PIECES OF THE CLIMATE PUZZLE: FITTING TOGETHER CLIMATE PLANNING IN REGIONAL URBAN PARK SYSTEMS, ECOSYSTEM SERVICES, AND COMMUNITY ENGAGEMENT

By

Ellie Ann Schiappa

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ABSTRACT

Climate change is continuing to accelerate and impact communities globally. While not experiencing the most extreme climate impacts, the state of Michigan is taking action to mitigate and adapt to an uncertain future in many ways, one of which is by creating expansive climate action plans. In 2022, we partnered with the Huron-Clinton Metropolitan Authority (HCMA or the Metroparks) to create their own climate action plan (CAP) that complements and extends existing climate action in the region, while addressing Metroparks-specific concerns. HCMA is a regional park district of 13 Metroparks across five counties in Michigan – Livingston, Oakland, Macomb, Wayne, and Washtenaw – and is proximate to two major urban centers – Detroit and Ann Arbor. HCMA provides nearly 25,000 acres of green space with multiple recreation opportunities for the 4.8 million residents of southeastern Michigan. Recognizing their role as leaders in the region for recreation and the well-being of their users, they were driven to create a plan to protect their communities within and beyond park borders.

This thesis is couched within this multi-phased project and is organized into four distinct chapters. My findings draw attention to a misalignment between managerial planning efforts, and perceived climate change observations by visitors of the Metroparks. By using a suite of qualitative methods and theoretical frameworks, I aim to address two main research questions: (1) How are climate actions and goals being framed in current planning efforts across southeastern Michigan? and (2) In what ways do community experiences align with and deviate from this current framing? Chapter one provides a comprehensive literature review for this thesis and these two questions. Chapter two addresses question one through a qualitative content analysis of ten CAPs from a co-defined region that intersects with the Metroparks. Using an expanded recreation amenities framework, this chapter discusses the network of climate actions already happening in the region, and presents opportunities to extend climate action further into/across the Metroparks. Chapter three addresses question two by using data gathered from park visitor focus groups. This chapter builds on findings from chapter one, and discusses the important role that water plays, year-round, in the lives of Metropark visitors. Analyzed using a water ecosystem services framework, this focus group chapter conceptualizes water's ability to transcend across settings, scales, and contexts. Chapter four summarizes contributions across the two main research questions and chapters. Overall, this research provides both managerial and theoretical and builds knowledge to bolster climate conversations in southeastern Michigan.

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LIST OF ABBREVIATIONS

HCMA Huron-Clinton Metropolitan Authority

CAP Climate Action Plan

ES Ecosystem Services

CES Cultural Ecosystem Services

ESw Water Ecosystem Services

‘’**Chapter 1:** Context of the program of research with the Huron-Clinton Metroparks

Climate Change in southeastern Michigan

Climate change poses a variety of social and ecological threats unique to each respective region across the world. Threats such as changes in expected temperatures can impact essential processes including migration patterns and shifted/altered habitats for plants and animals (USGCRP, 2018). Nutrient cycles can become disrupted, and the threat of drought may endanger water-reliant species from eating, reproducing, or migrating as water availability and the cycle stages change. Agricultural systems also face obstacles, as farmers must adjust harvest and planting seasons, face new crop pests and diseases, and manage the flooding of their crop fields (USGCRP, 2018). Flooding damages homes and degrades resources on which communities rely. Communities face climate changes in different combinations and at varying intensity, leading to the need for implementing intentional and individualized planning efforts.

The Midwest and Great Lakes region, for example, are not facing climatic shifts at the same magnitude as other regions of the U.S. but are encountering their own unique suite of concerns changing regional ecological communities. Due to the historical and industrial trends of this region, identifying changes directly related to climate changes can be difficult, and hard to differentiate from concurrent factors such as urbanization or land use change (Balasubramanyam et al., 2019). Regardless of the causes of ecological changes, the trends will continue to grow more drastic over coming decades, and urban spaces and natural areas will grow more vulnerable to these threats (Balasubramanyam et al., 2019; Deetjen et al., 2018; Elmqvist et al., 2019). The most prevalent climate issues that communities face in southeastern Michigan are increased precipitation and extreme heat events (USGCRP, 2018).

Increased Precipitation

Throughout the Great Lakes region, heavy precipitation events have increased 14% since 1951 (Environment and Climate Change Canada & U.S. National Oceanic and Atmospheric Administration, 2022). In the metro Detroit region, major flood events have become more frequent, causing recurrent household flooding and impacts to infrastructure (Sampson et al., 2019). Infrastructure in the region is aging and not adequate for the management of increased influxes of water. As a rust-belt city, there are many under-resourced communities that are facing the brunt of these water events, with chronic disinvestments in their communities (Sampson et al., 2019; Steis Thorsby et al., 2020). The current, and outdated, combined sewer and storm drain system in Detroit and the surrounding area causes dangerous backups into streets and household

basements, creating public health and safety concerns (Sampson et al., 2019; Steis Thorsby et al., 2020). These backups cause hazardous inland flooding, resulting in some of the highest economic, infrastructure, and public health concerns of any climate threat (Sampson et al., 2019).

Extreme Heat

The region's other main concern lays in extreme heat events. Overall, the average temperature has risen 2.3 degree Fahrenheit across the Great Lake states since 1951 (Environment and Climate Change Canada & U.S. National Oceanic and Atmospheric Administration, 2022). This rise is projected to increase drastically. Urban heat island effect causes severe health concerns by trapping hot air near buildings and blacktop or pavement. In a region that was not developed to manage this type of heat, residents who are low-income, elderly, and of other vulnerable populations are at high risk of facing heat stroke and other dangerous health conditions (USGCRP, 2018). Increasing financial concerns are also a major worry, as cooling costs will increase, adding to financial burdens and insecurity. These heat events in tandem with drought are also a threat to agriculture, a major industry in the region. In 2020, agriculture contributed $70 billion to the Michigan economy (GLBN, 2020). But with unpredictable temperatures, farmers will be forced to navigate changes in growing seasons, reconsider crop feasibility, and manage conflicts with new insects and diseases (USGCRP, 2018).

Despite these climate concerns, there is still time to prepare and act, using human resources to enact collaborative solutions. In Michigan specifically, many initiatives and programs exist to combat this issue and attempt to implement successful climate action within communities, organizations, and natural areas. Examples include the Michigan Climate Change Network, Groundwork Center for Resilient Communities, programs within Southeastern Michigan Council of Governments, and partnerships among watershed conservation groups. City and state government are also taking action by publishing jurisdictional climate action plans defining mitigation and adaptation strategies to address community-wide concerns. These include cities such as Detroit, Ann Arbor, and Kalamazoo, and a recently published statewide Climate Action Plan (EGLE, 2022). Drawing upon pre-existing frameworks, guidebooks, and climate programs, many Michigan and Great Lakes entities are preparing for a future of climate resilience.

Case of Huron-Clinton Metropolitan Authority

Situated in a uniquely urban area, the Huron-Clinton Metropolitan Authority (HCMA) is planning for climate action with the spirit of collaborative solutions. HCMA is an urban-proximate park system of 13 Metroparks in southeastern Michigan (Figure 1) with a unique, jurisdiction-related management structure. They are governed by an elected Board of seven Commissioners: two appointed by the Governor and five elected, one per county with HCMA presence: Macomb, Oakland, Livingston, Wayne, and Washtenaw. Separately, they have an Executive Director and Chief Officers for each relevant Department. HCMA functions independently and akin to a municipality, along with its own police department and regulation structure. Beyond this, they are still composed of the typical park administrative positions at the centralized, clustered, and park levels (e.g., interpretive, natural resources). These parks range from family-friendly recreational spaces with educational centers and park infrastructure, to simple right of ways and green spaces protected for river recreationists and anglers. Many support a range of social-ecological functions. This variety of park uses has contributed to growing concern within HCMA about climate change. Although park management has long recognized the diverse regional impacts to/from their parks, the important role that the Metroparks play in climate adaptation and mitigation throughout southeastern Michigan is now prominent. They are concerned for their own park system well-being but also recognize the unique opportunity that the Metroparks collectively offer as ecological buffers to build the region's climate resilience, provide urban populations places of climate refuge, and respond to climatic shifts.

With their many green spaces and distinctive waterways overlapping jurisdictions and communities, HCMA hopes to create an appropriate park system-wide climate action plan to address climate change throughout the region – a plan comprised of inspirational yet achievable work. This climate action plan will 1) consist of implementable goals and realistic strategies to advance social-ecological resilience in southeastern Michigan, and 2) complement climate planning efforts already occurring throughout the region. In conjunction with university researchers, external community members, and internal staff dialogue, HCMA has committed to creating a deliverable that appeases, excites, and challenges communities on climate action. Few U.S. parks have developed this type of regional park system climate plan, and there is even less published guidance or studies surrounding the process of creating one.

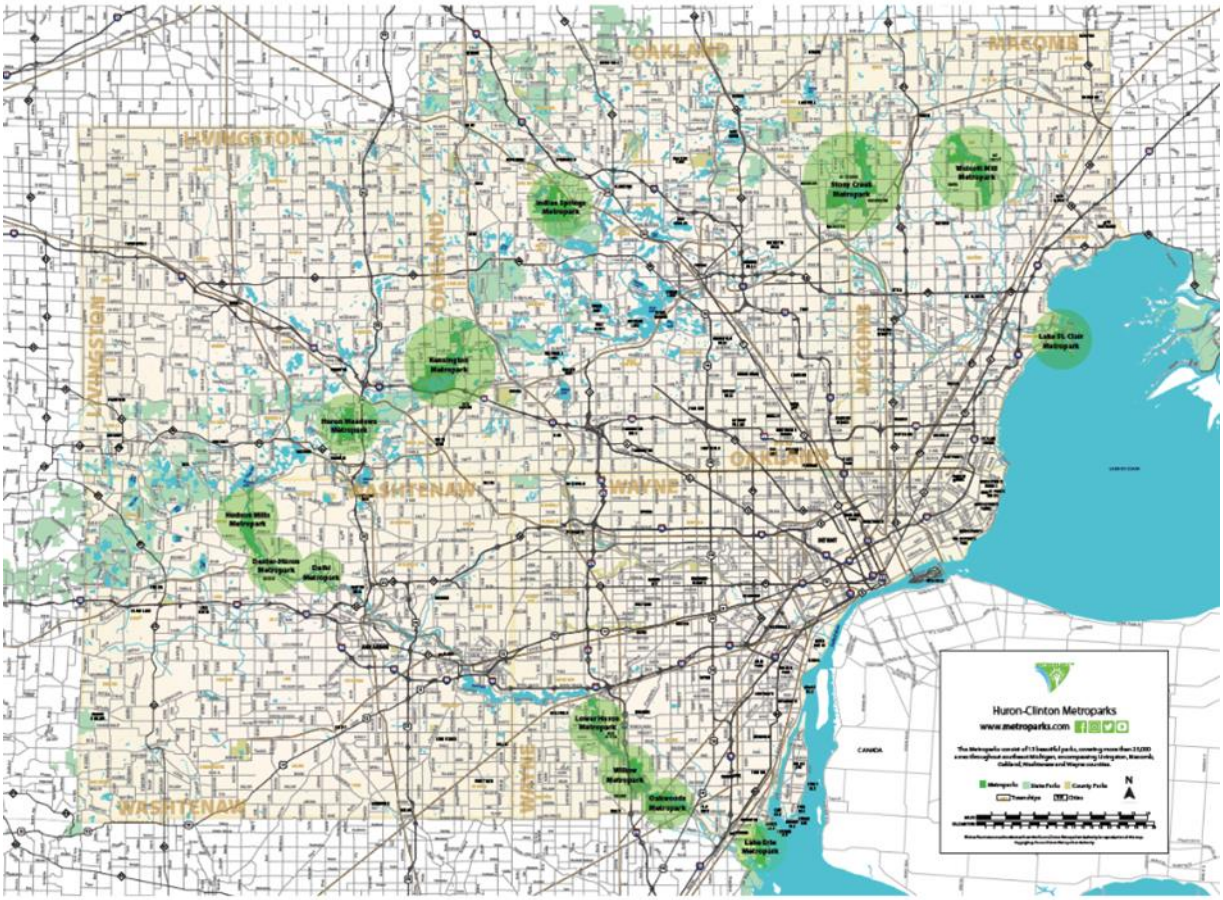

Figure 1. Map of Huron-Clinton Metropark System, provided by Huron-Clinton Metropolitan Authority.

