PROGRAM ON THE ENVIRONMENT
UNIVERSITY of WASHINGTON

# Autumn 2022

# CAPSTONE SYMPOSIUM

Wednesday, November 30, 2022
Online, 4:30 – 7:30 pm

Wednesday, December 7, 2022
In-Person, 5:00 – 7:30 pm

*The Capstone experience is a three-course series (ENVIR 490, 491, 492) centered on a quarter-long project-based internship with a community site partner. Capstone sites range from community-based non-profits and government agencies to faculty research projects and private sector initiatives. With the mentorship of a faculty advisor and the support of the site supervisor, students gain valuable hands-on experience, explore career possibilities, and build a wide spectrum of professional communication skills.*

**Share your thoughts on Twitter**
Students will be live-tweeting all sessions so if you miss one, follow the updates. If you tweet, we encourage you to share what you learn and use the hashtag, #POEcap.

Tree Health In a Warming Climate: A Synthesis of the Western Redcedar Case Study

Hibaaq Arte, @HibaaqArte, Program on the Environment, University of Washington

Session A, Breakout Room #1

Site Supervisor: Dr. Joseph Hulbert, Forest Health Watch/ WSU Puyallup Research and Extension Program

Faculty Advisor: Dr. Eli Wheat, Program on the Environment, University of Washington

Urban tree health is imperative to the overall functioning of the diverse ecosystem that is the urban environment. With climate change increasing in severity causing temperatures to rise, research on the impact of heat on urban trees is pivotal as we aim to keep communities and ecosystems healthy and balanced. My internship with the Forest Health Watch program focused on work performed by Dr. Joseph Hulbert, University of Washington capstone students (Angela Gaither and Lyndsay Felthoven) and community scientists on heat related impacts to the Western Red cedar. The coniferous tree is native to the Pacific Northwest and holds deep cultural ties to the state of Washington, thus making it the focus of the studies research efforts. During the study the health of 382 trees were measured within areas of King County Washington where air temperatures were estimated through a heat mapping effort (these measurements were conducted by 56 community scientists). Additionally, one-hundred and ten randomly selected street trees in Seattle and Renton were also visited to estimate the percent canopy dieback (these estimates were performed by Dr. Joseph, Angela Gaither and Lyndsay Felthoven). Distribution of temperature data were most distinct between health classes in the afternoon with the exception of trees that were dead. A positive linear relationship was noted between percent canopy dieback and average temperatures. These results indicate the benefits that communities receive from redcedar trees may be reduced by warming temperatures. Benefits such as their ability to mitigate the effects of urban heat islands, improve mental health, and even decrease urban crime rates.

# CRAB BATTLES: COMPARISON OF THE EARLY LIFE HISTORY OF DUNGENESS CRABS TO YELLOW SHORE CRABS

Brendan Beaudette, @Brendoscience, Program on the Environment, University of Washington

Session A, Breakout Room #2

Site Supervisor: Sean McDonald, University of Washington, Pacific Northwest Crab Research Group

Faculty Advisor: Julie Keister, College of the Environment, University of Washington

There has been a 97% decrease in Dungeness crab populations in the South Puget Sound region since 2005. The group I work with (Pacific Northwest Crab Research Group) is taking on the responsibility to understand why this is the case. The purpose of this study was to see if larval patterns in Dungeness crabs (*Cancer m.*) and yellow shore crabs (*hemigrapsus o.*) have a clear connection to the early benthic patterns in the two species. During my time with PCRG, I recorded abundances of Dungeness crab larvae and shore crab instars using a light trap to catch the two species. I then conducted a form of research called nearshore intertidal surveying to record abundances of Dungeness crab instars and yellow shore crab adults in nearshore habitats. The results of my research showed yellow shore crabs being more abundant than Dungeness crabs in both the light trap and nearshore habitats in the months of July and August, which points towards yellow shore crabs outcompeting Dungeness crabs for ideal nearshore habitats in their early benthic phase during those months. The significance of finding the connection between the early life histories of these two crab species is that it shows how the two species interact in their early life histories. Understanding the interaction between the two species in their early life histories is vital because it can answer important questions such as how the timing of abundance plays a role in the coexistence of both Dungeness crabs and yellow shore crabs.

# CAN TRAWLING GEAR BE MODIFIED TO CATCH FISH MORE EFFICIENTLY?

Yeandya Teklu, @YeandyaT, Program on the Environment, University of Washington

Session A, Breakout Room #3

Site Supervisor: Susan Wang, National Oceanic and Atmospheric Administration

Faculty Advisor: Tim Billo, Program on the Environment, University of Washington

Video analysis holds a great deal of information needed for researchers and scientists to understand better what improvements are needed in order to save the underwater ecosystem. With that said, bycatch is a major issue affecting marine life and negatively impacting the ecosystem. Trawl gear is largely connected to this issue, its large and aggressive net has been known to injure, kill or target species that were not meant to be caught. This has led to a decline in population, impending population recovery and harm to all kinds of species. The purpose of this study is to collect data on various marine species to better understand what it is that scientists and researchers can do to improve net function therefore improving fisheries management and decrease harm to marine life caught. To accomplish this I analyzed the video footage and categorizing the data to see what behavioral characteristics stood out most when fish interacted with the net. The longer we take to make these improvements the more environmental damage there is. Researching trawl gear and understanding the changes we can make to improve net safety for marine life is mandatory in order to improve the situation we face today.

# IDENTIFYING TRENDS IN DUNGENESS CRAB LARVAL ABUNDANCE ACROSS PUGET SOUND

Ally Galiotto, @angaliotto, Program on the Environment, Marine Biology, University of Washington

Session A, Breakout Room #4

Site Supervisor: P. Sean McDonald and Emily Buckner, University of Washington, Pacific Northwest Crab Research Group

Faculty Advisor: Tim Essington, School of Aquatic and Fishery Sciences, University of Washington

Dungeness crab (*Cancer magister*) populations declined unexpectedly and dramatically in South Puget Sound over the last decade. While the exact cause of collapse remains unknown, larval dynamics and recruitment processes were likely involved. Assuming the population is recruitment-limited, abundance and transport patterns of Dungeness megalopae (the final larval stage) can be used to make predictions about future adult population levels. This study aimed to explore the spatial and temporal variation of Dungeness megalopae in Puget Sound, and to identify patterns in abundance that correlate with changes in tidal forcing. I worked with Pacific Northwest Crab Research Group (PCRG) to track larval abundance at a sampling site in Seattle, and I obtained past data from four other locations in Puget Sound. I then modeled catch over time to compare the sites and fit relevant predictor variables. I found that megalopae abundance is higher and the settlement period is earlier at sites near the Strait of Juan de Fuca, suggesting an influx of oceanic megalopae into northern Puget Sound. Short-term peaks in abundance appear to coincide with spring tides, confirming the role of tidal forcing in larval transport. Overall, megalopae abundance is determined by the spring-neap tidal cycle, the timing of springtime upwelling, and circulation between the Pacific Ocean and inland waters. These results provide insight into the complex processes that drive settlement and recruitment in Dungeness populations. Eventually, PCRG will use megalopae abundance data to predict commercial catch four years in advance, allowing fishery managers to create sustainable, long-term management strategies.

