

2018 Minnesota Climate Adaptation Conference

“Past, Present, Future, Together”

November 14, 2018

University of Minnesota

[Continuing Education and Conference Center](#)

1890 Buford Avenue

St. Paul, MN 55108



Book of Abstracts

10:30-11:50 **Breakout Session I**

- **Local Examples: Planning for Healthier, More Resilient Communities**
Denise Engen, Hennepin County

This workshop presents a spectrum of approaches to climate adaptation/resilience by connecting to health, specifically in local comprehensive plans. The workshop uses the framework of the Metro Healthy Comprehensive Plans Workgroup, a Twin Cities area resource for local planners and public health staff. Learn how this effort has facilitated peer-to-peer learning, provided support, built skills, created tools and made connections, and in so doing built regional capacity to adapt to a changing climate by building healthier and more resilient communities.

Participants will: 1) Learn the central importance of 'place' to health; and the connections between health, equity, resilience and the built, social & natural environments and how to more effectively communicate about these; 2) Hear from a panel of communities about local approaches to health and resilience; 3) Get tools and resources, and key takeaways for others looking to build similar groups or efforts. Proposed format: 1) Introduction to the health and planning connection, the value of peer learning and resource sharing (15 min.). 2) Presentations by communities in differing stages of integrating climate adaptation/resilience (60 min.). Each will share what was integrated into the comprehensive plan, lessons learned and highlight a local adaptation effort: "Just getting started", a presentation by a community that is integrating climate adaptation/resilience for the first time; "Picking up momentum", a presentation by a community that is expanding their climate adaptation/resilience work; "Full steam ahead", a presentation by a community that is leading by example and serving as a model for other jurisdictions. 3) Panelist Q&A (15 min.)

Moderator: Denise Engen, Hennepin County

Room: 42

- **Adapting Minnesota's Forests to a Changing Climate**

Leslie Brandt, Northern Inst. Applied Climate, USDA Forest Service

Minnesota is home to a diverse array of forests that provide benefits such as clean water, recreation opportunities, and forest products. Minnesota's forests, along with the services they provide, are being threatened by changes in temperature, extreme weather events, altered precipitation patterns, pests, and disease. This panel will showcase some of the ways that forest managers are being proactive and helping forests adapt to changing conditions and what they are learning from their work. The Northern Institute of Applied Climate Science and the USDA Northern Forests Climate Hub are bringing together presenters from across the state, representing a variety of ownerships and forest types. The first half of the session will feature brief presentations by each panelist on their adaptation projects and lessons learned. In the second half of the session, participants will have the opportunity to ask questions and engage in dialogue about how Minnesota natural resource managers and land owners can help adapt forests to climate change.

Moderator: Stephen Handler, U.S. Forest Service

Room: 155A

- **Stormwater Infrastructure Vulnerability Assessment and Adaptation Planning**

Janna Kieffer, Barr Engineering

Sarah Stratton, Barr Engineering

Minnesota's vast network of stormwater infrastructure provides residents and businesses with important services. As precipitation patterns in the Midwest intensify and stormwater infrastructure ages, we must recognize the importance of developing a thoughtful, long-range plan to manage infrastructure and establish resilience. A risk-based approach to evaluating stormwater infrastructure vulnerabilities can help cities, counties, and watershed organizations understand potential impacts, assess community-specific vulnerabilities, and inform and prioritize both short-term decision-making and development of a long-term plan for a more resilient system.

Risk can be defined in many ways, but can generally be described as the combination of the probability of something occurring and the magnitude of impacts. This risk definition provides a framework for a planning approach to help identify higher-risk stormwater infrastructure and prioritize monitoring, inspection, and/or improvements to mitigate or adapt to risk. Opportunities to reduce social and environmental impacts due to stormwater infrastructure failure can also be accounted for by incorporating readily-available GIS data sets into the risk-based approach.

In this session, several project examples will be used to illustrate (a) planning processes and tools that can help identify stormwater infrastructure vulnerabilities under existing and future climate conditions, and (b) potential strategies for prioritizing and addressing vulnerabilities through risk mitigation and/or infrastructure adaptation projects. The session will include a facilitated discussion.

