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WE THANK YOU
To all faculty advisors, site supervisors, Program on the Environmental staff and to the audience for your support. We could not have done any of this without you!
TECHNOLOGY AS SCIENCE COMMUNICATION TOOL TO BENEFIT ENVIRONMENTAL EDUCATION
Session: Poster I, Breakout Room #1
Pranav Bhardwaj*, @pranavbhardwaj_, Program on the Environment, Earth & Space Science, University of Washington
Site Supervisor: Melissa Fleming, Stillwaters Environmental Center
Faculty Advisor: Drew Gorman-Lewis, Earth & Space Sciences, University of Washington

With close to half of the global population owning a smartphone, access to information and communication is greatly increased. Historically, environmental fields have a poor relationship with technology as it has caused nature deficit disorder in younger populations. Environmental informatics is an underdeveloped field of study. The purpose of this research is to outline innovative ways in which technology can be used to advance environmental education and to highlight any gaps in technological use in the environmental field. For this study, a literature review was used to understand the current benefits and challenges of two common tools used by environmental organizations: citizen cyberscience and geographic information systems (GIS). During my internship, a GIS manual and workshop were executed to train staff and volunteers of the Stillwaters Environmental Center. Finally, a survey of collegiate students administered to gauge their interactions with technology and environmental-related content. GIS and citizen cyberscience were found to advance environmental literacy through cognitive skill-building and the development of socio-political knowledge. Volunteer retention and project granularity the biggest challenges to mass-implementation. A high level of environmental and technological literacy is required to implement these projects. Survey results indicate that students with higher technical ability are less likely to positively interact with the environment. By understanding the intricacies of informatics and sociocultural contexts, environmental scientists will be able to design, implement, and teach efficient communication and education tools to reach a wider audience.
Evolving Communication: How Environmental Outreach Must Change with Its Audience

Session: Poster I, Breakout Room #2
Jackelyn Briseno Arceo*, @BrisenoArceo, Program on the Environment, University of Washington
Site Supervisor: Jenny Heins, Sustainable Ballard
Faculty Advisor: Stanley Asah, School of Environmental and Forest Sciences, University of Washington

Green stormwater infrastructure (GSI) incentive programs depend on public participation and social acceptance of GSI to fulfill their objectives. Program objectives include installing rain gardens and cisterns on private property to capture stormwater run-off and prevent it from entering and polluting nearby water bodies. The aim of this study was to determine how GSI incentive programs are being marketed to communities and which methods are most effective in garnering public participation in the programs. I interned with Sustainable Ballard; a community organization tasked with conducting outreach and education on green infrastructure by doorbelling in the North Seattle area. In addition to my internship duties, I conducted a content analysis of GSI incentive program primary outreach material like brochures and mailers for common themes and appeals to persuasion. I then interviewed these organizations to determine the success of their programs and how it related to their outreach methods. I found that as GSI programs age, appeals to personal benefits rather than collective environmental benefits are more successful since they reach a wider audience of people who are not already environmentally conscious. Additionally, through an analysis of program Facebook likes and engagement, I determined that different audiences have different desires from GSI programs, with established members desiring community building content from the programs. This means that GSI incentive programs should evolve their outreach to focus on personal benefits to the homeowner as the programs age, instead of collective environmental benefits which are not as widely appealing.
Children are our future and will have the largest impact on the fate of our world. The way they learn about the world around them will significantly alter the way they think, plan, and interact with their environment. As of now, children are disconnected from the natural world. The aim of this study was to understand barriers preventing children from interacting with nature and proposing solutions to overcome barriers discovered. During my internship with Oxbow Farm, I went to several meetings talking to parents, and staff about their student’s involvement in nature. I conducted research by analyzing studies about barriers that prohibit children from interacting with the natural world and potential solutions to this issue. Potential barriers included urbanization, nature degradation, technology, and outdoor access. Not every child will live in a location with nature that is accessible, safe, and abundant. Nature needs to be equitable for children of all socioeconomic backgrounds. Making nature programs mandatory at all public elementary schools will give children time in nature that may not be available to them elsewhere. There are endless opportunities to teach school curriculum outdoors. If children have time to interact with nature they will build an environmentally conscious attitude which can lead to society making environmentally conscious changes in the future. These outdoor education programs will drive change for the generations to come. Children outdoors will become a societal norm and the center of nature will be discovered once again.
Nitrogen is one of the key nutrients for all plants to grow healthily and eventually reproduce. Farmers need sustainable nitrogen sources in order to produce viable crops and an income. There are many ways to apply nitrogen to soils including cover crops and fertilizers. These methods aren’t readily available to farms like Hoja Nueva’s, so nitrogen fixing trees are used as a replacement. The purpose of this study was to see if the proximity an inga tree was planted away from a cacao tree had an impact on the cacao trees health and if this differed between shade and sun grown cacao farms. To complete this study, I randomly measured cacao trees for different health metrics and compared these with the distances these trees were away from the closest planted nitrogen fixing tree. Findings were inconclusive, the proximity that nitrogen fixing trees were planted in relation to cacao trees did not have a significant impact on the tree health. In conclusion, more studies on the impacts of nitrogen fixing trees need to be done in order to better understand how these trees can be utilized properly. If there is a better understanding of how nitrogen fixing trees impact soils and crop health, the use of these trees could be expanded into US orchard systems and many other agricultural systems to decrease fertilizer inputs. By decreasing these types of inputs on farms, overall costs to the farmer can be decreased as well.
News organizations have historically failed to communicate about climate change, leading to a significant deficit between the percentage of scientists that proved climate change was an urgent issue, and the number of Americans that believed that climate change was an urgent issue. Social media has surpassed print newspapers as a source of news for Americans. Twitter is one of the most popular social media platforms and an effective platform to share relevant news. The purpose of this study was to find the Twitter elements that most increased audience engagement amongst environmental news organizations. To complete this research, I interviewed three audience engagement experts, and analyzed ten environmental organizations’ top ten tweets using the program Twitonomy to determine what elements within a tweet drive the most engagement. Findings show that 100% of top tweets included a link or a video. Elements including @ mentions, hashtags, statistics and quotes appeared 13-30% of tweets were another effective way of increasing engagement. Additionally, reposting content multiple times at different times of day with different captions increased engagement. Based on expert elicitation interviews and analyzed tweets, news organizations had a range of styles and strategies for increasing engagement, but all organizations should consistently post links or videos with their tweets, and post content multiple times with different captions. Organizations should also consistently evaluate their own Twitter presence to determine what styles and elements best benefits their organization.
Salmon habitat restoration improves the health and function of watershed components which, in turn, provide a broader suite of benefits termed “ecosystem services”. Ecosystem services are the conditions and processes through which natural ecosystems and the species that make them up sustain and fulfill life. There is a lack of stakeholder and community awareness of the all-encompassing human benefits that come from watershed habitat protection and restoration. The aim of this study was to identify disparities in how ecosystem services are articulated and use this information to increase inclusive and holistic thinking about how humans will benefit from the protection and restoration of watershed habitat. To gather evidence, I completed a literature review of over 40 scientific studies, identifying the most noteworthy ecosystem service that was assessed within each study (e.g. provisional, regulatory, cultural, or supporting services). My results found that regulatory services (e.g. nutrient filtration, flood control, etc.) are most often articulated within scientific literature, demonstrating an inconsistency in how different types of watershed habitat services are perceived and prioritized in restoration and protection projects. By identifying that we most often place valuation on services that are easily quantifiable (e.g. regulatory services) over those that are not (e.g. cultural or supporting services) establishes that there is a necessity for new methods of valuation to be developed. All ecosystem services should be recognized and prioritized equally, and thus my results identify benefits in watershed habitat restoration that as a society we can better acknowledge and communicate.
CLEARING MUDDY WATERS: INVESTIGATING THE VIABILITY OF MARKET-BASED INSTRUMENTS AS A TOOL FOR WATER QUALITY IMPROVEMENT

