

Amaya Davidson

Miami Valley Career Technology Center

Clayton, OH, United States

Ireland, Water Quality

Water Quality and Contamination in Ireland

Approximately 5 million people live in Ireland as of 2022, about 1.5 million of those people living in the city of Dublin. Around 63.65% of Ireland's population lives in urban areas while the remaining 36.35% of families live in more rural areas. The average family in Ireland is 2.75 people per household, which is an increase from an average of 2.73 individuals recorded from 2011 to 2016. Roughly 70.2% of households contained family units, 23.5% were one-person households, and the remaining 6.1% were non-family households according to the Central Statistics Office census of 2016. While it appears that Ireland is a densely populated country, the current population starkly contrasts that prior to the Great Famine or Great Hunger that swept the country from 1845 to 1852, causing around 20-25% of Ireland's population to die or emigrate.

The country of Ireland is still no stranger to food insecurity. While the country is no longer affected by a great famine, it is still affected by poverty, and many families spend their days wondering when they will be able to eat their next meal. In 2019, it was reported that approximately 680,000 people are living in hunger, with around 200,000 of those individuals being children. According to the Borgen Project, about 2.5% of the population is currently living in hunger, and while that number has not increased in recent years, it also hasn't shown a decrease. In addition to food insecurity, the island also struggles with many contaminated water ways, and failures at water treatment plants in the country. In 2021, there were a recorded 52 (confirmed) hospitalizations due to a water pump failure, resulting in the drinking water not being properly sanitized (Whitworth, 2021.)

In addition to the contamination of drinking water due to the failure at water treatment plants, Ireland faces problems with their natural waterways and ponds as well, not only impacting the human populations, but the environment as well. It was reported that in 2012, an approximate 15% of Irish lakes were severely affected by eutrophication, as well as 19% of coastal water areas. Eutrophication is defined as "excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life due to lack of oxygen" (Oxford Language Dictionary.) With such a stark increase in algae growth, sunlight is unable to penetrate the surface of the body of water, which can inhibit growth of aquatic plants, hindering oxygen production in the water. After aquatic plants die, they are decomposed by microorganisms, which also rely on oxygen in the water to survive. The algae blooms due to eutrophication cause a severe domino effect, devastating entire ecosystems in the process, and while Ireland is also economically and socially dependent on fishing, the devastation eutrophication brings to aquatic ecosystems can severely impact the economy, along with increasing food insecurity.

Eutrophication is caused by fertilizers entering the source of water. Fertilizers contain nitrogen and phosphorus, which are essential in the process of photosynthesis, which allows rapid growth and reproduction of algal blooms and other aquatic plants. Fertilizers can enter these waterways through runoff from farmland, animal waste, or human sewage, through runoff due to rain showers. While eutrophication can occur naturally over thousands of years due to sediments filling up at the bottoms of ponds, lakes, and other sources of water, it is mainly (and rapidly) caused today by human activities. Concentrated Animal Feeding Operations (CAFOs) are described as the main contributor for the

phosphorus and nitrogen being deposited into waterways, due to the immense amounts of animal waste in one area that can be washed into water sources due to rainfall (Conserve Energy Future). In most recent years (post-1900s) industrial waste also serves as a significant contributor to eutrophication and general contamination of freshwater. Such damage to water sources not only is detrimental to human health, but also severely to that of livestock, which can also impact and increase food insecurity to those who depend on their own livestock for sustenance, but also can financially impact families that rely on their farm as income.

Preventative solutions to eutrophication can firstly be that of basic composting. Composting is the process of recycling organic matter, like lawn clippings, food waste, or general plant matter, and using it as a fertilizer while it decays. Using organic decaying materials as a fertilizer, rather than strong chemical fertilizers, can greatly reduce the amounts of phosphorus and nitrogen that would otherwise be washed into the nearby waterways, and severely impact those ecosystems. Laws and regulations can also be put into place to prevent large industrial factors from discharging waste and pollutants into the water sources close by, as well as for more regulations on municipal sewage systems to prevent leakage. Current solutions to eradicate the contaminants already polluting waterways can include removing and treating the water, before placing it back, although this can displace many species of plants and animals, and risk further disrupting the entire ecosystem. Draining approximately 10-20 centimeters of sediment from the bottom of a body of water has also shown to greatly decrease the levels of phosphorus, as it commonly settles into the soil/sediment. Oxygenating the water can also reduce the astronomical negative effects of eutrophication, and also restore the typical and comfortable oxygen levels in order to regulate the natural organic life in the ecosystem. By adding aluminum, iron, or calcium carbonate to the contaminated water, the chemical precipitation from these elements can reduce the excession of phosphorus in the sediment. Ultrasonic irradiation has also demonstrated success in eradicating algae blooms in water due to eutrophication.

