

Climate Impacts and Adaptation in Powell River, BC: Safeguarding a Coastal Community and Its Ecosystems

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Intro

Powell River is a coastal community historically tied to the natural resource industry, located on British Columbia's (BC) northern sunshine coast along the Malaspina Strait. Named after Dr. Israel Wood Powell, British Columbia's first Superintendent of Indian Affairs, the city was established in 1910 with a pulp mill owned by the Powell River Company, reflecting its origin in resource exploitation [1], [2].

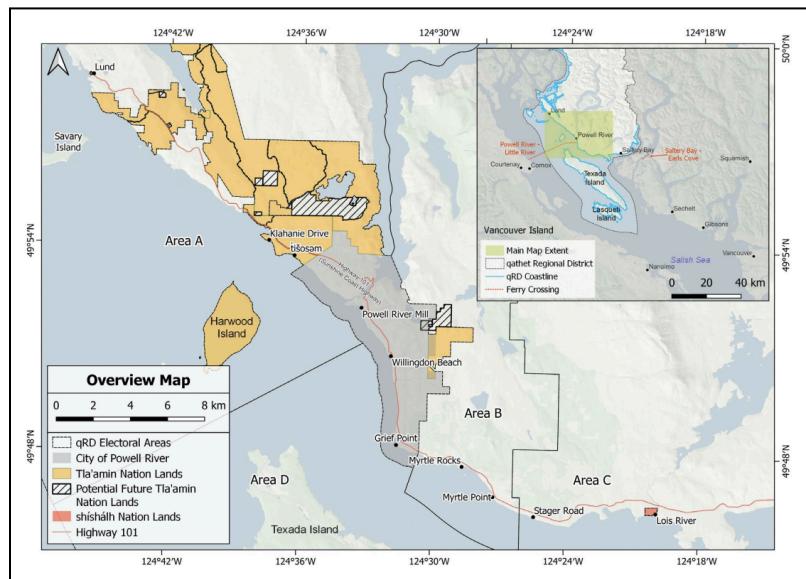


Figure 1: Regional Map. Adapted from [3].

Powell served from 1872 to 1889 and pursued assimilationist policies that disrupted the indigenous cultures, including the Tla'amin Nation, whose traditional lands cover the area [2]. Currently, climate changes threaten Powell River with rising sea levels, extreme heat, and ecological shifts impacting its infrastructure, residents, and ecosystems. This essay outlines Powell River's demographic, socioeconomic, and environmental profile and evaluates two

¹ This report was written entirely by me, and has not received any previous academic credit at this or any other institution.

impacts of climate change on human systems: increased flooding and coastal erosion and health risks from extreme heat. Additionally, this paper assesses two biophysical systems: forest ecosystem stress and marine ecosystem disruption. It proposes four adaptation options: flood-resilient infrastructure, heat action plans, sustainable forest management, and marine protected areas. Using secondary data from government reports, regional studies, historical records, and intimate knowledge of the area, the essay concludes by linking Powell River to the broader international climate trends and evaluating its vulnerability and adaptive capacity.

Description

Powell River's population is roughly 13,943, with a 2% increase in growth from 2016 to 2021 [4]. Its demographic skews older, with a median age of 53.2 and 31.8% of residents over 65 [4]. Socioeconomically, the town currently has had a shift from its logging and pulp mill dominance, embodied by the Catalyst Paper Tiskwat mill, which closed in 2021 after decades as a newsprint leader, to tourism, aquaculture (eg. Lois Lake fish farm), and renewable energy pursuits [5], [6]. The mill's closure, driven by the market shifts, cut local jobs, marking a pivoting economic transition [5].

Environmentally, Powell River sits in a temperate rainforest within the Coastal Western Hemlock zone, featuring mild and wet winters with cool summers [7]. This area houses dense forests of Douglas fir and cedar, along with marine habitats and freshwater systems like Powell Lake. The town's ecological footprint is quite significant; as a 2018 assessment estimated, it requires 3.5 Earths to sustain a Powell River citizen's lifestyle [8]. Powell River has committed to the BC Climate Action Charter since 2007, which targets carbon neutrality with initiatives like the Strategic Energy and Emissions Management Plan [8]. As the town notes, "Human activity...produce[s] greenhouse gases that alter the natural balance of the earth's atmosphere" [8], showing the awareness and local efforts to address these impacts from climate change.