Moderator: Erik Hansen, HGA

Room: 155B

- **Minnesota Ojibwe Bands Preparing for a Changing Climate**

Tansey Moore, 1854 Treaty Authority

Minnesota Ojibwe Bands are preparing for a changing climate through adaptation planning and monitoring projects to build resilience throughout the state. This presentation will feature the following speakers: Seth Moore, Environmental Biologist for the Grand Portage Band of Lake Superior Chippewa; Sara Smith, Midwest Tribal Resilience Liaison, College of Menominee Nation and Keith Karnes, Forester of Leech Lake Band of Ojibwe. The breakout sessions will highlight tribal adaptation efforts in Minnesota. This session will include presentations on adaptation strategies that focus on fish, wildlife and forestry as well as climate resilience coordination throughout the Midwest.

Moderator: Tansey Moore, 1854 Treaty Authority

Room: 83

1:20-1:45 **Poster session**

- **Northfield Food Recovery Expansion in Collaboration with the Supershelf Model**

Alex Miller, Carleton College

The City of Northfield, The Community Action Center of Northfield and Carleton College's Center for Community and Civic Engagement, and Sustainability Office are working to develop a community wide response to food recovery efforts. The Community Action Center of Northfield is transforming to a SuperShelf model, SuperShelf transforms food shelves, creating welcoming environments for communities to access appealing, healthy food. Partnering with food shelves across Minnesota, SuperShelf uses behavioral economic principles to promote healthy food choices, works with food shelves to meet specific SuperShelf stocking standards and values, and transforms the physical space to create an appealing environment. We are combining this SuperShelf model with Carleton's Food Recovery Network volunteer base and the City of Northfield's infrastructure to address food recovery at the community level. Northfield aspires to be a model community for food recovery, organic waste reduction and share this knowledge with other cities and communities. This case study highlights how a partnership between a college, non-profit and city government can reduce food insecurity and food waste in a community.

- **Religions United in view as Stewards of the Earth**

Carolyn Lonning

Information will be shared about Interfaith Power and Light, an interfaith environmental group and their involvement with Faith communities throughout Minnesota. They have helped congregations with solar energy, community gardens, divesting, and summer youth camps to name a few of the things they do. We will also share information about the International Environment Forum, a Baha'i inspired environmental organization active on local and international levels providing information and educating people about both the scientific, spiritual and moral aspects of caring for the earth.

- **Human Dimensions, Societal Issues, and Communications**

Moderator: Shahram Missaghi, University of Minnesota Extension

Room: 42

Climate Adaptation: Core Curriculum in an Academic Health Center

Shanda Demorest, UMN School of Nursing

Problem: According to leading experts, climate change is one of the most serious health crises that humanity has ever faced. Yet most health professionals do not learn about climate change in their education and therefore are ill equipped to support or lead mitigation and adaptation efforts as future professionals.

Significance: Health professionals are some of the most trusted members of the community, and therefore can positively impact behavior change. When health providers are educated about climate change they can effectively disseminate public health advisements and climate adaptation strategies aimed at creating healthier populations and communities.

Solution: The solution was to create an interprofessional climate change curriculum and process for inclusion to ensure that all students in an Academic Health Professional program will graduate with knowledge to take action on climate change. The approach involves three separate phases or levels of impact. These include: Phase I- orientation to climate basics during the first year; Phase II- climate and health impact content embedded throughout the curriculum; and Phase III- climate change mitigation or adaptation projects sometime during the final years of their studies. All three phases prepare students to make behavior changes in their personal and professional lives and lead climate change mitigation and adaptation efforts in their organizations.

Participant "take aways": Participants will be able to list specific steps to create and promote climate change content in the curriculum of any field of study.

Keep the North Cold: Exploring Unconventional Agriculture and Business Climate Collaboration

Aaron Reser, Green Lands Blue Waters

"A finger is often pointed at agriculture as a contributor to climate change. At the same time, farmers are facing realities of a changing climate. In the Midwest, we are likely to see more record hot days, more heavy precipitation events, and more frequent periods of soil moisture deficit caused by higher temperatures and greater evapotranspiration. While human population and food demand increase, the changing climate is expected to have an overall negative impact on global crop yields, including in the US Midwest. Current agricultural practices are contributing to this climate change, but farming with Continuous Living Cover has the potential to highlight agriculture as a climate change solution. Continuous Living Cover farming is the straightforward concept of getting as much value as possible from farmlands by growing crops that keep the soil covered year round, including cropping systems with cover crops and perennials.