Session: Poster II, Breakout Room #1
Regina Durst*, @rsdurst, Program on the Environment, University of Washington
Site Supervisor: Hannah Clark, American Farmland Trust
Faculty Advisor: Dr. Nives Dolšak, School of Marine and Environmental Affairs, University of Washington

Water Quality Trading (WQT) programs are market-based instruments that have the potential to greatly improve the health of many of our common-pool water resources. Although nutrient pollution negatively affects the environment, public health, and a multitude of aquatic industries, many of the nonpoint sources that discharge nutrient pollution remain unregulated in the United States. By encouraging WQT programs, where regulated point sources (PS) pay unregulated nonpoint sources (NPS) to offset their pollution, it may be possible to reduce the total environmental impact on our waters. The purpose of this study was to discover if a market-based trading program would be viable in Washington. To accomplish this task, I examined state legislature to see whether a program could be supported without further changes to local policy. I also conducted a literature review of case studies to understand the barriers that trading programs have historically faced and compared the proposed model with past successful markets. Findings show that, while Washington policies allow trading programs, it is unlikely that many trades would occur due to a number of concerns on both supply (NPS) and demand (PS) sides. Concerns were primarily focused on high transaction costs, reluctance to trade with unfamiliar parties, and the perception of some farmers that participating would lead to future regulation or greater public scrutiny. I concluded that, in its current iteration, WQT is unlikely to find great success in Washington State, and that it may be fruitful to pursue programs that work more directly with farmers and landowners instead.
The Salish Sea has been subject to substantial environmental degradation including toxic contamination, resource exploitation, species decline, and unchecked urban sprawl. In response, collaborative environmental mechanisms that capture the entire ecosystem from Washington state to British Columbia are essential to conserving the health of this transboundary region. The Joint Statement of Cooperation (SOC) is a management mechanism signed by EPA and Environment and Climate Change Canada (ECCC) specifically designed to protect and restore the Salish Sea. The purpose of this study was to define effective ecosystem management in the region and evaluate the SOC as an effective mechanism based on this criterion. To achieve these objectives, I conducted a literature review to identify elements that comprise effective Salish Sea ecosystem management. I also completed a historical review of SOC operations through an internship at EPA Region 10 to compare to my definition of effectiveness. The following seven elements, local empowerment, science-based action, clear monitoring and evaluation, ecosystem-based management, indigenous engagement, maintaining relationships, and information sharing emerged as key to effective regional environmental management and formed my evaluation criterion. Although the SOC addresses many of these components, my evaluation concluded it must prioritize local empowerment and indigenous engagement to be considered wholly effective. The lack of detailed evaluations and frameworks associated with transboundary ecosystem management efforts have burdened the productivity and longevity of many similar partnerships. My findings contribute to resolving this gap as they will directly influence future SOC Action Plans and may also be applied to similar transboundary regions.
Inspired by local food movements, this research project explores the ways in which technology can eliminate barriers to sourcing food from your community. The aim of this study was to understand how the internet, websites, and ecommerce platforms could play a role in (re)localizing food systems. I interned with Barn2Door (B2D), a local software startup building ecommerce platforms and websites for farmers to sell food directly online to their local communities. My internship responsibilities included lead list building, a marketing email stream, and general market research. With the help of B2D, I surveyed 90 farmers about their opinions on technology and its integration with farming. Finally, I completed an in depth literature review of academic journals related to my research question. From the survey results, I found that farmers have mixed feeling about the integration of technology in farming. Many noted that it was “a blessing and a curse” or a “necessary evil”. While technology can be burdensome and time consuming, almost everyone who responded said it benefitted their farm or business operation in some way- sales, marketing, communication, education. If farmers are willing to adopt websites and ecommerce platforms, the community may have an easier time accessing their food. In turn, local farming economies would be supported, consumers could be more involved in the environmental impact of food production practices, and overall people would be eating more nutritious healthy foods.
ENGAGING COMMUNITIES THROUGH ONLINE TOOLS IN GREEN INFRASTRUCTURE

Session: Poster I, Breakout Room #5
Jessica Garcia*, @JessicaG253, Program on the Environment, University of Washington
Site Supervisor: Emma Vowels, Stewardship Partners
Faculty Advisor: Yen-Chu Weng, Program on the Environment, University of Washington

