HUXLEY
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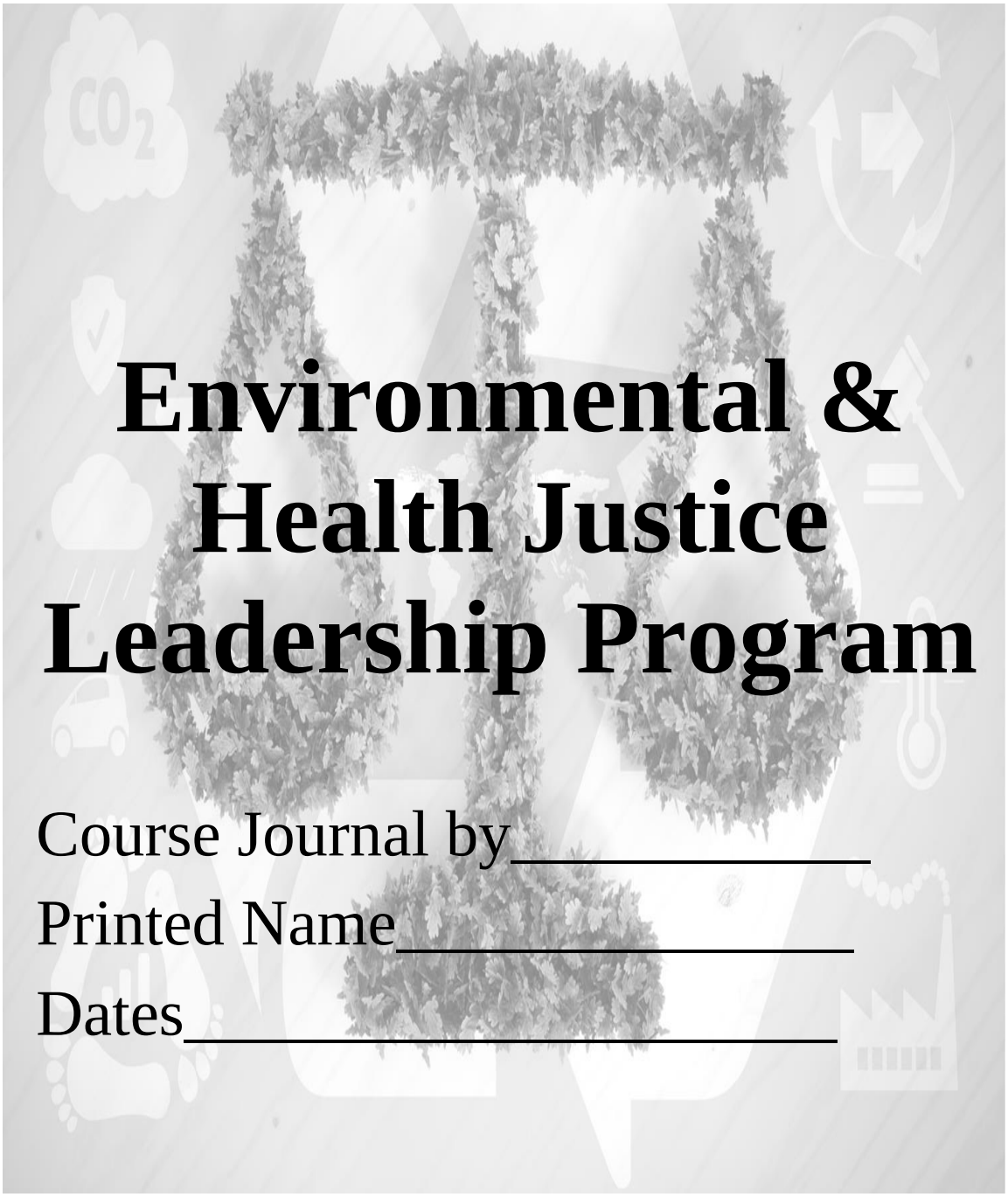
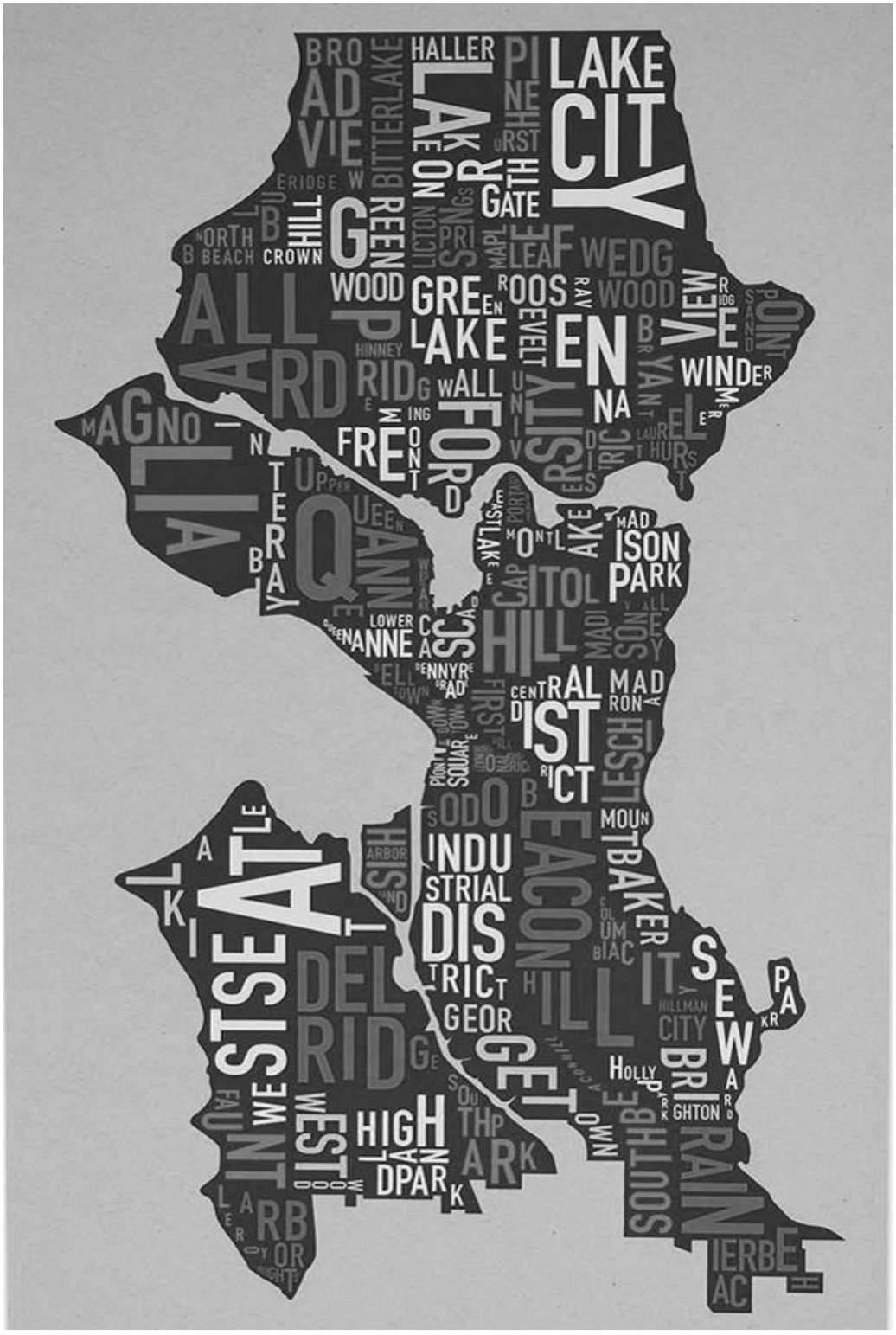


Environmental & Health Justice Leadership Program

Course Journal by_____

Printed Name_____

Dates_____



Are all of Seattle's neighborhoods achieving environmental and health justice?

Environmental and Health Justice Leadership Program

August 14 – 17, 2017

Troy D. Abel, Associate Professor and Program Director
Huxley College of the Environment
Western Washington University

Program Description

Congratulations on being selected for the inaugural Environmental and Health Justice Leadership (EHJL) program sponsored by the Department of Environmental Studies and Huxley College of the Environment at Western Washington University (WWU). Your contributions to Cleveland High School's 2017 Cumulative Health Impact Analysis were outstanding. You and your peers also helped advance WWU's air pollution biomonitoring research program by expanding our South Seattle sampling points. Thank you.

Objectives

The EHJL program from Seattle to WWU campuses in Poulsbo and Bellingham is built around three objectives. First, participants will continue to apply an integrative approach to understanding the human and environment interactions that result in environmental and health disparities. Second, participants will produce, interpret, and apply research in a solution-oriented context. Finally, participants will work collaboratively to identify and analyze complex environmental and health injustices, recognize diverse stakeholder perspectives, and synthesize creative solutions.