So what does it take to shift the paradigm toward agriculture as a climate change solution?

It takes all of us.

Green Lands Blue Waters works with a wide network of land grant universities, state and federal agencies and non-profit organizations; scientists, policy experts, agricultural advisors, farmers, and community organizers. Everyone from farmers to eaters, General Mills to local MN-based companies, and media and policy makers have a role in flipping this script. Learn about our work with a diverse -- and sometimes unexpected -- group of climate champions.

Youth Convening Minnesota: Youth Leading Climate Solutions

Jothsna Harris, Climate Generation

Climate change is one of the most defining issues of our time. This generation, meaning everyone alive today, is the first to really experience the effects of climate change, and will have the biggest influence on how we address it. Young people are the ones inheriting the consequences from decades of poor decision making, yet are also powerfully positioned to bring their communities together to lead conversations on climate change and insist on solutions. Climate Generation will share results from our successful Youth Convening Minnesota (YCM) program, a 7-month leadership opportunity for high school youth to learn about climate change and gain the leadership skills needed to inspire solutions, culminating with a youth-led, community-wide public convening on climate change. Designed in response to the urgent need to increase the competency and confidence of local communities to cope with and respond to the impacts of climate change, YCM brings science, storytelling, and local climate actions together under youth leadership. Climate Generation sees resiliency encompassing thriving, connected, and responsive communities, which involves building the capacity and innovation of individuals, organizations, and communities to constructively adapt to, mitigate, and address climate change.

Participants who attend this session will learn about Climate Generation's model for youth climate leadership, how to elevate youth to mobilize their communities to engage in solutions, and explore opportunities for youth leadership in their local community.

- **Natural Resources Adaptation Strategies**

Moderator: Fred Rozumalski, Barr Engineering

Room: 155A

Climate Adaptation Status, Issues, and Opportunities in Minnesota Forests

Eli Sagor, UMN Cloquet Forestry

Forest land accounts for about a third of Minnesota's land base, making long term forest health and productivity a high priority. Because trees generally take 35 to 80 years to reach maturity, planning and preparing for the future, including a changing climate, are essential for forest managers. Key forest adaptation issues include warming winters which constrain winter harvest opportunities and can enable range expansion of both desirable and undesirable species; changes to ecosystem processes from fire suppression and changes to native and non-native pests and pathogens; and varying levels of knowledge and motivation to change among the diverse natural resource manager and landowner communities.

However, for the most part climate adaptation planning and implementation are well underway on much of Minnesota's forest land. Forest adaptation to a changing climate tends to be grounded in the resistance, resilience, transition framework (Millar et al. 2007). Planning activities include continuing education and developing plant community-based silviculture prescriptions that account for increasing uncertainty. Key practices include ensuring strong alignment between the silvicultural prescription and the native plant community "trajectory," acting quickly to address invasive species and other issues that can compound climate-related stress, promoting ecosystem diversity and heterogeneity at a variety of scales, and favoring regeneration of species projected to respond favorably to future conditions. Opportunities to increase the scope and pace of climate adaptation include increased communication and continuing education, use of frameworks like the Northern Institute of Applied Climate Science's Climate Change Response Framework to simplify adaptation planning, and research to inform adaptation efforts.

Changing Climate Impacts on River Nitrogen Loads

Satish Gupta, UMN

Nitrogen (N) losses from the Midwest United States is contributing to the expansion of hypoxic zone in the Gulf of Mexico. Studies suggest that the expansion of hypoxic zone is from increased N fertilizer use and drain tile installation in agricultural landscapes. There are limited studies on the role of changing climate on increased N loads in various rivers. This study evaluated precipitation and land cover change impacts on streamflow, baseflow, flow weighted N concentrations, and N loads in seven Midwestern rivers: the Minnesota River, the Blue Earth River, and the Cottonwood River, MN; the Embarras River, and the Illinois River, IL; the Grand River, MO; and the Maumee River, OH. Analysis showed that annual streamflows and baseflows were controlled not only by the current year precipitation, but also by the previous year precipitation. The previous year precipitation effects were through increased or decreased soil wetness. Area under soybean production, a surrogate of increased tile drainage and replacement of prairies was generally not a significant explanatory variable in annual analysis. In monthly analysis, precipitation in both the current and previous months and in the previous year were important in controlling streamflow, baseflow, and N loads. Area under soybean production was significant in some months but had a lower statistical power than the precipitation. Large spikes in river N loads were caused by increased precipitation or leftover soil N from previous dry years. This presentation discusses pros and cons of different adaptation options in controlling N losses to Midwestern rivers.