# HOW GRASSROOTS SUSTAINABILITY INITIATIVES CAN BE FACILITATED IN THE CORPORATE SECTOR

Kaylee Kobashigawa, @kjkaylee_, Program on the Environment, University of Washington

Session A, Breakout Room #5

Site Supervisor: Sophia Ahn, Seattle Public Utilities

Faculty Advisor: Fred Pursell, Foster School of Business, University of Washington

Despite more companies feeling the pressure to commit to sustainability policies based on government, activist, and shareholder voices, the role of broader employees in shaping these sustainability practices remains minimally studied. However, employee-led sustainability approaches may aid in strengthening organizational engagement, ensuring long-lasting adoption, and increasing employee retention/recruitment. Due to this array of potential advantages, my study sought to investigate the factors that contribute to the origins of corporate sustainability practices (top-down vs bottom-up strategies). These lessons could then be utilized when approaching the implementation of my host organization's Reuse Seattle program. While interning with Seattle Public Utilities' Reuse Seattle team, I interviewed and surveyed corporate-sector employees about their experiences with sustainability to help answer my research questions. The interviews focused on the perspectives of senior-level corporate sustainability leadership while the surveys targeted entry/intermediate-level employees. Although my research showed that there are opportunities for both top-down and bottom-up approaches, they may be utilized for different purposes. My research and literature review also uncovered that work culture (as displayed through organizational support and co-worker relationships) and communication/education (as influencing employee perceptions of sustainability) can contribute to how workplace sustainability practices are initiated and engaged with by employees. Bridging organizational sustainability through effective communication/education and a more supportive work culture could be crucial for successfully implementing sustainability practices, like Reuse Seattle. As this occurs, workplace sustainability norms may shift and lead to the corporate sector scaling up its goals.

# AQUACIDE: DIQUAT DIBROMIDE AND ITS EFFECTS ON PORTAGE BAY WILDLIFE

Tore Landboe, @ToretheExplora, Program on the Environment, University of Washington

Session A, Breakout Room #6

Site Supervisor: Reynaldo Lopez, Agua Verde Paddle Club, Inc

Faculty Advisor: Jason Toft, School of Aquatic and Fishery Sciences, University of Washington

The Boat Street Marina is a small for-profit moorage located on Portage Bay in Seattle, Washington. Each summer the invasive aquatic plant Eurasian Milfoil blooms in the marina, tangling the props of patron boaters, and decreasing the area's property value. To reduce the presence of Milfoil, the aquatic herbicide Diquat-Dibromide is applied to the marina. Diquat is a non-selective and toxic chemical that is banned in the European Union, however readily available for use in the United States. The Boat Street marina is also habitat to species of bird, reptile, and amphibian which are in contact with the Diquat. However, the effects of Diquat on these wildlife populations has not been researched. The purpose of this study is to determine if correlation between Diquat levels in the marina and wildlife presence exists, and if this treatment technique should be modified. To accomplish this task wildlife populations were counted bi-weekly in three different locations within the Marina and surrounding area. Water and sediment samples were also taken from two locations in the marina and tested for Diquat concentrations. This data was then compiled onto graphs in order to directly compare Diquat levels to wildlife populations. Results show that with increased levels of Diquat , wildlife populations of observed species decreased. However wildlife populations fluctuated consistently in all three locations without change in Diquat presence. This suggests environmental factors other than Diquat are the main deterrent to wildlife in the Marina, and aquatic herbicide applications can continue without jeopardizing the marinas wildlife.

# SALMON HABITAT MONITORING EFFORTS AND AREAS FOR IMPROVEMENT

Jeremy Leung, @JremyLeung, Program on the Environment, University of Washington

Session A, Breakout Room #7

Site Supervisor: Melissa Fleming, Stillwaters Environmental Center

Faculty Advisor: Mark Scheuerell, School of Aquatic and Fishery Sciences, University of Washington

Salmon has been an ecologically and economically important subject in the Pacific Northwest region for time immemorial. From providing nutrients to a wide range of animals like orcas and bears to creating jobs in the multi-million dollar fishing industry, salmon continues to be a key species that many communities rely on for support. The problem arises when overfishing and human-made obstructions have limited salmon populations from recovering through the blockage of important habitat for growth. Within the recent two decades, multiple restoration and monitoring efforts have been implemented to restore salmon. The purpose of this study was to participate in one of these monitoring efforts to see the complexities of restoration work at Carpenter Creek led by Stillwaters Environmental Center in Kingston. To accomplish this task, I interned with Stillwaters to gather and analyze stream water data following the procedures with several volunteers, and corroborated the data with several literature articles on ideal salmon habitat and ways to optimize restoration. The resulting data was compiled into an infographic used by Stillwaters for the public. The findings from the work showed that there have been several times throughout the years of monitoring data in which certain spots of Carpenter Creek were nonoptimal for salmon development. Due to the way that data was taken only once a month by volunteers, methods of monitoring could be improved at a larger scale, as noted by several literature articles to improve the field of restoration work.

# RETURN TO EQUILIBRIUM: MONITORING THE RECOVERY OF A SALT MARSH IN KINGSTON, WA

David Lin, @lin2500, Program on the Environment, University of Washington

Session A, Breakout Room #8

Site Supervisor: Melissa Fleming, Program Director, Stillwaters Environmental Center

Faculty Advisor: Jason Toft, School of Aquatic and Fishery Sciences, University of Washington

Salt marshes are essential ecosystems for protecting coasts from extreme weather events by reducing erosion from floods and hurricanes, and for filtering pollutants that preserve water quality. Urban development along coastal areas has led to insulation of wetland ecosystems due to bridges with narrow underpasses, severely limiting the amount of water that can flow in from the sea. Over time, the lack of water converts wetlands into non-tidal riparian forests (near a body of water), and makes coastal communities more vulnerable. More recently, substantial efforts have been made to restore wetland ecosystems to their former state. However, the changes that have resulted in these projects are not well documented. The aim of this study was to evaluate the methods for which we can track these changes over time. This was accomplished by collecting quantitative data of red alder trees and the salinity of the soil near them along the Northwest edge of the Carpenter Creek salt marsh. Through analysis of tree ring widths and salinity of soil samples, my results found a positive correlation between the salinity of the soil and the decline of the alder tree's health. This study provides a proof of concept on how agencies like Stillwaters might evaluate the recovery of a salt marsh from the return of tidal inundation. A greater significance may be to evaluate how the exposure of riparian forests to sea water may serve as a proxy for how sea level rise may affect similar ecosystems in the future.