Green infrastructure is an approach that can mitigate storm-water runoff - and the pollution it can bring to our waterways - in an environmentally friendly way. Improving online tools used in green infrastructure and increasing community engagement could help generate an increase in green infrastructure used around the region. The aim of this study was to research the challenges and opportunities of green infrastructure and the online tools used in the field to increase community engagement. I interned with Stewardship Partners, a nonprofit organization working to create people-based solutions to engage the community in the Puget Sound region to care for the environment. I worked on their Sound Impacts tool, an online metrics portal that shows different green infrastructure projects on a map. My main duty was to create and send out a survey to Sound Impact users asking for feedback of the tool. I also conducted a literature review, where I examined different online tools used in green infrastructure. From my research and surveying, I found issues of accessibility, usability, and a lack of metrics that made it difficult for users to engage with these tools. From allowing public access of data, to creating a base framework that can be used throughout different green infrastructure tools, these concerns can be improved through multiple means. In order to reach and engage a larger community, these issues must be addressed so that people working in different fields will be able to connect to green infrastructure and help reduce the effects of storm-water runoff.
GREEN GENTRIFICATION: THE HIDDEN INJUSTICE BEHIND GREENING COMMUNITIES
Session: Poster I, Breakout Room #19
Shawn Imamura*, @SImamura0811, Program on the Environment, University of Washington
Site Supervisor: Karuna Poole, Green Seattle Partnership
Faculty Advisor: Tim Billo, Program on the Environment, University of Washington

Greenspaces come with many health benefits and provides an area where the members of a community can come together. With all this being said, there is a hidden environmental justice issues that lies beneath the surface of the development or improvement of greenspaces. Green gentrification is when vulnerable populations are displaced due to an improvement or development of a greenspace in a community. Often time, local governments approve of, and implement projects to build a new park, or to renovate one without working closely with the community, which leads to these complications. Currently in South Seattle, there is a controversial proposal to build a mountain bike trail in the Cheasty Greenspace, and this may lead to factors such as gentrification. The aim of this study was to directly see if residents around the Cheasty Greenspace were aware and informed about the plan of building a mountain bike trail. A survey of residents near the Cheasty Greenspace was conducted to measure both how much residents support and feel informed about the mountain bike trail. Overall, most residents seemed positive about the mountain bike trail, mentioning it would be a positive addition to the community, but only around 50% of the residents answered that they think property values would rise due to this change. There needs to be more awareness put around the possibility of a higher price of living due to improvements to greenspaces. Parks and urban forests should be an asset everyone has access to!
Community gardens provide social and environmental benefits for their greater municipalities. In King County, there is an opportunity to understand the span of community gardens better in order to support them and increase their potential community impact. The purpose of this study was to create an in-depth look or a ‘snapshot’ of community gardens within King County. The Biosolids Program situated in King County Wastewater Treatment Division (WTD) is interested in giving back to ratepayers and supporting community gardens at large. They are looking into a compost pilot which would create human waste compost or ‘biosolids.’ This product could be donated to gardens to both increase brand recognition and to provide free compost for valuable community gardens. To support this mission, I inventoried the current gardens in King County using ArcGIS. I also interviewed garden coordinators about their garden’s governance structure, resource access and intention. My work provided a general overview of community gardens in King County and provided insight into what made certain gardens successful, which included resource allocation, governance structure, and intention. These results can be used in King County and in other municipalities to provide the necessary support to allow community gardens to flourish and multiply. Gardens provide both social and environmental benefits through added green space, carbon sequestration, and food security and more. With increased support they can increase the general health and happiness of communities.
Rainforest conservation is crucial to the health of ecosystems and preserving critical habitat. Communication, education, and awareness surrounding many of these issues is done through social media and circulation of characteristic images to induce feelings and actions (i.e. rainforests burning). The aim of this study was to understand the knowledge, perspectives, emotions, and actions people may respond with when confronted with imagery of Amazon rainforest degradation. To accomplish this task, I worked with the Peruvian conservation organization Hoja Nueva to create and administer a Spanish survey for nearby Amazonian communities and an English survey for online western audiences to encompass participants of diverse backgrounds. Key issues contributing to the degradation were then identified and assigned corresponding imagery, followed by survey questions posed to evaluate the various perspectives. Findings show that humanizing environmental issues yields more empathy and that participant background had significant impact on perceived actions to take. It was also generally found that social media posts that include conservation imagery can be more effective towards accomplishing goals when accompanied with an educative summary and/or suggestion of course of action. As social media and visual aids continue being used as a communication tool when raising awareness on environmental issues, the importance of knowing audience perception and response becomes clear. This knowledge allows for more efficient engagement and targeted education by conservation organizations, which in turn can translate to increased preservation of our natural resources.
A STEP IN THE RIGHT DIRECTION: URBAN FOREST RESTORATION AND PREVENTING SOCIAL TRAILS
Session: Poster II, Breakout Room #12
Karly Lampard*, @larlykampard, Program on the Environment, University of Washington
Site Supervisor: Lisa McGinty, Friends of Lincoln Park
Faculty Advisor: Jim Fridley, School of Environmental and Forest Sciences, University of Washington

Urban forests are an important resource for cities and ecosystems, but they are prone to being overrun with invasive species. Restoration work, which involves removing invasive species and replanting with native species, is one way that this can be prevented. However, for this to be effective the sites must be maintained and protected. The purpose of this study was to research how to prevent social trails, which are informal trails in parks and natural areas that can result in trampling, erosion, compaction of soils, and potentially unsafe recreation conditions. Preventing social trails is important for protecting sensitive restoration sites and contributing to a healthier ecosystem. For my internship with Friends of Lincoln Park and Green Seattle Partnership (GSP), I restored a plot of urban forest that had a known social trail running through it. For my research in preventing these trails, I interviewed seven GSP Forest Stewards who had experience with social trails and studied surrounding literature on social trails and other related recreation concerns, like messaging as a way to prevent harmful behavior. Through this, I found out that a combination of physical barriers and messaging together are most effective at preventing social trails, along with proactive trail management like ensuring there are adequate formal trails in place. These results are important because they can help inform how to best protect restoration sites, which contributes to healthier urban forests and cities.
ENVIRONMENTAL EDUCATION: THE POWER OF RIBBITING DRAWINGS
Session: Poster I, Breakout Room #7
Ashley Lee*, @ashleylee_98, Program on the Environment, University of Washington
Site Supervisor: Hallie Sykes, Oxbow Farm & Conservation Center
Faculty Advisor: Jessica Thompson, College of Education, University of Washington

