SEAS DORIS DUKE CONSERVATION UNIVERSITY OF MICHIGAN 2019 Doris Duke Conservation Scholars Capstone Symposium

Friday, July 26th

School for Environment and Sustainabiliy (SEAS) 440 Church St, Ann Arbor MI, 48109



2019 UM Doris Duke Conservation Scholars



2018 UM Doris Duke Conservation Scholars

Overview

We are proud to present the fourth annual capstone symposium of the Doris Duke Conservation Scholars Program at the University of Michigan (DDCSP UM) – a program that prepares diverse group of undergraduate students across the United States for careers in conservation and the environment. In addition to learning more about the research and internship work these bright young scholars have engaged in this summer, we will learn more about pressing issues in wildlife conservation by watching the documentary "The Last Animals" followed by a discussion with our SEAS Professor Dr. Rebecca Hardin.

Are you interested in hosting a Doris Duke Conservation Scholar in your research lab or non-profit organization next summer? Please contact our DDCSP UM Program Managers Ima Otudor and Meg Daupan at seas-ddcsp@umich.edu to learn more.

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Agenda

8:30 am - 9:00 am	Registration and breakfast	Ford Commons (1st floor)
9:00 am - 10:30 am	Poster Presentations - 2019 scholars	Ford Commons (1st floor)
10:30 am - 10:45 am	Break	
10:45 am - 12:15 pm	Flash Talks - 2018 scholars	1040 Dana
12:15 pm - 1:15 pm	Lunch	Ford Commons (1st floor)
1:15 pm - 2:45 pm	Film Screening: The Last Animals	1040 Dana
2:45 pm - 3:15 pm	Open forum discussion with Dr. Rebecca Hardin	1040 Dana
3:15 pm - 3:30 pm	Closing remarks by Dr. Dorceta Taylor	1040 Dana



DORIS DUKE CONSERVATION SCHOLARS PROGRAM

The University of Michigan Doris Duke Conservation Scholars Program is generously funded by the Doris Duke Charitable Foundaiton.

University of Michigan Doris Duke Conservation Scholars Program Staff



Dr. Dorceta E. Taylor, Program Director and Principal Investigator

Dr. Dorceta E. Taylor is a Professor of Environmental Sociology at the University of Michigan's School for Environment and Sustainability (SEAS). She is the James E. Crowfoot Collegiate Chair and the Director of Diversity, Equity, and Inclusion at SEAS. She also holds a joint appointment with the Program in the Environment. Dr. Taylor is the former Field of Studies Coordinator for SEAS' Environmental Justice Program and a past Chair of the American Sociological Association's Environment and Technology Section. In 2018, she was awarded the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring and the National Audubon Society's Rachel Carson Women in Conservation Award. Earlier this year Dr. Taylor was featured in an Essence article titled "Black Women are leading the Way in Environmental Justice." Dr. Taylor received dual doctorates in Sociology and Forestry and Environmental Studies from Yale University in 1991, a Master of Arts and Master of Philosophy from Yale University in Sociology and Forestry and Environmental Studies in 1988, and a Master of Forest Science from the Yale School of Forestry and Environmental Studies in 1985.



Meg Daupan, Program Manager

Meg joined the Doris Duke Conservation Scholars Program (DDCSP) in September 2018 as a Program Manager. She oversees the program recruitment and coordinates the research (first years) component of the program. Prior to joining DDCSP, she designed and implemented a sustainability tour program with Detroit Blight Busters and served as Research and Database Management Assistant for the International Forestry Resources and Institutions (IFRI) at the University of Michigan. Meg earned her Master's degrees in Microbiology at the University of the Philippines and Conservation Ecology at the University of Michigan where she studied community-based mangrove forest management. During her free time, she loves to read, paint, and play her violin.

University of Michigan Doris Duke Conservation Scholars Program Staff



Ima Otudor, Program Manager

Ima has an academic background in Natural Resources and Wildlife Conservation with degrees from Fort Valley State University and the University of Michigan. She currently serves as the curriculum and professional development coordinator for the Doris Duke Conservation Scholars Program at the University of Michigan. She is also the staff liaison to the mentors who are part of the Year 2 scholar internship experience that culminates in a Capstone trip to Yellowstone National Park. In a former role, she implemented waste reduction initiatives and championed general awareness on sustainable and zero waste goals for the Georgia World Congress Center Authority. She is continually interested in sustainable practices and how humanity can be more connected to nature so that the next several generations can enjoy this beautiful and amazing planet.

