Shania Fernandes
Debakey High School for Health Professionals
Houston, TX, USA
Bhutan, Climate Change

Bhutan's Sustainable Path: A Vision

Bhutan is a small landlocked country about half the size of Indiana (U.S. state) bordered by two countries with the biggest populations: India and China (World Bank). However, as small as it may be, the rich biodiversity and serene mountainous landscapes in this Eastern Himalayan region have yet to bore anyone. Aside from being covered by glaciers and mountains, around “72.3% of the country is covered by forest” and a lot of the land is used for agriculture including rice, maize, wheat, barley, and potatoes (World Bank). All of this is usually produced on 2.5 acres to 5 acres of land, which compared to the 445 acres of land the U.S. uses per farm shows the limited space utilized (World Bank). Bhutan's agricultural exports include agricultural products such as fruits, vegetables, and processed foods (World Bank). Agriculture, livestock, forestry, and hydropower are what the economy is primarily based on and how the country provides for the small agrarian population (World Bank). Speaking of, the country’s population is approximately 789, 997 with 51.5% of the population residing in rural areas (“Bhutan Population 2024.”) Overall, this country is seen as a lower-middle income country, however it does have an organized system and growing economy (Murray). In particular, Bhutan is a constitutional monarchy with a parliamentary democracy (Murray). The head of state is the King of Bhutan, and the head of government is the Prime Minister, they both have implemented climate change policies and thanks to the vast forests the country absorbs more carbon than it releases, allowing its carbon negative status to be maintained (Murray). Bhutan experiences diverse climates due to varying elevations, ranging from a subtropical climate in the southern foothills with high humidity and heavy rainfall, to cooler temperatures in river valleys at higher elevations, and alpine conditions in the northern snow-capped peaks (World Bank). The country is divided into six agro-climatic regions, including alpine, cool temperate, warm temperate, dry subtropical, humid subtropical, and wet-subtropical (World Bank). The seasonal temperature range is significant, with summer months averaging 24°C-29°C and winter months near 0°C, while rainfall varies considerably more during the summer compared to the winter months, which directly impacts the culture and food of the Bhutanese people (World Bank)

Bhutanese cuisine often includes rice as a staple, accompanied by vegetables, dairy products, and meat, with red rice being a common variety (“FOOD IN BHUTAN: BHUTANESE CUISINE, DISHES AND CUSTOMS”). Most families rely on themselves to provide food by growing it and others get produce in local markets (“FOOD IN BHUTAN: BHUTANESE CUISINE, DISHES AND CUSTOMS). They prefer to cook their food over a wood fire and in total, a typical family in Bhutan spends 16 percent of its income on food, which may not seem a lot, but for most of the working class that barely earns around $400 (37,400 BTN), 16% of their income is a lot (“FOOD IN BHUTAN: BHUTANESE CUISINE, DISHES AND CUSTOMS”). The low wages are mainly because of the huge dependency the economy has on subsistence farming and handicraft production, unfortunately these jobs do not pay hefty wages. On the bright side, Bhutan does have a free healthcare system and has made significant progress in medical breakthroughs (“Optimism Regarding Healthcare in Bhutan”). It also has a free education system, however not everyone has access or others just choose to live a more traditional life in rural settings; these

disparities between urban and rural areas are also why Bhutan still has health difficulties and lack connectivity in certain regions (“Optimism Regarding Healthcare in Bhutan”).

Throughout this evergreen nation, climate change, which is a problem facing the entire world, hits hard and especially impacts food security and thus the economy that is highly dependent on agriculture. Climate change poses significant challenges to Bhutan, despite its carbon-neutral status (Kumar). The country is adversely affected by global greenhouse gas emissions, impacting agriculture, biodiversity, and the livelihoods of its people (Kumar). Extreme weather events, such as erratic precipitation and high-intensity rains, have led to damages in crops and livelihoods (Kumar). Rice farming, a major staple, is highly vulnerable, with dependence on monsoon-charged spring waters and glacier-fed streams (Kumar). Dryland farming, including cereals like maize and wheat, faces reduced yields due to changing precipitation and heat stress (Kumar). The horticulture industry, particularly citrus and apple orchards, suffers from diseases and pests intensified by climate change (Kumar). Challenges include loss of traditional genetic resources, decreasing crop diversity, and invasive weed species; Bhutan must consider implementing seed banks, promoting indigenous crop varieties, and utilizing integrated weed management to combat these threats (Kumar). The topography, limited land resources, and rural-urban migration further complicate the agricultural scenario in Bhutan (Kumar).