Project Overview

This project consists of three phases, the first two of which align relatively to Chapters 2 and 3. Phase 1 – context alignment – was conducted in spring and summer 2022. This phase aimed to understand the Metroparks' known priorities, and to examine climate plans across the region and across similar park systems for ideas on content, integration and bridging neighbors' work, and engagement processes. Chapter 2 was an outcome of this phase. Phase 2 – community alignment – was conducted in fall 2022 through winter 2022/2023. This phase's goal was engaging staff, partners, visitors, and regional residents primarily about climate observations, concerns, and actions in the region and specific to the Metroparks. This included facilitating focus groups and distributing a survey to the aforementioned communities of interest. Chapter 3 was an outcome related to this phase, representing a prominent theme within a subset of these data. The final phase, Phase 3 – capacity building - will include providing engagements for park staff to

understand the process and importance of the Metroparks climate action plan and deliver a portfolio of resources and deliverables to support the Metroparks' planning efforts and ongoing staff trainings. This phase will continue through summer 2023, with the Metroparks climate action plan expected to be publicly available by the end of 2023. This phased approach was used to promote an inclusive and comprehensive program of research assistance.

Research Inquiry

This thesis is couched within the larger climate planning process and provides insight for considering HCMA's climate action plan. The project phases expanded beyond the scope of this thesis, yet Chapters 2 and 3 provide a more focused insight. In these distinct chapters, I employ a suite of qualitative methods and theoretical frameworks to address two main research questions. Each is relevant to the subsequent chapters and is individually supported by smaller guiding questions braiding together the chapter-defined research streams.

(1) How are climate actions and goals being framed in current planning efforts across southeastern Michigan?
    a. What actions are present in climate action plans across southeastern Michigan?
    b. What spatial and temporal scales and involvement scope are associated with them?
    c. What do their patterns of categorization, scales, and scopes reveal about regional emphasis areas?
    d. In what ways might the Huron-Clinton Metroparks contribute to regional climate action in their forthcoming climate action plan by leveraging these patterns – complementing and extending others' existing types, scales, and scopes?

(2) In what ways do community experiences align with and deviate from this current framing?
    a. How are community members experiencing climate change within the region, and throughout the Metroparks?
    b. How is water framed within these observations, and specifically, what water ecosystem services are discussed?

Chapter 2 addresses question 1 via a qualitative content analysis, investigating current climate action plans published in proximity to the Metroparks (Hsieh & Shannon, 2005; Stemler, 2019). The region, and cities chosen for this analysis, was co-defined by the research team and a

dedicated HCMA staff planning team. This study involved an in-depth analysis of 10 climate action plans from nine prominent jurisdictions, using an adapted recreation amenities framework to explore climate actions, scale, and scope (Perry et al., 2020). Chapter 2 provides an overview of climate action strategies already implemented in southeastern Michigan and discusses lessons learned from this inquiry and missing pieces raised for consideration. This chapter was published in *Sustainability and Climate Change* (Schiappa et al., 2023) in a special issue with other early career researchers' climate-focused works.

Chapter 3 addresses question 2 via focus groups with park users and interprets climate change observations as reported by participants using an adapted water ecosystem services framework (Krueger, 1994; Morgan, 1996). This chapter builds on findings from the content analysis, specifically the mismatch in resource of a) focus and b) concern in the region. This resource of concern was identified through a literature review. Then, through the focus groups, I evaluated how park users discussed their climate concerns; water resources emerged as one of those concerns. While the focus group data collected was vast, the findings from Chapter 2 were of a narrow scope and built a robust story around the importance and vulnerability around water resources throughout the region.

Chapter 4 briefly ties together key themes from the differentiated investigations defining Chapters 2 and 3. In this final chapter of the thesis, I examine what the approaches, findings, and implications from the two focused studies mean for climate action planning efforts overall, in parks and for regions. This chapter includes revisiting the research questions listed above and the knowledge I contribute to these, theoretical implications, and the larger climate discussions.

This thesis ultimately explores climate change in southeastern Michigan, and the important role that water plays in the Great Lakes state. As a common, and necessary resource, water should be centerfold to enacting climate action. The findings throughout this thesis support the need to focus on water within the climate conversation in southeastern Michigan and are bolstered by literature and community dialogue. Though the primary audience of this work is a collection of researchers and HCMA park practitioners, I expect that the transcendent approaches and themes described have relevance for everyone associated with climate action planning and those who consider themselves stewards of climate-affected resources in parks and across their local regions. This thesis also challenges the traditional utility value placed on water when considering urban climate change, and instead places value on the presence of the water in its

natural, and pure state.

‘’**Chapter 2:** Local climate action planning toward larger impact: Enhancing a park system’s contributions by examining regional efforts

Short title: Enhancing park climate action planning

Ellie A. Schiappa[1], Elizabeth E. Perry[1*], Emily Huff[2], Maria Claudia Lopez[1]

[1]Department of Community Sustainability, Michigan State University, East Lansing, MI, USA
[2]Department of Forestry, Michigan State University, East Lansing, MI, USA
*Corresponding author – eeperry@msu.edu

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Abstract

Regional park systems hold a vital role in the health and wellbeing of the social-ecological systems within and surrounding them. One role these park systems inherently provide is assistance toward climate change adaptations and mitigations. This paper discusses a network of climate action plans (CAPs) in southeastern Michigan (US), including bordering Ohio (US) and Canada, and utilizes a qualitative content analysis to categorize what climate actions are being prioritized throughout the region. Using an integrated recreation amenities framework from traditional park planning research, our analysis examined the content, temporal and spatial scales, and entities responsible for implementation of actions in 10 CAPs in the region. Within this framing, opportunities for parks to complement and extend regional priorities were illuminated and discussed in park-relevant language. This analysis identified a basic plan framework common across the 10 CAPs from entities in the region: a main focus on managerial, internal actions on a short implementation time frame. We were also able to define content areas and foci for a park system to capitalize on, with three prominent themes discussed: including scaled natural resource foci, centering social and community needs, and creating integrated multi-emphasis actions that serve extensive roles. Findings presented here will help inform specific contributions for a Metropark system to consider as they create a regionally-appropriate yet distinctive CAP. These findings are not exclusive to southeastern Michigan but could be used to inform regional park systems around the country in how to pursue climate action.

Keywords:

Climate change, content analysis, Detroit, metroparks, Michigan, organizational studies

Introduction

As climate change impacts accelerate, our social-ecological communities are at risk. We must approach this wicked problem through an inclusive systems approach (Rittel & Webber, 1973). Currently, municipalities (e.g., cities) and levels of government (e.g., county, state, federal) are the primary entities taking broad scale action. However, it will take additional coordinated, scaled efforts to create meaningful progress and change the course of our climate future. Thinking beyond the capacities of any one administering agency, toward needs transcending political bounds, can promote efforts aligned to achieve larger climate action goals.

Regional park systems offer an ideal space to advance climate planning in a spatially scaled yet focused and collaborative way. Park systems, specifically urban and urban-proximate ones, exist at a unique nexus of community and environment and offer an essential space for engagement to assist in complementing and extending climate efforts. The overlap of social and ecological communities influences urban park systems to intentionally consider both in planning and management decisions. In this paper, we examine the content and scales of climate plans across southeastern Michigan (US), including the borders of Ohio (US) and Canada, to lend assistance to the Huron-Clinton Metropolitan Authority (HCMA) in creating a climate action plan contributory to park system and regional needs, and lend insight to broader climate plans conversation.

Climate Action Plans

Climate action plans (CAPs) set strategic goals to address climate impacts, implement policies, and reduce reliance on resources through practical solutions (Climate Smart Communities, 2012; Deetjen et al., 2018; Reckien et al., 2014; Tang et al., 2010). Throughout this paper, 'climate action' references climate mitigation and/or adaptation strategies. CAPs set goals and actions leading ideally to policy change, while guiding communities to reduce their collective carbon footprint (Climate Smart Communities, 2012). Cities, especially, are creating CAPs to prepare for, mitigate, and adapt to climate impacts (Laukkonen et al., 2009; Mckibbin et al., 2003). The combination of mitigation and adaptation is stressed due to the uncertainty ahead. Considering both in planning ensures preparedness and risk minimization (Laukkonen et al., 2009; Mckibbin et al., 2003). City CAPs often focus heavily on greenhouse gas emissions and their mitigation, while also containing a range of involved sectors and policies including transportation, energy

usage, public utilities, and green space expansion (Deetjen et al., 2018; Lamb et al., 2019; Reckien et al., 2014).

CAPs have been analyzed on different scales and with different lenses, (e.g., Deetjen et al., 2018; Reckien et al., 2014; Tozer, 2018). Many analyses routinely consider two characteristics of a "strong" CAP. The first is integration across sectors and resources (Deetjen et al., 2018; Tang et al., 2010; Tozer, 2018). The most robust plans contain practical recommendations or actions spanning climate-related areas including waste management, energy, and green space (Deetjen et al., 2018; Tang et al., 2010). The second is action with aligned metrics and adaptive management. Uncertainty warrants consistent check-ins and ability to adapt to changing circumstances, while also measuring rates of success (IPCC, 2022; Mckibbin et al., 2003). Providing these checks creates necessary pressure in following up and through on jurisdictional actions.

The landscape of CAPs remains uneven, as adoption is not yet universal across cities, nor do all municipalities in a region have such plans. Plans vary in strength, practicality, and direction (Reckien et al., 2014), which could create insufficient action to reach national or global goals and failure to contribute to regional resilience needs (Deetjen et al., 2018; Reckien et al., 2014). A need exists for local CAPs to complete the climate planning puzzle and bridge multi-level efforts and coordination (Laukkonen et al., 2009; Woodruff, 2022). As global emissions rise, effects will increasingly be localized, raising the urgency to prepare actions from the bottom-up (Huq et al., 2006; Laukkonen et al., 2009; Tang et al., 2010). Local jurisdictions can adapt strategies unique and tailored to community needs and engage closely with community members to raise awareness about potential impacts (Chu et al., 2018; Tang et al., 2010). This narrowed focus ensures actions are being implemented that assist small communities in preparing for a changing climate.