University of Michigan Doris Duke Conservation Scholars Program Alumni Administrative Assistants



Jorge Agudelo UM DDCSP 2017 B.A. Anthropology and Chemistry '19 Florida International University



Gabbie Buendia UM DDCSP 2017 B.A. Environmental Studies '19 Rollins College



Emily Rau UM DDCSP 2017 B.S. Environmental Sciences '19 University of Wisconsin-Madison



Film Screening: The Last Animals

Conflict photographer Kate Brooks turns her lens from the war zones she is used to covering to a new kind of genocide- the killing of African elephants and rhinos - in this sweeping and sobering expose of an underreported crisis. As the single -digit population of Northern White Rhinoceros ticks closer to zero, Brooks outlines the myriad factors contributing to the current epidemic of highly effective poaching and trafficking syndicates, drawing startling connections between the illegal wildlife trade and international terrorism and border security. But all is not yet lost- at the same time, Brooks documents the heroic efforts of conservationists, park rangers, and scientists to protect these animals on the verge of extinction in the face of seemingly insurmountable odds. The result is a potent plea for worldwide attention and action to combat the permanent loss of these majestic creatures.

[This excerpt is directly taken from https://thelastanimals.com/about/.]



Dr. Rebecca D. Hardin

Dr. Rebecca Hardin is a faculty member at the University of Michigan School for Environment and Sustainability (SEAS) and is the Director of the Michigan Sustainability Cases Initiative. Her current work includes research in educational innovation and environmental management, especially forest and water management in Kenya, Gabon, New England, and the upper Midwest.

Dr. Hardin teaches and mentors students interested in international environmental practice and policy, wildlife management, human relationships to landscape, environmental justice, and global health. She also provides support for the students who are the genius behind SEAS's weekly environmental talk and music show, It's Hot in Here, airing at noon on Fridays on WCBN FM 88.3.

Dr. Hardin lived for six years in the Central African Republic, and speaks three of that country's languages, in addition to fluent French. She has completed field projects spanning several years in both South Africa and Kenya. In her capacity as Board Member of the independent documentary film production company Interlock Media, she raised money, edited treatments, and obtained/reviewed archival footage for several human rights and conservation related films. Dr. Hardin was Kate Brook's advisor at the University of Michigan.

2019 Scholars Poster Presentations

Scholar	Research Title	Mentor(s)	
Portia Bharath Towson University	The relative effectiveness of common green behaviors	Dr. Shelie Miller , Director, Program in the Environment (PitE) Dr. Geoff Lewis , Research Specialist, Center for Sustainable Systems	20
Dominique Brown Virginia Commonwealth University	Hymenoptera in the Edwin S. George Reserve and Saginaw Forest: A closer look at familial diversities and abundances in the Michigan and Great Lakes regions	Dr. Erika Tucker , Research Scientist, Ecology and Evolutionary Biology (EEB)	16
Lindsay Canaday Hamilton College	Assessing fecal contamination impacts in the Clinton River Watershed: A pilot study using optical properties of water	Dr. Paul Seelbach , Professor of Practice, UM SEAS Christine Brown , Master's Student, UM SEAS and Environmental Engineering	18
Ryan Dapkus University of West Georgia	Reconstructing the fisheries management history of Bob Lake in Houghton County, Michigan	Dr. Karen Alofs , Assistant Professor, UM SEAS Kelsey Lucas , Research Fellow, UM SEAS	17
Toyosi Dickson Rutgers University	Using satellite images to characterize of cover crops in southwest Michigan	Dr. Meha Jain , Assistant Professor, UM SEAS Dr. Preeti Rao , Research Associate, UM SEAS	13
Clarice Hollenquest Michigan State University	Effects of herbivory on leaf shape morphology in sweet potatos (<i>Ipomea batatas</i>)	Dr. Regina Baucom , Associate Professor, Ecology and Evolutionary Biology (EEB) Sonal Gupta , Ph.D. Student, EEB	15
Lauren Holmes Oberlin College	Physiological measures of virtual reality (VR) engagement	Dr. Mark Lindquist , Assistant Professor, UM SEAS	20
Syed Hussain Wesleyan University	What The Fish? The effects of shoreline development on fish biodiversity in Michigan's inland lakes	Dr. Karen Alofs , Assistant Professor, UM SEAS Kelsey Lucas , Research Fellow, UM SEAS	17
Thea Louis Wellesley College	Understanding how soil fertility affects litter decomposition on organic farms	Dr. Jennifer Blesh , Assistant Professor, UM SEAS Beth VanDusen , Research Lab Tech, UM SEAS	13