Candidates for Future Sustainable Transportation

Michael Qiu, @Michael44576962, Program on the Environment, University of Washington

Session A, Breakout Room #9

Site Supervisor: Eugene Kramer, Seattle Subway Foundation

Faculty Advisor: Yen-Chu Weng, Program on the Environment, University of Washington

To make our society more sustainable, figuring out the necessity of merging green transportation into our future transportation structure is essential. Thus, effective green transportation should be designed and organized to reach the purpose. This project aims to compare the advantages of future green/sustainable transportation. Mostly, three types will be compared: EVs, biking, and public transportation. The basic method I employed is collecting people's opinions from an online survey. I have collected nearly 80 valid responses which will be used to visualize the data through figures and tables. These results are coming from public opinion from my outreach event. Also, I have done quantitative internet research and creditable academic work to get basic information. I find that every type of sustainable transportation has its unique advantage which confirms my initial idea, for example, taking public transport like the subway, could effectively reduce your travel time and money. However, it also has many unresolved problems, like no privacy or safety concerns. The importance is by figuring out some good candidates, the result could be used as an inspiration or advocation. It's not bad to let different audiences recognize how the public feels about current sustainable transportation and how they could change shortly.

# LUMBER MILLS AND CERTIFICATIONS: WHO KNEW IT WOULD BE THIS HARD?

Ashley Rosales, @ArosalRosales, Program on the Environment, University of Washington

Session A, Breakout Room #10

Site Supervisor: Rowan Braybrook and Seth Zuckerman, Northwest Natural Resource Group

Faculty Advisor: Indroneil Ganguly, Associate Professor, School of Environment and Forest Sciences, University of Washington

Lumber is a crucial element of Washington's economy. Green certifications in the lumber industry, like FSC certification, help show consumers that their wood comes from sustainability-managed forests and mills. However, there is a disconnect between FSC Certification and Lumber Mills in Washington, and Northwest Natural Resource Group (NNRG) wanted to know why. NNRG is a non-profit that does group certifications for forests in the pacific northwest. There is plenty of FSC-certified wood, but when it comes to getting it into certified mills, there is a missing link. The purpose of this study was to visit and interview the various lumber mills in Washington to ask them their general views on certifications and then, more specifically, why they aren't FSC certified, let their certification lapse, or are currently certified with a different certification like SFI or PEFC. To accomplish this task, I created a survey of about thirty questions that took me about thirty minutes to do as an in-person interview. I then took the different responses to these survey questions and compared them to each other to determine the most significant barriers for lumber mills in getting FSC certified. I found that the three most prevalent barriers to the lumber mills were the lack of price premium for FSC-certified wood, the lack of consumer interest, and the cost of certification. For FSC to expanding in Washington, there will need to be large changes that create a monetary gain for the lumber mills, or they will not be getting certified.

# DOUGLAS FIR MORTALITY: MONITORING DOUGLAS FIRS IN SEWARD PARK

Ryland Schaul, @SchaulRyland, Program on the Environment, University of Washington

Session A, Breakout Room #11

Site Supervisor: Paul Shannon, Friends of Seward Park

Faculty Advisor: Tim Billo, Program on the Environment, University of Washington

Douglas firs (DF) are a key and abundant tree species in the Pacific Northwest (PNW). DFs often dominate forests and serve various roles that include: becoming nurse logs, creating forest canopies, creating wildlife homes, and encouraging forest succession. Seward park is a DF dominated forest which has experienced decline in its major species (Western Hemlocks and Sword Ferns). This documented decline and elevated concerns raised the question: What is the mortality rate of DFs in Seward Park? With the effects of climate change increasing, longer summers and drought, the succession of PNW forests could be changing. The purpose of this study was to create an estimation on the mortality rate of DFs in Seward park to ensure that they were dying at their expected rate. To conduct this research, my site supervisor and I collected data on every fallen DF log we could locate within 20ft of the main trails. We surveyed for diameter at breast height, number of branches, level of collapse, number of epiphytes, and bark coverage. Upon gathering this data, we were able to use collapse as the most reliable measure of decay and created a model that approximated fall dates for DF logs. I also reviewed literature to identify a normal DF mortality rate. Through our research, we came to the conclusion that DFs in Seward park are within the normal range of DF mortality rates. These findings can prove to be helpful with forest adaption and succession concerns as climate change continues to progress.

# WEEKLY OBSERVATION OF TIDE DATA AND WIND CONDITIONS OF DUNGENESS CRAB MEGALOPAE

Taylor Welch, @twelchuw, Program on the Environment, University of Washington

Session A, Breakout Room #12

Site Supervisor: P. Sean McDonald, University of Washington, Pacific Northwest Crab Research Group (PCRG)

Faculty Advisor: Randie Bundy, Department of Oceanography, University of Washington

Dungeness crabs (Cancer magister) are found in the chilly waters of Puget Sound and are sustainable and delicious throughout the country. The Dungeness crab larval stages pass through six stages over a 105-to-125-day period and the last two stages are zoea and megalopae. The aim of this study was to understand the different environmental variables and compare the abundance of Dungeness crabs. The internship responsibilities were checking the light trap every other day at Shilshole Bay Marina and counting the abundance of Dungeness crab megalopae and other marine species with my cohorts. The Dungeness crab abundance information is noted on an updated shared PCRG Capstone Google drive. Additionally, I conducted independent research including two different websites to collect additional data. One of the sites contained saltwater tide information, which enabled me to check if the tide was going to be high or low and getting the tide's height as well. Another website was NOAA's National Data Buoy Center (NDBC) to check the wind conditions that were recorded the day of larvae collecting – including wind speed and wind direction. The implications are that the Dungeness crabs are likely to change with changing climate, thus understanding how environmental limitations impacts larval abundance will help us predict these changes in the future.

# AIDING THE BANDAID: HOW DO WE IMPROVE FOOD CHARITY?

Hannah Whobrey, @hannahwhobrey, Program on the Environment, School of Public Health

Session A, Breakout Room #13

Site Supervisor: Jordyn Egbert, City Fruit

Faculty Advisor: Alan Ismach, Center for Public Health Nutrition, University of Washington

At least 1 in 10 Americans struggle to access safe and nutritious food, known as food insecurity. Food assistance programs distribute food to support populations experiencing decreased access. However, these programs are primarily private and decentralized, leading to inefficiencies and limitations in addressing food access. Private programs often do not have enough food, offer limited choices, and suffer from instability and inaccessibility, causing indignities for program guests. Improving the support provided by these programs is critical in order to expand food access and reduce negative impacts, such as inadequate nutrition, on food insecure populations. The purpose of this study is to identify best practices for Seattle-area food assistance programs, in order to better serve food insecure populations. While interning at Seattle-based food assistance organization City Fruit, where I supported fruit harvesting and community outreach, I collected data through interviews with staff at 10 local programs and a public survey. Through these experiences, I gathered recommendations on how programs can better serve food insecure people. Key practices for cohesive, equitable care included eliminating barriers; prioritizing programs' host and target communities; actively countering stigma; and increasing inter-organization collaboration. These small scale changes to the frontlines of food assistance would make a rapid and tangible difference to food insecure populations, providing better support and mitigating harm on the ground while work continues toward systemic change addressing hunger's root causes.