EHJL 2017 Schedule

DAY	ACTIVITIES	Location Topic
Monday August 14	Environmental and Health Justice Efforts in Seattle	El Centro de la Raza Duwamish River Cleanup Coalition
Tuesday August 15	Leaf and air pollution sampling locations	Beacon Hill, Rainer Valley, and Duwamish River Valley
Wednesday August 16	WWU Bellingham Magnetism lab work, campus tour, lunch, Toxicology Lab	Environmental Studies, Arntzen Hall, Wilson Library
Thursday August 17	WWU and Olympic College Poulsbo SEA Discovery Center, Lunch, William and Sophia Bremer Science Laboratory	Poulsbo, Olympic Way Campus, WWU Extended Education

My list of new experiences and observations about Environmental and Health Justice

Please add to this throughout the program

Monday August 14 Questions.

How did the Cumulative Health Impact Analysis (CHIA) experience change your beliefs about environmental and health justice? What did you learn in the CHIA experience that you could not have learned in a traditional science class? Who should do more to help communities achieve environmental and health justice?

9am start at CHS	Introductions, journals distributed, name tags, and overview of program	CHS
9:30 depart for Beacon Hill	Podcast on EJ	El Centro de la Raza
10-10:20 am	Introduction of Maria Batayola and students. Names, cultural origins, and why are they interested in this topic. Tell us 3 things that you have that makes you a leader.	El Centro de la Raza Room 307
10:20-10:35am	Maria shows 3.5 minute EJ video and leads discussion.	Describe the photos of Seattle's social justice leaders and this historic place.
10:35-11am	How are equality and equity different exercise.	
Student prompt:	When you see this picture, what do you see? *Does it seem fair? What is unjust about it? How could you fix it so it would be fair?*	An equal distribution of resources does not necessarily achieve an equal outcome.
		
11 am	Body break	
11:15 - Noon	Cross-cultural competency practices.	Maria will distribute 3x5 cards about the EPA project to students who are bi-lingual. Then they summarize the project in their native language.
	Ask those that didn't understand, was it fair to hear the summaries in another language? How is it unjust? What are some things	
	Go back to the leadership qualities and the traditional European qualities (relational)	

The City of Seattle has long been a pioneer in the environmental movement. Though the City has made great strides to be green, it faces the **same challenge as the broader US environmental movement**: it is primarily white, upper-income communities that shape and benefit from environmental policies, approaches, and outcomes.

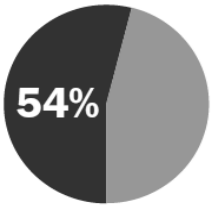
Across the US, race is the most significant predictor of a person living near contaminated air, water, or soil.[1]

Additionally, the demographics of our country, state, region and city are changing rapidly. This issue is more important than ever. According to Pew Social Trends:

2005: 1 in 8 Americans was an immigrant

2050: 1 in 5 Americans will be an immigrant

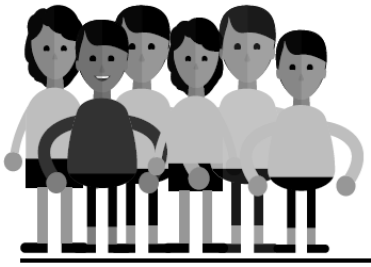
2040: 54% people of color in Seattle-Tacoma-Bellevue Metro area[2]



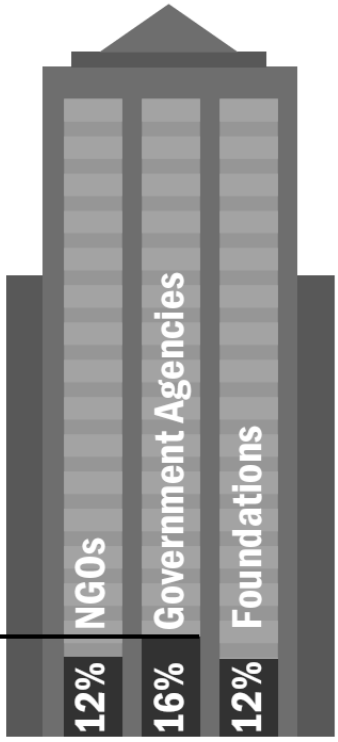
[1] Bryce Covert, "Racism and Discrimination Race Best Predicts Whether You Live Near Pollution," The Nation, February 18, 2016 , http://www.thenation.com/article/race-best-predicts-whether-you-live-near-pollution/

One reason environmental justice concerns often go unaddressed is because of the "green ceiling": those who are most impacted are underrepresented in environmental agencies and government. Despite the increasing racial diversity in the United States, **people of color make up only 12% to 16% of those working in environmental organizations, foundations, and government agencies**,[3] a percentage that has been in place for decades.

Systemic and institutional racism continue to keep environmental benefits from reaching all people.[4]



The Green Ceiling
People of color have only ever made up 16% environmental jobs, across NGOs, Government Agencies, and Foundations.



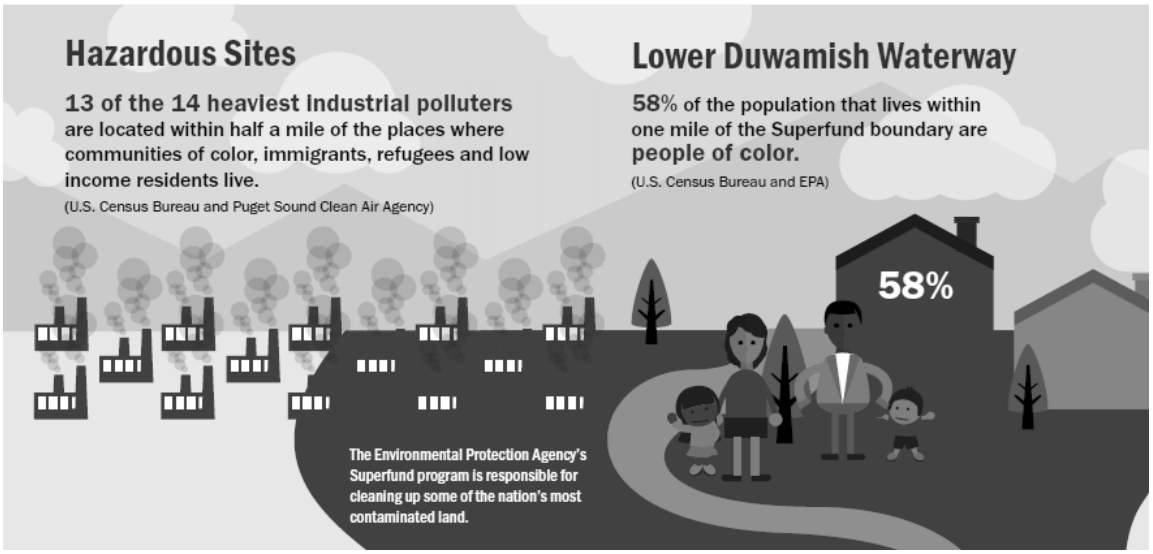
[2] "Indicators: Race/Ethnicity Seattle-Tacoma-Bellevue, WA Metro Area," The National Equity Atlas, 2016, http://nationalequityatlas.org/indicators
[3] Taylor, Dorceta, "The Challenge," The Green 2.0 Report, July 29, 2014 , http://www.diversegreen.org/the-challenge/
[4] "[A] number of studies have reported increased sensitivity to pollution, for communities with low income levels, low education levels, and other biological and social factors. This combination of multiple pollutants and increased sensitivity in these communities can result in a higher cumulative pollution impact." Cumulative Impacts: Building a Scientific Foundation, Office of Environmental Health Hazard Assessment, Dec. 2010, Exec. Summary, p. ix, http://oehha.ca.gov/ej/cipa123110.html

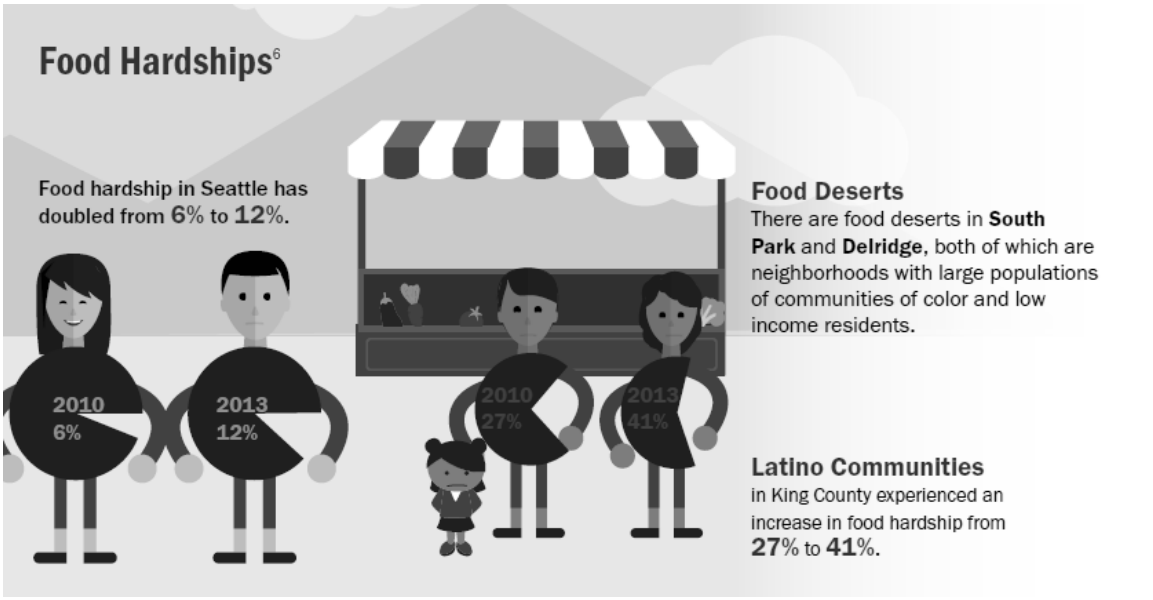
Community members expressed concerns about the interplay of multiple environmental hazards, toxics such as lead, indoor and outdoor air quality, diesel exhaust, noise pollution, proximity to polluted sites, litter, illegal dumping, lack of green space, climate change impacts, displacement, and lack of affordable, healthy, culturally appropriate food. Many also noted that existing regulations and programs tend to focus too narrowly on a single pollutant at a time and fail to address the compounding impacts of other environmental hazards and exacerbating issues of poverty, education issues, racial discrimination, public safety, displacement and gentrification.