2019 Scholars Poster Presentations

Scholar	Research Title	Mentor(s)	
Alanna Miyashiro University of Hawaii at Manoa	Trait trade-offs: Resistance to herbivory and herbicide in Velvetleaf (<i>Abutilon theophrasti</i>)	Dr. Regina Baucom , Associate Professor, Ecology and Evolutionary Biology (EEB) Nia Johnson , Ph.D. Student, EEB	15
Erin Noel University of Massachusetts, Boston	Private landowners and the changing northwoods: A study of beliefs towards climate change	Dr. Paige Fischer , Assistant Professor, UM SEAS Leigh Mitchell , Research Assistant, UM SEAS	21
Ian Ortiz Swarthmore College	Modeling climate change effects over time: National Climate Assessments indications and remaining uncertainties	Dr. Jenna Jorns , Program Manager, Great Lakes Integrated Sciences and Assessments (GLISA) Kimberly Channell , Climatologist, GLISA	12
Brayden Pollvogt Valparaiso University	Future of the forest: Comparing tree species' performance under climate change	Dr. Inés Ibáñez , Associate Professor, UM SEAS	14
Kiera Quigley Michigan State University	An overview of air quality monitoring in Detroit	Dr. Sam Stolper , Assistant Professor, UM SEAS	19
Mark Reid Denison University	Climate projections in the Great Lakes: Comparison of two National Climate Assessments in context of the Great Lakes watershed	Dr. Jenna Jorns , Program Manager, Great Lakes Integrated Sciences and Assessments (GLISA) Omar Gates , Climatologist, GLISA	12
Elle Sawyer Central Michigan University	Paper Wasps' (<i>Polistes fuscatus</i>) learning ability compared to facial variation	Dr. Elizabeth Tibbetts , Professor, Ecology and Evolutionary Biology (EEB) Meagan Simons , Ph.D. Student, EEB	16
Victoria Say Bryn Mawr College	Distribution of pollution in southeast Michigan: TRI facilities, income, and race	Dr. Sam Stolper , Assistant Professor, UM SEAS	19
Julia Talamo Mount Holyoke College	Perceptual reponses to virtual green spaces	Dr. Mark Lindquist , Assistant Professor, UM SEAS	21
Te'Yah Wright Alcorn State University	Impact of invasive species on native plant communities	Dr. Inés Ibáñez , Associate Professor, UM SEAS	14
Baili Zhong Pomona College	The role of cyanotoxins in <i>Daphnia</i> disease	Dr. Meghan Duffy , Professor, Ecology and Evolutionary Biology (EEB) Khadijah Payne , Frontiers Master's Student, EEB	18



2019 UM Doris Duke scholars' Water Conservation seminar trip to Shiawassee National Wildlife Refuge (June 28, 2019). Photo credit: Emily Rau



2019 UM Doris Duke scholars' Wildlife Conservation seminar trip to Detroit International Wildlife Refuge (July 12, 2019). Photo credit: Jeannie Braatz

Agriculture and Food Systems



Emily Chang, University of Michigan Fair Food Network | Angela Hojnacki Have your kale and eat it too: Bringing home the beets with Double Up Food Bucks

Double Up Fod Bucks is a program within Fair Food Network in which SNAP users double the amount they spend on fresh produce at farmers markets and grocery stores. The benefits are modeled on a triple bottom line of increased food access for consumers, new customers for local farmers, and more money for the local economy. As the outreach intern this summer, I am excited to share experiences and knowledge and hope everyone can also advocate for food access.



Alexis Hamilton, Florida A&M University Growing Hope | Elizabeth Bee Ayer *Growing more than just food: An urban farm experience*

This summer, I was introduced to the Growing Hope Farm in Ypsilanti, Michigan and some of their amazing programs. I was able to get hands-on experience on their farm and dabble in their Teen Leadership Program, Seed to Plate program, Home Vegetable Garden program, Incubator Kitchen, and Mobile Farm Stand.



Mia McPherson, Michigan State University The Farm at St. Joe's | Amanda Sweetman *Health promotion, equity, and education: Hospital-based farming solutions*

My talk will express how The Farm at St Joe's functions to implement communitybased solutions that promote healthy lifestyles and community engagement through hospital-based sustainable agriculture. My internship project focuses on improving outreach and education to members in our Produce to Patients program.

Community Engagement



Craig Freeland, Denison University UM Museum of Natural History | Brittany Burgess *Museum Education at the Natural History Museum*

I will highlight the two main dimensions of my internship, which involved working with the Museum's summer camp and designing the Investigate Lab. In addition, I will speak about the professional development I experienced while working at the museum.



Nathan Carpenter, Oberlin College Michigan Sea Grant | Catherine Riseng *Community engagement and education in Great Lakes conservation efforts*

I spent the summer working with Michigan Sea Grant, focusing primarily on two ongoing projects: developing an Adopt-A-Sturgeon program that we hope will ultimately become state-wide, and updating online materials for educators interested in teaching about Great Lakes science in an accessible and engaging way. These projects gave me a window into some of the conservation work happening in the area, how local residents can become active participants in that work, and the imperative of communicating about environmental topics in a clear and concise way.



Tiffany Pauls, Davidson College

National Wildlife Federation – Great Lakes Regional Center | Anna Bruner From the streets to the suites: Collaborating the NWF's Urban Initiative and Environmental Justice Program

This summer, I had the pleasure of working with Anna Brunner and Simone Lightfoot to develop communications content for the Urban Initiative program. I spent time developing their newsletter, establishing relationships within the programs networks, and conducting research for NWF's presidential platform that will target the 2020 campaigns.



