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Vignette 08: Connection to Place: Indigenous Leadership in səlilwət (Burrard Inlet)

Tsleil-Waututh Nation's Treaty Lands and Resources Department

Moving Forward—Identifying Where Stormwater Pollution Is Generated on the Landscape

A much-repeated phrase from stormwater managers is "how much and where" do we need to implement stormwater BMPs (Best Management Practices)? This is a difficult question to answer until we identify our ecological and social goals for stormwater management. The amount and spatial configuration of stormwater interception techniques will look very different depending on whether the goal is to meet permit regulations, recover coho salmon, or recover Southern Resident killer whales because biological organisms are susceptible to stormwater contaminants for different reasons, in different locations, at different scales, and at different points in time according to their life history traits (Levin et al. 2020). Incorporating robust monitoring programs, such as MusselWatch, the Benthic-Index of Biotic Integrity (B-IBI), and coho pre-spawn mortality observations, and considering the ecological scales at which different biota operate can help identify the biotic response to stormwater runoff, adding valuable ecological information to stormwater monitoring and loading data.

One starting place to answer the "how much and where" question is to build a predictive map quantifying levels of stormwater pollution generated across the landscape. This type of 'threat' heatmap can be coupled with ecological data to produce action maps for stormwater intervention. We have started building the predictive map; we statistically link local stormwater monitoring data to landuse and land cover characteristics, and then calculate the pollution load using local precipitation patterns at 15-minute timesteps for the 32 different hydrologic response units (soil types, landcover types) existing in Puget Sound. We use Big Data capabilities to model surface hydrology across the entirety of the Puget Sound watershed at a 1 m^2 spatial resolution, and aggregate data at several spatial scales for local, watershed, and regional-scale planning.

Areas with high percent cover of impervious surfaces, such as hard cityscapes, as well as industrial and commercial zones, tend to produce higher pollutant loads than high-density residential, low-density residential, and rural areas, which tend to have less impervious surface cover. Transportation networks—roads and highways—generate very high levels of stormwater contaminants, especially those with higher traffic intensity. Traffic behavior (e.g., congestion points) also plays a role, indicating that a combination of a static landscape structure and dynamic anthropogenic behavior layered atop that structure can combine to create stormwater pollution hotspots throughout the landscape. Once we finish building this baseline heatmap, we can begin to add in the ecological layers to understand exactly where on the landscape stormwater interventions will be most efficient and effective at breaking the link between urbanization and aquatic degradation.

08 CONNECTION TO PLACE: INDIGENOUS LEADERSHIP FOR HOLISTIC RESEARCH, RESTORATION, AND GOVERNANCE IN SƏLILWƏT (BURRARD INLET)

Tsleil-Waututh Nation's Treaty Lands and Resources Department, with contributions from Carleen Thomas, Anuradha Rao, Sarah Dal Santo, Lindsey Ogston, and Spencer Taft

Tsleil-Waututh means "People of the Inlet"; Tsleil-Waututh People were born with a sacred obligation to protect the waters of Burrard Inlet. Our first grandfather was transformed from a wolf into a human being. As he grew into a young man, he became lonely. The Creator gave him a vision that he was to dive off one of the tallest cliffs in Indian Arm, grab two handfuls of sediment from the floor of the Inlet, and bring them back to the beach. Our first grandmother was transformed from that. Our ties to this Inlet run deep. It's important that we hold that responsibility, that as a Nation we gather people around who see our vision, and that our work resonates with their own spirit.

Since time out of mind, Tsleil-Waututh have used and occupied Burrard Inlet and surrounding watersheds. Generations of Tsleil-Waututh people were brought up with the teaching, "When the tide went out, the table was set." About 90% of our diet was once derived from Burrard Inlet and the Fraser River, but today the Inlet is unable to support our needs. Cumulative effects of colonial settlement and development have eroded the ecological health, integrity, and diversity of the Inlet. Urbanization and industrialization have brought a complex cocktail of contaminants, transforming Burrard Inlet from our primary food source into a heavily polluted system. By 1972, sanitation and contamination concerns led to the closure of the Inlet to bivalve harvesting. Tsleil-Waututh Nation (TWN) has a goal to restore the health of the Inlet so that we, and future generations of Tsleil-Waututh People, can once again harvest wild marine resources and continue to practice our cultural and ceremonial activities in a clean and healthy environment. The return of herring and orcas shows us that the Inlet is coming back, but there is more work to be done, and we need to do the work together.