# How Art Helps Kids Process Environmental Knowledge

Autumn Aho, @AhoAutumn, Program on the Environment, Community, Environment, and Planning, University of Washington

Session B, Breakout Room #1

Site Supervisor: Nicolette Riggins, Chrysalis Forest School

Faculty Advisor: Lubna Alzaroo, Program on the Environment, University of Washington

My research project was focused on environmental education, a way to connect to future generations and create a framework for teaching methods. New practices are still being established within community efforts and educational data to support effective and meaningful learning strategies. This research seeks to understand how forestry schools as educational spaces can help students understand the environment more deeply through the use of data analysis. In order to answer this question, I made an annotated bibliography for 10 sources related to environmental education, forestry school, and using art as a teaching method. My internship was working with the Chrysalis Forestry School as an assistant teacher. I would collect data regarding if art can make a difference in supporting children to digest environmental knowledge. I did this research due to the current issue of children growing up not gaining an understanding of where the health of our planet stands through our current education system, in turn hindering their sense of environmental stewardship. My study had the forestry students draw what they think nature looks like throughout the internship. I took those drawings and analyzed the biotic and abiotic properties into a survey. In the survey over the internship I saw an increase in details and biotic figures, showcasing the importance of living figures to create a healthy biodiverse environment. Between the sources and drawings I came to the results showing that art can make a large difference in helping kids retain knowledge. Art is a form of teaching that can broaden the scope of environmental communication that I found through this research of teaching environmental ethics to children. Along with all sustainable resource management through a mixed methods approach of art along with an analytical method of surveys. This together gave me the most effective summary of the research that looked into the scale of environmental consciousness the students had when drawing their art and looking at the patterns of changes throughout the course length. These findings of this research are primarily meant for Chrysalis Forestry School, an outdoor school that can use the implications of art to make a difference in retaining environmental knowledge in schools and directly benefit the students.

# CLIMATE ANXIETY AND ITS RELATIONSHIP WITH ENVIRONMENTAL EDUCATION AND ACTIVISM

Camille Andrew, @CamilleAndrew_, Program on the Environment, University of Washington

Session B, Breakout Room #2

Site Supervisor: Kristen Attebery, University of Washington Bothell, and Stephan Classen, Cascadia College

Faculty Advisor: Gary Handwerk, Program on the Environment, University of Washington

Eco-anxiety, also known as climate anxiety, is term that defines the feelings of worry people feel in response to climate change. It's a relatively unexpected consequences of climate change and in recent years, the media and scientific research have been exploring how eco-anxiety is impacting people, especially the younger generations, around the world. The goal of my research was to explore the connection between eco-anxiety and environmental education as well as how this relationship in turn impacts involvement in activism. To address this, I interviewed 4 different environmental professionals on the Common Caws for Sustainability podcast: an ecofeminist philosopher-in-residence at an elementary school, a founder of an environmental activist organization, a president of a village tribal council, and a climate psychologist. Findings from the interviews suggest that education needs to be reframed in a manner that allows for inquiry; children should be able to ask questions about what's happening and receive honest answers. Emphasizing generational thinking in spaces of education is another key to better educate children. To alleviate eco-anxiety, the interviewees repeatedly mentioned finding groups of like-minded individuals to discuss and work through these feelings regarding climate change. These results provide guidance for educators and for parents/guardians to better prepare children for the climate crisis. Implementing steps in the current education system that motivate children to get involved in climate action without increasing levels of anxiety is crucial for slowing the effects of climate change and maintaining the mental health of the next generations.

# TREES? YES PLEASE: FOREST SCHOOLS & THE DEVELOPMENT OF SOCIAL AND ENVIRONMENTAL INTERACTIONS

Eva Maria Burns, @evamariaburns0, Program on the Environment, University of Washington

Session B, Breakout Room #3

Site Supervisor: Julia Glassy, Fiddleheads Forest School

Faculty Advisor: Jessica Thompson, College of Education, University of Washington

In recent years, there has been a growing concern that children are not spending enough time outside and are instead spending too much time inside on technology. Not only is this affecting their social development, but also their relationship to the environment. Forest Schools have been around since the 1950s and are viewed by many as a positive method of education. However, a lack of research has been done on the specific benefits of how forest schools could help children's development of social and environmental awareness. The purpose of this study was to examine how forest schools, such as Fiddleheads Forest School in Seattle, positively aid the development of social and environmental interactions among young children. To accomplish this task, I created and utilized an observational chart, in which I surveyed 4-5 students during each of the three summer classes. The factors I observed included how children dealt with productive tensions, collaborated with one another and how they interacted with nature. The observations I made during my time at Fiddleheads Forest School were positive. They demonstrated that forest schools are a great educational environment for students to strengthen their social and environmental development. The constantly changing environment provides students with different situations that increase their ability to face challenges within themselves, and how they act towards others. While Forest Schools may have certain elements that aren't necessarily suitable for all kids, there is great potential for many children to benefit from Forest Schools, or even from outdoor education

# THE LIMITATIONS OF RESIDENTIAL SUSTAINABLE LANDSCAPING AND HOW TO OVERCOME THEM

Alyson Cline, @A_cline9, Program on the Environment, University of Washington

Session B, Breakout Room #4

Site Supervisor: John Coghlan, HomeGrown Organics

Faculty Advisor: Ken Yocom, Landscape Architecture, University of Washington

We are all well aware of climate change and hear about its worsening impacts nearly daily. With urbanization and major corporations only making the problem worse, there seems to be little hope. But one step in the right direction could be sustainable landscaping in replacement of harmful, conventional grass lawns to reduce our negative environmental impact as a society. The purpose of this study was to figure out what was preventing or limiting homeowners from changing their own yards into a more sustainable alternative. To accomplish this task, I interviewed 4 subgroups of people while interning with HomeGrown Organics (1. Workers within sustainable landscaping 2. Homeowners with sustainable landscapes 3. Homeowners who inquired about sustainable landscaping but decided against it 4. Homeowners with a conventional landscape). The main themes throughout my interviews came down to 3 ideas: too expensive, lack of awareness/knowledge on the topic and did not like the aesthetic of sustainable landscaping, felt too wild. All 3 of these limitations can be overcome with economic incentives, educational programs, and social marketing, respectively. These changes could help encourage sustainable landscaping and make it more normalized in our society. Which in turn can lead towards a greener, more sustainable future.