As environmental issues increase, there is a push to implement environmental education at a young age. Finding the best ways to teach environmental education to a younger audience successfully is something we are still trying to figure out. To look further into this issue, I conducted a study to find out how well drawings reflected a student’s understanding of a habitat. This led me to the question of whether drawings can be used as an effective assessment tool. To accomplish this, I worked with Oxbow Farm & Conservation Center to develop and pilot an in-class lesson. The in-class lesson focused on the local amphibians found in the Snoqualmie Valley. During the lesson, I asked the students to draw what they thought an ideal habitat for an amphibian would look like pre and post lesson. While my study was done with a small number of students, it was still clear that their drawings reflected that they understood what factors are needed for an ideal amphibian habitat. Many of the students’ post-lesson drawings had moderate to visible changes that included factors that were taught during the lesson. Seeing that the drawings were an effective way in assessing learning, non-traditional teaching methods like this should be explored more. Further assessment guidelines should also be created to increase successful environmental education in the classroom.
The systems which influence the urban environment dictate the quality of the space. By designing with these systems in mind, the urban environment will improve for people. While working on the Public Life Counts! project, I analyzed people moving through spaces and staying in spaces within the Capitol Hill neighborhood. This data was used to create design recommendations based on the findings. The Public Life Counts! document can now be used to inform data-driven design in Capitol Hill and around Seattle. I built my own study off the Public Life Counts! project. The purpose of my study was to take urban systems into account when redesigning Pike and Pine, between Broadway and 12th, Pine and Union, in Capitol Hill. The methods used to create this redesign were a site analysis, precedent studies, and a literature review. The site analysis gave me contextual evidence about the site, the precedent studies informed my design process, and the literature review justified the design. By using these three approaches, I developed 6 guidelines for the site: creating an overhead catch system, reclaiming streets for pedestrians, increasing urban canopy, creating a system of bioretention planters, creating flexible space, like a plaza or town square, building a dog park, and building outdoor furniture. By including these guidelines into urban sites, cities can become more accommodating to people and the natural systems that occur within them. This in turn will make our cities more livable, lively, and comfortable.
When making informed decisions regarding the management of fish stocks, information about how fish grow is crucial. However, current methods of retrieving growth data are lethal and time-consuming. The purpose of this study was to identify a new method for monitoring length and growth in juvenile Chinook Salmon (Oncorhynchus tshawytscha).

Similar to trees, salmon deposit rings on their scales as they grow. This research was aimed at whether these ring patterns, (called ‘circuli patterns’) are an accurate indicator of length and growth within juvenile Chinook salmon. To investigate this, I interned with the National Oceanic Atmospheric Administration at their Northwest Fisheries Science Center, where I was responsible for the processing of fish scales, along with analyzing and modeling fish data.

Samples were collected from a pre-existing set of Wild Spring-Summer Chinook salmon parr from Valley Creek (Idaho, USA). Results indicated a strong relationship between the length of the fish and the size (radius) of their scales. As fish deposit more and more rings, results indicated that the space between rings will get smaller. Collective results signify juvenile salmon scales can in fact be used as an indicator of length and growth. The outcomes of this project can guide the direction researchers may take regarding advancing this methodology. If this method continues to present as an accurate index, it will implement researchers with more access to sampling endangered wild populations and continue the application of this methodology to related stocks.
DIFFERENTIAL INSTRUCTION IN THE CONTEXT OF ENVIRONMENTAL EDUCATION
Session: Poster I, Breakout Room #8
Emily Minkus*, @EmilyMinkus, Program on the Environment, University of Washington
Site Supervisor: Hallie Sykes, Oxbow Farm and Conservation Center
Faculty Advisor: Jessica Thompson, College of Education, University of Washington

Research shows that receiving environmental education during formative, childhood years is linked to an increased passion for the environment. Many different methods of instruction have proven beneficial in the field of environmental education, but recently, differential instruction has come center stage. Differential instruction is defined as a range of different avenues for helping children in understanding new information in terms of acquiring content and processing, constructing, or making sense of ideas, and has been lauded for its classroom inclusivity. The purpose of this study was to conclude what instruction method could best be used to create the most effective learning for students studying environmental topics; differential or traditional. To accomplish this task, I worked alongside the education team at Oxbow Farm and Conservation Center to create a lesson plan targeting elementary aged students. Students received both traditional and differential instruction on topics regarding native amphibian species, and knowledge checks consisting of drawing and storytelling were administered after each type of instruction to gauge interest and retention of information. Findings show an increased understanding of concepts after differential instruction versus traditional instruction. These findings are similar to those done in large scale, intensive studies showing a positive correlation between unconventional instruction methods and an increased understanding of topics. Findings from all case studies may help guide educators in redefining how to create an effective learning environment that benefits all students and ignites a passion for topics such as these.
Urban parks are essential for maintaining healthy cities; unfortunately, these sites tend to be severely degraded due to urban pressures. Efforts to restore these spaces can go through several challenges; therefore, it is critical to have well-conceived plans in order to carry out effective restoration projects. The purpose of this study was to find out what these projects consist of and what techniques/strategies restoration organizations use in order to ensure the highest level of ecosystem recovery possible. To accomplish this, I worked hands on with Green Seattle Partnership to restore a section of the North Beacon Hill Greenbelt at Cheasty green space and surveyed GSP forest stewards to gauge their perspective on urban forest restoration projects. I found that in order to reach the highest level of ecosystem recovery possible, restoration projects should: 1.) Draw on a variety of different types of knowledge: acquired practitioner knowledge, Traditional Ecological Knowledge, local ecological knowledge, and scientific evidence (SER). 2.) Identify native reference ecosystems to serve as a guide for planning and a benchmark for evaluating success 3.) Have a flexible plan in place with components such as: a desired vision, measurable goals and objectives, stakeholder involvement, a timeline that outlines work activities and responsibilities, and a plan for maintenance and monitoring to evaluate how well objectives have been met (SER). This information can be used as a tool to improve current and future restoration projects which can help maximize the ecological and social benefits from restoration.
Atmospheric and oceanic CO2 levels are rising causing the climate to change at unprecedented levels. However, the good news is we already have the knowledge and technology to solve this existential problem. For my internship, I ran an experiment that tested a potential solution involving kelp amendments on grasslands and how this can sequester carbon from the atmosphere and sink it into stable soil stocks. Through soil and grass samples analysis from four treatment groups we can determine which kelp application technique is most effective at fixing carbon into the soil. Furthermore, the implications of this technique reach beyond climate change mitigation. On any treated grassland the sequestered carbon can be calculated and converted into a carbon credit that hold financial value in a competitive cap-and-trade system, which provides incentive and can finance farmers and landowners to continue implementing sequestration techniques and sustainable practices.
Alaskan tribes have been left out in the cold to manage solid waste in their community with little government support. Rather than having a trash collecting service or city dump, 9 out of 10 Alaskan tribes have waste disposal dump sites in their communities (Zender). The Environmental Protection Agency (EPA) is providing resources but is lacking in several areas to help Alaskan tribes combat this issue. The purpose of this study is to help understand what communication and resources the EPA can provide to Alaskan tribes to aid in their waste management. I completed my internship with the EPA and worked in the Land, Chemical and Redevelopment Division. I gathered my data by conducting interviews with EPA, state, and tribal employees. I also collected data by analyzing EPA Tribal Environmental Plans (ETEP) created by tribes. The data showed a form of communication that was lacking was face-to-face interaction and that there was a significant amount of resources available to tribes weren’t all in one place making them hard to find. My data showed a need for more face-to-face communication which can be achieved by the EPA implementing a mentorship program where tribes who have had solid waste management success can be a resource to other tribes struggling. My findings also showed a need for all the resources provided by the EPA to be in one place, this can be accomplished by creating a baseline waste management guide for rural Alaskan tribes with all the resources EPA provides.
WAYS TO USE COLLEGE ATHLETICS AS A PLATFORM FOR SUSTAINABILITY
Session: Poster II, Breakout Room #19
Avie Niece*, @AvieNiece, Program on the Environment, University of Washington
Site Supervisor: Karen Baebler, Assistant Director for Sport Operations, University of Washington
Faculty Advisor: Brian McCullough, Management, Sustainability in Sport Business, Seattle University