Human System Impacts

Increased Flooding and Coastal Erosion

Due to where Powell River is located, its position makes it susceptible to rising sea levels and storm surges. With the changing climate, the risks of extreme weather events have increased as

the town is predicted to have at least one occurrence of “damaging waves” in the next 10 years which you can see in figure 2 below, highlighting the high risk area [9].

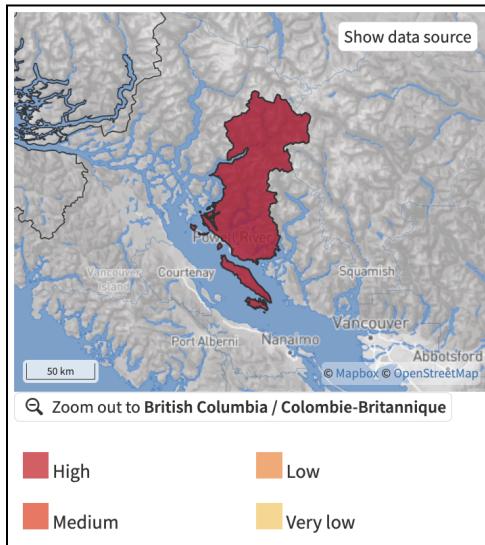


Figure 2: High Risk Map. Adapted from [9].

Additionally, the predicted sea level rise for this region could be up to 55 cm within the century [3]. Flooding threatens residents in low-lying areas, impacts the ability to access medical care, and important infrastructure faces potential damage [3]. As an example, “damage to a ferry dock affects...community and supply chains,” limiting the main mode of travel/transport to the town [3]. Economically, reduced tourism could strain finances, while environmentally, sensitive ecosystems are put at risk and have the potential to be wiped out. Flooding disrupts the local businesses, particularly those that rely on coastal access, such as fishing and marine tourism, and threatens the Tla’amin Nation’s cultural practices like shellfish harvesting by degrading sacred coastal sites [10]. The town itself is marine-based, erosion and flooding of this area will impact the community very hard.

Health Risks from Extreme Heat

With an aging population that generally faces an increase of health risks, the extreme heat does not help. The 2021 BC heat dome, with temperatures rising about 40°C, led to 612 correlated deaths [11]. CleanBC states, “Summers are longer and hotter and heat waves are more intense and frequent,” posing risks of heat stroke for seniors [12]. The town notes Environment Canada issues Arctic Outflow Warnings when wind chills reach -20°C for 6 or more hours and Extreme

Cold Warnings at -35°C for 2 or more hours [13]. With these harsh conditions, the people are potentially subjected to hypothermia, especially the seniors and those with no shelter. Extreme heat intensifies chronic conditions in this already vulnerable population, increasing the strain on the town's small healthcare system due to an increase in hospital visits. The same goes for extreme cold, especially with many old homes not having adequate heating or infrastructure for the winter.

Biophysical System Impacts

Forest Ecosystem Stress

Warmer temperatures are steering forest ecosystem stress in Powell River, particularly through the range expansion of the mountain pine beetle and the Douglas-fir bark beetle [14], [15]. Historically, the beetle's range in British Columbia was limited by climate, not host availability, as lodgepole pine extends far north and east [15]. Though it was found that "there has been a substantial shift in climatically benign habitats for mountain pine beetle northward, and toward higher elevations," with suitable habitats expanding to south-central and southeastern BC in later years. Similarly, the Douglas-fir bark beetle, native to BC, has historically caused outbreaks in Sunshine Coast Forest District, killing many of the trees. With the rising climate and lack of cold in the winter, these beetles haven't been killed off enough to stop the spread of them [16]. Along with their rising numbers, these beetles also contribute to greenhouse gas levels, with forests infected by them giving off a higher content of CO₂ [16]. With trees dying, it continues the cycle as the beetles feed off of these dead trees, and as their populations grow, there's no break for the town's forests.

Marine Ecosystem Disruption

Marine ecosystems suffer from warming waters and acidification, specifically affecting salmon vital to aquaculture and the Tla'amin Nation. A 2020 UBC study warned that "up to 84% of the area currently suitable for fish farming could be lost" due to the rising ocean temperatures [17]. Though salmon can adapt to certain temperatures, there are many other animals that don't have that same adaptive quality, especially with increased plankton blooms and jellyfish posing new challenges [17]. Along with the impacts of our rising climate, the now-closed mill has acted as a catalyst for climate change. Though it happened all throughout history, a notable incident in 2012

caused the company to be fined for dumping “3,500,000 liters of effluent” into the Malaspina Strait [18]. Though not specifically tied to climate change, the increase in pollutants in the waters acts as a catalyst to increase the rate of impact that climate change is having. More pollutants in the water will help accelerate the rate of warming and spread to the marine-life, potentially harming them.