TWN is a leader in weaving western and Indigenous science to inform integrated, inter-disciplinary governance and stewardship of natural systems. The science-based, TWN-led Burrard Inlet Action Plan (BIAP) brought together teams of knowledge holders, researchers, practitioners, decision-makers, and community members to share scientific knowledge about the state of Burrard Inlet, to foster development of a shared vision for environmental stewardship, and to identify actions to improve the health and integrity of Burrard Inlet by 2025 so that:

- healthy, wild marine foods can be harvested safely and sustainably;
- water and sediment are safe and clean for cultural and recreational activities;
- important habitats are productive, connected, and support biodiversity; and
- healthy populations of key species are viable and will continue to persist in the long-term.

Applying an Indigenous lens to re-focus water quality science, monitoring, and decision-making, TWN values are starting to reshape on-the-ground research and water quality policy. TWN, in collaboration with the Province of British Columbia, is leading an

update to the Provincial Water Quality Objectives for Burrard Inlet, and has co-developed and co-approved provincial water quality policy. TWN established a multi-sector, regional roundtable, as well as technical advisory teams, to review this work. Discussions and relationship building at
these tables are proving to be as important as the updated policy.

TWN's holistic approach to water quality improvement has enriched the understanding of the nature and extent of marine pollution, and opportunities to reduce it, through:

- compiling comprehensive water, sediment, and tissue quality data for Burrard Inlet from available scientific sources;
- mapping watershed-wide spatial data for Burrard Inlet water quality (including point and non-point sources of pollution), and drawing linkages between terrestrial activities and marine impacts; and
- developing water, sediment, and tissue objectives for a wide array of legacy and emerging contaminants, and ensuring that these objectives are protective of key values including health of aquatic life, and consumption of seafood by coastal Indigenous peoples.

Oral histories and community values inform all TWN projects. For example, TWN's Climate Change Resilience Project used a community values-based approach to inform identification of the key community vulnerabilities to the impacts of climate change, including sea level rise, coastal and creek flooding, and erosion. A community-based advisory committee is helping to inform development of practical solutions for climate action.

Burrard Inlet
Photo: Anuradha Rao

Knowledge sharing and relationship building are important objectives for TWN work. To restore a traditional relationship with the Inlet, with benefits for all, TWN is breaking down silos and bringing together cultural values, disparate data sets, and diverse actors in a way that hasn't been done before. We have hosted three Burrard Inlet Science Symposia, each attended by approximately 150 participants from dozens of organizations, with the most recent (held in 2019) focused on stormwater management solutions. Building relationships and sharing knowledge increase understanding and connections in our stewardship programs and initiatives.

From eelgrass to elk, TWN takes a watershed-scale approach to leading ecosystem monitoring and restoration, and working in partnership with others to improve the health and integrity of marine and land-based ecosystems. Restoration projects have included eelgrass transplants, re-establishment of the first community shellfish harvests since 1972, inland salmon habitat restoration, invasive species removal, elk re-introduction, and the re-establishment of community elk harvests. These projects embody Tsleil-Waututh principles of environmental stewardship, build community connection to the lands and waters, and work to ensure current and future community access to natural and cultural resources.

A littleneck clam held in a person's hand
Photo: Tsleil-Waututh Nation

Connecting past, present, and future, TWN's Cumulative Effects Monitoring Initiative employs mapping and modelling of available data on environmental monitoring with cultural and archaeological analysis to reconstruct historical ecosystem states, food web dynamics, and shoreline uses. This work is supported by TWN-led field programs to monitor contaminants, underwater noise, marine plants and algae, invertebrates, fish, and terrestrial systems. This work will build an understanding of the cumulative environmental effects of two centuries of development and industry (since European contact) and help predict future states associated with regional development and climate change. This work will be used to inform complex management decisions in and around Burrard Inlet and reveal opportunities for environmental protection, restoration, and enhancement toward ecosystem health and food security.

Tsleil-Waututh Nation and culture are rooted in the lands and waters surrounding Burrard Inlet. Since thousands of years pre-contact, our stewardship laws, Indigenous knowledge, and practices have enabled us to govern, manage, and protect these lands, waters, and resources. More recent pressures of unprecedented regional growth, development, and climate change have created new challenges and reinforced the urgency of environmental stewardship and restoration. In working to address these challenges, TWN has been making strides to integrate Indigenous knowledge, science-based research, inter-disciplinary thinking, community values, knowledge sharing, relationship building, and collaboration within ongoing TWN stewardship programs and initiatives to improve the health of Burrard Inlet and surrounding areas.