Jurisdictional (e.g., city government) planning is not in sole control of local climate action; others also contribute (Laukkonen et al., 2009). Many entities working locally contribute to systems-wide efforts. Parks are one of these entities. Local and regional park systems prominently support community wellbeing and decision-making and are already instrumental in community building efforts such as food access, public health, and youth development (Perry et al., 2019). They also strongly support and manage a portion of a community's ecological components (Berke et al., 2015). Many park systems already *de facto* engage in climate

mitigation and adaptation strategies, whether or not listed in their management plans. Some actions are inherent in resource management, such as prescribed burns, tree plantings and canopy increases, and species protection. Formalizing these actions is a next step to parks emerging as community leaders and actors in regional CAP networks. The National Park Service has created strong widespread climate initiatives and outreach surrounding climate adaptability for their parks. However, there is less traction across regional park districts, with only sporadic examples containing expansive climate plans (e.g., Metro Parks Tacoma, 2015; NYC Parks, 2010; Urbana Park District, 2021). But, regional park systems are where more action is needed – these places could substantially impact and support local social systems needing climate adaptation assistance (Rega et al., 2022).

Scaled Planning Networks

Climate change and environmental concerns do not live by political or administrative boundaries – they work on spatial scales transcending social categorization of jurisdictions (Chu et al., 2018). Common pool resources cross jurisdictional lines creating social-ecological systems within an entire region. For example, river flooding after a heavy rainfall event could result in one community battling flooded streets and stormwater concerns with another facing flooded agricultural fields and loss of crops. In this, a singular extreme weather event has perpetuated different concerns. Climate change effects are similarly and intimately felt within communities, though the causes and resources run parallel. This presents a challenge to insular planning approaches.

Scaled approaches may address such challenges. As climate impacts are felt heavily on a local level, adaptation is necessary. But, mitigation strategies are needed to moderate larger scale concerns and assist in global efforts to curb climate change (Laukkonen et al., 2009; Mckibbin et al., 2003). Consideration of scale includes an array of strategies and CAP coordination at multi-jurisdictional and sector levels to encourage systems-wide security nets (Woodruff, 2022). Attention to scale also centers deliberate change without overshooting, and related manageable and accepted approaches (Folke et al., 2010). Studies suggest strong networks of plans in a jurisdiction can help realize a less hazardous future, if that network includes all sectors and organizational bodies and attends to vulnerabilities, community needs, and resources (Berke et al., 2015; Woodruff, 2022; Woodruff et al., 2022). Lack of coordination could lead to missing pieces and risky exposure when faced with extreme events or fluctuating threats (Woodruff,

2022). Research analyzing networks of urban hazard mitigation plans in cities across the US (e.g., Boston, New Orleans) have found incomplete coordination within local planning and policy efforts of a plan network exposes social and ecological vulnerabilities (Berke et al., 2015; Burby, 2006; Woodruff, 2022).

Temporal scale presents similar CAP challenges. Traditional planning horizons make it difficult to consider climate change happening on uncertain and longer time scales (Laukkonen et al., 2009). It is also difficult to plan for an unknown future. Adaptation strategies need to be considered on longer time scales to strengthen system resilience when issues inevitably arise (Laukkonen et al., 2009; Mckibbin et al., 2003). Larger and longer scale climate approaches help match response scope to problem scope, and a strong planning network can take this response from ideas to actions (Berke et al., 2015; Woodruff et al., 2022). Granted, no singular plan can be everything for everyone, but each organization focusing on their strengths and relationships can collectively build overall network capacity (Chu et al., 2018; Granovetter, 1973). Defaulting to collaboration avoids climate action as a competition and reduces fragmentation through strengths-based collective action.

Parks and Protected Areas' Contributions and Frameworks

Parks are integral when considering collective climate action. Though CAPs are frequently found in city and jurisdictional entities, parks offer a space to implement and demonstrate unique and complementary efforts. Parks are increasingly working beyond their boundaries on other important issues, such as environmental justice, regional outdoor recreation economies, and landscape-level conservation. Their natural fit into concepts to approach climate change provides an ideal space to uniquely contribute. Many parks are already seizing the opportunity to emerge as CAP leaders (e.g., Chicago, 2019; Metro Parks Tacoma, 2015; NYC Parks, 2010; Urbana Park District, 2021). Parks offer space to address climate change concerns, through green spaces and tree canopy that create cool zones in cities, or natural buffers to manage stormwater and flooding (Brown et al., 2015; Gearey, 2018; Kellman & Hersher, 2022; Rega et al., 2022; Schottland, 2019; Vieira et al., 2018). These spaces are already used for resource conservation, education/interpretation, and appreciation. Including climate within their planning could contribute to regional system needs.

Coordination of larger-scale planning requires participation and recognition of where contribution is best suited. Park systems already envision a regional identity and future and their

contributions toward it using management-by-objectives (e.g., Seattle Park and Recreation, San Francisco Recreation and Parks) (Manning, 2022). This approach provides climate action implementation check-ins via monitoring and revision. City parks provide assistance in urban built environments (Brown et al., 2015; Kellman & Hersher, 2022; Rega et al., 2022; Xing & Brimblecombe, 2020), but regional parks can provide an expanded, integrated approach to climate action and resilience. They can function as a connector among others' efforts while devising goals and actions unique to their social-ecological conditions (Perry et al., 2018). This opportunity to complement and extend climate action can solidify a strong network of properly prepared plans while continuing to contribute to mitigation efforts that provide relief on a global scale (Huq et al., 2006; Laukkonen et al., 2009; Woodruff, 2022).

This study uses an integrated recreation amenities framework to analyze climate actions across multiple domains and scales (Perry et al., 2020). Perry and colleagues' framework builds on established parks-related frameworks and re-envisions content areas within the traditional three themes (managerial, social, and resource conditions) to encompass more transcending topical, spatial, and temporal aspects and allow conceptual space for emergent aspects (Manning, 2022; Interagency Visitor Use Management Council, 2016). Following the expansive and emergent spirit of the integrated model by Perry et al. (2020), we test its application in CAPs across the park-community divide. In this way, the framework could identify climate action commonalities that could be addressed by both parks and communities within a single region and assist in understanding park systems' role in regional climate action.

Inquiry

We center this work on fundamental questions of the content, scale, and scope of a CAP within a region and discuss these findings specifically in relation to park contributions. The novelty of our inquiry is also highlighted by use of a park framework beyond a park-only context and in the application to a specific regional setting – southeastern Michigan and the Huron-Clinton Metroparks system. Our guiding questions for approach and interpretation are:

(1) What actions are present in CAPs across southeastern Michigan?
(2) What spatial and temporal scales and involvement scope are associated with them?
(3) What do their patterns of categorization, scales, and scopes reveal about regional emphasis areas?

(4) In what ways might the Huron-Clinton Metroparks contribute to regional climate action in their forthcoming CAP by leveraging these patterns – complementing and extending others' existing types, scales, and scopes?

Southeastern Michigan and the Huron-Clinton Metroparks

Michigan is a state in the US' upper Midwest, comprised of two peninsulas jutting into the Great Lakes and bordering Canada. Southeastern Michigan is its most populous area, home of half of the state's population and the US' tenth largest metro area, Detroit. It is also an area rich in natural and cultural resources, many of which are conserved for protection and public enjoyment in parks. The Huron-Clinton Metropolitan Authority (HCMA) manages 13 Metroparks across five counties in southeastern Michigan. These parks provide over 4.8 million residents access to 25,000 acres of green space and natural areas (HCMA, 2022; SEMCOG, 2021). The park system provides access to recreation facilities and four-season pursuits including fishing, boating, golf, skiing, birdwatching, hiking, mountain biking, and environmental education.

The Metroparks offer a community space and recognize the importance of this space in the region for recreational access, community building, and assistance (HCMA, 2022). They also recognize their role beyond park boundaries, enhancing southeastern Michigan's social and environmental resilience. Climate change and its localized impacts concern HCMA, as the organization considers actions to retain and improve its functioning within and beyond its boundaries.

As climate change worsens worldwide, Michigan and the Midwest are experiencing its effects (USGCRP, 2018). Heavy precipitation events have increased by 14% since 1951 across the Great Lakes region (Environment and Climate Change Canada & U.S. National Oceanic and Atmospheric Administration, 2022) and the average temperature has risen 2.3 degrees Fahrenheit (Environment and Climate Change Canada & U.S. National Oceanic and Atmospheric Administration, 2022). In Detroit and across southeastern Michigan, major flood events have become more frequent, causing recurrent household flooding and detrimentally impacting infrastructure (Sampson et al., 2019). Extreme heat is creating major public health and infrastructure concerns, as some do not have access to cooling strategies (e.g., air conditioning) and those who do are increasingly relying on it to keep their homes habitable (USGCRP, 2018; White-Newsome et al., 2014; Ziegler et al., 2019). Those without air conditioning face health risks including heat exhaustion and respiratory or cardiovascular illnesses (USGCRP, 2018).

Parks can play an important role in combatting these climate issues and helping communities navigate climate impacts (Rega et al., 2022; Schottland, 2019). As pre-existing green spaces already contributing to social-ecological resilience, parks and park plans can advance this further by addressing climate change and its impacts. HCMA has embraced providing this service regionally, deciding in 2022 to craft a park-contextualized yet regionally relevant CAP. This builds on earlier recognitions that the Metroparks serve an important role in social-ecological health and safety. Existing HCMA plans have included climate-related actions. For example, the HCMA Sustainability Plan (2019) implemented sustainable and green efforts within internal processes. Other plans with climate-related actions include their Mowing Plan (2018), park-specific Stormwater Management Recommendation Plans (2019), and Deer Herd and Ecosystem Management Plan (2021). They are now eager to create a CAP that addresses climate change within the Metroparks and increases regional climate resilience.

Cities across southeastern Michigan are taking on climate action and prioritizing it within planning processes (e.g., Southeast Michigan Council of Governments Climate Initiatives, 2021; Huron River Watershed Council Climate Change Program, 2022). HCMA hopes their plan will nestle appropriately into this growing network of plans, to complement and extend climate capacity and implementation. As a Metropark system that functions independently, spans multiple counties, and borders multiple jurisdictions, their reach exceeds that of a single city. This potentially provides them the agency and ability to implement impactful goals and strong actions coordinated to meet their needs and those of the larger region.

Methods

Data Collection and Inclusion

HCMA leadership partnered with [university – redacted] researchers (the authors of this work) to create a CAP aiming toward park and regional ambitions and meeting criteria of scientific rigor and organizational capacity-building. Part of this work was on context alignment, or analyzing existing CAPs in the region, which we center here. We sought insight from these CAPs on what was being included in southeastern Michigan.

First, we worked with HCMA staff to define the boundaries of "southeastern Michigan." For the purposes of HCMA's CAP and regional scope, we co-defined it as the five counties of southeastern Michigan (Wayne, Washtenaw, Livingston, Oakland, and Macomb), statewide

efforts affecting these counties, and two large metropolitan neighbors (Toledo, Ohio, US, and Windsor, Ontario, Canada).