The Landscape of Proposed Adaptation Projects in the US and Midwest Conservation Sector

Sarah Skikne, UC Santa Cruz

Despite progress in climate adaptation planning, there is limited understanding of how climate adaptation is being implemented in the conservation sector. To address this gap, we synthesize early efforts to implement adaptation through on-the-ground projects across the US and in the Midwest in particular. By synthesizing a fragmented field and focusing attention on gaps, we sought to enhance strategic resource allocation, targeted capacity building, and adaptation outcomes. We used a unique data set of 415 project proposals submitted to the Wildlife Conservation Society's Climate Adaptation Fund from 2011-2015. In order to assess emerging efforts, we evaluated the distribution of proposed projects across ecosystems and taxa, the types of strategies and tools described, and the geographic alignment of proposed projects with predicted climate impacts. We also analyzed the sixty-one projects proposed by non-profits in the

Midwest, to assess how efforts vary within the region and differ from projects elsewhere in the country. Across the US, most proposals focused on river and riparian ecosystems, and fish were the most common taxonomic focus. Broad strategies included some novel conservation approaches, while actions proposed to deploy them were mostly traditional, well-established management techniques. Our findings highlight the need for expansion of the current taxonomic, ecosystem and geographic foci of emerging climate adaptation efforts.

- **Infrastructure Adaptation Strategies**

Moderator: Patrick Hamilton, Science Museum of Minnesota

Room: 83

Climate Resiliency Planning and Energy Efficient Buildings

Douglas Ahl, Seventh Wave

Climate resiliency has become an important strategy in sustainability planning for communities and the implementation of energy efficiency in buildings is often included as an important plan element. However, there are no standardized methods for estimating future climate impacts to building systems and design. Research suggests that due to the changing climate, predicted energy savings from ‘green’ buildings in design today may be significantly different from actual building performance, particularly in the coming years. This presentation will provide case studies and research on the impact of future weather scenarios on energy use of buildings and energy efficiency strategies including code compliance, and discuss survey-based feedback from a wide variety of stakeholders about climate and clean energy planning. This presentation will provide attendees an overview of the sustainable building design and operations industry with particular attention to building energy performance resiliency to climate change in Minnesota and the Midwest. Attendees are expected to gain insight and ideas for using the climate data available to plan for sustainable building performance in the future.

Potential Benefits of Rural Photovoltaics to Climate Adaptation

Shawn Schottler, Science Museum of Minnesota

Heavy precipitation events due to climate change are increasing in frequency in many part of Minnesota and raising the risk of more erosion on farmlands planted with annual crops and increasing the likelihood of more downstream sedimentation and flooding. Many farms have some portions of their acreages that are marginally profitable when planted to conventional crops, such as corn and beans.

The costs of solar photovoltaic energy have dropped so precipitously in recent years that ground-mounted solar arrays with pollinator-friendly perennials planted as ground cover beneath them are now economically viable in many locations. The conversion of marginal cropland into solar farms generating electricity would help attenuate storm water runoff and downstream flooding from heavy rains while also providing many co-benefits – a dependable, supplemental income for farmers; groundwater recharge; wildlife habitat; cleaner surface waters, and below ground carbon sequestration.

This session will review recent modeling work in Minnesota of the economics of using solar photovoltaics as a novel new “crop” for farmers in combination with perennial groundcovers, explore several examples

of existing rural solar photovoltaic arrays in Minnesota, and conclude with a discussion involving both session leaders and audience members about how to encourage the conversion of more marginal cropland to solar photovoltaics with perennial ground covers in Minnesota.