Many immigrants and refugees shared that their experience of the natural environment in Seattle is substantially better than their countries of origin and they expressed enthusiasm for strong environmental policies. Yet we as a community still have much work to do to provide healthy and safe environments in which to work, play, and raise our families.

"I have to drive to a different neighborhood to take [a walk]. The sidewalk does not exist in my neighborhood and has poor pavement."

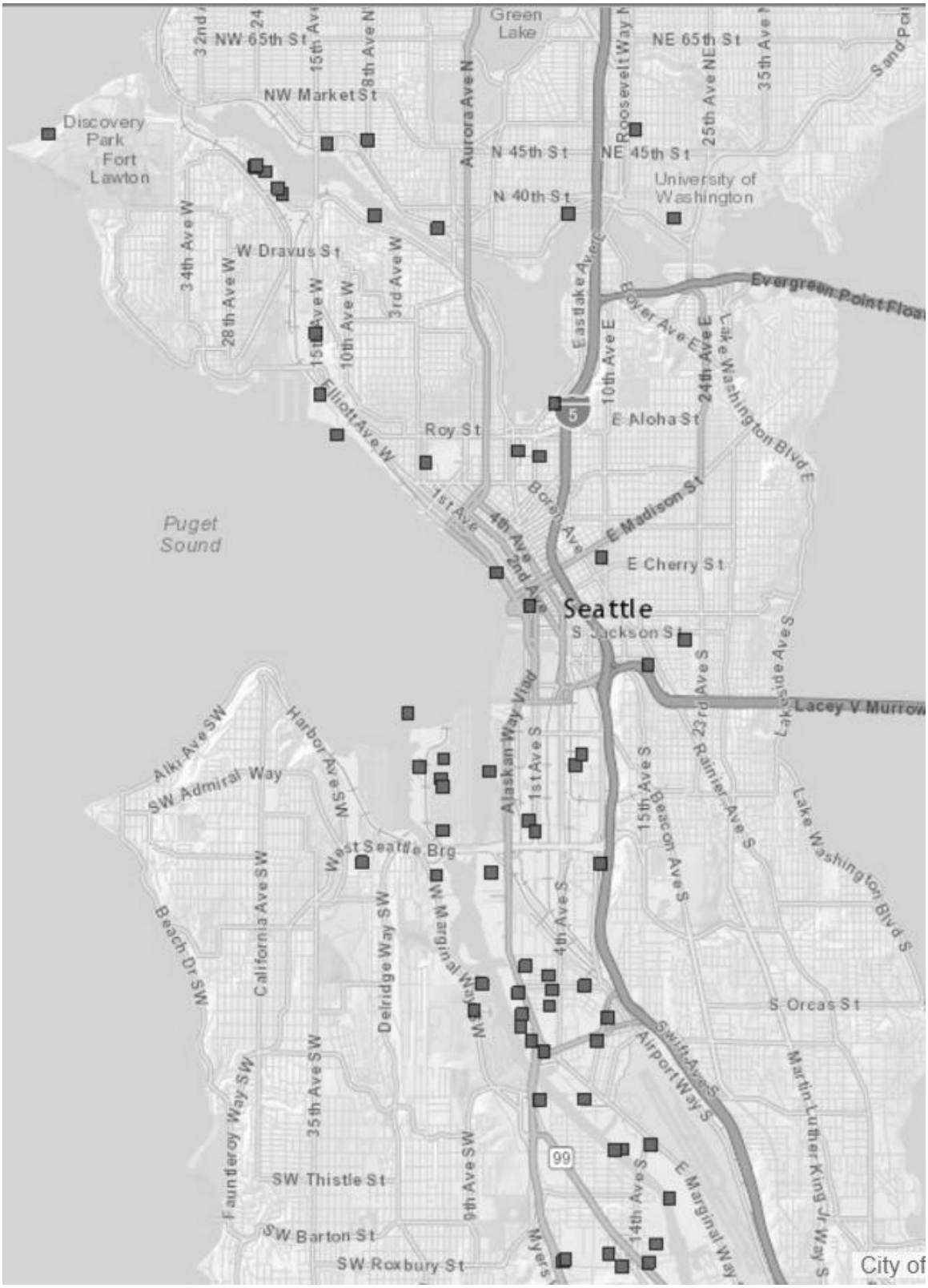
— Community member, East African Community



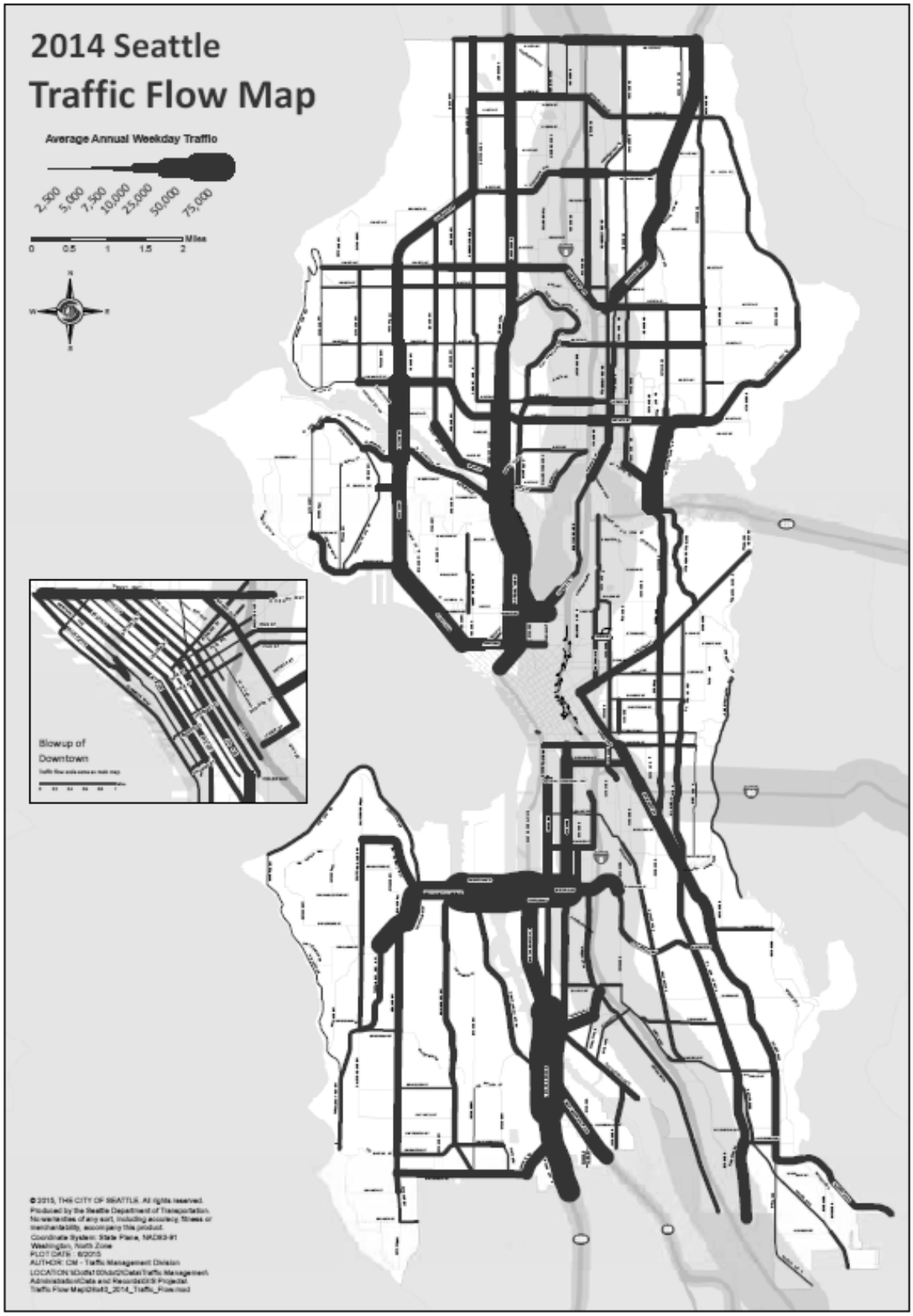


Have you, members of your family, or some of your friends experienced environmental and health injustice? What is preventing them from achieving environmental and health justice?