College athletics contributes largely to each university’s ecological footprint; it is a platform that can reach diverse ranges of people. Athletes are role models for younger generations as well as representatives of the university; their knowledge and practices should be a priority for the university. The aim of the study was to grasp how student-athletes understand and act on sustainability. I was expecting most student-athletes to believe sustainability was important and take actions to be sustainable when possible. Interviewed 20 student-athletes and assisted athletic department at the University of Washington (UW) to create methods for educating and involving athletes with sustainability. Education through tangible products was my method to reach as many people as possible during and following my work with the sustainability department. Formal interview results differed between student-athletes at UW but were overall hopeful, all athletes had a desire to learn and some wanted to adapt quickly to better practices. Many thought athletes could create a more sustainable world. Some wanted to take part in a sustainability group surrounding athletics specifically. College athletics is a huge platform that other programs around the country look to for leadership, they have assisted America in taking positive leaps forward; sustainability should be the next. Athletic departments should work to make changes, this will help the university and surrounding communities. By incorporating relevant signage, presenting a slideshow for every sport and involving student-athletes through a sustainability group landfill waste will be minimized and natural resources will be used more efficiently.
COMPONENTS INVOLVED WITH A SUCCESSFUL SMALL-SCALE RURAL WATER SUPPLY SYSTEM IN DEVELOPING COMMUNITIES

Session: Poster I, Breakout Room #21
Alex Peck*, @AlexpeckUW, Program on the Environment, Economics, University of Washington
Site Supervisor: Danielle Bogardus, Connect-3
Faculty Advisor: Sergey Rabotyagov, Environmental and Forest Sciences, University of Washington