Building Resiliency in South Washington County

John Loomis, South Washington WD

The South Washington Watershed District (SWWD), through its watershed management planning process, identified addressing climate change as a top priority, with a stated goal of facilitating increased resilience of District resources and public infrastructure through development of information and strategies and implementation of accepted climate adaptation practices. As a step toward achieving that goal, SWWD collaborated with its member communities and stakeholders, including adjacent watershed organizations, to identify the top concerns and priorities of the community relative to climate change. SWWD hosted a series of workshops to educate the policy-makers, staff, and concerned residents of the member communities and to provide an opportunity for the communities to identify their top climate hazards and associated mitigation strategies. SWWD compiled the stakeholder input into 4-page summaries specific to each community. Several of the communities and the county are using this planning information in their 10-year planning efforts. SWWD then performed further analysis and developed recommendations on three key concerns raised at the workshops: storm sewer infrastructure, natural resources, and groundwater resiliency. SWWD developed a climate resiliency plan that SWWD and some of its communities are already using to implement projects. This session will discuss how SWWD is working to reduce climate-related risks through planning, stakeholder engagement, and project implementation throughout its watershed leveraging partnerships with its member communities and stakeholders.

- **Tools**

Moderator: Ann Banitt, U.S. Army Corps of Engineers

Room: 155B

Utilizing Forecast Technology for Flood Prevention

Tiffany Schaufler, Minnehaha Creek WD

The Minnehaha Creek Watershed District (MCWD) has observed extreme rainfall events as a result of climate change, and through a partnership with the National Weather Service (NWS), is taking steps to proactively control dam operations to prevent flooding. MCWD operates a dam on Lake Minnetonka in accordance with an approved operating plan which prescribes discharge zones based on the time of year, the existing lake level, downstream capacity in Minnehaha Creek, and forecasted precipitation.

In 2014, MCWD experienced a record amount of precipitation in the first half of the year, resulting in flooding throughout the watershed. Lake Minnetonka reached an all-time high level in 2014 which caused the dam to become inundated and thus inoperable for 83 days, resulting in major flood damage along Lake Minnetonka and Minnehaha Creek. After the 2014 flooding, MCWD set a goal to identify ways to refine dam operations in an attempt to respond to the effects of climate change.

The NWS has been a critical partner to assist MCWD with this goal and has developed two tools for MCWD. The first tool is a precipitation forecast for the Lake Minnetonka drainage area which feeds into the second tool, a reservoir inflow model for Lake Minnetonka. This model allows the NWS to create inflow and lake level predictions for Lake Minnetonka which MCWD uses to inform dam operations. The value of this partnership was observed in 2016 as proactive dam management prevented flooding on Lake Minnetonka and Minnehaha Creek during the wettest year on record.

Trends in the Frequency of Intense Rainfall Events in Minnesota from 1948-2017

Jason Ulrich, Science Museum St. Croix Research Station

Increasing trends in the frequency of intense rainfall events (commonly defined as 1 or 2 inches or greater in 24 hours) have been reported from state-wide to upper Midwest geographic scales, mostly based on the comparison between the sums of total intense events between two periods (e.g., 1961-1980 vs. 1981-2000). Our work takes a relatively long period of record (1948-2017) and applies different statistical trend tests to 1, 2, 3, 4 inch or greater rainfall events (over 24- and 72-hour durations) across ~150 NWS COOP stations in (and within 10 miles of) Minnesota. Stations were selected based on an 80% valid data criterion. We analyzed trends on annual and monthly timescales at each station as well as aggregated climate-division and basin scales. Our results show increases in intense rainfall events occurring at the majority of stations; however, the extent of increase and statistical significance varies considerably across regions in the state, with the southwest and southeast regions of the state generally seeing the largest increases in intense event frequency. Increases are generally largest for 1 inch or greater/24 hour events, and the largest relative increases are observed in the spring and fall. We will report our results in detail and discuss implications for hydrology and water quality in Minnesota.

Cool and Collected: A Means to Resilience

Eric Wojchik and Emily Resseger, Met Council

Climate hazards can take a toll on regional investments, be they transit infrastructure or our wastewater assets. As an agency, the Metropolitan Council maintains regional assets and manages investments with climate change in mind. The regional Climate Vulnerability Assessment (CVA) consists of tools and best practices that can assist in Council and community planning efforts to build resilience and reduce the potential risks associated with climate change. The CVA can reveal system vulnerabilities to currently occurring and, to some extent, expected climatic changes.