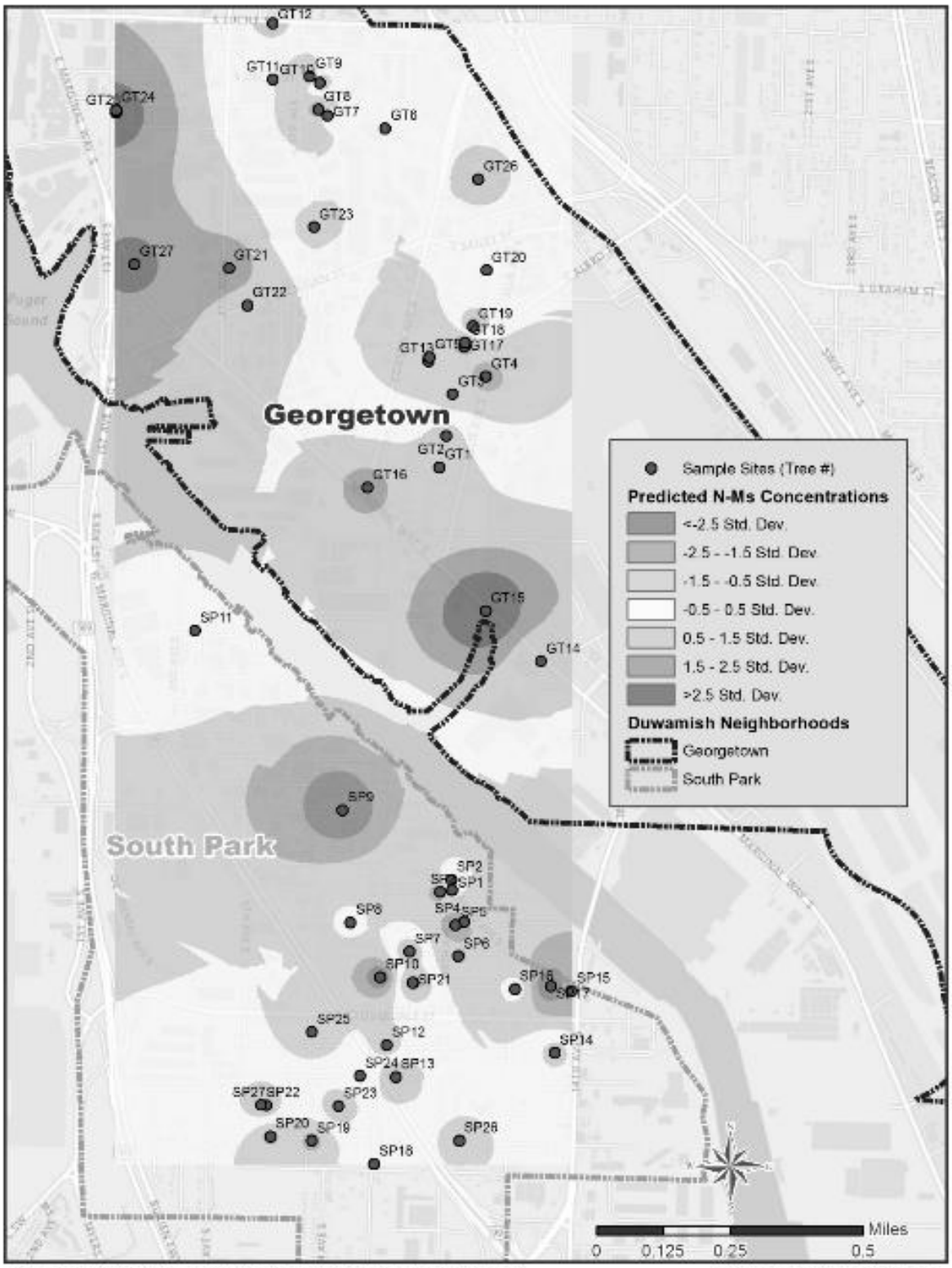
Cleveland High School Leaf Sampling Locations



Air Polluters Across Seattle (Source: https://ejscreen.epa.gov/mapper/)



Traffic Flows (Source: Seattle Dept. of Transportation)



Tree Magnetism in Lauren Templeton's Senior Project at WWU

Readings for Tuesday night August 15. Jenner, Nick. 2015. Western Washington University, "Drawing a new map," *The Planet*. 73.

SURROUNDED BY INDUSTRY

STORY NICK JENNER | **PHOTOS** KRAMER JANDERS

In southern Seattle, past the skyscrapers of downtown, another picture exists: the polluted Duwamish River. People living in the Duwamish Valley have life expectancy rates 13 years shorter than in one of the city's most affluent neighborhoods.

THE DUWAMISH RIVER, named a federal Superfund site by the Environmental Protection Agency in 2001, runs straight through the core of Seattle's industrial district. For over a century, the river, also known as the Duwamish Waterway, has served as a corridor for the city's cargo ships and a dumping ground for its hazardous industrial chemicals. The surrounding area, the Duwamish Valley, is frequently trafficked by trucks, trains and planes.

Seattle's South Park, Georgetown and Beacon Hill neighborhoods, squeezed tight into the valley, all share a breathing zone with the city's industry. This breathing zone ranks highly in air pollution and lack of access to a healthy environment, according to the Duwamish Valley Cumulative Health Impacts Analysis, or CHIA, compiled by the University of Washington and the Duwamish River Cleanup Coalition.

Duwamish Valley's Georgetown neighborhood is surrounded on all sides by industrial traffic: bound by the Duwamish River and Interstate 5 on either side, trapped by railroads to the north and locked in by Boeing Field to the south. Meanwhile, industrial trucks regularly weave their way through the neighborhood's streets.

"We're just like a little island, and everything is just going on around us," said Kelly Welker, a resident of Georgetown.

Welker, a CT scan technician working for the Cancer Care Alliance, has been living in the Georgetown neighborhood for nine years with her husband and 6-year-old son. For the past two or three years, Welker said that she has experienced a harder time breathing.

"I feel like I need a running start just to take a breath," Welker said.

Breathing became such an issue for Welker that last winter she decided to get a CT scan of her lungs. The scan results didn't indicate anything in particular, though her doctor advised her to use an inhaler and consider moving from the neighborhood.

"I can't just up and move," Welker said. "It's not economic for us right now. We don't have the ability to do that."

After witnessing other Georgetown residents and their children develop asthma, Welker worries her son will also acquire the respiratory illness. Duwamish Valley neighborhoods have the most childhood asthma hospitalizations in Seattle, according to CHIA.

In 2015, the Department of Civil and Environmental Engineering at Hayang University published a review of particulate matter health impacts. According to the review, particulate matter — small, inhalable particles released from the burning of wood and petrol fuels — can linger in the atmosphere long after being released. Inhalation of particulate matter is strongly correlated to chest discomfort, shortness of breath, coughing, heart disease, diabetes, hospitalizations, premature death and more.

Traffic is the main source of diesel particulate matter, which produces a finer particulate matter that lingers longer in the air and penetrates deeper into the lungs, according to the review. Each day, shipping trucks trace their way through Duwamish Valley neighborhoods, compounding their particulate matter with that of nearby trains, ships and airplanes.

Readings for Tuesday night August 15. Jenner, Nick. 2015. Western Washington University, "Drawing a new map," *The Planet*. 73.

James Rasmussen is the coordinator of the Duwamish River Cleanup Coalition and was born and raised in Beacon Hill. According to Rasmussen, some of the worst diesel emissions come on the days when companies are loading or unloading their container ships. Trucks drive through the neighborhoods to get to the port and sometimes even sit idle in the neighborhoods while waiting to unload freight.

According to Welker, Prologis, an industrial real estate developer, has filed plans to install a new 14-acre, two-story warehouse in Georgetown for trucks to load and unload freight. Welker said the two-story warehouse would be a terrifying addition to her neighborhood.

"I understand that this is the industrial area, but there are other industrial areas," Welker said. "And if you have an industrial area that already has such a high count of diesel particulates — such a high amount of children with asthma or respiratory issues — couldn't you spread that out a little bit?"

In February, Welker noticed a factory breaking down drywall across the street from her block. At night she saw giant floodlights illuminating thick dust clouds rising in the air. At first there was a neighborhood joke about the taste in the air, but months later no one thought it was funny, she said.

Around the same time that Welker noticed the factory, Megan Davis, a Georgetown resident for 15 years, noticed that her 8-year-old son was experiencing unusual congestion and sneezing.

According to Davis, her 4-year-old daughter has been to the emergency room multiple times for problems stemming from asthma. The neighborhood's air quality certainly doesn't help, Davis said. From the time when her daughter's symptoms emerged, Davis said her family had been considering moving from the area.

Welker made a Facebook page for community members to voice their dust concerns.

Seattle holds city council meetings for citizens to voice concerns. According to Welker, many Georgetown residents affected by pollution sometimes have more than one job or have kids and don't have time to attend city council meetings.

"Even if you email somebody, you know it's probably not going to them — it's going to whoever checks their email and determines that it's important enough to look at that day," Welker said. "I think we get disheartened because it's been going on for so long."