Hal Terry, University of Michigan Great Lakes Commission | Elaine Ferrier *Great Lakes Invasive Plants Outreach*

To increase public awareness of the invasive grass *Phragmites*, I compiled successful restoration projects and interviewed experts in *Phragmites* management across the Midwest. Using this information, I created case studies and management guides for the Great Lakes Phragmites Collaborative's website.

Community Engagement



Danielle Vermeer, Arizona State University

National Wildlife Federation – Great Lakes Regional Center | Elizabeth Lillard Elevating women in conservation

During my internship I developed a communications plan for the Women in Conservation Leadership 2020 Summit. In my role I curated core content, interviewed program participants from around the nation, and wrote a blog highlighting participant experiences in the environmental arena.

Data and Land Management



Mikaila Davis, DePaul University

City of Ann Arbor Natural Area Preservation | Tina Stephens and Mike Hahn No time for a NAP: Invasive plant management at Natural Area Preservation

I worked with the Natural Area Preservation of Ann Arbor to restore, preserve, and protect the natural spaces around the city and build an environmental ethic among residents.



Alliyah Lusuegro, Swarthmore College (left photo) Jazlyn Marcos, DePaul University (right photo) Ecology Center | Jeff Gearhart and Gillian Miller Not always a breath of fresh air: Public health in the nonprofit world



We worked in the Healthy Stuff sector of the Ecology Center, primarily focusing on testing air quality monitors. This work included a mix of data clean-up, data analysis, task management, and lab work.

Data and Land Management



Erika Perez, Stockton University

UM Matthaei Botanical Garden and Nichols Arboretum | Mike Kost Reconnecting the Public with Nature using Location Based Technology

One of the goals of Matthaei Botanical Garden and Nichols Arboretum is to educate the public of the natural preserves it manages. My internship mainly consisted of collecting tree measurements, visuals, and location information on Big Tree specimens in Nichols Arboretum and combining this content into a Story Map for anyone to learn from and enjoy.

Water Quality and Management



Samara Almonte, Western Washington University Washtenaw County Water Resources Commissioner's Office | Catie Wytychak *Green infrastructure and water quality in Washtenaw County*

My talk will cover an overview of the Rain Garden Program at the Washtenaw County Water Resources Commissioner's Office and the impact it has on community engagement.



Sam Bower, University of Michigan Huron River Watershed Council | Jason Frenzel How to protect a river in eight weeks

From writing marketing materials to researching social media dashboards to assessing erosion in streams and creeks around the Huron River watershed, I have been exposed to the hugely collaborative and multidisciplinary work of the Huron River Watershed Council. Each person I've met has such an important role in protecting and restoring the Huron River and I am so fortunate to have gotten a glimpse of their commitment to this watershed.



Maria Ramirez, University of the South: Sewanee Washtenaw County Water Resources Commissioner's Office | Catie Wytychak *Spatial analysis on green infrastructure*

I worked for the Water Resource Commissioner's Office in Washtenaw County on rain garden design and maintenance while learning how this improves water quality. I used GIS on green infrastructure such as detention basins and drains which helped locate where they were for further analysis.

Climate Projections in the Great Lakes Region



lan Ortiz

Modeling climate change effects over time: National Climate Assessments indications and remaining uncertainties

The Great Lakes Integrated Sciences and Assessments (GLISA) program is funded by the National Oceanic and Atmospheric Administration and consists of climate and social scientists. GLISA's mission is to help build the region's capacity to prepare for and adapt to climate variability and change by bringing climate information to decision makers in a way that is usable and accessible to their needs. GLISA's work is used to inform the federal National Climate Assessment (NCA) reports that are published every four years to inform policy makers, tribal governments, and municipalities about the adverse disruptions to natural and human systems, as well as effective mitigation and adaptation strategies.

The purpose of our project is to assist GLISA with representing how datasets, model projections, and climate variables have been reported in the past, and how they developed over time between the 3rd and 4th NCA publications. Our concise synthesis of the information and sources renders the publications into informative tables and graphics that are accessible to be referenced by GLISA. This information can help inform GLISA's messaging around climate projections.



Mark Reid

Climate projections in the Great Lakes: Comparison of two National Climate Assessments in context of the Great Lakes watershed

Understanding the climate projections for the Great Lakes region is extremely important for future progress on climate action, as the Great Lakes region is a vital watershed and ecosystem. Research with Great Lakes Integrated Sciences + Assessments (GLISA), a National Oceanographic and Atmospheric Administration (NOAA)-funded research program, advances climate knowledge for adaptation in the Great Lakes. We critically analyzed and compared the 3rd and 4th National Climate Assessments (NCA3 + NCA4) and created comparison deliverables on several platforms. In summary, it was found that these assessments have moderate differences, as they exhibit some inconsistency in the data presented.

