconsciously dispose of trash in the appropriate areas. The problem with the water is complicated,

and it cannot be managed by just one entity on their own. Because of this, everyone ought to be accountable for their local community in terms of sharing resources, working together to safeguard water supplies, and raising public awareness and knowledge of the situation.

In contrast to Guam, the United States Department of the Navy has dedicated their time to the preparation and construction of a model known as the "PRMS – Precipitation Runoff Modeling System." The purpose of this model is to calibrate and verify the use in estimating the future availability of water in the Fena Valley Reservoir in response to a variety of different combinations of water withdrawal rates and weather conditions (Yeung, 2005). The water supply and the water demand of the people living on the island will both benefit from the use of this concept.

The United States Marine Corps and the Water and Environmental Research Institute of the Western Pacific at the University of Guam have worked together on a project to investigate the groundwater dynamics in the Northern Guam Lens Aquifer. The goal of this study is to provide estimates of recharge, develop a numerical groundwater flow and transport model for groundwater production, and assist with the sustainable management of the resource (Gingerich, 2013). This intervention is likely to positively impact the island's water supply and quality. It is noteworthy to mention that the military is allocating resources to oversee the water supply, which is a logical step considering the expansion of military operations on the island.

In spite of the fact that the United States military intends to send additional soldiers to the island, which will result in an increase in the population and, as a result, an increase in the demand for water, the people who live on Guam should engage in water education in order to help reduce their water consumption and gain an understanding of the significance of water security and the role it plays in their society and globally. People who are able to understand how to conserve water or even just think about conserving water intentionally have a better chance of reducing the

quantity of water that is needlessly wasted to a large degree. Rainwater collection systems are common across the Micronesian archipelago, including on the island of Guam. These systems are typically erected on top of buildings. It is a method that can be implemented in communities that are situated close to streams and rivers that convey precipitation to the ocean, and it should be implemented since it can be done at a low cost and can be implemented.

Due to the fact that preparations are being made to move military personnel, I feel that the United States and its armed forces should share part of the responsibility for the water supply. Based on the findings of my investigation, it would appear that a number of authorities, including the Guam Environmental Protection Agency, the Water Quality Certification, the National Pollutant Discharge Elimination System, the Guam Power Authority, and the United States Environmental Protection Agency, to name a few, are all engaged in the process of verifying compliance and regulating effluent from the sewage treatment facilities. This is the case because it appears that the Guam Environmental Protection Agency is responsible for overseeing the sewage treatment facilities. In light of everything that has been mentioned, it does not appear that there is a lack of governance or corruption in the effort to find solutions to the problems with water quality.

CONCLUSION

Throughout the research I have found several ways to reduce India's water deficit, but it starts with the government and people being more conscious of the lack of infrastructure, the cause of pollution, and the need to create rainwater collection plants, which is expensive, whereas Guam's military facilities are contributing to the groundwater quality along with the population growth and tourists each year. I think that the government of New Delhi and businesses that trade

with other countries should reach out to their consumers and ask for help to improve agriculture, since the consumers depend on India's food crop production.

When I compare my experience with the lack of water in India to living in the U.S., it is clear that people in Delhi have to work hard to get water, while people in the U.S. can drink water straight from the sink without worrying about getting sick. Pandey (2022), states

> "*We have to buy the water tanker during scarcity, especially again during peak summer so we prepare appropriately, and I have ample overhead water tanks to fill up from an entire tanker,"(S. Pandey, personal communication, November 27, 2022)*

It raises the question of whether other individuals and the government can afford this strategy. To combat the water deficit, both the government and the people of New Delhi must actively and positively engage in the field of water management. When it comes to conserving water, small adjustments can have an enormous impact, and this can apply to all people globally. It is realistic to assume that India is experiencing significantly more obstacles than Guam due to the vast population difference between the two countries; yet this does not imply that it is any less vital for Guam to manage the issue of water security than it is in India. Guam is coping with the amount of water quantity owing to tourism and population increase; in contrast, the residents of India are struggling with a variety of health issues as a result of the country's reliance on agriculture, which is sold across the world at the expense of the people who live in India itself.

In comparison to the agricultural industry of India, which operates on a considerably larger land area, the agricultural sector of Guam is relatively smaller in scale. The primary challenge faced by Guam pertains to the exponential growth of its population and the consequent surge in water demands, which is further compounded by the island's limited geographical expanse. Both of these areas face the issue of a climate change environment as well as the challenge of an expanding population; the one and only distinction lies in the population scale at which the two

face their respective problems. Recognizing that water is a vital element for the continuation of life on a global scale, I feel that it matters to have a solid understanding of the current water issue. The lack of available water is a problem that will have a significant impact on the crops that are grown across the world, which in turn influences the quantity of food that is available for people, which is especially concerning given the rise in the worldwide population.

My roots are in Guam, where I spent most of my early childhood. Throughout those years, I vividly recall my parents teaching me about the importance of water conservation. When I was in New Delhi, I had similar sentiments towards the saving of water, such as turning off the shower when I was not using it, brushing my teeth, cleaning the dishes, and utilizing rainwater. The growing problem of surface water availability and the increasing levels of pollution, population growth and increased demand threaten to hamper water supply. Not only does this apply to India and Guam but it applies globally, and it is the people's job to help conserve water. The primary objective of this research is to spread awareness of the water problem. It does not matter how large the territory is or how densely populated it is; everybody can and should relate to water security because of how it connects all of us internationally and how important it is for human survival.

You might be wondering why compare such a large country with a huge population to a tiny island; Consider the importance of biodiversity because it creates distinct ecosystems, each of which is home to a diverse collection of indigenous plant and animal species. The marine ecology benefits from the presence of small islands all over the world, and these islands also promote food security and economic opportunities. In addition, the size of a location is not a factor in determining its worth. Irrespective of geographical location, there exist individuals who face challenges with regards to water security. Thus, it is crucial to impart knowledge and awareness among the populace regarding water-related issues. Even if India has one of the greatest populations in the

world and the health effects are the same as or even more severe than those in other areas of the globe, it is imperative to adopt water conservation everywhere in the world in order to protect the variety of human life.

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