Developing communities often lack access to clean drinking water, and the population suffers from environmental health-related sicknesses. Third-party assistance is needed, and water projects are funded, but sometimes fail in the long-run. My internship at an organization called Connect-3 consisted of conducting research to this question: What are the multiple components involved with the success of small-scale rural water supply systems in developing communities? In my internship, I composed a literature review, as well as gathered evidence drawn upon resources to strengthen Connect-3’s ideals. Information was collected by researching scientific articles, journals and case studies that were published online. Additionally, information was conversed and consulted through team meetings within Connect-3. Descriptive analysis was used by absorbing and organizing the information obtained to conclude a summary of findings. The findings were sorted and organized into more general categories of funding, infrastructure, and maintenance for the purpose of clarity and organization. Additionally, in my analysis, I discuss the costs associated with the interconnection and relationship of the components. My research found eight key components for a successful rural small-scale water system: initial funding, continued funding, water source, water transportation, water preservation, waste management and sanitation, education, and routine evaluations. These findings can be used to help educate donors and increase success rates of rural water supply systems in developing areas, ultimately increasing access to clean drinking water for developing communities and bettering their quality of life.
Government agencies and other organizations increasingly use scientific data to make important environmental decisions. In order to capture quality data an agency must have a sound and consistent system to track, store, and log the data that is collected. One way to accomplish this is through the development of an electronic database that serves these functions. The purpose of this study was to see how tracking environmental data ultimately leads to better environmental projects and decision-making throughout the Environmental Protection Agency’s (EPA) Region 10 program offices- land, air, and water in hopes of maintaining quality and confidence. To accomplish this task my main responsibility was to deploy an electronic database to track Quality Assurance Project Plan (QAPP) submissions using an existing Access Database. QAPPs are one way in which the EPA maintains a robust quality system to provide the needed management and technical practices to assure that the environmental data used to support Agency decisions are of upmost quality. My findings showed that to produce a fully functioning database that captures the essence of quality science it must contain three elements: ease of use, capture useful information, and maintain common data elements across different environmental programs. By maintaining a desired level of quality that can be captured through electronic databases agencies are able to set targets, meet expectations, and set standards that lead to better decision-making and overall environmental good.
Buildings produce around 40% of carbon emissions across the world. In order to reach the goal set by the Paris Climate Accord of only 2 degrees Celsius warming we need to use green building to reduce these carbon emissions. My study looked to identify what the barriers and motivators of green building were in the Seattle area. I conducted a literature review to understand what common influences are in green building. I then conducted a survey of green builders in the Seattle area to understand how their experiences differed or remained the same. I found that personal values and beliefs along with market demand were the largest motivators. The most commonly identified barrier to green building was cost, both in my survey of green builders and in my literature review of barriers among all builders. These results show that those who are currently building green are primarily motivated by personal beliefs and values while government incentives are underutilized to offset expensive first costs. These findings are important because if we believe staying below 2 degree Celsius is important to our goals then we need to increase incentives to mitigate the barrier of expensive costs and to bring more conventional builders without the initial personal beliefs driving their decision into green building.
THE UNSEEN EFFECT OF COASTAL CONTAMINATION
Session: Poster II, Breakout Room #15
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In the arid city of cape town there is much work being done to prevent dangerous water shortages and utilize groundwater as a reliable source of water. Projects to strengthen water resilience include work to diversify the water source and utilize groundwater. Much of the groundwater is contaminated by industry and may affect coastal ecosystems via groundwater transport. The purpose of the study was to see the environmental danger that urbanization can have on groundwater and coastal ecosystems. Coastal ecosystems can be degraded when toxins and nutrients affect the composition of water and can destroy fragile coastal habitat. To accomplish this I worked with the company Umvoto working as part of a water testing team to check wells around the cape town limits. I was researching a section of coast using nitrate testing strips to test for organics in the groundwater. I found that there was no direct correlation to groundwater affecting the surf zone, there was however an increase in background nitrate concentration and important dynamics at play in the region. Groundwater can be a major asset but can also interact directly with near-shore environments, this process can be applied to most coastal environments. Areas that rely on groundwater must understand its interactions with the environment and its effects on water security, climate change and equity.
Currently, Tribal communities are disproportionately impacted by climate change. In addition they are also under supported by the United States Government. Discovering where system and organizational changes need to be made to improve support would have a positive impact on the lives of those most impacted. The aim of this study was to determine the need for a new government agency focused on climate change and to propose the main priorities for the new agency. While interning for the U.S. Environmental Protection Agency I worked on Tribal Climate Adaptation in the Pacific Northwest. During this time I observed the steps required for Tribes to procure government resources for their climate adaptation efforts. By combining these personal observations, along with my research, and interviews with experts I sought to answer my capstone question. The results presented the significant need for a new government agency singularly focused on climate change. This new agency would consolidate resources and improve communication. The findings also revealed how leadership and decision making would be crucial focal points within the design of the agency. Incorporating direct Tribal involvement in these two design categories was discovered to be the most trustworthy way to ensure Tribal voices were acknowledged and included. This design places the priority on Tribal needs while also ensuring that their strength is recognized and bolstered. Improved support for climate adaptation leads to a better future for all.
Industrial meat production drives 15% of global carbon emissions and accounts for a significant portion of global land degradation. Rotational livestock grazing offers an alternative to commercial livestock production and promises improved health for the animal, the consumer, and the planet. The purpose of this study was to determine the ecological impact of rotationally grazing livestock and the benefit of utilizing rotational grazing on regenerative agriculture farms. Regenerative agriculture is described as farming and grazing practices that focus on mitigating climate change by building topsoil, increasing biodiversity, improving the water cycle, and strengthening the overall health of the farm ecosystem. Through a six-month internship at SkyRoot Farm, I conducted a randomized grazing experiment utilizing goats and sheep on a 9-acre pasture in three different treatment conditions: no grazing, grazing with only goats, and grazing with goats and chickens. I supplemented the experiment with interviews with farmers practicing rotational grazing and a literature review of existing research on rotational grazing. The findings show that rotational grazing and continuous grazing each offer unique benefits to the farmer, but that rotational grazing improves degraded ecosystem function by increasing ecological biodiversity. However, the evidence of increased carbon sequestration capacity is insufficient. Ultimately, current grazing conventions will not be sufficient to mitigate climate change and ecosystem destruction. A paradigmatic shift in favor of ecological improvements rather than maximized profits is vital to sustaining the planet and the food system.
During my internship at Clark Fork Organics, an entirely female powered farm, I was inspired by the ability of women to defy societal standards of work that are typically dominated by men. Leaders in our food system, and particularly on farms, are predominately white males. Female farm producers increased by 23% from 2012 to 2017 according to the U.S. Census of Agriculture. The aim of my research was to understand how women’s work in sustainable agriculture is influenced by their identity and how the barriers and opportunities they face affect their work. Throughout my capstone, I first interned at Clark Fork Organics, an eight acre, organic, diversified vegetable farm in Missoula, Montana. I learned the complexities of operating a small scale farm from my female farm manager. Second, I conducted a series of interviews with women in sustainable agriculture across the Pacific Northwest. I learned that women in sustainable agriculture find barriers in their work through societal, functional, and political gendered standards. Numbers of women in the field of agriculture are increasing, so we must continue to make farmers more transparent to their consumers, work to change policy that will better support women, and create pathways for women to start careers in the field.