Unfortunately, climate change isn’t just simply the earth heating up and indeed has unintended consequences on the environment including the threat of glacial lake outburst floods (GLOFs). With 677 glacial lakes contained by moraines in Bhutan, GLOFs pose a significant risk, causing devastating floods downstream when barriers fail (Giri). Additionally, mudslides and floods have become more frequent, with 32 extreme weather events since 2016, impacting communities and causing flash floods and landslides (Giri). Agriculture and livestock, as said before is vital for Bhutan's population, is adversely affected by unpredictable weather patterns, irregular rainfall, lack of irrigation infrastructure and increased pests and diseases (Giri). Furthermore, despite abundant water resources, Bhutan faces water scarcity due to the decreasing amount of clean drinking water sources and extreme weather conditions affecting irrigation systems (Giri). Mosquitoes, carriers of diseases like malaria and dengue, now inhabit higher elevations, posing a health risk and complicating disease control efforts (Giri). On top of that, forest fires, a growing crisis, have seen over 1,400 incidents in the last decade, destroying biodiversity and contributing to global carbon emissions (Giri). As a result, the degrading environment leads to reduced food cultivation causing little to no economic growth, which sadly means increased food insecurity and more hungry children/families that become stricken to poverty (Giri). These challenges highlight the complex interaction between climate change, environmental impacts, and the socio-economic well-being of Bhutan.

Bhutan's commitment to a low-carbon pathway underscores the need for immediate action and regional/global cooperation. However, addressing climate challenges is hindered by a lack of research and institutional capacity. To solve this, Bhutan can work with international partners to create climate research centers and promote local education programs focused on environmental science. Strengthening climate research, education, and outreach is imperative as Bhutan transitions to a mid-level income country, ensuring effective adaptation and mitigation strategies. Despite leading in prioritizing Glacial Lake Outburst Flood (GLOF) prevention, Bhutan has faced numerous GLOF events, including a major one in 2019 (Giri). Limited by its economic capacity, Bhutan relies heavily on manual labor for mitigation

efforts, therefore something greater is needed in order to restore its water resources (Giri). Moreso, Bhutan's power sector, largely dependent on hydropower, faces vulnerabilities due to climate change (Lutz). This is especially a problem, since a lot of the energy that was created would be exported to countries like India, which is how Bhutan grew their economy, however now the amount of energy being created is not meeting their goals (Lutz). As a result, to diversify its energy sources and mitigate risks, Bhutan is initiating the deployment of non-hydro renewables at utility scale in order to diversify its energy resources (Lutz).

One of these renewables would be solar power which has emerged as a crucial solution to Nepal's energy crisis, particularly in rural areas where power cuts are common (Rekow). In hospitals and clinics, solar panels have replaced diesel generators, ensuring uninterrupted power supply for critical services (Rekow). For instance, Kirtipur Hospital's burns unit in Kathmandu Valley operates on a solar-powered system, facilitating emergency care even during energy shortages (Rekow). Similarly, Bayalpata Hospital in Acham district utilizes solar photovoltaic systems to provide backup power for essential equipment and maintain internet access (Rekow). This shift towards solar energy reflects Nepal's recognition of the need for a diversified energy mix beyond hydropower, especially amidst ongoing fuel shortages (Rekow). Similarly, in neighboring Bhutan, solar energy initiatives have also gained traction, as demonstrated by a pilot project at Tenzinling hotel in Paro (Rekow). The project, aimed at reducing grid energy consumption and enhancing environmental performance, involved the installation of solar water heaters (Rekow). Despite initial challenges such as hot water shortages during peak usage times, adjustments in usage patterns and tap types improved efficiency (Rekow). Overall, the success of these solar initiatives highlights the potential for this renewable energy to mitigate energy crises, reduce emissions, and enhance sustainability in the region. However, to make solar energy accessible on a national scale, Bhutan needs to collaborate with international donors, the Global Environment Facility (GEF), and programs like the UNDP to secure funding, training, and installation support. Ordinary citizens should also be educated about solar technologies through community workshops to ensure public participation in energy transitions. Furthermore, solar power is a key to saving Bhutan’s energy and economy crisis all at once.