A vital component of the Metropolitan Council's CVA work includes the provision of tools and resources for metropolitan community and stakeholder use. The Council has created a Localized Flood Screening Map Tool and an Extreme Heat Map Tool (along with publicly available datasets) to assist communities in identifying areas and infrastructure at risk of localized flooding and the characteristics that exacerbate the Urban Heat Island (UHI) effect. Both of the tools are interactive and user-friendly. To complement the tools, the Council has produced GIS-based Story Maps that provide a public interface for the CVA work. To assist stakeholders, the resources include recommendations and best practices to mitigate the effects of the localized flooding and extreme heat climate hazards.

Staff from the Metropolitan Council will display these resources and tools and demonstrate their application for asset and community resilience planning. The aim of this session is to promote best practices through the delivery and use of tools for diverse user needs.

3:30-5:00 **Breakout Session III**

- **Human Dimensions, Societal Issues, and Communications**

Moderator: Nissa Tupper, Minnesota Department of Health

Room: 42

Exploring the Leadership Role of Higher Education in Minnesota Climate Adaptation

Troy Goodnough, UMN Morris

This workshop will discuss how several Minnesota higher educational institutions (University of Minnesota (Morris, Twin Cities), Bemidji State University, Carleton, Macalester, and others) are working to engage with their campuses and communities on climate adaptation. Minnesota colleges have been working for the past decade to mitigate carbon, but collectively, they are at the beginning of their adaptation journey. Collaborations between campuses and communities can provide unique opportunities for student learning and engagement. In rural areas, discussing resilience instead of climate change can open doors to conversation about community vitality and what climate-related vulnerabilities threaten it. The topic of resilience has emerged as an increasingly important topic in the national sustainability conversation. This workshop will discuss how higher education is working with national, statewide, and local partners to improve their resilience efforts (e.g. Second Nature Climate Commitment, Rural Climate Dialogues). The workshop will provide space for colleges to consider next steps in their own campus goal-setting. The workshop panelists will also provide brief case studies of how they have been taking steps towards increased campus-and-community resilience.

Engaging Rural Communities on Climate and Energy Issues

Camille Morse Nicholson, Jefferson Center

Rural communities play a key role in our energy, climate, and agricultural future. However, residents and businesses in rural areas are often underrepresented in policy development and civic engagement. The Rural Dialogues, launched by the Institute for Agriculture and Trade Policy and the Jefferson Center in 2013, seek to change that.

Based on the notion that unleashing the diversity of a community is the best way to solve tough problems, the Rural Dialogues convene a group of demographically stratified community members to learn together over multiple days and filter critical information to share with the rest of the community, discuss their values and unique perspectives, and develop community-specific policy recommendations based on shared priorities. These recommendations form the basis of community adaptation planning, with partners from the public and private sectors focused on implementation in conjunction with citizens.

To date, Dialogues and complementary projects have been hosted in Stevens County, Itasca County, and Winona County, focused on climate change, extreme weather, and community resiliency, and energy

issues. The Dialogues have sparked new partnerships and supported community-driven action, including a unique utility-community action agency collaboration focused on energy efficiency for low-income households, and a multi-partner strategic plan for the future of the energy system in Stevens County.

Presentation attendees will walk away with an understanding of more productive strategies for community engagement and cross-sector collaboration on climate adaptation.

Exploring the Role of Outdoor Recreation in Climate Resilience

Thomas Beery, UMN Sea Grant

Climate change has implications for outdoor recreation in Minnesota including the need for adaptation efforts to safeguard outdoor recreational infrastructure and resources. Beyond this need, an opportunity for outdoor recreation to contribute to broad-based community adaptation exists. This presentation will highlight an October 2017 climate adaptation workshop held in Duluth. The workshop used a National Oceanic and Atmospheric Administration (NOAA) program as a foundation for the training; this NOAA workshop template has been used successfully in numerous communities across the US. For the Duluth workshop, the curriculum was customized and localized to serve outdoor recreation professionals in the Twin Ports of Minnesota and Wisconsin. This effort was undertaken both in acknowledgement of the importance of outdoor recreation and nature-based tourism for the region, while also grounded on the idea that outdoor recreation has an important role to play in adaptation efforts. During the workshop the opportunity to capitalize on various co-benefits provided by a focus on outdoor recreation and climate adaptation was considered. For example, open space planning to address outdoor recreation opportunity coupled with stormwater management (adaptation) may serve a variety of other benefits such as biodiversity, water quality, urban aesthetics, etc. Specific outcomes and implications from the Duluth workshop will be presented including the development of a resilience checklist for the City of Duluth Park and Recreation Department, a tool to mainstream the discussion of climate adaptation into municipal park and recreation planning. Finally, this presentation will provide ideas for moving the climate change/outdoor recreation adaptation agenda forward.