One of Welker's neighbors has already moved because of his health issues and noticed he could breathe much better outside the area, Welker said.

Alberto Rodriguez, project manager for the Duwamish River Cleanup Coalition, works in the area but does not call it home. Rodriguez lives in an area just west of Laurelhurst, an affluent neighborhood where residents will live an average 13 years longer than those of the Duwamish Valley, according to CHIA.

The Duwamish Valley has more trucks, whereas the Laurelhurst area has more trees to filter the particulates in the air, Rodriguez said.

According to CHIA, a disparity in tree canopies exists between the Laurelhurst and University District zip code and that of Beacon Hill,

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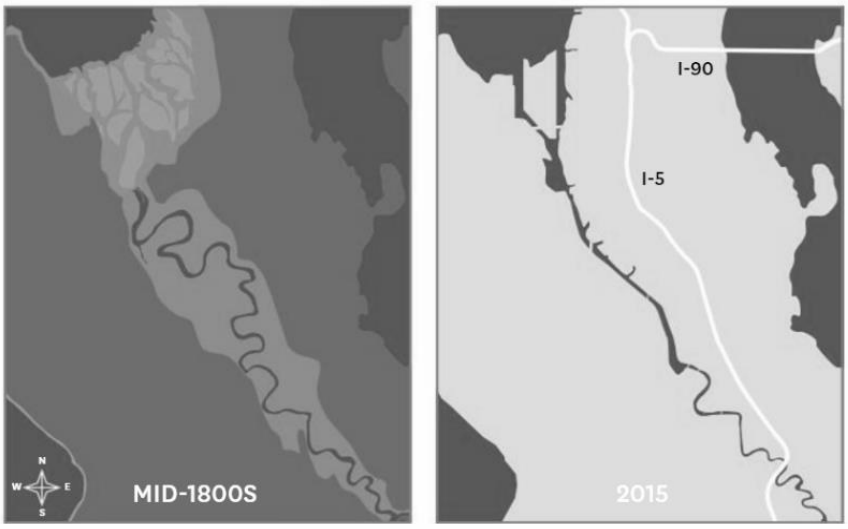


A CHANGE OF COURSE

Over the course of the 20th century, the Duwamish River was straightened to make way for city development and industry. Industrialization dramatically reduced the volume of water flowing through the Duwamish River. Elimination of wetland habitats and pollution of air and water burdened ecosystem health. Residents in Duwamish neighborhoods closest to industrial traffic are experiencing health problems from breathing airborne pollution from industry and highways.

Map developed from burkemuseum.org/waterlines.

Georgetown and South Park. About 20 percent of the Laurelhurst and University District zip code is covered by tree canopy, compared to about 6 percent of canopy coverage in the Duwamish Valley.

Troy Abel, a Western Washington University professor, published research in the American Journal of Public Health examining unequal distribution of Seattle pollution.

Since 1990, the number of industrial sites in Seattle and the volume of toxins in the air have decreased, according to Abel's study. However, Seattle's toxic release sites are shown converging on the Duwamish Valley along with citizens of lower socioeconomic status as a result of gentrification.

Gentrification, as generally defined by Abel's report, is the process by which citizens of higher socioeconomic status move into a neighborhood, raising its housing prices and forcing residents of lower socioeconomic status into more affordable, often more polluted neighborhoods.

Between 1990 and 2000, the Duwamish Valley neighborhoods' population of people of color increased from 37.5 percent to 53.4 percent.

According to Abel's study, Sound Propeller Services was responsible for 95 percent of Seattle's air pollution production in 2007. The ship propeller company relocated out of the gentrifying Lake Union area and into the Duwamish Valley.

Since Abel's study began in 1990, 14 new or relocated facilities moved nearby the Industrial District of South Seattle, whereas fewer facilities relocated to gentrifying areas such as Lake Union and downtown Seattle.

Even though individual decisions may have been rational, collective city permit decisions concentrated environmental injustices in South Seattle, Abel said.

The city works with the EPA and the Duwamish River Cleanup Coalition to clean the Duwamish Superfund site and its surrounding communities. However, the Duwamish Valley's breathing zone remains saturated by industrial emissions.

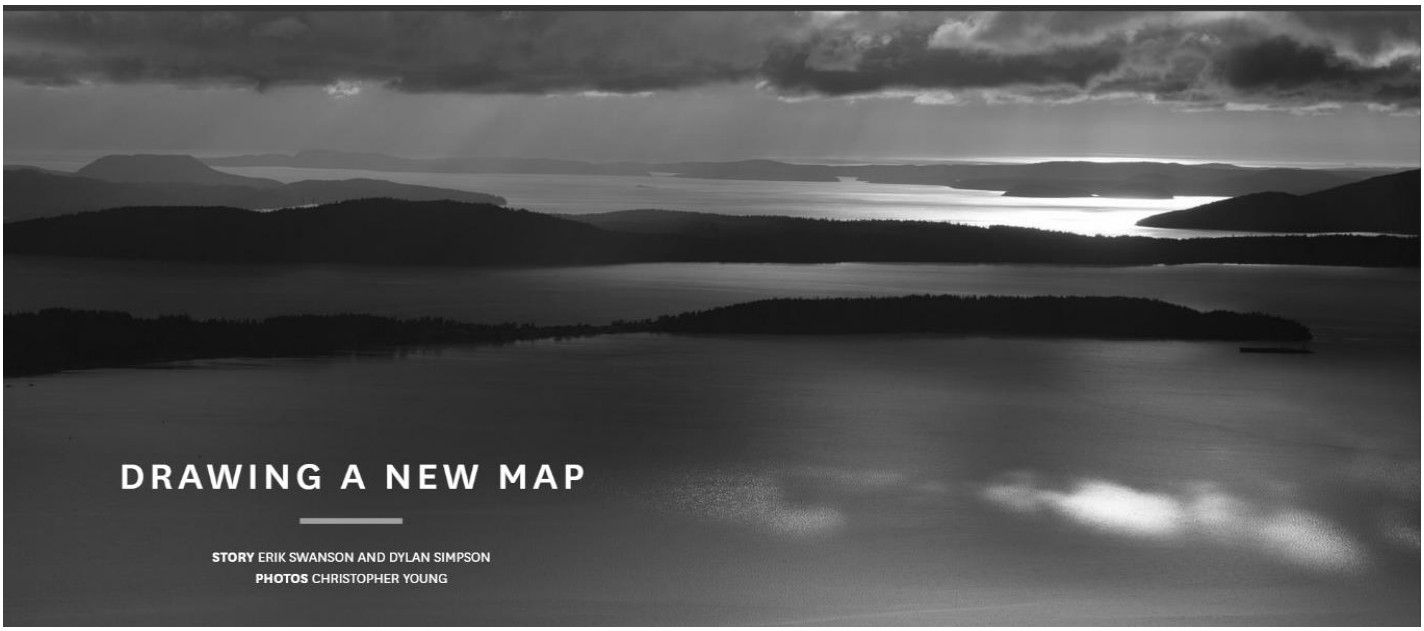
To see multimedia coverage of this story, visit theplanetmagazine.net.

NICK JENNER is a visual journalism major who enjoys meeting new people, exploring foreign places, capturing photos, reading and taking long walks in the woods.

KRAMER JANDERS is a senior studying visual journalism and business at Western Washington University. After class, he enjoys taking photographs, cooking and the outdoors.

Summarize your field research. How much data have you collected? What kinds of environmental and health hazards did you observe? Did you see similar or different patterns from the CHIA project?

Readings for Wednesday night August 16. Swanson, Erik. 2014. Western Washington University, "Drawing a new map," *The Planet*. 73.



DRAWING A NEW MAP

STORY ERIK SWANSON AND DYLAN SIMPSON
PHOTOS CHRISTOPHER YOUNG

Until 2009, the northwestern body of water encompassing more than 16,800 square kilometers did not have a name. People have called the rich, evergreen-covered coastline their home for centuries but have identified it with different names. The Strait of Juan de Fuca, the Strait of Georgia and the Puget Sound are now part of one body of water: the Salish Sea.

THE NAMING OF THE SALISH SEA

After failing to gain support in the late 1980s, Bert Webber, professor emeritus of biology at Western Washington University, renewed his effort to name this shared sea in 2007. With Stefan Freelan, geographic information systems specialist at Western Washington University, Webber successfully catalyzed the official recognition of the Salish Sea in October 2009.

The reason behind the naming was to bring focus to the ecosystem that supports regional natural resource systems and acknowledge tribal nations that first settled in the Salish Sea, Webber said.

"I'm a biologist by trade and one of our favorite things to do is to name things. If you don't name something, it's hard to understand it," he said.

In 2008, natural resource management was more contentious than during Webber's initial effort. Regions without a name were difficult to manage, Webber said.

Webber knocked on the office door of his longtime friend, the son of a former Western Washington University colleague, Stefan Freelan, and asked him to make a map of the Salish Sea.

Years later, in his office, Freelan sat back in his chair with his hands folded behind his head. Assorted maps were pinned on the wall next to a bookcase with various publications, some containing his new map.

"He just wanted something that he could show and hold up to be able to talk about. So I said, well, let's make it beautiful," Freelan said.