Adaptation Options

Flood-Resilient Infrastructure

Flood-resilient infrastructure can mitigate flooding and erosion along the town’s coastline, though a risk-based approach is needed. KWL advocates for a “phased risk management approach that relates and captures the changing risk conditions,” emphasizing flood hazard mapping and increased hydrometric data collection to better understand and assess risks [19]. In Powell River, this could involve updating flood maps, currently outdated, and installing more hydrometric stations to improve predictions. With this, it’s cautioned that creating rock walls or seawalls can lead to more erosion and create a more unstable coastline. The qathet Coastal Flood Adaptation Strategy recommends more natural solutions like wetland restoration that can reduce wave energy and the extent of flooding [3].

Extreme Weather Action Plans

Powell River can expand action plans for the heat and cold, leveraging the qathet regional extreme heat response plan recommendations [20]. Cooling centers, not used well during the 2021 heat dome due to lack of upkeep, need to remain a strategy and be better utilized, noting that “many communities opened cooling centers and uptake tends to vary, and most commonly, it is poor” [20]. Increasing outreach to vulnerable populations, such as seniors, could improve the effectiveness of this by ensuring the community is looked after during these times. For winter, it’s recommended to be aware of any community notifications and prepare emergency kits and use the public warming stations, such as the public library [20]. Being able to expand on the shelter capacity and quality is needed for hard times, with weather conditions rising and lowering dramatically in temperature. Especially with the elderly and the homeless population, these stations need to be kept and serviced.

Sustainable Forest Management

Sustainable forest management can counter the bark beetle outbreaks through controlled burns, reforestation, pest monitoring, and pheromone-based strategies [21]. It was found that pheromone trapping and trap trees can protect windfalls and that there was a significant enough relationship between trapping effort and windfall protection [21]. In Powell River, where windstorms and drought in turn have increased beetle populations [22], implementing a similar tactic, such as deploying trap trees could possibly reduce outbreak risks. Figure 3 depicts a trap that is commonly used for trapping beetles using pheromones, and it is placed among the forest.



Figure 3: Pheromone Beetle Trap. Adapted from [23].

For the Douglas-fir bark beetle, the town could increase trap tree programs where healthy trees are felled to attract beetles and then be removed, helping to curb the issue. Additionally, the government has suggested that applying MCH (methylcyclohexanone) anti-aggregation pheromones also has the ability to prevent outbreaks [24].

Marine Protected Areas

Marine protected areas (MPAs) can safeguard biodiversity, while innovations like a semi-closed containment system and pollution cleanup efforts address aquaculture risks and historical contamination [17]. CPAWS recommends that MPAs prohibit industrial activities like bottom

trawling, oil and gas development, and open-net pen aquaculture, and restrict shipping to protect the biodiversity, noting that “partially protected areas provide only limited benefits” [25]. In Powell River, where salmon habitats are critical to the local community and Tla’amin Nation, MPAs could protect against climate-driven stressors. There’s an importance of Indigenous Protected Areas (IPAs), highlighting the need to work together with our Indigenous communities and ensuring culturally and ecologically sensitive MPA management [25].

Conclusion

Powell River’s coastal setting faces many climate change challenges, with rising sea level, extreme heat, forest stress from bark beetles, and marine disruptions threatening its ecosystems and residents. The town’s coastal location and its aging population increase the community’s vulnerability, while its historical reliance on resource industries, mixed with a 3.5-Earth ecological footprint, indicates environmental strain. Flooding risks threaten infrastructure and access to services, while extreme weather temperatures pose health risks to seniors, as seen in the 2021 heat dome. Bark beetles, populations growing from the climate, endangered forests, and marine ecosystems suffer from warming waters, plankton blooms, and historical pollution, aligning with global trends where only 13% of oceans remain undamaged [26]. Powell River has the adaptive capacity to take proactive measures: flood-resilient infrastructure and restoration, heat action plans, sustainable forest management with pheromone trapping, and MPAs with strict standards and indigenous co-governance. While Power River has a promising framework, its high vulnerability suggests that its adaptive capacity is not yet adequate, requiring more funding, more stations to get data, and collaboration to meet global standards like those set by the CBD [27].

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