- **Natural Resources Adaptation Strategies**

Moderator: Leslie Yetka, Freshwater

Room: 155A

Adaptation Strategies for Fisheries Management in Northeastern Minnesota

Dean Paron, MNDNR Fisheries

Northeastern Minnesota streams, rivers, and lakes support a valuable recreational fisheries for cold-water trout species including brook trout, rainbow trout, lake trout, steelhead, and splake. Climate change is rapidly altering aquatic systems with increasing temperatures, changes to precipitation and streamflow patterns, and increased disturbance. These changes are particularly problematic for trout that depend on cold, clean water in interconnected stream networks. Consequently, recent work has predicted changes in stream and lake temperature under realistic climate scenarios in an effort to identify and preserve vital and resilient cold-water habitats and refugia. However, little has been work done to incorporate strategies that protect or enhance these habitats once identified. Therefore, the Minnesota Department of Natural Resources Finland Area

Fisheries office has been recently incorporating adaptation management strategies to address the changing climate, while balancing short-term management needs of stakeholders. Here we describe the importance of long term monitoring to implement climate change strategies and to provide adaptive management when necessary. Also, we will describe current adaptation strategies that develop resilient ecosystems by using current management actions that manage riparian zones, restore connectivity, manage at the landscape-level, protect ground water inputs, and use stream geomorphology to guide restoration efforts.

Understanding Largemouth Bass Range Expansion in Northeastern Minnesota

Bethany Bethke, MNDNR Fisheries

Largemouth Bass distribution and abundance appears to be increasing in the northern edge of the species' range, including in northeastern Minnesota. Although Largemouth Bass are considered native they have remained at very low or undetectable levels in many lakes until recently. Now anglers are catching Largemouth Bass with more frequency resulting in concerns about the species competing with other sportfish and questions about why Largemouth Bass are increasing. Because of these concerns, more information is needed about factors making lakes likely to have more Largemouth Bass and Largemouth Bass interactions with other sport fish. We studied nine northeastern Minnesota lakes with different types of Largemouth Bass populations (lakes with no bass, populations first detected after 1990, and populations established before 1970). We compared the aquatic vegetation abundance, water clarity and temperature, and feeding habits of sport fish in these lakes. We found that lakes with higher abundances of aquatic vegetation were more likely to have Largemouth Bass, but that Largemouth Bass diets did not overlap with other adult sport fish. The hydroacoustic methods used to measure aquatic vegetation can be applied by to other lakes using a commercially available software and depth finder, and the technique will be demonstrated in this presentation. As longer growing seasons may be leading to increases in aquatic vegetation abundance, this method may have many applications for understanding how aquatic ecosystems are responding to climate change and adapting to that change.

Climate Warming Presents Challenges for Water Quality Restoration in Lake of the Woods

Jesse Anderson, MPCA

Lake of the Woods (LoW) is a large, complex lake on the border of Minnesota and the Canadian provinces of Ontario and Manitoba. LoW serves as a drinking water source for over 750,000 people, and is a premier summer cottage, fishing, and tourism destination. Minnesota declared portions of the lake impaired in 2008, due to high levels of nutrients and algae. Although algal blooms were recorded historically in LoW, there's a perception by the public and resource managers that blooms have worsened over the last few decades - despite significant reductions in nutrient loadings to the lake. Climate change impacts to LoW are evident and have been the subject of recent studies in the peer-reviewed literature. In summary, in northern basins, increases in the ice-free period coupled with warmer winter and summer temperatures, have increased algal production and changed biological communities- a concern for lake managers. In the expansive southern basin, there are no trends in ice-out datasets (although the ice phenology record is shorter) and remote-sensing research indicates blooms are most severe in warm, dry years. Climate change will complicate recovery of LoW as warmer water, thermal stability, and changes in ice duration may exacerbate nutrient release from lake sediments, further feeding algal blooms. Climate change adaptation will be difficult, as forests, wetlands, and water comprise greater than 95% of the basin's land area. Climate change will be a fundamental component of

future research, monitoring, and restoration and civic engagement activities in the 25,000 mi² LoW basin.