Second, we systematically searched for and collected municipal CAPs across this geography in spring 2022. Plans were gathered through a county-by-county search, the Global Covenant of Mayors for Climate and Energy, the Carbon Disclosure Project Open Data Portal, Michigan Climate Network, and input from HCMA staff. To be initially included, a plan had to: 1) be published and publicly available; 2) have defined goals/objectives; and 3) contain explicitly climate-focused actions.

Nineteen cities had climate initiatives, but ultimately seven were determined to have CAPs fitting our scope. One city (Detroit) had two iterations of a CAP in the past 5 years. We included both due to Detroit's large regional presence. Two additional entities – the state of Michigan and the University of Michigan – had plans that met the inclusion criteria. In total, 10 plans were included (Table 1). Four "sustainability plans" were included, as they were within the region and co-located climate and sustainability actions in a single plan. For these, we only considered climate actions in our analysis. We acknowledge that there are a variety of climate actions being implemented across the region and beyond the scope of this study's inclusion parameters, such as those beyond official planning documents (e.g., initiatives listed on websites but not detailed in public plans, draft plans, contributory commercial or community actions not phrased as climate-focused).

Table 1. Regional plans analyzed (n = 10). Plans included both climate action and sustainability plans, though only climate-related goals were analyzed in the latter.

State/Province	Entity	Plan	Year
Michigan, US	Statewide	MI Healthy Climate Plan	2022
	Ann Arbor	Living Carbon Neutrality Plan	2020
	Detroit	Climate Action Plan	2017
	Detroit	Sustainability Agenda	2019
	Northville	Sustainability Plan	2020
	Royal Oak	Sustainability and Climate Action Plan	2022
	University of Michigan	Planet Blue Campus	2021
	Ypsilanti	Climate Action Plan	2012
Ohio, US	Toledo	Go Green, Sustainability Plan	2014
Ontario, Canada	Windsor	Corporate Climate Action Plan	2017

Data Analysis

We used a conventional, qualitative content analysis (Hsieh & Shannon, 2005; Stemler, 2019) to analyze climate actions and the process to achieve them. The 10 plans were uploaded into Nvivo (1.7), a qualitative data analysis software that assists in data management and coding structure organization (QSR International Pty Ltd., 2020). Our process was framed by *a priori* and emergent, iterative coding. We included regular meetings with academic and practitioner experts, which, along with increasing content familiarity, expanded and adapted our coding structure. Our *a priori* codes were based on the integrated framework for recreation amenities components of theme and spatial and temporal scale (Perry et al., 2020) described above. The three major themes of this framework encompass managerial, resource, and social actions. Perry et al. (2020) recognize "community" as an inherent fourth theme and leave space for currently untitled considerations. This active inclusion and active blank space acknowledge that contextualized and emergent factors occur in any application of the framework and encourage others to adapt it as appropriate. We have used this framework in such a way. An initial coding round with the existing themes and categories (i.e., content areas and foci) helped to accurately capture the plans' climate actions identified and the purpose of plans and each action. We found "community" to be essential within the CAPs and climate actions, and thus added it as a theme for this analysis. Further foci were added to those presented by Perry and colleagues, recognizing the diversity inherent in the framework's application to climate change and beyond-park planning. We coded all actions to their main content area plus a resource code, if applicable. This required using a generic Not Specified resource code for any action lacking a specific resource for data management purposes, though we have excluded these instances from the reporting of results to avoid skewing of resource-related actions. Table 2 lists and describes the final coding structure applied.

Within each main theme, we also coded for temporal and spatial scale and involvement scope. Temporal scales were analyzed on a pre-determined scale and grouped into near term (≤ 5 years), mid-range (6-20 years), long term (≥ 21 years), and unspecified/unquantified time scales. Our intention was to summarize scales of action on three common planning horizons, to examine general patterns and trends. This cross-plan summation meant that our coding at times did not match a specific plan's wording (e.g., Detroit's Sustainability Agenda defines mid-range as 3-5

years), but we feel that this approach generally matched the corpus and its intended application for HCMA.

Spatial scales also reflected the corpus' general content. We used six categories, ranging from smaller to larger geographies and acknowledging a similar or different resource base:

(1) Site: Single location or site of focus (i.e., golf course);
(2) Multiple Sites, Similar Resource: Multiple locations throughout city of similar resource or use (i.e., all public swimming pools);
(3) Neighborhood: City neighborhood, block, etc.;
(4) Multiple Neighborhoods: Multiple city neighborhoods or cluster of neighborhoods (region of city specified);
(5) City: City-wide goals; and
(6) Region: Goals that reach beyond city borders or impact surrounding towns.

Finally, recognizing that involving others through partnerships, collaborations, and inclusion principles can expand a plan's scope organizationally, we coded actions for involvement scope. This captured whom was indicated as responsible for implementation and/or success. If no collaboration or partner was mentioned, it was assumed that responsibility fell solely on the plan creator. We used three codes, derived from the data and ways in which involvement is often typified (Andrade & Rhodes, 2012; Chu et al., 2018; Koontz & Newig, 2014):

(1) Sole Administrative Entity: Only managing entity's responsibility for success within goal, or undefined so assumed no other partners;
(2) Organizational Partners: Defined organization or agency partners; and
(3) Community Collaboration: Assistance and collaboration with community or the public.

Table 2. Final Codebook Used in This Inquiry, Including 44 Foci Named and Defined: Foci Are Organized by Content Areas - Managerial, Social, Resource, and Community.

Managerial		
Adaptive Governance		Policy/programming and internal changes, includes staffing structure
Construction		New construction, deconstruction, or demolition projects
Economic		Funding implications, including internal revenue, purchasing, or reallocations
Education & Interpretation		Educating community on climate change, sustainability, and actions entity is taking towards both
Facilities		Entity buildings and structures
Equipment		Entity equipment used for maintenance of space or office equipment
Fleet & Employee Transportation		Internal transportation related issues including daily commute and vehicle fleet used in transit for entity purposes
General Innovation		Embracing ingenuity & ensuring mindset of innovation
Information Gathering		Gathering data or information to inform managerial decision
Land Acquisition & Siting		Siting for new facilities and infrastructure, and/or acquiring new green space or park land
Organizational Learning		Internal training and education, building staff capacity, as well as changing staff culture and behavior changes
Transportation Infrastructure		Transportation specific infrastructure of resource/space action items
Waste Management		Recycling, composting, or eliminating landfill-borne waste
Social		
Cultural		Cultural ecosystem services, cultural relationship with space and connections to space
Experiential		Better human experiences in city - leisure time and human experience in parks
Health & Well-being		Human physical/mental health
Information Gathering		Gathering information as related to social relationships with space
Transportation & Access		Physical access to space and equitable access to transportation
Resources		
Air Quality		Health of atmosphere and clean air to breath
Built Infrastructure		Built infrastructure (bridges, impervious surfaces, trails, playgrounds)
Carbon		General carbon sequestration, and actions to achieve carbon neutrality or reduce carbon footprint
Developed Space		Open space that has been developed but does not hold active facilities or infrastructure (i.e. parking lots, vacant lots, etc.)
Ecological Information Gathering		Gathering information, data, and increasing understanding about climate change as related to natural resources specifically (GHG, vulnerabilities)
Energy	Building	Utility & building efficiency, both commercial, and residential buildings
	Transportation	Energy emitted or planned to reduce due to transportation vehicles
	Renewable	Use of solar, wind, etc. energy or exploration of use

Table 2 (cont'd)

Extreme Weather	Any extreme weather event - drought, flooding, wildfire, extreme heat, natural disasters, etc., and generalized hazardous weather/event preparation
Fauna	Wildlife (animals)
Flora	Native plants
Forests	Specified forests/forestry spaces, excluding urban forests
Generalized Habitat	Habitat mentioned but generally
Habitat Restoration	Restoration of habitat, fragmented habitat, or habitat corridors to strengthen ecosystem
Maintained Landscape	Any human manufactured space goals, including irrigation, turf, gardens, landscaped space, etc. not natural or wild areas
Not Specified	Action item towards climate change, but now specific resource mentioned or specified
Open Space	Open lots with no infrastructure or development
Soils	Soil health as relates to support of biodiversity, as well as ability for carbon sequestration, also applies to erosion and landslide concerns
Stormwater & Green Infrastructure	Water running over impervious surfaces (due to precipitation), All-season run-off; green infrastructure to manage
Urban Forests	Forests within urban space, including tree canopy and foliage, urban heat island effect, and shading/cooling
Wetlands	Wetlands as a habitat
Water Bodies	Water quality and health of water bodies, including lakes, streams, and reservoirs
Water Usage	Human water usage (drinking water, water in buildings, generalized water conservation)
Watershed	Watersheds and catchment basins
Community	
Community Building	Community funding, volunteer programs, external support for green jobs
Community Engagement	Community programming, engagement, inclusion
Equity & Environmental Justice	Focused on equitable or environmental justice related goals
Partnerships	Physically initiate, create, or explore opportunity to partner - this is not partners being involved or being included, but the main goal is to partner

The analysis was validated through inter-coding reliability checks between the first two authors and with six researchers uninvolved with this work, as well as with member checks with HCMA staff. No major discrepancies were found through this process. We focused purely on the *actions* defined within these plans, rather than on the hierarchy of goals, actions, and metrics conducted in previous CAP content analyses (e.g., Deetjen et al., 2018; Tang et al., 2013; Woodruff et al., 2022).

Results

Climate Action Content

We identified 292 actions in total, representing 44 foci across four content areas: 22 resource, 13 managerial, 5 social, and 4 community. Each action had a main focus. A few had dual or multi-emphasis foci. Our coding approach captured these overlaps (Figure 2). Percentages presented represent portions of the total coded foci (n = 344) unless otherwise stated, and may surpass 100% in sum because of instances of dual or multi-emphasis foci.

Patterns emerged from this thematic coding. Over half of all actions were managerial, nearly half were resource, and less than a fifth were either community or social. Keeping community and social codes separate to better identify the ideas and message shared could explain the similarities in their frequencies and the gap between the two categories and managerial and resource. If combined though, they would still be the least common, attributing for just over a third of all codes.

Three of the four main content areas were represented in all 10 plans, with social absent from one plan (Windsor Corporate CAP). Many actions had either one focus or two or more foci within the same content area. Looking only at those with multiple content areas identifies broader integrations. The most common dual-emphasis action content overlap was managerial – resource (n= 71; 20.6%). The next most common were managerial – community and resource – social (both n = 15; 4.5%), though these were far less abundant than managerial – resource overlaps.

Eighteen actions had multi-emphasis content areas. The most common was managerial – resource – community (n = 9; 2.7%). Only one action was coded within all four themes: “Create programs to catalyze and accelerate the transition to cleaner technologies like electric and hydrogen fuel-cell farm equipment” (MI Healthy Climate Plan, 2022, p. 47). There were no co-occurrences of managerial – community – social.