Freelan's task was to construct a map without political borders or city names, representing the natural boundaries of the Salish Sea, Webber said.

Readings for Wednesday night August 16. Swanson, Erik. 2014. Western Washington University, "Drawing a new map," *The Planet*. 73.

Naming the geographic area had to pass through naming boards in Washington state and British Columbia, Freelan said. The boards inquire in local communities to test if a particular name is being used to determine its validity.

The name did not need a lot of publicity because from 1989 through 2008 it was being used informally in places such as natural resource management, Webber said.

Webber said it feels good to be connected with the Salish Sea — when he is associated with the name it is like an introduction and people give him a warm welcome.

"The name has caught on, it's not going to go away," he said.

ECOSYSTEM DECAY

As of 2013, 119 species in the Salish Sea are endangered or at risk of becoming endangered, according to a report by the SeaDoc Society. This number has nearly doubled since 2002. If endangered species become locally extinct, biodiversity and its many functions will decrease, said John Rybczyk, an ecologist and professor at Western.

Each government manages threatened and endangered species with its own qualifiers and list, said Joe Gaydos, chief scientist at the SeaDoc Socieity. According to the report, Washington state lists 44 percent of the 119 species, the U.S. lists 22 percent, British Columbia lists 58 percent and Canada lists 61 percent.

Recognizing the Salish Sea's economic contribution to the region is essential to effectively manage its resources, Gaydos said.

"It's not just about loving it, it's about actually having innate value," he said.

Commercial fishing contributed $3.9 billion to Washington earnings in 2007, according to a 2011 report by natural resource economist Hans Radtke. Wildlife watching alone brought $980 million to Washington state in 2001, according to a 2008 Earth Economics report.

Ecosystems also offer non-marketable services, Rybczyk said. Wetlands filter pollutants from water and remove carbon from the atmosphere.

Diversity is important because organisms primarily provide these services, and a diverse system is more able to adapt and rebound from disturbances.

Less diverse systems remove fewer pollutants and support fewer fisheries, according to a 2006 *Science* article.

Chemical and noise pollution and overfishing plague the Salish Sea, Gaydos said. Population declines are not caused by any one variable, but rather a cumulative effect.

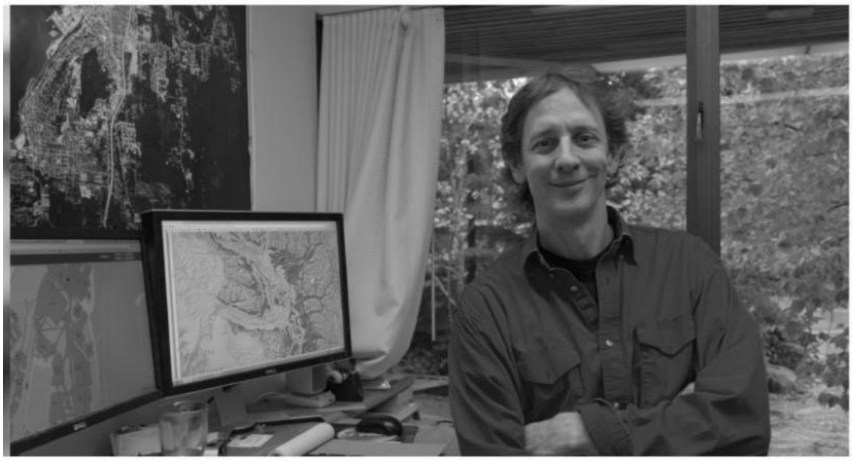
Population declines in the Salish Sea are indicative of ecosystem decay, according to the SeaDoc report. Ecosystem decay is a term coined by conservation biologist Tom Lovejoy to describe the effects of habitat fragmentation.

A habitat reduced in size cannot support the same number of species, Lovejoy said. In turn, the ecosystem will shed species and transition to a simpler state.

Historically, ocean conservation policy has focused on individual species, said Gary Davis, a marine biologist. But an integrated approach focusing on the whole ecosystem would best protect a system like the Salish Sea.

Davis suggests mimicking Australia's Great Barrier Reef Marine Park, in which some areas are protected and some zoned for commercial or recreational use.

Zoning would be challenging because the Salish Sea crosses an international boundary and involves many native tribes and First Nations,



PREVIOUS PAGE: *The Salish Sea, located in the Pacific Northwest, is over 16,800 square kilometers and encompasses the Strait of Georgia, The Strait of Juan de Fuca and the Puget Sound. Naming the Salish Sea was an attempt to focus on the ecosystem, which is driving important natural resource systems, and to acknowledge tribal nations who first settled the region.*

OPPOSITE: *Bert Webber, professor emeritus of biology at Western Washington University, first attempted to name the Salish Sea back in the 1980s because he wanted people to recognize the ecosystem. After failing to gain support, Webber tried again in 2007. With the help of Stefan Freelan, geographic information systems specialist (GIS) at Western Washington University, the Salish Sea became official in October 2009.*

LEFT: *Stefan Freelan designed the current map of the Salish Sea. Webber asked Freelan to create a map without political boundaries so people would notice the physical landscape.*

Davis said. Any regulation is met with competing social and economic interests of many separate sovereign entities, each with their own perspectives of conservation, he said.

Doug Tolchin, president of River Oak Properties, has applied the Salish Sea name to garner support for the proposed Salish Sea Marine Sanctuary, he said. The goal is to not only protect, but restore the wildlife population to 50 percent of its historical level.

Fracking, neonicotinoids — a type of insecticides — and GMOs would be banned, Tolchin said. Potential sanctuary regulations would cap fossil fuel tanker traffic at 2012 levels and launch restoration in tributaries, rivers, creeks and aquifers.

Marine sanctuaries maintain both the habitat and ecological services of natural living resources, like a national park of the sea, as described in the National Marine Sanctuaries Act.

Tolchin said he hopes Washington state will have the opportunity to vote on this park of the sea in November 2016. Roughly 8 percent of voters must first sign a petition to create a citizen initiative that adopts the proposed sanctuary. May 2017 is the next citizen-initiated vote in B.C.

"The power is with the people, but they have to unify and agree around whatever it is that they want to express their power toward," Tolchin said.

CHEMICAL AND NOISE POLLUTION AND OVERFISHING PLAGUE THE SALISH SEA, GAYDOS SAID. POPULATION DECLINES ARE NOT CAUSED BY ANY ONE VARIABLE, BUT RATHER A CUMULATIVE EFFECT.

COAST SALISH RIGHTS AND CULTURE

Several years before the official naming of the Salish Sea, local tribes gathered in Tulalip, Washington to sign a treaty. The signatures, signed on a deer hide, showed that though they have been separated by tribal affiliation they are all Coast Salish people, said Randy Kinley, harvest policy representative at Lummi Natural Resources (LNR).

THE REASON BEHIND THE NAMING WAS TO BRING FOCUS TO THE ECOSYSTEM THAT SUPPORTS REGIONAL NATURAL RESOURCE SYSTEMS AND ACKNOWLEDGE TRIBAL NATIONS THAT FIRST SETTLED IN THE SALISH SEA, WEBBER SAID.

Kinley said Tolchin's proposed sanctuary could put them in a bad position by impeding their treaty rights and requiring them to enforce new laws within their reservation that go against cultural tradition.

Matthew Sparke, director of Integrated Social Sciences at University of Washington, said one of the more problematic aspects of the name Salish Sea was it referenced native people directly but may not extend beyond acknowledgement.

"You might think that it's a reference of respect for first people's indigenous sovereignty at some level, but it seems to me that it doesn't go that deep," Sparke said.

Native communities are frustrated that indigenous imagery and names are often used as examples of aboriginal Cascadia without being invited to make any sort of decisions, Sparke said.

The issue needs to go beyond the cultural relationship of the name and involve native leadership, he said.

Kinley said the tribes put a lot of effort toward conservation and management objectives, but the burden of habitat conservation should fall to those outside the tribal members.

"The end result is that it's going to be a complex issue. The tribes are going to get behind when you start calling it a sanctuary, then you're going to get some resistance. It would be more on us than anybody," Kinley said.

Frank Lawrence, water resources planner and future department director of LNR, said some people choose to ignore the native perspective.

"Everything that we fight for and everything we talk about, we talk from our spiritual point of view. We do this because it's us," Lawrence said. "Most of the world doesn't seem to want to listen or care about who we are, how we are and where we've come from."

Sparke said finding agreement between all parties can have its challenges but it can work.

Different issues on each side of the border make establishing something like an international marine sanctuary difficult. While U.S. Navy sonar blast drills kill sea mammals, Victoria is pouring sewage into the water, Sparke said.

"I think it's worth struggling for," Sparke said. "Personally, I think it's an obvious thing around which local people on both sides of the international boundary ought to be able to come to agreement on."

ERIK SWANSON is a journalism student who hopes to make an impact through writing. He is always planning his next adventure and has yet to find anywhere that beats the Pacific Northwest.

DYLAN SIMPSON is a native of the Pacific Northwest pursuing a degree in environmental science. He enjoys hiking, biking, climbing and sleeping outside. Also, books.