# ENCOURAGING BEACHGOERS TO KEEP WILDLIFE WILD: PINNIPED SCIENCE COMMUNICATION

Mikaela Ebbeson, @MikaelaEbbeson, Program on the Environment, Dance, University of Washington

Session B, Breakout Room #5

Site Supervisor: Donielle Stevens, NOAA Fisheries West Coast Region

Faculty Advisor: Kristi Straus, Program on the Environment, University of Washington

With an increase in coastal urbanization and pinniped populations, there has been an increase in harmful human interaction with the wildlife that impacts animal survival behaviors, public health, and sentinel research efforts. Communicating responsible wildlife viewing guidelines has not been as successful as needed in this area would benefit from examination. The aim of this study is to identify and amplify the best communication practices to encourage responsible wildlife viewing of pinnipeds. I interned with NOAA Fisheries West Coast Region on the Share the Shore campaign where I learned about communication strategies focused on responsible wildlife viewing guidelines for pinnipeds and other marine mammals, as well as created various web content materials. I also conducted a literature review and interviewed six marine science communication experts specialized in a variety of communication mediums. I found that transdisciplinary collaboration, community inclusion, a balance of accessible and experiential learning opportunities, and intentionally designed and delivered messaging are vital components of successful marine science communication. These practices can spark the most change in the most impactful audiences, promote stronger retention of knowledge, and cultivate a sense of personal ownership in marine issues. These are all important to reducing harmful interactions between beachgoers and pinnipeds and will also build up ocean stewardship in coastal communities on a larger scale. Amplifying these practices in marine science communication will promote human and wildlife health and facilitate better human relationships with marine environments amidst growing conflict over the use of these shared natural spaces.

# HOW COMMUNICATION DIFFERENCES IMPACT THE EFFECTIVENESS OF ENVIRONMENTAL ORGANIZATIONS

McKenna Eggers, @EggersMckenna, Program on the Environment, Interdisciplinary Honors Program, University of Washington

Session B, Breakout Room #6

Site Supervisor: Lara Whitely Binder, King County Climate Action Team

Faculty Advisor: John Meyer, Communications, College of the Environment

Implementing suitable communication techniques is critical to the effectiveness of an environmental organization. There are large differences in how environmental organizations choose to communicate with the public that, in turn, create differences in how effective an organization is at promoting action. The specific methods employed by an organization can expand or limit its support and scope of influence. Communication methods are largely influenced by organization-specific goals, target audience, available resources, use of emotion, and organization structure. This study investigates communication techniques to identify key differences and determine how communication methods impact an environment organization's ability to promote action. Evidence was collected through a literature review, supported with anecdotal findings during development of the King County Climate Action Team's Climate Change Resource Hub. Results indicate that the four aforementioned factors have an interdependent impact on how an organization communicates. Furthermore, how organizations approach each of these factors impacts their ability to promote action. Creating competing audiences, relying on membership funds, failing to incorporate emotion, and inadequate utilization of resources and social media all impede an environmental organization's ability to promote action. Therefore, communication is a key source of information when analyzing environmental organizations; the public must be conscious of these communication methods when engaging with environmental organizations. Additionally, it is important for environmental organizations to be able to effectively communicate about other ways to participate in climate action outside of their specific goals.

# BRIDGING THE GAP: USING COMPLEX DOCUMENTS FOR GENERAL ENVIRONMENTAL COMMUNICATION

Rachel Glessner, @RachelRoo7, Program on the Environment, University of Washington

Session B, Breakout Room #7

Site Supervisor: Eugene Kramer, Seattle Subway Foundation

Faculty Advisor: Leah Rubinsky, Environmental Communication, University of Washington

Environmental impact statements (EIS) are complex and valuable documents that are used mostly in political and professional spheres to monitor the potential a proposed project has to impact the surrounding environment. However, there is a surplus of information provided by these documents, such as traffic changes, air quality, water quality etc., that is not being shared properly with the public and local communities that these documents were created in. The purpose of this project was to find ways to use environmental impact statements to their fullest as environmental communication tools, on local and national scales. To accomplish this task, I gained first hand experience writing an EIS and gained familiarity with the greater Seattle community. Much of my experiential data was gathered from conversations about transit at farmers markets, pride events, and other public settings all over Seattle. From these experiences I noticed there was a disconnect between the complex environmental document I was writing and the extremely general information we were giving the public. The observational data I gathered resulted in the discovery that environmental impact statements are not being used to their fullest potential and can be modified easily to better serve the public. Through synthesizing pertinent information into an easily digestible and distributable document, easily accessible websites with the EIS's listed and providing spaces to discuss results, environmental impact statements can become much more useful environmental communication tools.

# THE RULE OF LAW: EQUITABLE ENVIRONMENTAL POLICY IN THE UNITED STATES

Anneliese Hasenbalg, @itsonalease, Program on the Environment, University of Washington

Session B, Breakout Room #8

Site Supervisor: Lisa Hiruki-Raring, National Oceanic and Atmospheric Administration, Alaska Fisheries Science Center

Faculty Advisor: Gary Handwerk, Program on the Environment, University of Washington

As climate change continues to affect weather patterns, ecosystems, and human infrastructure, often for the worse, life in this country will change dramatically. It is the responsibility of the government to support their communities and provide aid in times of need. The purpose of this study was to analyze two historical cases of legal action focused on underserved communities, the Japanese Redress movement of the 1970's and 80's, and the Flint, Michigan water crisis. I believe that these cases and similar early reparations-style policy could be used to to assist the United States government develop environmental crisis remediation policy. My work with the National Oceanic and Atmospheric Administration Alaska Fisheries Science Center (NOAA AFSC) provided me with many resources connected to the Japanese incarceration during the Second World War, as well as information on many diversity initiatives. I conducted online research about both cases to build my analysis, as well as examining research on environmental inequity, reparations, and relationship management. A governmental office that could accept communities' claims for aid in cases of environmentally-based tragedies, as well as give those communities a platform to control the public narrative of their story could be beneficial to communities in need and reduce human suffering. By developing federal policy that could more effectively and equitably distribute aid to communities in need, the government would be better prepared to address environmentally based crises.