2019 Scholars Abstracts Forest and Agricultural Land Responses to Global Change Factors



Toyosi Dickson

Using satellite images to characterize of cover crops in southwest Michigan

Long term climate projections for the Midwestern region of the United States predict an overall increase in seasonal temperatures and precipitation, which will lead to a higher chance of soil erosion from agricultural lands due to increased drought and flooding events. To mitigate the effects that long term climate change will have on agricultural production in the Midwest, crop diversity and agricultural practices will need to be monitored. This project's goal is to confirm whether cover crops and management practices can be monitored with the help of remote sensing. We will use machine learning algorithms to predict and classify individual primary cover crop species on farms with an accuracy >85% (the target accuracy of our model), and ultimately determine which cover crops increase grain resilience. Ground data was collected from Berrien, St. Joseph, and Van Buren counties in southwest Michigan via field surveys to identify primary and secondary cover crop types grown in summer 2019, soil types, and other characteristics of the sampled fields. Sentinel 2 satellite images were collected for this time period (April-July 2019) and vegetation indices such as NDVI (Normalized Difference Vegetation Index) calculated from these satellite bands over time. We are able to interpret the vegetation phenologies from the temporal patterns of NDVI. From the ground data, it was found that the cereal rye was the most common primary cover crop followed by pasture and hay fields, and ryegrass. Amongst the primary cover crops, hay fields and pastures have consistently high NDVI values followed by annual ryegrass. Both cereal rye and crop cover mixtures demonstrated sporadic change between increasing and decreasing NDVI values, though both demonstrated an overall increase in NDVI values. The random forest classification algorithm is still in development and will be later tested to determine its ability to map individual crop cover species.



Thea Louis

Understanding how soil fertility affects litter decomposition on organic farms

Cover crops are non-harvested crops that can increase ecosystem functions on farms. Cover crop litter decomposition rates drive nutrient availability in organic and low-input agroecosystems, and are influenced by soil properties and soil management history. We designed an experiment on two farms in Ann Arbor, Michigan with similar soil types but different soil fertility levels, to determine the relative ability of each soil to decompose cover crop litter material. Following tillage of a legume-grass cover crop mixture, bags of fresh litter were buried in cover cropped and non-cover cropped areas of each field, and then recovered at two, six, 10, and 16 week intervals, with litter mass loss assessed at each time point. Initial decomposition rates were highest on the higher fertility farm; however, rates in the cover-cropped section of the lower fertility farm increased after two weeks so that total decomposition was not different from the higher fertility farm by week six. These results suggest that building soil organic matter through cover cropping can lead to increased rates of decomposition on lower fertility soils, and enhance nutrient availability from biological processes over relatively short timescales.

2019 Scholars Abstracts Forest and Agricultural Land Responses to Global Change Factors



Brayden Pollvogt

Future of the forest: Comparing tree species' performance under climate change

This study looks at how different species within the same forest respond to drought during the summer months. To investigate this question, we took tree cores from 101 different trees in the Saginaw Forest located in southeast Michigan. The species observed included Liriodendron tulipifera, Quercus alba, Quercus rubra, and Robinia pseudoacacia. Yearly tree growth was measured and correlated with the growing season temperature and precipitation from 1980 to 2009. Our results showed all species' growth to be positively impacted by increased precipitation and negatively impacted by dryer conditions although R. pseudoacacia and Q. alba are not heavily affected in any of the models. L. tulipifera is significantly affected by the varying levels of precipitation. We also found that increased average May temperatures positively affect the growth of R. pseudoacacia and L. tulipifera because of the increase in growing season. High max June and July temperatures negatively impact Q. alba growth. All species do well with high temperatures in a wet climate. This research is important because it helps to determine what species will comprise the forests in this area in the future. Determining whether a species will be around or not is useful because it may be a significant economical resource or it may affect certain wildlife that depend on that species for food or shelter. Further research should be done to help shape a better idea of what the forests in this area will be composed of in the coming decades.



Te'Yah Wright

Future of the forest: Comparing tree species' performance under climate change

Invasive species in forests may have a variety of mechanisms in which they are able to suppress or inhibit native regeneration. In contrast, deciduous forest ecosystems are usually related to systems with a low propensity to invasion (i.e., invasibility) due to light availability, a key resource for species recruitment. However, the establishment of secondary forests, as commonly found in the Great Lakes region, usually occurs in the presence of anthropogenic disturbances and propagule pressure of invasive species increasing the suitable conditions to plant invasion. In that sense, this research investigates invasive species use of resources (mainly space, light and soil moisture) and its impact to the abundance and diversity of native plant species in temperate deciduous forests. An observational experiment was implemented in four research sites in Southern Michigan: Edwin S. George Reserve, Saginaw Forest, Matthaei Botanical Gardens, and Nichols Arboretum. I compared 35 sets of paired plots (i.e., non-invaded and invaded) in regard to cover (% of natives and invasive species), native species richness, and abundance as well as environmental variables soil moisture (volumetric water content; %) and light availability (photosynthetically active radiation - PAR). The data were analyzed within a Bayesian framework. The results revealed that within invaded plots, there was less abundance as well as the diversity of native species. With respect to the resource of light, native species were directly competing with invasives. In contrast, the native species seem unable to out-compete invasives in space. Sites with higher soil moisture had no effect on native but enhances the ability of invasive species to take over.