CHRISTOPHER YOUNG is a senior pursuing a major in environmental science. During the summer, he enjoys campfires and crabbing on the Salish Sea.

SARAH HEIDRICH is an aspiring veterinarian and a senior biology major at Western Washington University. She works at a doggie daycare and is an advocate for the environment and animal rights.

Map of the Salish Sea & Surrounding Basin, Stefan Freelan, WWU, 2009

The *SALISH SEA (& Surrounding Basin)*

The *SALISH SEA* extends from the north end of the *Strait of Georgia* and *Desolation Sound* to the south end of the *Puget Sound* and west to the mouth of the *Strait of Juan de Fuca* including the inland marine waters of southern British Columbia, Canada and northern Washington, USA. These separately named bodies of water form a single estuarine ecosystem. Formally adopted by British Columbia and Washington State in 2009, *'The Salish Sea'* as a name for these waters has been embraced by citizens on both sides of the border for years including the Coast Salish Gathering (the alliance of Coast Salish Tribal and First Nation leaders).

The *Salish Sea* is connected to the *Pacific Ocean* primarily via the *Strait of Juan de Fuca* (with relatively slight tidal influence from the north around *Vancouver Island* and through *Johnstone Strait*) and is contained by *Vancouver Island* and the *Olympic Peninsula*. In addition to the *Gulf* and *San Juan Islands* the watershed contains the lower *Fraser River Delta* and the *Puget Lowlands* as well as the *Hood Canal*, the *Tacoma Narrows* and *Deception Pass*.

Over 7 million people live within the drainage basin of the *Salish Sea*[1] (sometimes referred to as the *Georgia Basin - Puget Sound* watershed), including the cities of Vancouver, Seattle, Victoria, Olympia, Nanaimo, Bellingham, Everett, Port Angeles, Port Townsend and Tacoma.

Salish Sea Details:

The surface area of the *Salish Sea* (saltwater) is approximately 18,000 sq. km. (or about 7,000 sq miles).[2] Within the *Salish Sea* there are hundreds of islands (or even thousands, depending upon one's definition of an 'island').

	Approximate Maximum **Water Depths**[3] [4]	Approximate **Saltwater Surface Area**	Saltwater Surface Area **% of Salish Sea**
Strait of Georgia (inc. N. Gulf Islands)	410 m.	6,400 sq. km.	36 %
Strait of Juan de Fuca	250 m.	4,400 sq. km.	24 %
Desolation Sound	600 m.	1,100 sq. km.	6 %
Puget Sound	280 m.	2,500 sq. km.	14 %
Other BC	660 m. (*Jervis Inlet*)	2,000 sq. km.	11 %
(*Discovery Passage, Jervis Inlet, Howe Sound, S. Gulf Islands*)			
Other WA	300 m. (*Haro Strait*)	1,600 sq. km.	9 %

The surrounding *Salish Sea* drainage basin (not counting the upper *Fraser River* watershed) includes approximately 110,000 sq km (or about 42,000 sq miles). In addition to the human population, the ecosystem is home to over 200 different species of fish, over 100 different species of bird, 20 different species of marine mammal and over 3,000 different species of invertebrates.[5] [6]

Name Details:

The name *Salish Sea* is not a historical term for the inland waters of British Columbia and Washington State. It was proposed by marine biologist Bert Webber in 1988. Dr. Webber recognized the need for a single geographic term that encompassed the entire ecosystem, spanning across the international border. Having a name to identify the entire area calls attention to the trans-border commonality of water, air, wildlife and history. Rather than being a replacement for any of the existing names, the designation *Salish Sea* is an overlay which includes and unites the established and familiar names of the

various water and land bodies (the S*trait of Georgia, Strait of Juan de Fuca, Puget Sound, Gulf Islands, San Juan Islands,* etc.). The name also pays tribute to the Coast Salish peoples who have inhabited the area since long before Euro-American explorers first arrived. In 2009 the governments of both British Columbia and Washington officially adopted the name *Salish Sea*.[7]

Map Details:

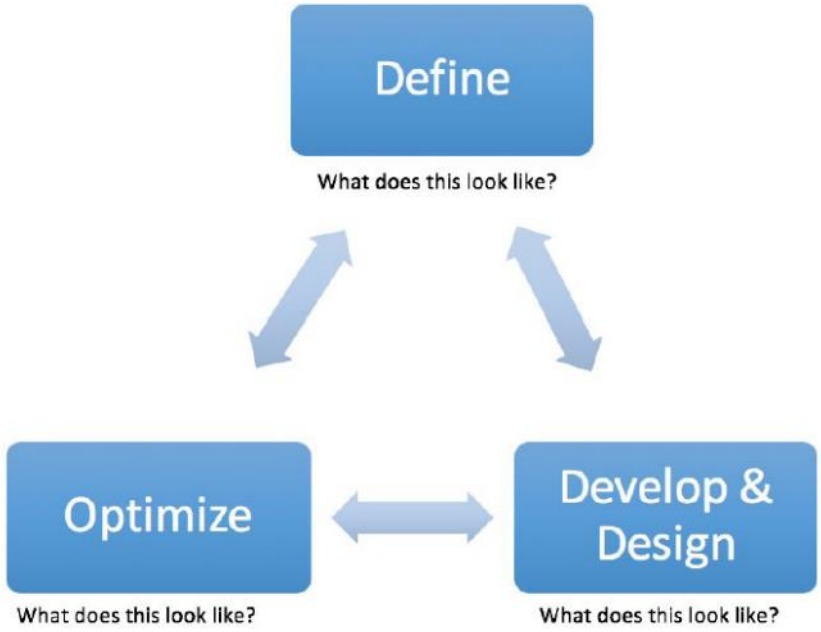
The *Salish Sea* map was produced using a Geographic Information System (GIS) and publically available spatial datasets for elevation, bathymetry and hydrology. Variations of color on the map are based on elevation (not actual land cover). Colors were chosen to mimic the 'feel' of the Pacific coast landscape (lighter greens for the lowlands, white for the mountain peaks). In addition a *'hillshade'* effect has been created casting a virtual 'shadow' across the landscape to better depict the topography as if one is seeing a 3-dimensional shaded relief model. Similar color gradations are applied to the bathymetric data, again with a shadow effect applied as a *'floorshade'* (i.e. a 'hill'-shade for the ocean floor).
The *Salish Sea* basin boundary was derived from the elevation data following the peaks and ridges. Areas outside the surrounding basin have been shaded by a semi-transparent overlay to highlight the geographic area draining into the *Salish Sea*. Note that the entire upper *Fraser River* watershed is technically a part of the *Salish Sea* drainage area. For this map, the *Salish Sea* basin has been defined as just that area draining directly to the ocean, including only the lower *Fraser River* watershed. It is unusual for a map of this type to not include the cities, roads and borders that have been created by humans. Instead, this map focuses on the *Salish Sea* and its surrounding watershed, defined not by political jurisdictions but by the geography of the water and land itself. As such, the text labels on the main map are likewise used only for the natural features defining the *Salish Sea*.

Cartography: Stefan Freelan, 2009 Elevation Data: SRTM (CGIAR-CSI)8
Software: ESRI's ArcGIS 9.2 Bathymetry Data: NOAA, Wa. DFW
Adobe Photoshop CS 8.0 Additional Data: Wa. DNR, BC Digital Atlas, ESRI

1 GIS calculations derived from US Census Bureau data and Canadian Census statistics (http://www.censusfinder.com/ & http://www.metrovancouver.org/about/publications/Publications/KeyFacts-MetroVancouverPopulationEstimates1996-2007.pdf & http://www.vancouverisland.com/information/).
2 GIS calculations derived from SRTM elevation data.
3 *Water Properties in the Straits of Georgia and Juan de Fuca*, Emilie Davenne and Diane Masson, Institute of Ocean Sciences, Sidney, BC, Canada, 2001 (http://www.pac.dfo-mpo.gc.ca/sci/osap/projects/straitofgeorgia/JdFG_e.pdf).
4 *The Puget Sound Model Summary*, John H. Lincoln, University of Washington, Department of Oceanography, Seattle, Wa.
5 *Species of Concern within the Georgia Basin Puget Sound Marine Ecosystem: Changes from 2002 to 2006*, Nicholas A. Brown and Joseph K. Gaydos, The SeaDoc Society, 2007 (http://www.vetmed.ucdavis.edu/whc/seadoc/pdfs/brown-gaydos07.pdf).
6 *Puget Sound Georgia Basin Ecosystem*, US EPA website, 2009 (http://www.epa.gov/region10/psgb/).
7 *The Washington State Board of Geographic Names* (http://www.dnr.wa.gov/AboutDNR/BoardsCouncils/WBGN/) and the *Province of British Columbia Geographialc Names Office*.
8 *2008, Hole-filled SRTM for the globe Version 4*, Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara, (available from the CGIAR-CSI SRTM 90m Database: http://srtm.csi.cgiar.org).

What did you learn about environmental and health justice in the WWU and Huxley College leadership program? Are local community members influential in efforts to achieve environmental and health justice? If not, do you have some ideas of how they could be more involved, and more influential?

Think like an engineer. Engineers are problem solvers. How do they do it?