# ENVIRONMENTAL MORAL DILEMMAS: UNDERSTANDING AND LIVING WITH MORAL UNCERTAINTY ABOUT CLIMATE CHANGE AND BEYOND

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Session B, Breakout Room #9

Site Supervisor: Stephan Classen, Cascadia College; Kristen Attebery, University of Washington – Bothell

Faculty Advisor: Stephen Gardiner, Department of Philosophy, University of Washington

Moral uncertainty is defined as being unsure of what the morally correct choice is under given circumstances. With regards to environmentalism, moral uncertainty can manifest itself in multiple ways. One way is through ethical dilemmas: is it permissible to keep animals in zoos if they experience good welfare? Another way is uncertainty of the extent that personal sacrifices must be made, such as if one should buy an electric car. At a personal level, moral uncertainty may cause people to experience guilt from feeling as though they are not acting adequately. At a societal level, it can lead to "action paralysis", i.e., inaction. The purpose of my research was to gather insights about how one ought to behave under environmental moral uncertainty to both alleviate feelings of guilt for individuals and prevent "action paralysis." To accomplish this, I analyzed literature about moral uncertainty itself and used a case study in the ethics of humanely raised meat to learn how moral uncertainty manifests itself in real environmental issues. I also interviewed three UW faculty members in the philosophy department. My findings show some common themes: that there are some issues within environmental ethics in which moral uncertainty exists; that people should not worry about being "morally perfect" but should aim for being "morally good"; and that people should keep an open mind when hearing debates within environmental ethics. The pervasiveness and gravity of moral uncertainty within environmental ethics warrants a closer look, to benefit both individuals and society.

# SUPPORTING ENVIRONMENTAL JUSTICE THROUGH SCREENING AND MAPPING TOOLS

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Session B, Breakout Room #10

Site Supervisor: Laurel Jennings and Larissa Lee, NOAA Restoration Center

Faculty Advisor: Karen Baebler, University of Washington Athletics

Environmental justice has been a prevalent issue spanning across the world and more specifically in the United States. Research in environmental justice began in 1978 after toxins were released in a minority and low-income community. Environmental justice screening and mapping (EJSM) tools have been used increasingly over the past few decades to map instances of environmental injustice and support minority and low-income populations. The purpose of this study was to analyze how current EJSM tools can be improved to support disadvantaged communities. During my internship portion of the capstone, I had the opportunity to work with NOAA's Restoration Center. For the majority of my internship, I explored many different EJSM tools and assessed them on how feasible these tools are for the use of NOAA's Restoration Center and their restoration projects. I also conducted independent research by looking at past studies on EJSM tools and applying these tools to various sites of interest. In this article, I have provided some of the pros, cons, and shortcomings of the current EJSM tools available for public use. I also came up with a few suggestions on using EJSM tools and how they should be improved for future applications. My findings showed that EJSM tools should provide more information on specific communities, include race as an indicator, and stakeholders should come together to define common terminology and definitions for mapping tools.

# EXPANDING SOLAR POWER: HOW IDENTIFYING BARRIERS CAN FOSTER NEW GROWTH FOR GREEN ENERGY IN KING COUNTY

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Session B, Breakout Room #11

Site Supervisor: David Broustis, King County Government, Department of Parks and Natural Resources

Faculty Advisor: Jan Whittington, Urban Design and Planning, University of Washington

As the threat of climate change continues to loom, environmental experts are looking toward climate mitigation strategies that limit human impact on the planet. One of the most significant impacts on the planet is greenhouse gasses and burning fossil fuels for energy, prompting experts to look into renewable energy sources with limited environmental impacts. King County's Department of Parks and Natural Resources has developed a Solar power expansion project to mitigate its climate effects and promote sustainable energy. However, their efforts are moving slower than necessary to meet King County's climate goals. Therefore, given the slow pace of solar expansion, my research aims to identify the barriers to solar power expansion in King County and how to overcome these barriers. To identify these barriers, I conducted a literature review on solar barriers in other markets, collected anecdotal evidence from my internship at King County, and conducted expert interviews with King County personnel with a background or connection to solar. My research indicates that current financial incentives are insufficient in stimulating solar growth, and jurisdictions' failure to adopt solar-ready policy hinders solar adoption and expansion. Tackling these barriers requires jurisdictions to work with utility companies and increase net-metering laws (a financial incentive that credits users for the solar they produce) and jurisdictions to update building codes to better suit future solar installations. By expanding its solar power policy, King County can expand its green energy efforts and work toward combating climate change.

# LINKING SEATTLE'S YOUTH: THE QUEST TO INCREASE YOUTH LIGHT RAIL RIDERSHIP

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Session B, Breakout Room #12

Site Supervisor: Eugene Kramer, Seattle Subway C3 Board Vice President, Seattle Subway Foundation

Faculty Advisor: Tim Billo, Program on the Environment, University of Washington

Carbon dioxide (CO2) and other air pollutants plague cities from vehicle emissions. People may develop an array of health issues from exposure to air pollution. Washington state's CO2 emissions are the highest in the transportation sector among all other sectors. To decrease emissions, mass transit is preferred. Of the various forms of public transportation, light rail systems tend to run on renewable energy and have the capacity to carry many people at once. The key to curbing CO2 emissions from the transportation sector is by increasing and sustaining higher ridership levels on the Link light rail. It is important the youth have access to the Link light rail as the next generation of riders that will benefit most from the completed construction of the light rail system. The purpose of this study was to better understand patterns in youth knowledge and ridership of the Link light rail to highlight points for potential increased ridership. I interned with Seattle Subway, a nonprofit organization advocating for light rail system expansions. I conducted a survey and researched the light rail systems' environmental context. This helped me conclude that more youth outreach and education are necessary. As well as expanding access to the Link light rail by extending the lines as suggested in Seattle Subway's ST4 vision map. These three solutions have the potential to increase youth ridership of the Link light rail. Increased ridership of the light rail is the key way that it will be able to maintain an environmental advantage over cars.

# HOW TO CRUSH CLIMATE CHANGE COMMUNICATION

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Session B, Breakout Room #13

Site Supervisor: Jared Schneider, EM Program Manager - Mitigation, King County

Faculty Advisor: Ann Bostrom, Evans School of Policy & Governance, University of Washington

Without adequate climate change communication, it is impossible to unite our diverse society in solving equally diverse and threatening issues relating to the climate crisis. Climate change risks are only becoming more prevalent, and the way in which we educate and empower one another will be detrimental towards climate stability. The purpose of this study was to reveal the most effective methodology of climate change communication for both the project partners in King County and the greater community. Through my internship with King County, I created a climate change education plan for King County's project partners, who oversee the drafting of national grant applications for projects directly related to climate issues. Simultaneously, by interviewing five climate experts and completing a literature review, I researched major themes in successful climate change communication to implement in the education plan. According to experts and the literature, the inclusion of clear and simple visual aids, an optimistic tone or solutions, the space for questions, local and specific evidence, the repetition of key ideas, and the use of storytelling were highlighted as essential. By incorporating these themes into the education plan, the presentation is more accessible, increasing the likelihood that project partners will receive the funding for King County projects that benefit the wellbeing of the greater Seattle area. More generally, these results help climate change communicators ensure they are informing well, further empowering individuals to cause a great multitude of environmental and societal benefits.