Crop Improvement Traits for Resiliency



Clarice Hollenquest

Effects of herbivory on leaf shape morphology in sweet potatoes (Ipomea batatas)

Leaf shape is one of the most variable plant traits that are affected by multiple factors. One such factor is herbivory -- studies have found that herbivores influence the evolution of leaf shape and size, favoring certain leaf shape morphologies over others. Sweet potato, *Ipomea batatas*, is an important root crop that exhibits a wide morphology variation, especially leaf shape, but studies investigating this variation and importantly the factors influencing leaf shape variation are limited. We conducted a large scale field experiment to examine the extent of leaf shape variation and test whether leaf shape in sweetpotato is influenced by herbivory. We grew 2-3 replicates of 94 accessions of sweetpotato and analyzed three leaves each from a total of 235 plants for leaf shape traits and herbivory. We found that leaf shape in sweetpotato is highly varied with highly dissected leaves to no dissection and with highly elongated to round leaves. Further, we found no correlation between leaf shape traits, circularity and aspect ratio, and herbivory in sweetpotatoes indicating that herbivory might not be maintaining leaf shape diversity in this species.



Alanna Miyshiro

Trait trade-offs: Resistance to herbivory and herbicide in Velvetleaf (Abutilon theophrasti)

The introduction of chemical herbicide use in agriculture has led to the evolution of a variation of traits that aid in herbicide resistance. Herbicide resistance is a plant's ability to mitigate the effects of herbicide by developing defense mechanisms on a physiological level with a genetic basis. Velvetleft, Abutilon theophrasti, is an agricultural weed prevalent in the mid-western United States. A. theophrasti is known to heavily impact crop yields in corn and soy fields and is exposed to extensive herbicide treatment, leading to evolved resistance to multiple herbicides including glyphosate (active ingredient in "Roundup"). It is proposed that the allocation of resources to herbicide resistance is a tradeoff for herbivory resistance due to a limitation in the amount of resources. Before glyphosate application, herbicide resistant maternal lines will show a higher amount of damage from herbivores as compared to maternal lines that are not as herbicide resistant. After glyphosate application, the difference in herbivore damage will be increased significantly as herbicide resistant maternal lines allocate more resources to mitigate impacts from the glyphosate. With an increasing need for more sustainable agricultural practices, understanding how to limit herbicide use while maximizing crop yield is critical to decreasing negative environmental, ecological, and economic impacts.

Animal Diversity and Interactions: Fishes, Wasps, and Parasites



Dominique Brown

Hymenoptera in the Edwin S. George Reserve and Saginaw Forest: A closer look at familial diversities and abundances in the Michigan and Great Lakes regions

The animal order Hymenoptera (wasps, bees, sawflies, and ants) is incredibly diverse, encompassing a range of environmentally important behaviors from pollinators and parasitoids to herbivores and predators. They are considered the most diverse order beside Coleoptera (beetles). Studies on Hymenoptera in Michigan and the Great Lakes region, specifically those involving anything outside of bee and ant populations, are incredibly sparse. Little is known about many basic, yet essential, questions relating to hymenopteran biology and ecology. Yet, they provide incredibly necessary and beneficial assets to all life on earth, such as pollinating flowers of staple foods and regulating populations of pest insects. The objectives of this study were to, 1) Document what Hymenoptera are present in southern Michigan, and 2) Discover what habitats support the greatest diversity and abundance of Hymenoptera. To do this, Hymenoptera specimens and their associated data were collected at two field sites: the Edwin S. George Reserve (ESGR), a 1,300 acre educational and research land plot located 25 miles from downtown Ann Arbor, and the Saginaw Forest, an 80 acre plot of land located five miles from downtown Ann Arbor. Although not statistically significant, higher abundance and greater familiar diversity was found at the ESGR compared to Saginaw Forest. Family level composition was substantially different between the two sites as well. Differences in familial and guild composition between the two sites may be due to habitat size differences, floral composition, incomplete sampling (i.e. this is part of a larger project still in progress), or other unknown factors. Future research may include examining distributions as they relate to climate change over time, as well as continued study on current species present in Michigan, the habitats they live in, and food and host requirement.



Elle Sawyer

Paper Wasps' (Polistes fuscatus) learning ability compared to facial variation

Paper Wasps (*Polistes fuscatus*) commonly have lots of variation from population to population. The goal is to analyze how variation in Paper Wasp faces can be linked to learning ability and individual recognition. The wasps were tested with T-Maze using a negative reinforcement and their faces were analyzed. Results of the tests showed that populations with higher variation in faces were better at learning faces than those with little or no variation. Wasps with higher facial variation are better qualified to recognize faces and associate them with an individual.