Secondly, the next factor that Bhutan’s economy heavily relies on is agriculture (Giri). So, therefore, the proposed solution to improve agriculture and address malnutrition in Bhutan involves maximizing the use of available land for farming and investing in livestock (Oldfield). Suggestions include clearing plains for agriculture and expanding livestock farming, particularly with cows, chickens, goats, and pigs (Oldfield). However, Bhutan's constitutional requirement to maintain 60% of land as protected forests poses a challenge to expanding agricultural activities domestically (Oldfield). Therefore, importing crops from neighboring agricultural giants like China and India is proposed as an alternative (Oldfield). Additionally, transitioning some labor from farming to the tourism sector is suggested, capitalizing on Bhutan's appeal as a vacation destination (Oldfield). Furthermore, allowing the construction of major highways through Bhutan, funded by China and India, could stimulate economic growth and create job opportunities Revenue from these highways should be reinvested into rural farming support programs, including irrigation systems, organic farming training, and access to climate-resilient seeds. (Oldfield). To ensure success, implementation should involve collaboration with Bhutan's Ministry of Agriculture and Forests, the WFP, and the UNDP, which can help fund and sustain these initiatives while engaging local communities. Collaboration with organizations like the UNDP and WFP could further support efforts to reduce poverty and the downsides of climate change in Bhutan. Overall, this comprehensive approach

aims to address both economic and nutritional challenges in Bhutan by diversifying livelihoods, enhancing infrastructure, and ensuring food security through a combination of domestic and international initiatives. Food security is not just a logistical challenge, it is an ethical one. Bhutan's commitment to Gross National Happiness demands that every citizen have access to nutritious and culturally appropriate food. Climate-resilient solar energy systems can help make that vision a reality by ensuring consistent power for food production, storage, and distribution. The economic implications of ignoring these energy and food challenges are grave: Bhutan risks rising rural poverty, increased dependence on imported food, and further strain on its health system due to malnutrition. A solar-powered rural infrastructure could transform this outcome ensuring food systems remain equitable and self-reliant in the face of climate change.

In conclusion, Bhutan faces significant challenges, from climate change impacts to economic limitations. However, its commitment to sustainability and innovation offers hope for a better future. By diversifying its energy sources, such as embracing solar power, and implementing strategies to enhance agriculture while addressing malnutrition, Bhutan can overcome these hurdles. With support from governments, global organizations, and everyday citizens alike, the country has the opportunity to turn obstacles into stepping stones. With concerted efforts and collaboration, Bhutan' s story can start to unfold as a tale of courage, vision, and the timeless quest for a brighter tomorrow.

Works Cited

"Bhutan Population (2024)." *Worldometer*, https://www.worldometers.info/world-population/bhutan-population/. Accessed 12 April 2024.

"FOOD IN BHUTAN: BHUTANESE CUISINE, DISHES AND CUSTOMS." *Facts and Details*, https://factsanddetails.com/south-asia/Bhutan/Life_Bhutan/entry-7910.html. Accessed 12 April 2024.

Giri, Srijana. "How Climate Change is Quietly Rewriting Bhutan's Future." *The Climate Reality Project*, 20 October 2023, https://www.climaterealityproject.org/blog/how-climate-change-quietly-rewriting-bhutans-future. Accessed 12 April 2024.

Kumar, Lalit. "Climate change and potential impacts on agriculture in Bhutan: a discussion of pertinent issues - Agriculture & Food Security." *Agriculture & Food Security*, 1 November 2018, https://agricultureandfoodsecurity.biomedcentral.com/articles/10.1186/s40066-018-0229-6. Accessed 12 April 2024.

Lutz, Arthur. "Renewable Energy for Climate Resilience in Bhutan – FutureWater." *FutureWater*, 2021, https://www.futurewater.eu/projects/renewable-energy-for-climate-resilience-in-bhutan/. Accessed 12 April 2024.

Murray, Lorraine. "Bhutan - Absolute Monarchy, Parliamentary Democracy." *Britannica*, https://www.britannica.com/place/Bhutan/From-absolute-monarchy-to-parliamentary-democracy. Accessed 12 April 2024.

Oldfield, John. "How Bhutan is addressing climate change." *Inter-Parliamentary Union*, 17 May 2023, https://www.ipu.org/news/case-studies/2023-05/how-bhutan-addressing-climate-change. Accessed 12 April 2024.

"Optimism Regarding Healthcare in Bhutan." *The Borgen Project*, 7 July 2021, https://borgenproject.org/healthcare-in-bhutan/. Accessed 12 April 2024.

Rekow, Lea. *Wikipedia*, BifrostOnline, 21 March 2016, https://bifrostonline.org/bhutans-quest-for-alternative-energy/. Accessed 12 April 2024.

World Bank. “Bhutan - Summary | Climate Change Knowledge Portal.” *Climate Change Knowledge Portal*, 2021, https://climateknowledgeportal.worldbank.org/country/bhutan. Accessed 12 April 2024.