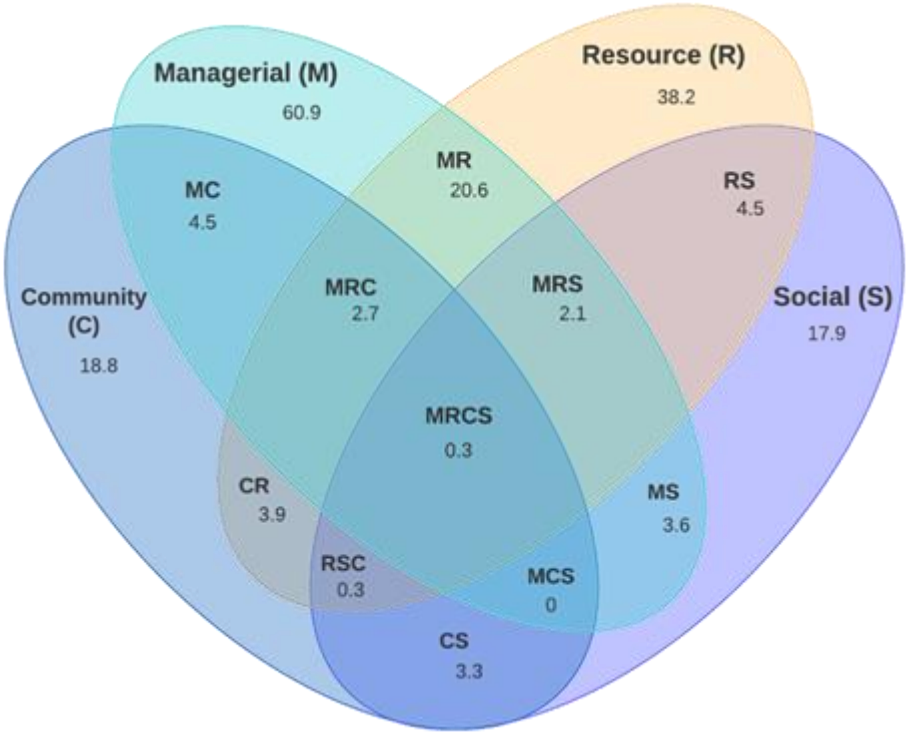

Figure 2. Percentages (%) of singular, dual, and multi-emphasis content areas within each climate action. Actions within a singular content area may reference a focus or multiple foci within that area. Abbreviations: (M) = managerial, (R) = resource, (S) = social.

Content area sub-codes highlighted the specific foci for climate action (Table 2). The most common managerial focus was economic. This relates to actions concerning incoming funding, reallocation for funds, or economic support for climate action. Nine plans had economic actions (all except the 2017 Detroit CAP), accounting for almost a quarter of managerial actions.

Although not the most common of managerial foci, facilities and waste management was present in all 10 plans and therefore the most ubiquitous managerial action. Waste management included actions related to recycling, composting, landfill production, construction-materials, and related technology and processes (e.g., innovations to help local businesses decrease waste [City of Northville Sustainability Plan, 2020], developing/formalizing a corporate waste target and strategy [Windsor Corporate CAP, 2017]).

Facilities-related actions ranged in specificity from phrasings such as “Improve energy efficiency and durability of homes” (Detroit CAP, 2017, p. 57) to:

> “Embark on a phased, district-level approach to converting U-M’s heating and cooling infrastructure to be fossil fuel free, beginning with electrified systems centered on geoexchange with heat recovery chiller technology and with the flexibility to pivot to other proven technological solutions as they emerge” (University of Michigan Planet Blue Campus, 2021, p. 62).

The most common social focus was transportation and related access, accounting for nearly half of the social content area and present across eight plans. These actions aligned with increases in and access to public transportation and decreases in emissions from community transportation, such as improving accessibility “for all abilities and income levels” (Royal Oak Sustainability & CAP, 2022, p. 53) and increasing park and ride options to “ensure seamless connection to transit” (Ann Arbor A2Zero, 2020, p. 76).

The most common community focus was community engagement. Community building was the second most common. Community engagement concerned outreach or including the community in decision-making about climate change, such as tailoring carbon neutrality awareness campaigns with audience-specific formats and opportunities for input (University of Michigan Planet Blue Campus, 2021). Contrastingly, community building included actions such as fostering community capacity or creating community programming. This could be generally expanding “green jobs training and workforce development programs” (Detroit Sustainability Agenda, 2019, p. 41) or specifically supporting business lifecycle assessments about clean energy and conducting “trainings to support minority-owned, veteran-owned, women-owned, tribal-owned clean energy businesses and help them compete in utility and state procurement programs” (MI Healthy Climate Plan, 2022, pg. 29). No single community focus was represented across all 10 plans, but all 10 plans were represented throughout the content area.

Resources represented almost half of all actions, and within that, energy dominated. Energy-related actions were in all 10 plans, most frequently attributed to residential or commercial building energy. Many of these actions referred to increasing building efficiency, implementing weatherization programs, and reducing overall emissions from built infrastructure. Often overlapping tightly with the facilities focus, these included a variety of efforts such as workshops about retrofitting and weatherizing homes (Detroit CAP, 2017) and developing

minimum energy efficiency standards to deepen savings and reduce emissions from new buildings (Windsor Corporate CAP, 2017).

Table 3. The climate action plans' content areas (4) and foci (44), summarized by presence across actions, plans, and foci. Content area and foci (n = 344) totals exceed the number of climate actions (n = 292), as multiple foci were applied to actions as appropriate.

Content Areas & Foci	Number of:		Percentage (%) of:	
	Actions	Plans	All Foci	Content Area
Managerial	**201**	**10**	**58.4**	
Economic	43	9	12.5	21.4
Adaptive Governance	38	8	11.0	18.9
Facilities	36	10	10.5	17.9
Waste Management	31	10	9.0	15.4
Transportation Infrastructure	17	9	4.9	8.5
Fleet & Employee Transportation	16	5	4.7	8.0
Information Gathering	14	4	4.1	7.0
Education & Interp.	13	7	3.8	6.5
Construction	7	3	2.0	3.5
Organizational Learning	7	2	2.0	3.5
Land Acquisition & Siting	7	6	2.0	3.5
General Innovation	3	3	0.9	1.5
Equipment	2	2	0.6	1.0
Social	**59**	**9**	**17.2**	
Transportation & Access	23	8	6.7	39.0
Health & Well-being	16	7	4.7	27.1
Experiential	9	4	2.6	15.3
Information Gathering	9	5	2.6	15.3
Cultural	7	5	2.0	11.9
Resources	**126**	**10**	**36.6**	
Energy	64	10	14.8	40.5
Building Energy	40	10	11.6	31.7
Renewable Energy	17	7	4.9	13.5
Transportation Energy	7	5	2.0	5.6
Not Specified	23	9	6.7	18.3
Water Usage	13	7	3.8	10.3
Carbon	12	2	3.5	9.5
Ecological Information Gathering	12	4	3.5	9.5
Stormwater & Green Infrastructure	11	6	3.2	8.7
Built Infrastructure	7	4	2.0	5.6
Water Bodies	7	4	2.0	5.6

Table 3 (cont'd)

Urban Forests	6	5	1.7	4.8
Open Space	5	3	1.5	4.0
Habitat Restoration	3	3	0.9	2.4
Maintained Landscape	3	3	0.9	2.4
Soils	3	2	0.9	2.4
Flora	2	2	0.6	1.6
Air Quality	2	1	0.6	1.6
Developed Space	2	2	0.6	1.6
Generalized Habitat	2	2	0.6	1.6
Extreme Weather	2	1	0.6	1.6
Forests	1	1	0.3	0.8
Wetlands	1	1	0.3	0.8
Watershed	1	1	0.3	0.8
Fauna	1	1	0.3	0.8
Community	**62**	**10**	**18.0**	
Community Engagement	23	7	6.7	37.1
Community Building	14	5	4.1	22.6
Equity & Environmental Justice	12	4	3.5	19.4
Partnerships	4	4	1.2	6.5

Climate Action Scale and Scope

Temporal and spatial scales were present as structural and monitoring components. We identified two basic sets: scales for whole plans and scales for individual actions. We focus on action-level scales (Table 4). Because our six spatial categories centered resources and divisions of cities, we excluded two plans – the State of Michigan and the University of Michigan – from the scales analysis.

The distribution of temporal scales suggests actions are most likely to be of immediate, near-term priority: implementing climate actions within 5 years of the plan publication date (e.g., a common planning cycle). This immediacy was evidenced in actions such as committing to updating managerial plans as they sunset to "integrate information on climate change risks for residents and infrastructure and identify potential mitigation strategies" (Detroit Sustainability Action Agenda, 2022, p. 83) or specifying that the entire plan is based on a three-year action strategy (Royal Oak Sustainability and CAP, 2022).

Table 4. Frequency of temporal and spatial scale codes in the dataset.

Scale	Codes	
	Number of:	**Percentage (%):**
Temporal	**316**	
Near-Term (≤ 5 years)	129	40.8
Mid-Range (6-20 years)	63	19.9
Long-Term (≥ 20 years)	32	10.1
Not Specified	92	29.1
Spatial (8 plans only)	**221**	
Site	11	4.9
Multiple Sites, Similar Resources across City	34	15.4
Neighborhood	12	5.4
City	111	50.2
Region	13	5.9
Specified, Non-Spatial	40	18.1

Conversely, actions taking a great length of time to implement/achieve – longer than 20 years – were the least prevalent. These were seen in actions that provided stepwise active metrics of success. Examples include the 2017 Detroit CAP's emphasis on reducing transportation, energy, and built environment emissions from a 2012 baseline: 10% by 2022, 30% by 2032, and 80% by 2050 and the 2017 Windsor Corporate CAP's emphasis on reducing primary energy use from a 2014 baseline: 11% by 2030 and 25% by 2041. Other plans referred to a more distinct future. One action in the MI Healthy Climate Plan (2022) illustrates this: "Provide incentives and technical assistance to advance the energy efficiency and other process improvements necessary to achieve carbon neutrality in the industrial sector by 2050." (p. 45).

Almost a third of actions did not specify a stated measure for temporal evaluation of success, leaving this metric undetermined at least within the public-facing plan. The Toledo Go Green Sustainability Plan (2014) exhibited this with broad actions such as supporting "farmers in adopting best practices to help their farms remain productive while protecting the health of nearby lands and waters" (p. 26) and developing "programs and policies that connect neighborhoods to nearby businesses and open spaces with walking and/or biking trails or sidewalk" (p. 39). These also included actions where the city was already successfully engaging, such as continuing a commitment to developing and expanding cycling infrastructure (bike racks, storage, etc.) (Windsor Corporate CAP, 2017).

Spatially, actions overwhelmingly encompassed city-wide goals and initiatives. Most plans did not focus on certain sites, neighborhoods, or collections of similar sites across cities, but rather on broader geographies of city climate action. This includes actions to electrify city bus systems (Ann Arbor A2Zero Plan, 2020) and prioritize waste management access (e.g., recycling, composting) to city residents at home, work, and leisure locations (Detroit CAP, 2017).

Specified, non-spatial actions were the second most common, pertaining to internal and policy-related actions regarding governmental/administrative processes (e.g., Department of Public Works updates) rather than spatial extents. These appeared as increasing managerial capacity by aligning budgetary items, contract agreements, and internal staffing.

Collections of similar sites was the third most referenced, and similar in number to specified, non-spatial. Examples included broadly creating and renovating parks throughout the city (Detroit Sustainability Agenda, 2019) and specifically seeking financing for Solar Ypsi solar installations by monitoring "grant opportunities for solar hybrid systems on high water-usage public buildings, such as the Rutherford Pool and Fire Department" and remaining "alert for low-cost ways to support private installations" (Ypsilanti CAP, 2012, p. 18).