# WHAT DOES IT TAKE FOR A WORKFORCE DEVELOPMENT PROGRAM TO BE SUCCESSFUL?

Mackenzie Rippel, @mackenzierippel, Program on the Environment, University of Washington

Session B, Breakout Room #14

Site Supervisor: John Kennedy, 2050 Project

Faculty Advisor: Benjamin Brunjes, Evans School of Public Policy & Governance, University of Washington

As scientists begin to understand more and more information surrounding Earth's climate and environment, industries and careers in these fields are expanding just as fast. With new policies and green codes and research coming out every day, there becomes a need for new positions and more hands to help fill these positions and the labor force. This summer I attempted to answer the research question of what are the best elements that a workforce development program should have. The way I went about answering this question was administrating a survey to environmental majors at the University of Washington, attending a workforce development convention with my site supervisor, as well as an in-depth independent literature review and research. I discovered that the majority of students had rarely come across environmental workforce programs. I also concluded that programs designed for other industries are successful when they allow participants to work hands on, put emphasis on teaching soft skill, and are accommodating to participants who may have special circumstances, such as being a single parent without childcare or someone who cannot afford transportation. I got to apply this research when I had the privilege to work with 2050 Project on a workforce development program plan to garner more interest in environmental fields amongst Seattle youth. Programs such as these are important to help push younger workers towards environmental careers to continue the expansion and progress of environmental fields. We cannot have innovation or progress without people to push it forward.

# TACKLING MULTIFACETED ENVIRONMENTAL JUSTICE ISSUES: THE IMPORTANCE OF COMMUNITY ENGAGEMENT AND HOW TO CREATE IT

Isla Scott, @islascott21, Program on the Environment, University of Washington

Session B, Breakout Room #15

Site Supervisor: Noemie Maxwell, Defenders of North SeaTac Park

Faculty Advisor: Karen Litfin, Political Science, University of Washington

Research has shown that community engagement is critical for creating political and public change. However, creating this type of engagement in low-income and multi-ethnic communities can be challenging. Because of unjust systemic patterns, these communities often face more immediate needs, such as affordable housing, and cannot prioritize long-term problems, such as climate change, or narrow concerns, such as risks to local parks. Through an internship with the South Seattle Climate Action Network, I addressed these problems concerning community engagement by using North SeaTac Park as a case study and implementing various research methods. The purpose of the study was to determine the most productive and effective ways of communicating environmental concerns to affected communities that would create and enhance community engagement. To do this, I conducted a literature review of effective communication methods and the importance of community engagement. I also conducted in-person and digital outreach and utilized traditional marketing, such as flyers and fact sheets I made. Lastly, I commented at Port of Seattle and King County Council public hearings. My findings showed that in-person outreach was the most effective method, and the use of pathos and communication with the local government are also vital. Thus, as a result of my work, I propose an environmental communications framework that focuses on three tiers, defined as network of communication, platform of outreach, and delivery of message, to increase engagement in any given community. Utilizing this finding and its implications can drastically drive social transformation by amplifying a community's voice.

# FOUR OUTREACH COMPONENTS TO GARNER PARTICIPATION IN ENVIRONMENTAL STEWARDSHIP PROGRAMS

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Session B, Breakout Room #16

Site Supervisor: Paige Morris, City of Burien

Faculty Advisor: Gary Handwerk, Program on the Environment, University of Washington

With an increase in both size and scale of environmental issues, communities are working to incorporate environmental programs to create a difference at the individual level. These environmental stewardship programs have had varying levels of participation, sometimes wasting valuable time and money with limited results. The aim of this study is to determine what outreach practices are helpful in gaining community participation. This research can be used in future program outreach to make positive environmental change. To accomplish this task, I used observations from promoting the Adopt-a-Drain program at community events as well as a literature review into what outreach techniques have positive results. The combination of personal experience and research into outreach practices helped to determine the best outreach practices for environmental stewardship programs such as the Adopt-a-Drian program. The results of my research and experience displayed how the four components of community, commitment, connection, and creativity are beneficial focuses in outreach practices. By including outreach components centered around shaping social norms, making tasks both easy and accessible, creating emotional ties, and making the task fun or personalized, people are more likely to participate, Understanding the psychology behind actions can help us create better outreach materials and create better program layouts to appeal to the communities that we want to reach. Garnering participation in environmental programs not only encourages more people to complete a simple task, but creates a more environmentally aware public.

# SALMON, CULVERTS, AND COURT: WHAT HAPPENED AND WHAT TO EXPECT

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Advisors: Todd Wildermuth, University of Washington School of Law; Lawrence Watters, University of Washington

Host Organization: Coast Salmon Partnership

Many salmon populations in Washington State have seen declines in recent decades due to a multitude of factors. One of the most significant threats to salmon populations is habitat loss. I spent this summer working with Coast Salmon Partnership to assess this threat, analyzing stream survey reports and creating an ArcGIS web map layer depicting areas where stream manipulation had occurred. Alongside my internship, I supported my interests in environmental law by conducting an extensive literature and legal review to fully understand what role litigation played in addressing fish passage barriers and what the implications of this litigation are. I supplemented these findings with expert interviews with a lawyer and engineer. I analyzed the historic US v. Washington Boldt Decision and Culvert Case to uncover patterns within these legal battles and what the decisions in these cases meant on the ground. I presented projects like the Coastal 29 and Kitsap 29, which are currently underway due to the Culvert Case injunction. I also revealed what we might expect for further culvert replacement and construction. Overall, I connected the salmon population decline to infrastructure, litigation, and construction to comprehensively outline the current removal of fish passage barriers in Washington State. Ultimately the significance of this project revolves around the State's long pattern of ignoring treaty fish harvesting rights and the risks and burdens of litigation that consequently benefited the State as a whole.

# SUSTAINABLE COMMUNICATION: INITIAL ENGAGEMENT METHODS AND MAINTENANCE OF HOPE

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Site Supervisor: Alicia Keefe, National Oceanic and Atmospheric Administration, West Coast Region

Faculty Advisor: Taiko Aoki-Marcial, Assistant Director of Expository Writing Program and Predoctoral Instructor, University of Washington Department of English

Initial engagement of environmental issues along with maintenance of hope and resilience are important factors in creating a society focused on sustainability. Science communication can often seem distant, unrelatable, and lacking in emotion. The purpose of this study is to research how environmental organizations communicate their findings to engage the public in an effective manner as well as to research how the practitioners themselves stay resilient in the field. Through a human-subjects based experiment, answers were obtained from environmental organizations' interviewees about their approaches to audience engagement. The interviewees came from a set of very diverse environmental organizations – some including the Washington Department of Ecology and Oregon State University's Marine Studies Initiative. This study hopes to synthesize relevant information regarding how to best communicate environmental media and how to engage people in a way that will sustain a love for the environment throughout their lives. I conducted this study by working with my site supervisor from the National Oceanic and Atmospheric Administration (NOAA) in the West Coast Region (comprising Washington, Oregon, Idaho, and California), by creating a comprehensive set of questions to ask my interviewees. I asked them what their organizations do to engage people, how they personally became involved in the environment, and why they are still in the field today. Effective communication through personal connections, storytelling, emotions, hope communication, and creativity are of utmost importance in making people aware of environmental issues. These tactics allow people to maintain their initial love for the environment.

