LOW CARBON RESILIENCE CASE STUDY: CITY OF NORTH VANCOUVER RAIN GARDENS

This case study provides an example of a municipal-level ecosystem-based approach to sustainable land and water use that has low carbon resilience (LCR) benefits.

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Green Infrastructure-Based Stormwater Management Using Rain Gardens

Rain gardens are small naturalized areas designed to manage rainfall by providing infiltration opportunities and slowing entry into a city's conventional stormwater infrastructure or natural water bodies. The City of North Vancouver has installed approximately 50 rain gardens as part of its water management strategy.[1]

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[2] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[3] Low carbon resilience (LCR) is a lens designed to achieve strategic and systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date.[4] Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[5] will help align climate action goals and advance the transition toward a more energy efficient, resilient and sustainable future.

North Vancouver's Rain Gardens

Metro Vancouver's North Shore municipalities, including North Vancouver, have partnered with university researches and community members for a rain gardens pilot project,[6] with the first stages of the research focusing on community involvement and

implementation and future stages focusing on the benefits of rain gardens.[7] North Vancouver's rain gardens project demonstrates that green infrastructure can provide LCR benefits. Green infrastructure is a broad category that includes natural assets (e.g., wetlands), enhanced assets (e.g., stormwater ponds), and engineered assets (e.g., green roofs).[8] It harnesses services provided by natural and naturalized areas to replace or augment the role of human-made infrastructure in water filtration, flood absorption, and other services.[9] Widespread implementation of rain gardens will help prepare North Vancouver for climate change impacts by augmenting the capacity of conventional stormwater management infrastructure, while avoiding the need to upgrade existing drainage infrastructure and/or process stormwater using GHG emissions-intensive processes. The LCR benefits include reductions in emissions and infrastructure costs, and reduced vulnerability to climate impacts.

Climate Change Adaptation Benefits

Stormwater management – Metro Vancouver has identified stormwater management as a key focus for municipal climate change preparedness.[10] Rain gardens and other forms of green infrastructure can help North Vancouver cope with climate change impacts such as increased rainfall by reducing the presence of impervious surfaces that contribute to peak flows entering traditional stormwater infrastructure and enhancing water absorption. Extreme precipitation events may still overwhelm green infrastructure systems, so these solutions must be planned in tandem with grey infrastructure and flood preparedness.

Local climate control – The average number of very hot days (above 30°C) in Metro Vancouver is projected to increase from 1.2 per year in 2018 to 13 per year by 2051-2080.[11] Natural areas have a cooling influence that can counter the urban heat island effect caused by factors such as human-made surfaces, building heights, and heat emitted by traffic and industrial processes in cities. Green infrastructure can play a beneficial role for human and wildlife health through reducing temperatures.[12]

Flood risk reduction – Increasing water infiltration through permeable surfaces reduces runoff, aiding in minimizing local and sometimes regional flood risk.[13]

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Climate Change Mitigation Benefits

Avoiding emissions – Extending the life of existing stormwater infrastructure by supplementing with green or "soft" infrastructure approaches, thus avoiding or delaying the need for carbon-intensive concrete infrastructure replacement, has the potential to significantly reduce greenhouse gas (GHG) emissions. Green infrastructure also helps lower emissions through reduced energy demand for stormwater collection, pumping, filtration and treatment, as well as natural cooling for surrounding infrastructure, reducing the need for air conditioning.[14] Research suggests that, over their lifecycle, rain gardens produce 30-90% fewer emissions than conventional stormwater management alternatives.[15]

Carbon storage – Vegetation in rain gardens, and downstream ecosystems benefitting from their presence, contribute to emissions reductions by absorbing and storing carbon.

LCR Co-benefits

Cost savings – The green infrastructure approach reduces costs associated with installing and maintaining traditional infrastructure, with the additional value of sequestering carbon locally rather than purchasing carbon offsets. A comparison of grey and green infrastructure approaches concluded that rain gardens reduced costs by 42% over their life cycle.[16]

Water and Air-related Benefits:

Water quality protection – Green infrastructure acts as a natural filter by intercepting pollutants such as oil, fertilizers, pesticides, sediments, and chemicals that would otherwise enter streams, rivers and lakes, helping to protect aquatic and non-aquatic species and prevent drinking water contamination. Protecting salmon habitat was an important motivation for North Vancouver's rain garden project.[17]

Groundwater recharge – Rain gardens increase rainfall infiltration while reducing runoff.

Improved air quality – Augmenting green space filters particles and pollutants via evapotranspiration.

Ecological Benefits:

Biodiversity – Naturalized spaces increase biodiversity habitat and contribute to opportunities for establishing green corridors that can help nurture wildlife species survival in a changing climate.

Pollination – Urban vegetation can support species of birds, bats and bees that play a crucial role in pollination and seed dispersal.

Human Benefits:

Noise reduction – Vegetation has been shown to absorb soundwaves and reduce noise levels.

Amenity value – Green infrastructure provides aesthetic benefits, including recreational amenity spaces that increase the overall wellbeing of the community. Accessible natural environments encourage walking, cycling, and spending time outside, contributing to community health and the protection of downstream recreational swimming and fishing areas.

Health – Natural green areas have benefits for physical, psychological, and respiratory health through improved air and water quality, opportunities for recreation, and cultural and spiritual benefits.

Pedestrian safety – North Vancouver's rain gardens are making their locations more pedestrian-friendly.[18]

Natural assets – Green infrastructure illustrates the value of natural assets, providing infrastructure redundancies and increasing community resiliency. For example, water bodies in or nearby the community can serve as both stormwater filtration ponds and back-up emergency sources of non-potable water.

Key Resources

Best management practices for rain gardens and other forms of green infrastructure:
City of Vancouver (2016). Best Management Practice Toolkit: Volume II. Retrieved from https://vancouver.ca/files/cov/integrated-stormwater-management-best-practice-toolkit-volume-2.pdf

Cost-benefit analysis for evaluating the monetary and non-monetary effects of rain gardens as a form of green infrastructure:
Erlandsen, A. M., Vennemo, H., Skjeflo, S. W. (2017). Cost-Benefit Analysis of Climate Change Adaptation Projects. Vista Analyse, CLIM CITIES & Iceland, Liechtenstein Norway grants. ISBN 978-82-8126-343-7.

END NOTES

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