Actions extending beyond the city, to a region, were relatively uncommon. These occasionally referenced partnering with nearby jurisdictions, such as the City of Windsor collaborating "with neighboring municipalities to establish an organics program" (Windsor Corporate CAP, 2017, p. 48).

We also examined the scales' intersections for each action (Figure 3). This indicated actions' temporal-spatial relationships. Actions were most often defined as near-term and city-wide, such as finalizing and integrating a Circular Economy strategy into all planning initiatives by 2022 in Ann Arbor (A2Zero Plan, 2020) or identifying catalyst projects to prioritize in Toledo's current planning cycle (Toledo Sustainability Plan, 2014).

Site, multiple sites, and neighborhood actions were also most often phrased as implementable in the next 5 years. City-wide actions much more commonly included mid and long-term timelines. Mid-term examples included actions such as implementing a Community Choice Aggregation program throughout the city of Ann Arbor by 2027 (A2Zero, 2017). Long-term examples included actions such as the City of Northville Sustainability Plan (2020)

expanding electrical vehicle infrastructure and increasing permeable surfaces across the city by 2040. Regional actions had low frequency and had no instances of long-term scale.

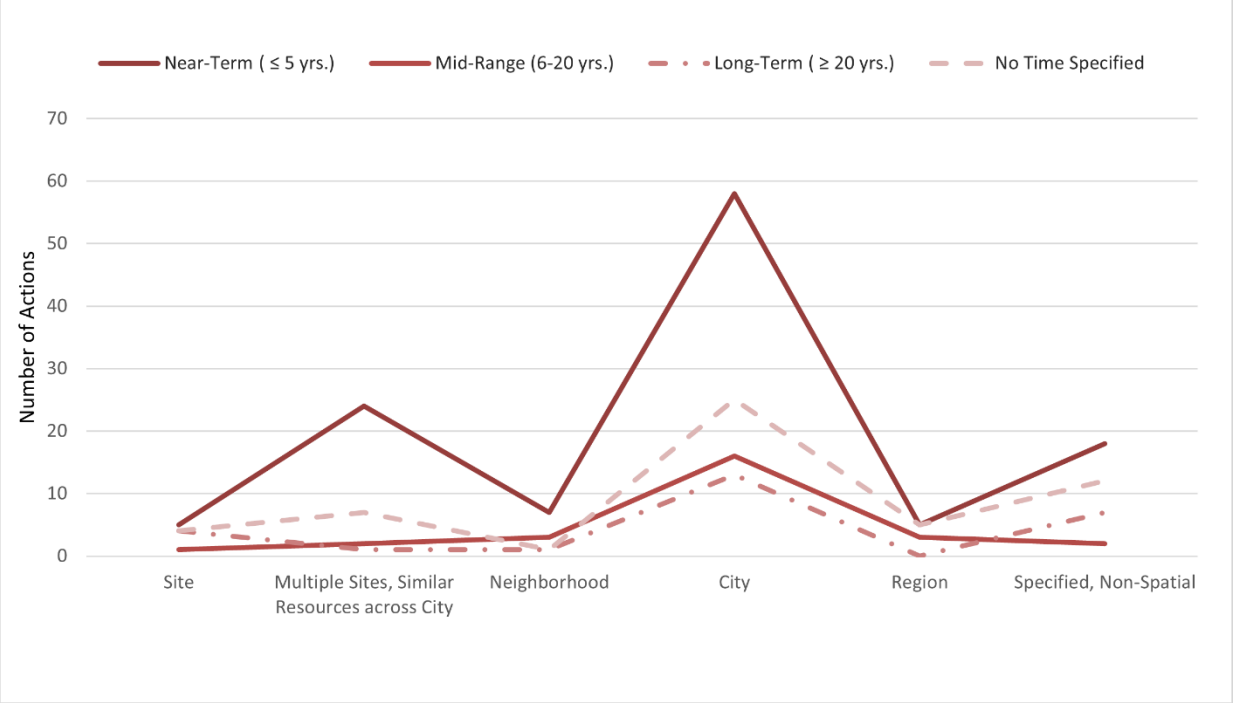

Figure 3. Relationships between spatial and temporal scales (n= 224) in city-level climate action plans in the dataset (n = 8).

Finally, we examined actions' involvement scopes and frequencies. This lent insight into whom was indicated as responsible for implementation: the administrative entity, an organizational partner, the community, or multiple responsible parties. Across the 292 actions, there were 346 descriptions of involvement. Three-quarters (75.1%, n = 260) of the actions were based mostly or solely within the administrative entity. This was explicit, such as when the 2019 Detroit Sustainability Agenda specified that the city "would lead by an example and expand recycling efforts in all municipal buildings" (p. 68), or implicit, such as when the same plan would "launch a citywide recycling campaign" (p. 68) with fewer details on who would head the effort.

About a third (33.5%, n = 116) named organizational partners as action implementers or co-implementers. Many of these highlighted partners pursuing their own related actions clearly within the plan, identifying individual organizations for individual actions. The Ann Arbor A2Zero Plan (2020) and Royal Oak Sustainability and CAP (2022) both contained such language and also identified specific city departments to assist in implementation.

Actions with only internal departments identified were considered under sole administrative entity control. A few (8.3%, n = 29) indicated collaboration with community members including local landlords, homeowners, community neighborhood ambassadors, community organizations, or advisory committees.

There could be dual or multi-emphasis involvements, recognizing collective implementation to achieve objectives and indicators. This was uncommon though, as only 7.5% (n = 22) of the actions involved two entities. Pairing an organizational entity and community collaborator was most pronounced, with an entity working with community organizations and neighborhood ambassadors to share information, conduct outreach, or understand community needs. For example, the Ypsilanti CAP identified they must engage community partners to gather more information on residents' needs, while recognizing certain organizations to specifically assist in outreach and implementation. There were no instances in which all three entities were explicitly mentioned as implementers.

Integrated Discussion

We found three major takeaways through this content analysis of southeastern Michigan CAPs that could inform HCMA's CAP and regionally relevant park climate plans generally.

(1) There is a collective disconnect between the resource of focus in plans and the resource of concern in the region, suggesting extensive opportunity to contribute to climate action in alternate ways than those currently detailed.

(2) Managerial actions were overwhelmingly the most common while community and social actions were the least common throughout plans. This suggests that cities are both creating these plans and assuming (rather than offloading) responsibility for their adequate implementation. This also identifies a place for greater effort in creating and strengthening plan networks toward citywide climate response and community wellbeing.

(3) The many dual and multi-emphases provided depth to a systems approach. Urban-proximate regional park systems may address the lesser-emphasized overlaps among social, community, and resource-related actions, as they exist and work deeply within this nexus. Information gathering was a pronounced action within all four content areas and provides an example of actions that could extend across content areas to address multiple needs and inquiries through an integrated approach.

We frame the ensuing discussion around these takeaways and their implications for HCMA and other regional park systems. Additionally, we extrapolate contributions toward the applicability of the integrated recreation amenities framework at a regional level, limitations of this work, and conclusions.

The Potential Mismatch in Regional Resource Foci

The resource content area made up nearly half of all actions in the plans, aligning with our expectations of resources-based content being prominent among CAPs. However, the prominence of particular foci within resources is interesting and potentially actionable. The most common resource mentioned was energy, specifically building energy consumption and emissions. All 10 plans included related actions. Commercial and residential building efficiency were covered in two broad ways, decreasing emissions escaping from buildings and increasing the efficiency within them. Energy efficiency is important for addressing high temperature concerns but is not the sole solution. Within the region, there appears to be an exaggerated reliance on building energy-related actions to address high temperatures and heat when other resource actions could assist in amelioration. Other considerations to manage temperature and heat could be the increasing of tree canopies; conversion of open, developed space; and other green infrastructure strategies (Brown et al., 2015; Reynolds et al., 2020). These resources were present but lacked prominence across plans. Tree canopy and urban forest actions were only mentioned in half of the plans and represented less than 5% of all resource foci, indicating either a paucity or another source of plans (e.g., urban forest plans). Only the 2019 Detroit Sustainability Agenda mentioned the urban heat island effect as a concern: defining actions to expand emergency preparedness to extreme weather and integrating climate change into pre-existing hazard mitigation plans.

The plans also lacked water resources mentions. Water usage was second to energy for resource foci, but with a large gap between their placements: 64 actions and 10 plans with energy versus 13 actions and seven plans for water usage. Considering the likely regional climate impact of increased precipitation, surprisingly only six plans had stormwater infrastructure goals (8.7% of resource foci). There was also an absence in attention to the region's significant waterbodies. If you are anywhere in Michigan, you are no more than 6 miles from a waterbody (Vaccaro, 2012). Southeastern Michigan is home to many of these, including two Great Lakes and Lake St. Clair. These natural resources define and critically support the region's social-ecological health,

so the lack of actions within plans is notable. Our approach excluded non-plan based initiatives (e.g., projects stated on websites) that may contain such actions, but our scope does suggest water-related actions are not commonly considered in prioritized climate planning.

This fragmentation between resource of focus and resource of concern presents a major opportunity for HCMA and their CAP, especially within the ecological system. While it seems that a major focus is attending to building efficiency to contribute to high heat concerns, the Metroparks can expand past these efforts to assist in other vital ways. The Metroparks' extensive green space provides ample opportunity to consider provisioning of shade and regional cooling (Brown et al., 2015; Schottland, 2019; Vieira et al., 2018; Xing & Brimblecombe, 2020) and stormwater management (Rega et al., 2022; Schottland, 2019). HCMA's 2019 Stormwater Management Plan offered recommendations regarding stormwater conveyance structure maintenance and replacement, and green infrastructure projects each of its parks should pursue (OHM & HCMA, 2019). Community members have expressed related concerns. In HCMA's Community Needs Assessment, park users identified managing stormwater to protect water quality and reducing flooding as their biggest sustainability concerns (ETC Institute & HCMA, 2022).

The Metroparks also have a climate action opportunity with the region's waterbodies. The parks are located within three major watersheds within the greater Lake Erie Watershed (Vaccaro, 2012). The Metroparks were also developed along the Huron and Clinton Rivers, two major rivers in the region. Six of the Metroparks act as ecological corridors for the Huron River and are large draws for park visitors (see Figure 1). Another two Metroparks are located directly on the Great Lakes / Lake St. Clair, with a collective 14 miles of shoreline (HCMA, 2017). The Metroparks also manage 3,634 acres of inland lakes (HCMA, 2017). This all emphasizes the importance and integration of water within the Metroparks. Beyond park-specific responsibilities, HCMA has an ability to consider these resources and impacts at the broader scale in which they work – a regional jurisdiction. They already play a substantial role in supporting these resources, but reliance on our waters for recreation and wellbeing is increasingly stressed (Perry et al., 2018). As a park system with access to these resources, they may see more visitors seeking heat refugia and recreation. Considering both of these issues may provide strong guidance as they outline their climate goals and specific actions. The use of the

integrated recreation amenities framework helped to capitalize on this pattern and identify these specific foci.