- **Infrastructure Adaptation Strategies**

Holistic Planning for Campus Resilience: Collaborative Gaming Workshop (limit 36)

Elizabeth Turner, Precipitate, PLLC

College campuses today face multiple demands on their physical infrastructure beyond supporting academic and research needs while being fiscally responsible. They must be resilient to weather and other disruptions while attracting and supporting students and demonstrating sustainability. Stakeholders in planning efforts bring varied perspectives on what should be prioritized, and separate plans for each of these goals can lead to inefficient use of resources in the planning process as well as overlooked design opportunities. Workshop attendees will explore the benefits of Integrative Planning by playing "Campus Resilience", an educational and collaborative campus planning game. Condensing several decades of decision-making into one hour of game play, participants will take on a role of a campus stakeholder to plan campus development that supports the academic experience while balancing funding of sustainability projects with operations and deferred maintenance, mimicking the real competition for priorities (and dollars) that campuses face. Players will test the resilience of their campus to external events and work together to achieve academic, cultural, environmental, and financial vitality. This game demonstrates that an integrated approach to planning for facilities, resilience, and carbon neutrality is fundamental to creating flexible campus facilities plans that meet the needs of campuses now and well into the future. Participants will leave with a more holistic understanding on impacts to campus resilience, able to identify and communicate facilities maintenance and sustainability strategies with highest impact at least cost. They will build empathy by better understanding diverse perspectives, improving stakeholder engagement.

- **Tools**

Moderator: Erik Hansen, HGA

Room: 83

Incorporating Climate Resilience within Civil Works Studies

Garrett Blomstrand, US COE

Climate change has the potential to affect each of the missions of the U.S. Army Corps of Engineers (USACE). Water resources professionals must recognize that the assumption that past conditions can be used to predict the future may no longer hold true as a result of climate change. It is necessary to develop guidance and tools which can be used to study climate related variables and build resilience into civil works projects. The purpose of this workshop is to spread awareness of USACE efforts to study climate change and create tools which assist in the civil works planning process.

Participants who attend this workshop will gain an understanding of how the USACE performs qualitative climate assessments and incorporates the results of these assessments into civil works projects. Tools for assessing stationarity, trends in hydroclimatic variables, and projections of future streamflow will be discussed. Results from these tools can be incorporated into the planning and design

process for a variety of different civil works projects. A case study of how the climate assessment tools are applied to the Minnesota River Watershed to assess impacts of climate change to flood risk management activities, ecosystem restoration activities, and riverine navigation will be presented.

Minnesota Interagency Climate Adaptation Team

Laura Millberg, MPCA; Dan Shaw, BWSR

Floods, winter thaws and freezes, landslides, erosion, urban heat.... These are not new issues for Minnesota but they may become a bigger problem as we continue to experience extreme precipitation, warming temperatures and other impacts of climate change. To move forward on recommendations in the 2017 report “Adapting to Climate Change in Minnesota,” the State’s Interagency Climate Adaptation Team has been engaging stakeholders over the past year to help prioritize next steps. Topics explored related to extreme precipitation, health, natural habitat, agricultural water management, buildings and infrastructure, and climate information for public outreach with the goal of further refining climate resiliency strategies by state agencies. Key issues raised by stakeholders, common themes, and prioritized action items will be presented, followed by a conversation about potential next steps.

Connect on Health Tips and Tricks for Effective Climate Communication

Micaela Resh, MDH

Confusing science. Distant impacts. Partisan issue.

Climate communication can be daunting, but it doesn’t have to be.

It’s time to start a new conversation about climate change. Micaela Resh from the Climate and Health Program at the Minnesota Department of Health will be providing tips and tricks for effective climate communication—based in health.

This presentation will cover:

- Current research on public climate knowledge
- New strategies to engage the public in climate and science solutions
- Tools for educators and communicators to engage more effectively with their audiences

Micaela will share communication success stories from the Minnesota Climate and Health Program. Projects will span a variety of media, including social media, videos, printed materials, and graphics. The communication techniques discussed can be applied across state agencies, local units of government, schools, universities, non-profits, and the private sector.