# GLEANING IN PUBLIC CONSCIOUSNESS: HOW GLEANING HAS CHANGED AND IT'S POTENTIAL TO ADVANCE FOOD JUSTICE

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Site Supervisor: Jordyn Egbert, City Fruit

Faculty Advisor: Ian Schnee, Department of Philosophy, University of Washington

The practice of food recovery known as gleaning has experienced a radical change over the past centuries. What began as a divine commandment to allow the poor to harvest leftover crops, and eventually an enforced right in European kingdoms, exists today as a charitable act undertaken by non-profit organizations as part of the greater food assistance system. Gleaning often takes the same hierarchical form as the rest of food assistance: an active upperclass with control providing a service for a passive underclass, with little control over the food they are provided. The purpose of this study is to examine why gleaning has changed, and how it can be reincorporated into mainstream food assistance which counters the hierarchical nature, harkening back to the values of communal ownership and subsistence that gleaning originally had. Working with City Fruit to glean from Urban fruit trees in Seattle, I interacted with people at every stage of the gleaning process, and learned what they get, and what they want out of gleaning. Through surveying members of the public and reviewing historical and modern literature on gleaning, I came to the conclusion that for gleaning to advance food justice and not uphold existing power structures, three factors must be emphasized: the equitable accessibility of gleaned produce, the inclusion of those receiving food assistance in the harvest and organizational process, and the awareness of gleaning’s potential for advancing food justice to those who can contribute to it, incorporate it into food assistance, and benefit from it.

# FOREST HEALTH: COMPOUNDING DISTURBANCES & THE ADVANCEMENTS OF MANAGEMENT TECHNOLOGY

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Site Supervisor: Lauren Kuehne, Omnifishient Consulting

Host Organization: WA Department of Natural Resources

Faculty Advisor: Tim Billo, Program on the Environment, University of Washington

In the era of climate change, our forests are having to put up with many disturbances that can have rapid and oftentimes permanent effects. With this increase in temperature comes the possibility of compounding disturbances which can drastically alter forest ecosystems if not discovered early on. Compounding disturbances refers to one disturbance creating a favorable condition for another disturbance to thrive and so on. That's where developed management resources come into play. Oftentimes compounding disturbances are not found because it takes a lot of man hours to survey an entire section of the forest. With the advancement of AI technology, scientists can create a digital model of the forest and run scenarios. This technology can also help find patterns in data to predict when an outbreak or compounding condition will occur. For my internship I spent a few weeks with the Washington Department of Natural Resources in the Olympic Mountains by Forks Washington and conducted habitat surveys of different logging techniques. In all the sites an abundance of dead wood was present. Having reliable technology can not only eliminate many unnecessary man hours but also keep those in charge of the forests up to date with any changes that are currently happening instead of discovering them too late. The purpose of this study was to analyze the effects of compounding disturbances on our forests as well as beginning to think ahead of how to implement AI resources to better prepare us to combat these issues.

# EARLY FISH GETS THE WORM: EXAMINING DIFFERENCES IN SPAWNING TIMING BETWEEN MALE AND FEMALE HATCHERY AND WILD CHUM SALMON

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Site Supervisor: Alex McCarrel, Sitka Sound Science Center

Faculty Advisor: Thomas Quinn, Aquatic and Fisheries Sciences, University of Washington

Over the past half-century, fish hatcheries have been heavily utilized as both a response to declining wild stock and increased public demand for seafood. Recently, however, studies have been published reevaluating the efficacy of hatchery-release programs and the actual benefit that they provide to wild ecosystems. Hatchery fishes are often the product of inbreeding and are raised in cramped pens where disease runs rampant, making their eventual release into the wild potentially problematic. The logic of hatchery-release programs meant to augment wild stock relies on a single notion; hatchery fish, once released, must act in the same manner as wild fish. The purpose of this study was to analyze the difference in spawning timing between male and female wild chum salmon and evaluate whether hatchery fish also engage in these same patterns. In my research, I relied on field observations, data on hatchery returns provided by the Alaska Department of Fish and game, and several peer-reviewed journals. Findings show that, in both wild and hatchery chum salmon, male chum salmon tended to enter spawning streams throughout the season, while females did so primarily in the middle third. Hatchery chum salmon, however, tend to enter their spawning streams a few days earlier than wild fish do for both males and females. This puts hatchery chum salmon at a distinct reproductive advantage over wild chum salmon as they have more time to find and compete for spawning territory.

# PITCHING THE SWITCH TO REUSE: HOW TO OVERCOME THE BARRIERS TO CORPORATE SUSTAINABILITY

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Site Supervisor: Christy Chow, Cascadia Consulting Group

Faculty Advisor: Lauren Brohawn, Buerk Center for Entrepreneurship, University of Washington

Marine plastic pollution is a global issue that has exacerbated problems of environmental degradation, bioaccumulation, and biodiversity loss. As awareness of the magnitude and implications of this pollution has spread, businesses are beginning to adopt reusable packaging systems to minimize single-use waste. However, there are various barriers that prevent corporations from implementing reusables. Thus, the purpose of this study is to identify the barriers to adopting a reusable packaging system and provide solutions to better market these systems to businesses. To accomplish this task, I worked closely with Cascadia Consulting Group under their Reuse Seattle initiative to obtain a more precise look at reusable packaging systems. I then conducted research through interviews with professionals in the corporate sustainability field, analysis of data on various packaging materials, and library research to estimate environmental and fiscal values. Findings show that perceived barriers to reusables center around costs to businesses and consumers. In order to surmount these obstacles, reusables must be presented in a way where there is no upfront cost, they are legitimized, and cost parity is established. Additionally, vendors must be empowered to market reusables to customers and build a consumer base with in-café events. Lastly, data shows that switching from compostable single-use plastics to reusable polypropylene plastics yields the largest economic savings and environmental favorability. These solutions should thus be implemented when adopting reusable packaging systems in order to embolden the shift away from single-use. Through this, marine plastic pollution will shrink, ultimately benefiting the health of ecosystems and humanity.