The Relative Preponderance of Managerial versus Social and Community Actions

It is unsurprising that in the corpus of governmental plans, the most common actions were managerial. Actions focused mostly on budgetary concerns, policy and planning, and community infrastructure. These plans were created by and for governmental entities, so centering managerial actions seems logical, as they are within the entity's means to implement and enforce. This is encouraging, as internalizing these actions creates active pressure to achieve them. This also creates checkpoints to track progress and dedicate follow-up. It thus appears that jurisdictions are owning their power to create and enact change. They are assigning themselves the work instead of pushing it to others to achieve. We acknowledge that this pattern, especially in contrast to the abundance of managerial actions, may result from our action-level coding approach. Considering hierarchy within plans may show social and community themes represented in higher-level goals rather than specific actions. Though this may be a study limitation, we suggest it also opens an important consideration about governmental definition and implementation of climate actions. It is uncertain whether the de-emphasis of social and community actions was intentional or inherent in the planning process when considering climate resilience. We suggest this was intentional framing, as some discussed their community engagement processes (if any), yet actions and involvements both spoke rarely beyond a managerial/administrative locus of control.

This creates a model for HCMA. The plans heavily focus on managerial actions (Table 3), and thus provide a guide as HCMA considers how their CAP will fit into the broader network of actions. Using the integrated recreation amenities framework content areas to interpret regional plans for park contributions seems appropriate in this way, to draw parallels between traditional park management and neighboring jurisdictions. Park management is presented with an opportunity to complement regional managerial actions, extending their contributions beyond park borders. For example, regional parks could assist in framing land acquisition actions as related to climate change. CAPs reference this as a way to expand green space and develop land in just and ecologically-friendly ways. Many regional park systems already include land acquisition in their strategic plans, so this could bridge relevant climate actions (e.g., Long Beach

Parks, Recreation & Marine Strategic Plan (2021-2031), Arlington County Department of Parks and Recreation Strategic Plan (2021-2025)).

This pattern of actions also explores a unique entry into augmenting the existing plan network. As a regional jurisdiction bordering municipalities engaged in climate action, HCMA touches and transcends the priorities within city bounds. HCMA can specifically extend these actions by addressing and including their own unique park community within their plan. This community includes the many visitors who enjoy the Metroparks, as well as local non-visitors. There is an opportunity to consider community on a different scale than traditional jurisdictions, and potentially incorporate them into defined collective action. HCMA, and other urban-proximate regional parks, already are situated uniquely in social-ecological systems. With established and extensive interpretation and outreach programming, relationships are sustained, and a trusted, reciprocal relationship may be upheld (Baur & Tynon, 2010). Unlike government entities, these relationships could lead to integration of social and community actions without the notion of offloading climate responsibility. Park systems often rely on partnerships to achieve management goals. These relationships remain inherent in planning processes. Climate action may not look any different on the park scale, and the incorporation of community assistance could be expected and welcomed.

The Encouraging Dual and Multi-Emphases

Lastly, regional park systems have opportunity to consider the lesser-emphasized overlaps among social, community, and resource-related actions. The patterns in Figure 2 identify where jurisdictions are thinking multidimensionally and purposefully. The most common of these was overlap in managerial and resource content, accounting for almost 21% of all actions. This further supports the trends previously discussed: managerial actions and natural resources were of highest concern and of most reference. This content overlap was unique among the 10 plans coded and exemplifies the importance of a resource and managerial ownership of protecting/enhancing it. Examples include:

- “Develop a comprehensive, County-wide plan to protect and improve the quality of fresh water in the County's rivers and lakes.” (Toledo Go Green, 2014, pg. 24),
- “Promote innovation and comprehensive strategic planning which considers the watershed (Clinton River Watershed) and the Great Lakes ecosystem” (Royal Oak Sustainability & CAP, 2022, pg. 67), and

- "To deepen energy savings and reduce emissions from new buildings, the City should develop a minimum energy efficiency standard for all new buildings (e.g., 70 per cent more efficient than existing buildings)" (Windsor Corporate CAP, 2017, pg. 23).

However, this pattern was not as prevalent across other content area intersections. There was only one action in one plan containing all four content areas. There was also only a sole action containing social, community, and resource content areas: "Expand emergency preparedness and communication tools" (Detroit Sustainability Agenda, 2017, pg. 28), concerning extreme weather preparedness and community wellbeing when facing major storms. The lack of actions at the managerial, social, and community intersection is of interest. While this may stem from the decoupling of social and community in the coding process, we did see ways in which this separation was warranted and thus suspect it is not due entirely to research design. For example, there were distinctions in multi-emphasis content area actions with managerial and resource and either social or community. Social examples included "Invest in institutional structures to expand and support carbon neutrality-focused 'living-learning labs' across all three U-M campuses" (University of Michigan Planet Blue, 2021, pg. 43) and "Create a citywide truck routing network" (Detroit Sustainability Agenda, 2017, pg. 38). Community examples were more focused on community wellbeing, such as "Expand Weatherization Program" and "Transition Affordable Housing Sites to Net Zero Energy" both from the Ann Arbor A2Zero plan (Ann Arbor A2Zero, 2020, pg. 66 and pg. 58).

We thus conclude there is a lack of integration between actions of managerial implementation and community focus. The data patterns and examples illustrate that while community and social are a piece of actions, they are the focus rather than the driving force. There is a strong trend of managerial propulsion toward a community end vision. The integrated recreation amenities framework allowed us to qualify these actions in ways recognizing subtle differences while offering a unique outlet to translate to park opportunity.

From this, regional park systems can extend climate action efforts. The Metroparks are a piece of many community members' everyday lives, and visitors in turn bring the Metroparks into their community conversations and concerns. This relationship inherently includes the park system's resources. Visitors are consistently interacting with the parks' natural environments, pressing parks to regularly revisit the balance between recreationists' expectations and park ecological health. This is an inherent consideration in parks, especially high use and urban-

proximate ones. Recreation is both critical and projected to change drastically in the coming years (Groshong et al., 2018; Perry et al., 2018). It – and its balance with resource integrity – is at the forefront of management decisions.

Ultimately, this provides a clear opportunity to extend climate actions centering social, community, and resource foci: implementing meaningful actions that protect the natural spaces and favorite recreation activities of southeastern Michigan through a varied and uncertain future. Looking beyond recreation in this nexus is necessary, though, to continue advancing and cultivating a distinctive yet cross-scale relevant CAP. We suggest that information gathering, which emerged as a pronounced action across content areas, has a key role. Information gathering described the need for insight on what climate change means for the region while working within questions of global uncertainty. Advancing dual and multi-emphasis content area knowledge provides a pathway to finding deeper and broader intersections across types of action. For example, parks demonstrating waste reduction management initiatives with composting could pair citizen science inquiries on efficacy with green infrastructure development, interpretation, and ultimately improved soil and water quality. Parks are spaces for learning and already serve a role of where people can explore, ask questions, and study social-ecological systems. There is a regional, practical need for this. By providing space to explore furthering regional knowledge on climate impacts and actions, this assists in strengthening and refining integrated actions. HCMA, specifically, can act as such a conduit: engage and enhance climate actions and expand knowledge about climate change on managerial, resource, social, and community levels.

Authors' Contributions

Ellie A. Schiappa: conceptualization, methodology, formal analysis, data curation, visualization, writing original draft. Elizabeth E. Perry: conceptualization, methodology, investigation, writing original draft, supervision, project administration, funding acquisition. Emily Huff and Maria Claudia Lopez: review and editing

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‘’**Chapter 3:** Noticeable changes in the flow: A water cycle framing of community-experienced climate changes and disrupted water ecosystem services in southeastern Michigan

Short title: Disrupted water ecosystem services

Ellie A. Schiappa[a], Elizabeth E. Perry[a]*, Emily Huff[b], Maria Claudia Lopez[a]

[a]*Department of Community Sustainability, Michigan State University, East Lansing, MI, USA*
[b]*Department of Forestry, Michigan State University, East Lansing, MI, USA*

*Corresponding author: eeperry@msu.edu

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Abstract

Throughout the Great Lakes region, climate change is being experienced in ways such as shifts in seasons, changes to precipitation patterns, and fluctuations in water levels. These impacts are expected to intensify. States such as Michigan, Wisconsin, Minnesota, and Illinois have recently released climate action plans (CAPs), to acknowledge and enact state-level strategies for mitigating and adapting to current and expected changes. Cities in this region (e.g., Detroit, Minneapolis, Chicago) are similarly publishing CAPs that focus on more localized concerns and solutions. Southeastern Michigan, in particular, has seen a proliferation of such municipal CAPs, with 10 (and counting) cities releasing CAPs and others promoting regional initiatives to address the increasing climate concerns. But it will take more than solely municipal efforts to create lasting change and supplement efforts to protect the region's residents and resources. Particularly with regard to the region's water-abundant (though also water-troubled) identity, concerted effort is needed on detailing climate changes related to water experienced by residents and rippling across jurisdictions**.** In 2021, the Huron-Clinton Metropolitan Authority (HCMA or 'the Metroparks') was inspired to augment these efforts and began crafting their own CAP. The Metroparks is a regional park district of 13 parks across five counties of southeastern Michigan, providing nearly 25,000 acres of green space supporting diverse recreation opportunities for the region's 4.8 million residents. Park leadership recognized the Metroparks' important role in resource stewardship and community well-being, and sought to complement and extend their neighbors' current climate mitigation and adaptation actions. We assisted them in crafting their CAP, using a mixed-method research approach with attention to engagement through inclusion principles. Based on this work and in relation to the need for water-specific, community-informed climate inquiry, we use an adapted water ecosystem services (ESw) framework here to address: (1) How are community members perceiving climate change regionally and throughout the Metroparks; and (2) How is water, specifically water ecosystem services, framed within these observations? We present data from eight focus groups conducted in fall 2022, which were part of our larger project, to highlight community-perceived climate changes observed in the Metroparks and throughout southeastern Michigan. These focus groups illuminated the expansive concerns expressed by residents on the health of water at all stages and across all seasons in southeastern Michigan. We apply the water cycle and ESw to these observations to discuss the disruptions to the water cycle caused by climate change, and the relevant impacts to

residents not just in southeastern Michigan, but across the Great Lakes region and beyond. For example, participants consistently referenced the lack of snow and ice impacting accessible winter recreation, and concerns surrounding flooding both in and outside of the Metroparks. In the novel intersections of community perspectives, water cycle attributes and disruptors, and incorporating regional inquiry into park CAP planning, this research and these findings have practical utility for the Metroparks' CAP and other such endeavors. It also contributes conceptually toward finding points of concern and motivation throughout the climate action conversation.
Keywords: focus groups; water ecosystem services; water cycle; climate change; urban parks; Michigan: Detroit; community engagement

Introduction

The Midwest and Great Lakes region are slowly experiencing the effects of climate change (USGCRP, 2018). The lakes are warming, biodiversity is changing, and corresponding economic impacts are affecting recreation and commercial fishing. Beyond this, human and ecological well-being demand attention. Summers are getting warmer and winters are getting drier. In southeastern Michigan, specifically, communities are managing an increasing number of excessive heat warnings and flood warnings in their own backyards. These changes are stressing our water resources, endangering the essential water cycle, and shifting the way in which communities interact with it. Using an ecosystem services framework speaks to these changes and can help to conceptualize what these changes mean and the impacts they may cause. Community-engaged methods help us to understand, and reveal, a fuller picture of what is occurring in southeastern Michigan and how climate changes are impacting the communities living there.