The Washington Department of Natural Resources (DNR) does not have baseline data of behaviors, perceptions, or awareness of western Washington (WA) residents regarding wildfire. To effectively perform outreach, circulate educational materials, and conduct research, this knowledge gap must be filled. This study’s purpose was to choose a pilot area to develop some of this baseline data. For this project, our team created and administered a survey to Seattle metropolitan residents who frequently recreate in central or eastern WA, choosing that population because people within frequently move between different fire regimes, and they may bring awareness, perceptions, and behaviors of eastern WA over to western WA. Alongside the survey, I conducted a literature review of similar studies. Survey results show that most respondents (63.2%) indicated they were informed or very informed of wildfire risks; however, fewer respondents (46.91%) correctly answered the wildfire knowledge questions. This discrepancy indicates the WADNR must focus more on wildfire-risk education. Being more aware and active in recreation can give people the chance to help prevent fires. Additionally, about half of respondents (54.7%) have experienced wildfire, and most respondents feel that a wildfire within a few miles (89.2%) or within a mile (87.9%) of their recreation site would adversely affect their recreation ability. This study only identified baseline information, so more focused analysis is needed for specific community behaviors and perceptions of wildfire. Finally, this study only considered the Seattle metropolitan area, so other studies in western WA, especially within the Wildland-Urban Interface (WUI), should be conducted.
INVISIBLE CHEMICAL DANGER IN CHILD CARE FACILITIES
Session: Poster II, Breakout Room #6
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Currently, approximately 8.4 million children in the US are placed in early child care and development facilities such as preschools and day care centers. The question that currently resides at the front of the ATSDRs mind is how to keep those children safe from potential environmental harms such as chemical exposures including hazardous materials like lead, mercury, radon, formaldehydes, asbestos, etc. These risks are posed both in and around child care facilities. Contributors to these chemical outputs are business ventures such as Dry Cleaners, Nail Salons, and gas stations. For my Capstone question I have worked with the ATSDR on reviewing published chemical findings in these areas of business in order to determine what kind of measurements a tool/study would need to possess in order to accurately gauge a safe proximity for child care centers to be located away from these chemical outputs. Sufficed to say, the presence of a pre-existing set of defined measurement tools is lacking. However, various points data gathered within my research point to its creation being both possible and attainable. The implications of this research point towards the need for Prox. Based air quality tests, Soil quality tests, and ground water/drinking water quality tests displayed in a standardized format. Once these base tests are established the ATSDR will be able to set more accurate laws and regulations when creating new child care facilities, thus decreasing the endangerment of children in child care facilities.
SIGNAGE SCIENCE: WHAT MAKES A SIGN EFFECTIVE?
Session: Poster I, Breakout Room #10
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In the context of compost, food waste sorting can determine whether composting operations will succeed or fail. Waste hauling and composting agencies often use outreach signage to promote proper waste sorting behavior, so it’s important to assess signage for how effectively they can communicate these messages. The goal of this study was to understand which textual and visual elements of waste sorting signage would most effectively communicate proper sorting habits to the general public. Beginning January 2020, I interned with Cedar Grove (CG) as a Waste Diversion and Outreach Intern. My primary responsibilities at CG were distributing signage to organizations with contaminated organics containers, talking compost, and translating existing outreach documents into different languages. Additionally, for my personal research, I created and distributed an online Google survey asking respondents to rank and provide feedback on different sorting guides. A key finding of my research was that respondents preferred signage balanced with plentiful images and text, and without containing “too much” information, as it could overwhelm them. Furthermore, respondents desired more multilingualism in signage. My results show that some elements of signage are, indeed, more effective than others at communicating proper waste sorting behavior. Therefore, waste agencies should take these findings into consideration and develop a more cooperative approach to creating standardized signage, which would help the general public achieve an equal baseline understanding. Also, in order to serve all communities, more multilingualism needs to be integrated into outreach signage, which could increase participation in waste systems overall.
SHOWING BIG BUSINESS THAT ON-SITE WASTE MANAGEMENT ISN’T A WASTE OF TIME
Session: Poster II, Breakout Room #21
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Businesses like Microsoft, Amazon, Apple, and Boeing are just a few examples of companies with massive personnel presences in offices and warehouses. The large number of on-site employees has often resulted in a hefty waste stream coming from these sites that are often inefficient, unorganized, and costly. Creating a more sustainable waste stream is beneficial for businesses with large on-site employee presences for a variety of reasons, including reductions in landfill costs, improvements in employee morale, and improvements in public perception of the businesses. Since there are bottom line motivations for businesses to create more sustainable waste streams, the question then becomes: what are ways that businesses can be more sustainable about on-site waste? The purpose of this study was to answer this question and determine ways that businesses with large employee counts can create a more sustainable waste stream with a focus on employee behavior. To answer this question, I utilized my internship with Engh Group as a way to observe second hand methods of improving employee waste habits and then supplemented this observational data with a literature review of available information on methods of improving waste behavior in the workplace. Methods of sustainable action can involve many different approaches and levels of upper-level employee involvement, including, but not limited to: increased availability of proper waste receptacles, directly administered employee sustainability trainings, and distributing literature physically or electronically to employees on improving waste habits. In any method, there is a need for action and an overall shared interest in improving the system in question from multiple individuals at various levels.
Place connections are key ways that people develop an affinity and care for the natural world. Facilitating place connections in early learners is an important step in raising a generation that prioritizes nature. For my capstone, I interned at Fiddleheads Forest School, an outdoor preschool in Washington Park Arboretum. The purpose of my capstone work was to analyze which types of materials should be included in outdoor preschools to best facilitate connections with nature. To do this, I introduced different nature-focused materials into the classroom and recorded the number, length, and quality of the children’s interactions with the materials. The materials included pages from standard bird field guides, a scavenger hunt with pictures of different ways to notice a bird (hearing, sight, etc.), sound makers that played different bird calls, binoculars, and bird cut-outs that were placed in trees around the classroom. I also had informal conversations with the students about their experiences in nature. The most prominent results from my research indicated that even with many different types of materials introduced, the children were still most interested in nature itself. These results are important because they point to the presence of materials in outdoor classrooms to be for comfort and security. Building connections with nature is best done by interacting with nature itself through the use of the 5 senses. These experiences teach valuable observational skills that extend to many other parts of life.
Due to the rising popularity and newness of nature-based preschools, it is essential to analyze and the effects of nature-based education. Research has shown outdoor education has many benefits such as improved happiness and decreased stress in children and adults. However, research is lacking on specific benefits such as improved interpersonal skills. Interpersonal skills are essential for academic and life success due to their necessity for human-to-human communication. My study aims to answer the question: Do preschool aged children show more positive interpersonal behaviors when in an urban outdoor setting vs. an indoor setting? I conducted a 9 week observational study at Wildflowers Preschool. I determined the frequency of both positive and negative interpersonal behaviors in outdoor urban greenspaces vs. the indoor classroom setting through a coded list of interpersonal behaviors in each setting. The behaviors chosen were drawn from a list of categories of positive interpersonal behaviors: active listening, caring, motivation, responsibility, and teamwork. Negative interpersonal behaviors included not displaying active listening or engaging in arguments with peers. The results showed that there was a similar level of positive interpersonal behaviors in both settings but the frequency of negative interpersonal behaviors was lower in the outdoor setting. More specific results include an increased display of empathy and self-expression in the outdoor setting as well as less interpersonal conflicts. This shows evidence that nature-based learning has the potential to have a positive impact on the development of interpersonal skills in preschoolers.