Animal Diversity and Interactions: Fishes, Wasps, and Parasites



Ryan Dapkus

Reconstructing the fisheries management history of Bob Lake in Houghton County, Michigan

Fish assemblages in lakes can be heavily impacted by many factors including climate change, habitat alteration and management decisions causing shifts in the biological composition over time. In order to determine what controls current fish assemblages, it is vital to consider historical records. The Institute for Fisheries Research (IFR) is a partnership between the University of Michigan and Michigan Department of Natural Resources (MDNR). IFR has more than 80 years of inland lake data for thousands of lakes across the state, including extensive records of habitat and biological surveys and management events. However, historical IFR records are on paper, disjoint or non-standardized, and in cases incomplete. This makes identifying the causes leading to changes in community composition difficult. I collected lake survey reports, chemical treatment records, stocking records, and other notes associated with numerous lakes. Here, as a case study, I reconstruct the management history of a single lake and describe patterns in Bullhead (Ameiurus spp.) abundance and size that appear to have occurred as a result of physical and chemical fish removal practices. I also look at the impacts of the introduction of a predator (Walleye, Sander vitreus). These events likely produced the modern fish assemblage in this lake, which is characterized by an established Walleve fishery and fewer and larger bullheads. Here, I show that a lake's historical management is important for understanding fish assemblages.



Syed Hussain

What The Fish? The Effects of Shoreline Development on Fish Biodiversity in Michigan's Inland Lakes

Residential shoreline development poses serious concerns for the health of lake ecosystems. Human removal of deadwood, armoring of shorelines, and hardening of surfaces can negatively impact the variety of habitats available for fish and thus reduce biodiversity. Historical records from the Institute for Fisheries Research recorded cottage numbers as one way of quantifying the extent of human development on Michigan's inland lakes. These records also track the fish species found in initial surveys of the state's lakes. Using these two factors along with potentially confounding variables such as climate metrics and size and depth of the examined lakes, we examined the relationship between anthropogenic development on lake shores and the richness of fish species in a sample of Michigan's inland lakes, based on surveys from 1931-1960. Analysis of this historical data together with examination of modern trends could prove highly insightful for future lake management, protection, and restoration.

Animal Diversity and Interactions: Fishes, Wasps, and Parasites



Baili Zhong

The Role of Cyanotoxins in Daphnia Disease

Cyanobacteria release a variety of secondary metabolites into the environment that have both direct and/or indirect effects to other aquatic organisms. Cyanotoxins are of particular interest given their known negative consequences to vertebrates such as humans and other aquatic biota. However, little is known of the interaction between cyanotoxins and the parasites of aquatic organisms and whether secondary metabolites released in the water exacerbate or mitigate disease. To address the question of whether cyanotoxins have a negative impact on transmission parasites' spores in aquatic organisms, we exposed spores of the fungal parasite Metsch (Metschnikowia bicuspidata) to two well known cyanotoxins, microcystin-LR and anatoxin-a. Here, we exposed the fungal spores to different concentrations of the toxins with different exposure times. We then used those same spores to infect Daphnia dentifera and observed how infective and virulent the parasite was in the different concentration and exposure time treatments. Preliminary results show that longer exposure times and higher concentrations decrease the parasites ability to infect for microcystin-LR while anatoxin-a made the parasite more virulent (survivorship decreased) with increasing concentration. This study illustrates that different secondary metabolites have differential impacts on parasites of aquatic organisms that can lead to complex host-parasite interactions.

Air and Water Pollution in Metro Detroit



Lindsay Canaday

Assessing fecal contamination impacts in the Clinton River Watershed: A pilot study using optical properties of water

As part of a larger ongoing effort to address water quality stressors in the Clinton River Watershed, this study aims to evaluate continuous monitoring techniques for fecal contamination indicators. Methods are intended to replicate a similar previous study conducted in South Africa in order to expand the sample set, strengthen or contradict patterns found in results, and determine whether indicator patterns are watershed or condition specific. Sensors deployed throughout the watershed collect data continuously on specific fecal indicators, including tryptophan and optical brightener fluorescence and turbidity, that are compared to fecal bacteria lab analysis results of grab samples. This project is in its early stages, but with enough data, regression analyses will eventually determine the predictive ability of the indicators to identify fecal bacteria concentrations and the usefulness of this real-time data technology to inform decision making in watershed management.