Ultrasonic irradiation works by emitting a low-power ultrasound (sound wavelengths) into a source of water. The sound waves move through the water, and create what is called a water column, which disrupts the upper layer of water where algae rests. Algae growth relies on buoyancy, therefore it grows on stagnant bodies of water, where it can sit and absorb the sun and undergo photosynthesis; growing rapidly and covering the surface of a pond/lake. The ultrasonic waves constantly move the water around, disturbing the algae growth, causing the algae cells to sink lower and lower into the water where they can no longer reach any sunlight to be able to grow and reproduce. According to LG Sonic, “typically, ultrasonic algae control doesn’t significantly alter the initial algae sounds in a water body. However, ultrasound directly affects the vertical distribution of algae throughout a water column, therefore directly influencing the ability of algae to form a bloom. Generally, these blooms can be reduced up to 90% in concentration, compared to no treatment.” A study done in Japan in 2020 recorded that once a source of water was treated using ultrasonic technology, “...the removal rate of Microcystin reaches 99% after 15 min of ultrasound treatment (1200 W), and almost all of them are removed...” (Chen, Ding, Zhou, 2020.) Microcystins are the toxins produced by freshwater cyanobacteria, also known as blue-green algae. Microcystins have been shown to cause severe allergic reactions, skin and eye irritation, and even kidney and liver failure when the toxins have been consumed.

The EPA (Environmental Protection Agency) of Ireland has developed a list for “at-risk” areas of water in the country, and maintains an RAL (Remedial Action List) to ensure that all water is currently safe to drink, and remains so in the future. Safety insurance has been completed at the following water treatment plants: Cork City, Longford Central, and Corofin, Co. Clare. According to the Environmental Protection Agency’s public report on water quality back in 2020, groups of people like the young or elderly are extremely vulnerable to becoming ill by consuming water contaminated by bacteria and other organisms, as well as chemical substances. Irish Water projects a completion date of December 2026 for

every source on the RAL (Remedial Action List,) which concerns some, based on how long it would take to ensure clean and safe drinking water for all. On the more positive side, every source on the Remedial Action List was not shown to have traces of any bacteria, meaning that the disinfection processes at water treatment sites have shown to be in working order.

Works cited:

“Private Households - CSO - Central Statistics Office.” *CSO*, 17 Apr. 2020, www.cso.ie/en/releasesandpublications/ep/p-cp4hf/cp4hf/hhlds/.

Philipp, Jennifer. “3 Things to Know about Hunger in Ireland.” *The Borgen Project*, Jennifer Philipp https://Borgenproject.org/Wp-Content/Uploads/The_Borgen_Project_Logo_small.Jpg, 13 Feb. 2021, borgenproject.org/3-things-to-know-about-hunger-in-ireland/#:~:text=Poverty%20rates%20in%20Ireland%20are,for%20themselves%20and%20their%20families.

Horgan, Joe. “The Unspoken Truth about Ireland's Class System.” *The Irish Post*, The Irish Post, 1 Oct. 2021, www.irishpost.com/culture/the-unspoken-truth-about-irelands-class-system-221093.

Irish Origins, and Irish Origins. “Ireland's Social Classes.” *Irish Origins*, 16 Apr. 2016, irishorigins.wordpress.com/2014/03/03/irelands-social-classes/.

Philipp, Jennifer. “Great Famine.” *The Borgen Project*, Jennifer Philipp https://Borgenproject.org/Wp-Content/Uploads/The_Borgen_Project_Logo_small.Jpg, 13 Feb. 2021, borgenproject.org/tag/great-famine/.

About RinkeshA true environmentalist by heart ❤️. Founded Conserve Energy Future with the sole motto of providing helpful information related to our rapidly depleting environment. Unless you strongly believe in Elon Musk’s idea of making Mars as another h , et al. “Causes, Effects and Solutions to Ecological Problem of Eutrophication.” *Conserve Energy Future*, 20 June 2020, www.conserve-energy-future.com/causes-effects-and-solutions-to-eutrophication.php.

Heng, Liang, et al. “Algae Removal by Ultrasonic Irradiation–Coagulation.” *Desalination*, Elsevier, 11 Feb. 2009, www.sciencedirect.com/science/article/abs/pii/S0011916409000344.

“How LG Sonic Ultrasound Technology Controls Algae.” *LG Sonic*, 22 Sept. 2021,
www.lgsonic.com/how-lgsonic-ultrasound-technology-controls-algae/.

Chen, Guobin, et al. “Study on Ultrasonic Treatment for Degradation of Microcystins (MCS).”
Ultrasonics Sonochemistry, Elsevier, 26 Nov. 2019,
www.sciencedirect.com/science/article/abs/pii/S1350417719314245.

EPA, Environmental Protection Agency,
www.epa.gov/national-aquatic-resource-surveys/indicators-algal-toxins-microcystin.

Agency, Environmental Protection. “Annual Drinking Water Reports.” *Home*,
www.epa.ie/publications/compliance--enforcement/drinking-water/annual-drinking-water-reports/drinking-water-quality-in-public-supplies-2020-.php.