Native Americans are among the most vulnerable to climate change impacts. The U.S. Environmental Protection Agency (EPA) wants to support tribal nations as they adapt to climate change, but the agency does not have a good understanding of tribal nations’ priorities. The purpose of this study was to investigate 1) how the climate adaptation priorities that tribal nations list in EPA Tribal Environmental Plans (ETEPs) compare to the physical climate change impacts that scientific literature expects for the Pacific Northwest and Alaska and 2) how effective ETEPs are as a tool for understanding the climate adaptation priorities of tribal nations in this region. As an intern with EPA Region 10 (Washington, Oregon, Idaho, and Alaska), I investigated tribal nations’ climate adaptation priorities by reviewing all ETEPs submitted between 2014 and 2018. I also reviewed academic literature on how climate change will impact the Pacific Northwest and Alaska, as well as tribal nations in those regions. My findings show that the climate adaptation priorities reported in ETEPs did not include several climate change impacts anticipated by scientific literature. These include decreased forest productivity, increased risk of wildfire, and increased irregularity of weather. Revising ETEP forms could provide EPA with a more accurate picture of tribal nations’ climate adaptation priorities. This would help EPA, and other government agencies addressing this topic, to better support adaptation efforts by offering more targeted tools, resources, and funding.
Due to projected increase in wildfires, droughts as well as insect outbreaks, forest health and resiliency is of urgent concern for communities in Eastern Washington. The Washington 20 Year Strategic Forest Health plan was created to increase the scale and pace of treatment of 2.7 million acres of forest land in Eastern Washington. However, with more than 33 agencies involved in this effort, a framework to analyze the effectiveness of stakeholders is needed. The purpose of this study was to assess different stakeholders’ involvement in a large scale governmental forestation project and identify gaps between stakeholders to increase collaboration amongst different entities. I worked directly with one of the forest collaboratives - South Gifford Pinchot Collaborative (SGPC). Forest collaboratives organize relevant stakeholders and are responsible management of funding and project oversight. I had informational interviews with the management team of the SGPC and sent out a survey to the members of the collaborative (22 responses, 66% participation rate). Based on different stakeholders’ input, two main points of tension were identified; representation and goal alignment. The issue of time commitment was consistent throughout the responses. Moreover, many of the members oppose off forest planning projects whereas the 20 Year Forest Plan calls for an ‘all-lands’ approach. Overall, the survey and interview provided important context for the current state of the collaborative which is significant because the same method can be used for all 8 forest collaboratives in Eastern Washington to identify tension points, gauge stakeholders’ perception and create new funding avenues for future projects and partnerships.
Grants for environmental projects are an important source of funding for many non-profit and government entities. With grant funds, organizations can conduct projects that advance environmental goals locally, regionally, and even nationally. Grant funding programs, programs that distribute grant money to chosen organizations, can play a large role in environmental protection due to their ability to enable a variety of environmental projects. Yet, seldom do the dynamics of grant funding programs get analyzed in-depth. Due to this, it is important to understand which Best Management Practices (BMPs) could have the most impact on grant funding program performance. The purpose of this study was to analyze which BMPs could be utilized by grant funding programs to increase program performance. To do this, I conducted a literary analysis of grant management literature as well as by analyzing BMPs through the use of sample application data. My research was also aided by my internship at the U.S. Environmental Protection Agency Region 10 as a program support intern for the Columbia River Basin Grant Program. The results of my research indicate that grant funding programs can benefit from ensuring that selected projects align with organizational goals. Grant funding programs can also benefit by conducting analyses of project performance and by using application information and project outcomes to inform future project selections. By effectively integrating BMPs, grant funding programs can meet their organizational and environmental goals more effectively.
With extractive industries growing in Las Piedras region of Madre de Dios, Peru, it is important to recognize the impact on the sensitive ecosystems that predator species are apart of. Decreased home-ranges and increased presence of humans is causing more human-wildlife conflict than ever. The aim of the study was to identify which animals are conflicting most with humans and what kinds of conflict this overlap is causing. I created a survey to conduct qualitative interviews with the people living along Las Piedras River. This survey collected demographic information as well as work history and sizes of land ownership. A “presence/absence” question as well as questions that identify which animals these people are coming into conflict with will help determine which kinds of mitigation strategies are necessary. The main results show that ocelots and boas are the main perpetrators of human wildlife conflict. This is important to know because we can use what we know about the ecology of these species to form a greater understanding of the problem. The survey also revealed that the perceived threat of predator species is greater than the threat they actually pose. This coupled with the knowledge that agricultural practices are exacerbating the conflict tells us that education around alternative agriculture practices could be a part of the solution. It is possible that patterns of conflict will change with different patterns of land use. An interdisciplinary approach will be necessary when developing mitigation strategies.
Cook Inlet belugas (CIB) are critically endangered and still shows no signs of recovery since full protection decades ago. More understanding of this group of animals is needed in order to better protect and conserve their species. Whale vocalization has proved to be extremely informative on whale’s social structure and geographic distribution. Therefore, learning about beluga vocalization may be the first step in understanding the fundamentals of this species. The purpose of this study is first, to try to learn more about beluga vocalization through analyzing their recorded calls in order to infer their geographic distribution and population structure. Secondly, to explore audio analysis programs on existing audio data and determine its efficiency in studying vocalizations. For my internship with NOAA, I Analyzed collected audio data from captive beluga whales using the audio analysis program, Raven. I was able to categorize several distinctive call types using only the spectrogram and audio and was able to relate each call to a possible owner. It is reasonable to think that each beluga has its own distinctive signature call through all the data analyzed and the method using audio analysis has proved to be efficient and adequate in study beluga vocalization. From this research, we can confirm that more audio analysis can be used for future vocalization studies when the subject is less accessible in the wild. It can also be a more convenient and less expensive way to test hypotheses than other methodologies.
The utilization citizen scientist volunteers, along with automatic sound detection can streamline monitoring projects on the order of hundreds of man hours in terms of data collection and processing. The aim of my internship was to verify the applicability of in-person ecosystem surveys, set-up and operation of acoustic monitoring devices, and to determine if a computer software package could collect results autonomously at the desired level of accuracy for a future experiment that will be carried out by EarthWatch. I worked with my site supervisor to develop and conduct standardized and field tests of our acoustic monitoring devices, along with various types of ecosystem assessments in small teams of people. After our time in the field, I worked in the coding platform RStudio to see if I could fine-tune a software package developed to pick out certain sound signatures within a .wav file. The effectiveness of the Swift recording devices are suitable for the future experiment, however the automatic detection is not able to produce reliable enough results to be relied on entirely on a large scale. Due to the small size and pre-programmability of the recording devices, they could be easily sent to volunteers across the country/globe to be set up anywhere to collect desired data. Despite its inability to provide consistent and accurate counts and detections at this time, automatic detection software shows immense amounts of promise for the near future in this field.