Air and Water Pollution in Metro Detroit



Victoria Say

Distribution of pollution in southeast Michigan: Toxic Release Inventory (TRI) facilities, income, and race

Michigan has had ongoing environmental challenges for years, such as water guality and chemical pollution. This project explores ongoing environmental injustices caused by toxic waste, which include multitudes of carcinogens. The objective of this study is to investigate the relationships between pollution exposure and race and income in Southeast Michigan. Using data from the Toxic Release Inventory (TRI), we calculate the total number of facilities and toxic releases by census tract, averaged over the five-year period from 2013 to 2017. We then merge these data with income and race indicators from the American Community Survey over the same time period. We find a robust negative correlation between TRI counts and income, which suggests that the current burden of toxics exposure is borne disproportionately by low-income communities. We also find a negative correlation between TRI counts and proportion non-white. While this result is inconsistent with some other findings on the relationship between pollution and race, it could be explained by (a) imprecision in our current measure of exposure or (b) unobserved differences across census tracts that are correlated with race and affect toxic release siting. Future work will focus on improved exposure modeling and the addition of other census-tract level information as controls.



Kiera Quigley

An overview of air quality monitoring in Detroit

The objective of this study is to examine the past and current state of air quality in Metro Detroit using Environmental Protection Agency (EPA) Air Quality System data. We analyze annual data from air quality monitors in Wayne County, Michigan between 1980 and 2018. Annual, county-wide average concentrations of sulfur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), and lead have decreased significantly since 1980; trends in ozone concentrations remain inconsistent. Annual-average levels, however, mask significant variation in daily and hourly pollution exposure; in Southwest Detroit, peak SO2 levels frequently violate National Ambient Air Quality Standards. The monitoring network in this area is sparse: during our 39-year period of observation, only seven of the 25 unique monitors that show up in EPA data have recorded annual measurements in 20 years or more.

Human Behavior and the Environment



Portia Bharath

The relative effectiveness of common green behaviors

Green behaviors are those everyday actions an individual consciously takes to help the environment or, at the very least, minimize damage to the environment. Turning off the lights when not in use or recycling aluminum are strong examples of green behaviors, or green habits. In this study, four behaviors are evaluated: switching incandescent light bulbs for LED bulbs, reducing beef consumption, using alternative modes of transportation for the work commute, and avoiding disposable coffee cups. The goal of this inquiry is to quantify the effectiveness of a select group of these habits and determine if one has a greater impact than another. The carbon footprint of each activity was calculated based on an extensive Internet search for statistics and national data points. To make the findings more applicable to daily living, each green behavior was anchored on a year-long scenario corresponding to the life of an average American citizen. The key objective of the study is for people to understand that small everyday habits can have a significant effect on their personal carbon footprint, and to feel encouraged to make manageable changes that will decrease their negative impact on the environment.



Lauren Holmes

Physiological measures of virtual reality (VR) engagement

As digital technology and virtual reality (VR) become more prevalent in our society, research is required to investigate its effects and benefits. Specifically, research studying the correlations between VR and environmental understanding has been initiated. For my research, I explored the differences in physiological arousal, through galvanic skin response (GSR), comparing viewing a landscape via a simple screen environment versus using a head mounted virtual reality display (HMD). This research can be used to simulate outside environments in order to increase knowledge on topics like community engagement, accessibility to outdoor resources, or about the emotional responses to different landscapes. Experiencing an environment in VR is hypothesized to be more physiologically stimulating as it should be perceived as more realistic versus the same environment on a computer monitor. In order to test this hypothesis, I had participants experience three landscapes in both VR and screen conditions while their skin conductance was being measured by the Shimmer 3+ GSR device. This study found a significant difference in mean GSR measurements between the VR condition and screen, allowing us to conclude that VR is more engaging than experiencing environments via a screen.

Human Behavior and the Environment



Erin Noel

Private landowners and the changing northwoods: A study of beliefs towards climate change

Climate change is a crucial issue that society is facing. While many focus on climate change effects, this study focuses on how specific demographics perceive and believe climate change differently. A mailed survey was conducted on private landowners of the Northwoods forest region; The Northwoods forest region is located in the state of Michigan, Minnesota, and Wisconsin. Data from the survey was then analyzed to learn about private landowners' beliefs of climate change. The results show that gender, education, and income can influence beliefs towards climate change. This study contributes to an understanding of individuals beliefs on climate change, which can be used to target information and education material to different demographic groups better.



Julia Talamo

Perceptual reponses to multisensory virtual green spaces

Sound and visual experience affect the emotional responses of people to green spaces because they can enhance the human connection. Little is still known about how multisensory experiences impact perception. This research investigated affective and perceptual responses to multisensory simulations experienced on a screen and in virtual reality via a head mounted display (HMD). Results show a significant increase in affective responses when viewing landscapes with sound, as well as increasing perceived biodiversity. Centering the data collection on the 13 subjects and their experiences with the virtual landscapes has increased our understanding on what stimulates a human response to the environment observed. This is important because all the stakeholders must participate when designing landscapes and virtual reality has an opportunity to elevate environmental engagement for community members. This research will help define the relationship of a human connection to a virtual green space through visual and sound elements.

Thank you to our mentors and host sites!















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