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ECHS Malta New York, United States Iceland, Climate
Volatility **Sheltering Iceland From the Impact of Climate
Volatility**

Like many other countries, Iceland is facing consequences of climate volatility. In Iceland, this problem is exacerbating. Media outlets provide images and stories that help most people to understand the impact that climate has on a society's ability to thrive or even survive in certain areas. Global warming has significantly impacted Iceland, which one day may not be suitable for life because of increasingly harsh weather that threatens arable land.

Iceland is a country located midway between North America and mainland Europe. Iceland's climate is subpolar oceanic, meaning it has cold winters and cool summers. Fortunately, the Gulf Stream allows for milder winters (especially around the coast) because it brings warmer winds, which ensure a more temperate climate (Mila). Iceland is largely an "arctic desert" with mountains, glaciers, geysers, hot springs, volcanoes, and waterfalls scattered throughout. Most of the vegetation and agricultural areas are in the lowlands close to the coastline (Brys et al).

Households in Iceland are on average comprised of a typical nuclear family, parents and their children. Overall not densely populated, the capital of the country, Reykjavik, is its most populated area. Families in Iceland fish and farm to provide food (Esri). Iceland is largely reliant on its own resources for food.

The traditional diet of Iceland consists of lamb, dairy, fish, and crops. The most consumed are fish and crops. Global warming has resulted in rising temperatures, destroying fish habitats. Crops are being destroyed because of drastically changing wind speeds. Wind abrasion ruins arable land and does not allow crops to grow. Iceland is losing its sources of food.

Icelandic people are becoming less and less willing to farm their challenging geography. "About 78% of Iceland is agriculturally unproductive, and only about 1% of the land area is actually cultivated. Of this amount, 99% is used to cultivate hay and other fodder crops, with the remaining 1% used for potato and fodder root production (Nations Encyclopedia). In Iceland, the drive to be a farmer is slowly decreasing. There were about 4,000 full-time farmers in the 1990s, with about 75% living on their own land; some holdings have been in the same families for centuries. In the 19th century and earlier, agriculture was the chief occupation but, by 1930, fewer than 36% of the people devoted their energies to farming, and the proportion has continued to fall" (Nations Encyclopedia). 78% of the land is unproductive because it is not arable; it is almost impossible for a farm to survive in that area. Overall, farming is an occupation that is declining in Iceland because of geographic challenges and

culture change.

Government groups like The Soil Conservation Service of Iceland and a pair of scientists known as The Arnald's Brothers spearhead the initiative to combat Iceland's abrasive climate in regards to agriculture. The Soil Conservation Service of Iceland, helps support many projects that aid in soil recovery (Government of Iceland). The Arnald's brothers determine and find ways to better the soil (Harris). A common theme for both groups is an appeal to the general population's morals to better the country's environment. Iceland promoting responsibility of the general public motivates its people to take action, and many have made it a hobby to plant trees as a result. Although every effort counts, this alone does not solve the problem.

The major problem facing Iceland is climate volatility. More specifically, the wind is causing tremendous damage. Wind speeds in Iceland can change drastically and suddenly because of the Gulf Stream. These changing and forceful wind speeds cause soil erosion, a great challenge for Iceland. Soil and many other particles are lifted and carried with the wind at high speeds. These particles damage vegetation by abrasion (Iceland Press).

The impact of this challenge is considerable. Known for its beautiful geography, Iceland makes most of its money from tourism. In 2019, tourism revenue accounted for 42% of Iceland's economy, an increase from around 27 percent in 2013. Drastically changing wind speeds that cause wind abrasion and land destruction will threaten Iceland's natural beauties. As a result, tourism will decline and Iceland's economy will be threatened because of it. However, there are ways to face this challenge.

Iceland is the world's largest electricity producer per capita. This is due mainly to its geothermal and hydroelectric energy sources. This means that Iceland's power is very cheap, and people there do not have to worry about paying for it because of its abundance. With revenue related to energy production, the government could promote using greenhouses for food production.

Greenhouses could combat the consequences of climate volatility in Iceland. Much of Iceland is conducive to greenhouse farming. The government could fund greenhouses or provide incentives to encourage the public to build and utilize them. Using greenhouses, Iceland could start growing more exotic fruits and vegetables that it has had to import. Such an initiative could encourage a cultural shift back to farming and return the country to greater agricultural self-sufficiency. Part of this solution involves using grow-lights in warehouses. Grow lights allow plants to artificially grow in a darkened area without the sun. Their use in innovative greenhouses could allow plants to be practically stacked on top of one another on vertical shelf systems. One drawback is that grow-lights consume a lot of power, however, Iceland produces so much power that their use would

still be very cheap. A great example of this technique in use is Mike Zelkind's 80-acre Farms (Higgins). The name "80 Acres" is inspired by the amount of food they grow, not the amount of land used to grow it. Using highly efficient vertical farming techniques, they produce about the equivalent of a farm with 80 acres of land in a small space (Higgins). "The plant factory produces 200,000 pounds of leafy greens, vine crops, herbs, and microgreens annually in a 12,000-square-foot warehouse" (Higgins). The farm produces 100 times more food than an ordinary farm. With 100% renewable energy and 97% less water. Using innovative greenhouses and warehouses that use grow-lights, Iceland could reduce the amount of land needed to grow crops. With these two techniques, crops would be protected and Iceland would retain open land for tourism or energy production.

Other solutions to the volatile climate involve more "natural" advanced farming techniques. This would offer Iceland an alternative if its public were opposed to greenhouses and warehouses being used to grow their food. In no-till farming, the soil is not uplifted/plowed through. Rather, the soil is left alone and not dug up. There are many benefits to this beyond reducing soil erosion. "No-till farming minimizes soil disturbance, which helps keep carbon in the soil. It also enriches soil biodiversity, reducing the need for chemical fertilizers that emit greenhouse gases. Studies have shown that organic no-till practices, when combined with cover cropping and organic management, help increase soil organic carbon by up to 9 percent after two years and 21 percent after six years" (Regeneration International). While protecting the soil from erosion, no-till farming also enriches the soil.

Another natural innovation involves windbreaks. A windbreak is a block, such as a row of trees or a fence, wall, or screen, that provides shelter or protection from the wind. Windbreaks could be planted (most likely by trees because of the amount of area they protect) throughout farmlands to reduce/prevent soil erosion. Farmers would have to cultivate smaller areas of farmland because windbreaks can only protect so much land. To aid windbreaks, farmers could also make sure that the land is well irrigated so that soil cannot be uplifted as easily.

These innovations and techniques would facilitate crop production, which would benefit Iceland's economy. Rather than importing certain fruits and vegetables, Iceland could make enough to both use and export such food. All of these solutions could be funded by revenue from tourism and energy production. While benefiting its economy, Iceland would be able to make enough food to properly sustain itself.

It is possible to address the challenges Iceland is facing. Greenhouses, no-till farming, and use of windbreaks provide an opportunity to lessen the blow of the volatile climate that is causing soil erosion, allow Iceland's farms to yield more and more diverse food, benefit its economy, and make

more efficient use of its precious land.

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