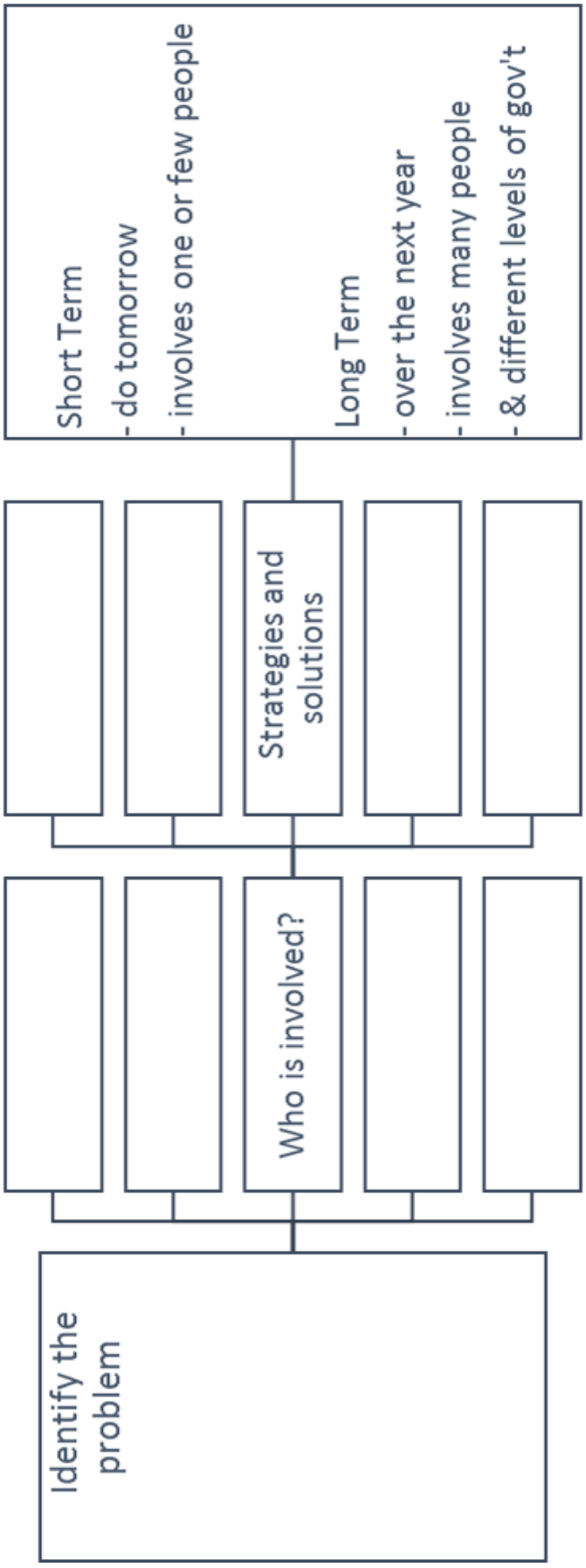


Research, research, research. What has already been done to tackle the problem? Who has done it? Where has it been done? What did they find out?

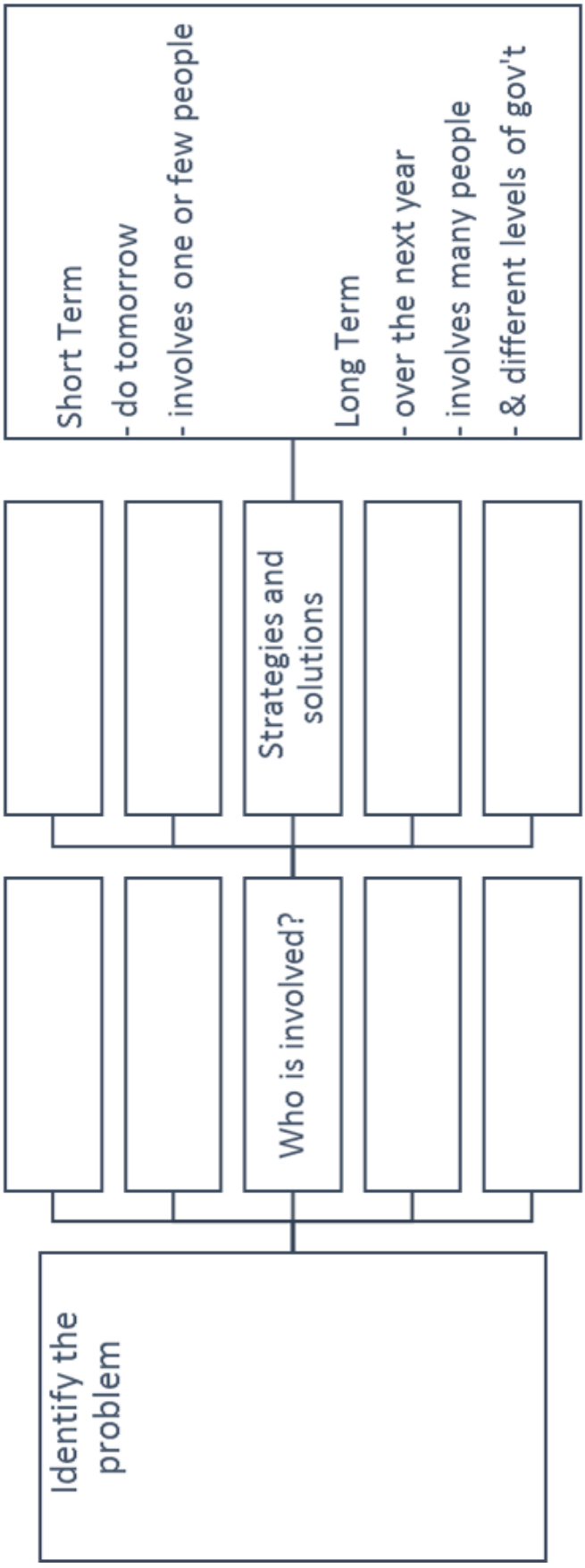
Brainstorm a bunch of ideas. What would a developed solution or prototype look like?

There is no perfect solution...so analyze your solution. What are its constraints, parameters, possible failure points, and trade-offs you make in your proposed solution.

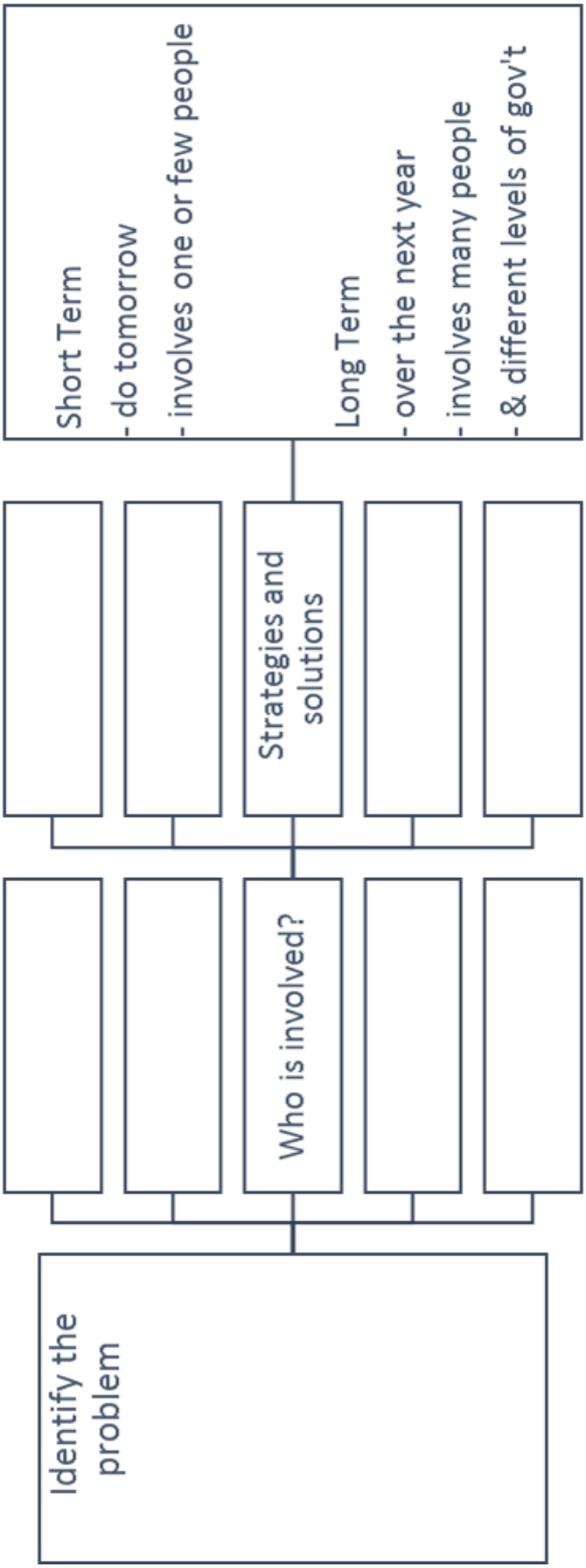
Mr. D’s Problem-Solving Trees.



Mr. D’s Problem-Solving Trees.



Mr. D’s Problem-Solving Trees.



Mr. D’s Problem-Solving Trees.