Ecosystem Services

Ecosystem services (ES) is a framework used across social-ecological contexts and increasingly in parks and outdoor spaces for participatory decision-making (e.g., Campbell et al., 2016; Rice et al., 2020). This research study will consider the foundational definition of ES by the Millennium Ecosystem Assessment (MEA), that ecosystem services are benefits that ecosystems provide to humans (Millennium Ecosystem Assessment, 2005), though there are other definitions shaped by various perspectives (e.g., The Economics of Ecosystems and Biodiversity, the UK National Ecosystem Assessment; Potschin & Haines-Young, 2016). This framework considers four major categories of ES: provisioning, regulating, supporting, and cultural. In brief, *provisioning services* are those that humans can directly benefit from and are able to extract from their environment for their own benefit (e.g., timber, natural gas). *Regulating services* are those that control processes to allow basic human life and natural phenomena (e.g., pollination, erosion control). *Supporting services* are less visible, as they are the fundamental processes that function for all of life to occur (e.g., water cycle, nutrient cycle). *Cultural services* are the nonmaterial or intangible benefits humans receive from natural ecosystems that contribute to social well-being (e.g., recreation, spirituality). Studies continue to enlarge our understanding of what constitutes a CES, and how to categorize them, expanding from more researched services such as spirituality, reflection, sense of place, and education to begin to capture concepts such as artistic inspiration,

preservation for future generations, cultural diversity, natural history, and one's identity (e.g., Ament et al., 2017; Campbell et al., 2016; Chan et al., 2012; Gould et al., 2019; Gould & Lincoln, 2017; Millennium Ecosystem Assessment, 2005).

Water Ecosystem Services

Of the vast services within ecosystems, terrestrial ecosystems also serve a specific subset of water ecosystem services (ESw). These services have been identified and analyzed, most commonly to evaluate the economic function and value of a region (e.g., Grizzetti et al., 2016; Rosini & Revelli, 2020). Throughout industrialization, water has been broadly used and regarded as a commodity through the use of hydroelectricity, irrigation, and drinking water, among others. But water also holds an essential function in ecosystems and is interlinked across almost all system processes (NOAA, 2019). The hydrologic or water cycle is the continuous movement of water between Earth and the atmosphere and back again (NOAA, 2019). This is a complex cycle but is often simplified into five major stages: (1) precipitation, (2) percolation or runoff, (3) transpiration, (4) evaporation, and (5) condensation (NOAA, 2019). These useful delineations frame how we discuss this cycle. Because the water cycle is necessary to ensure the basics of life, it is frequently regarded as a supporting service within the ES framework (Brauman et al., 2007). Despite this there are ESw that can be further identified within and across each of the cycle's stages. These ESw can help identify interventions and places of action to address changes in the cycle. ESw specifics vary across investigations (Brauman et al. 2007, Grizzetti et al. 2016, Reynaud & Lanzanova 2017, Shaad et al. 2022, and Vollmer et al. 2018). Previously detailed ESw concerns about terrestrial ecosystems using freshwater resources can be compiled into a framework with 13 areas apparent: air quality regulation, biotic populations and habitats, erosion and sediment regulation, fisheries and aquaculture, flood regulation, hydroperiod, intellectual and aesthetics, local climate regulation, pest and disease control, recreation, water for non-drinking purposes, water quality regulation, and water supply reliability.

The disruption of any of these stages may throw the rest of the cycle off balance, which could become detrimental to landscapes and ecosystems broadly (Trenberth et al., 2003). Many events may disrupt the water cycle (e.g., natural disasters, atmospheric events), but human development and climate change are two consistent, long-term disrupters (NOAA, 2019; Rosini & Revelli, 2020). Figure 4 illustrates the snowball effect of impacts that can cause imbalances in/to the water cycle. To sustain the health of the system and the interlinkages between the water

cycle and human well-being, attention must be given to each stage and the delicate nature of its processes (Brauman, 2015). For example, as the annual temperature rises, less snowfall is predicted. Many states and regions rely on snowfall to replenish freshwater resources during spring snowmelt. This disruption could cause many concerns, including access to drinking water or healthy water levels in streams and/or lakes.

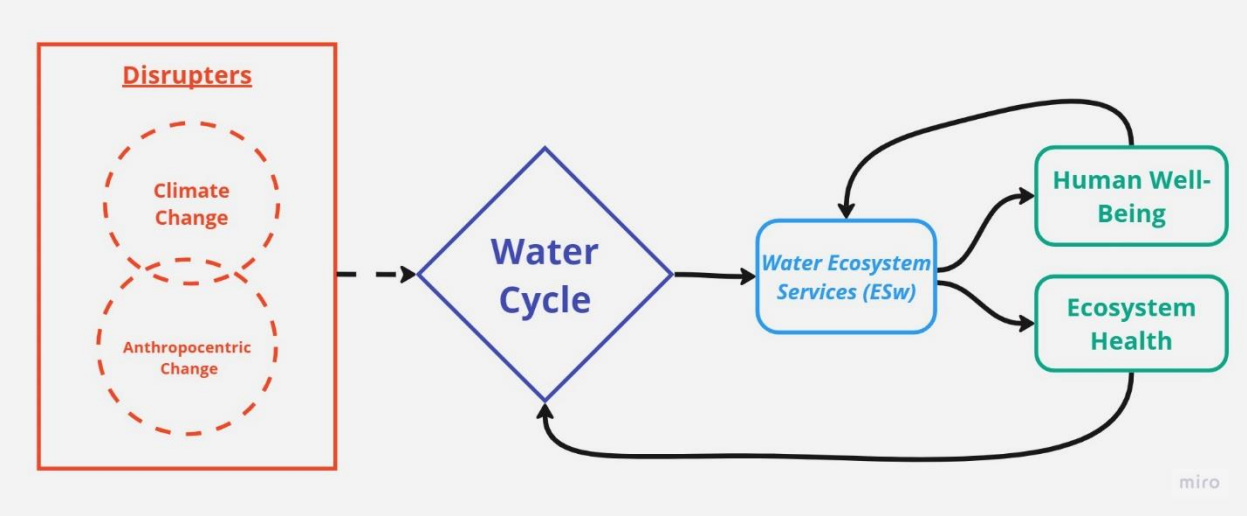

Figure 4. Representation of disrupted ESw within the water cycle. This study focuses on climate change as a disrupter, though many concerns could be closely interlinked with human development (Rosini and Revelli, 2020).

Winter, Water, Wonderland

Attention to ESw and the health of the water cycle is especially important where water is a center point, such as in Michigan, U.S. Michigan borders four of the five Great Lakes and is home to 11,000 inland lakes (MLSA, 2022). The state also boasts a motto – "Water, Winter, Wonderland" – that emphasizes liquid and frozen water are both core to Michigan recreation, economy, and daily life. But disruptions to the water cycle have put the health of water and winter at risk, endangering the identity of the state. Overall, precipitation patterns are changing throughout Michigan, bringing heavier rains in the summer and less snow accumulation through the winter (EGLE, 2022). This limits the amount of snowmelt in the spring, lowering water tables and impacting agriculture reliant on this water source. The inconsistency of precipitation combined with warmer weather trends has caused major flooding year-round, leading to public health and infrastructure concerns, among others (Sampson et al., 2019). The unpredictability of weather patterns create new recreation and the economic risks. In 2019, boating/fishing brought

in over $800 million (5th in the nation) and winter recreation brought in over $88 million (15th in the nation) to Michigan's economy, while agriculture contributed more than $70 billion (BEA, 2021; GLBN, 2020). Impacts to these industries could decrease the well-being of Michigan residents, layering on top of the decline to ecological health by the changes in climate.

Southeastern Michigan is especially vulnerable to these changes. Home to the tenth largest metro area in the U.S., Detroit, southeastern Michigan supports nearly 5 million residents, accounting for nearly 50% of the state's population (SEMCOG, 2021). Paired with this population density and the region's historic industrialization, changes in expected climate patterns and precipitation come at a considerable cost. To recognize and address these concerns, southeastern Michigan cities are publishing climate action plans (CAPs) to begin implementing mitigation and adaptation strategies. For example, Ann Arbor's Living Carbon Neutrality Plan (2017) centers on a just transition to carbon neutrality by 2030. Detroit's Sustainability Agenda (2019) strives to expand local air quality monitoring systems, create green infrastructure projects on a neighborhood scale, and integrate climate change into hazard mitigation planning. Royal Oak's Sustainability and Climate Action Plan (2022) promotes accessibility to efficient and renewable energy while ensuring regular sewer system maintenance and increasing stormwater resilience. Michigan also has published a CAP (MI Health Climate Plan, 2021), to encourage statewide action for the future, becoming the fourth (of six) Great Lakes state to do so.

In a recent review of these plans (Schiappa et al., 2023), we found key themes in the topical, spatial, and temporal domains of their actions. For example, the majority of actions centered managerial efforts at the citywide scale in the next 5 years. Looking specifically at the topical domains represented, "resources" accounted for about 37% of the actions. This means that the main substance of "action" within about a third of the actions for this region related to a natural or human-defined component of the environment (e.g., energy, water usage, carbon, forests, soils air quality, extreme weather). Within this, energy was the most prominent, despite the "water" character – and need – of the region. Water-themed actions included those related to water usage (13%), stormwater (12%), water bodies (7%), extreme weather like storms (2%), and wetlands (1%). This discrepancy between the lack of CAP actions within the water-defined identity of Michigan, and human needs for surviving and thriving in southeastern Michigan in particular, suggest that water may require a more explicit focus in CAP conversations and content.

Concurrently, the Huron-Clinton Metropolitan Authority (HCMA or 'the Metroparks') expressed interest in CAP development, recognizing the important ecological role their lands play in providing essential green space buffers to mitigate climate changes. HCMA is a regional park system consisting of 13 Metroparks across the five main counties defining southeastern Michigan and generally along the Huron and Clinton Rivers. By providing access to 25,000 acres of green and blue space for southeastern Michigan's residents, the Metroparks are a prominent entity in many Michiganders' lives. The Metroparks have provided recreational opportunities for generations, often being a place of memories and attachment for their users. They also act as ecological corridors for the sensitive resources of southeastern Michigan, currently managing 14 miles of shoreline along Lake St. Clair and Lake Erie and protecting 3,634 acres of inland lakes too (HCMA, 2022).

The urgency to develop an inclusive, data-driven, and meaningful plan positioned for regional impact precipitated a relationship with us, Michigan State University researchers. Together, we have been aiming toward a thoughtful plan, well-rounded and supported with robust scientific inquiry. This planning process has been multi-phasic, including in-depth content analysis and extensive community engagement. These phases have been instrumental in understanding what types of climate planning are happening in southeastern Michigan and regional urban parks nationwide, while inviting community involvement from park users and area residents. As detailed in our related CAP review, our analysis of current climate planning in southeastern Michigan (Schiappa et al. 2023) found that water had not emerged as a planning priority in the region despite previous research and community reports expressing it as a consistent concern (e.g., Sampson et al. 2019, Carmichael et al. 2019). Therefore, we explicitly address this issue here, aided by ESw framings and through the case of the Metroparks, to analyze the function of climate change as a disruption of the water cycle and the impacts observed by community members that are ultimately aiding the creation of regionally-relevant and community engaged climate actions for a CAP.

Research Questions

Based on these concepts and the applied context of the Metroparks' CAP, this study focuses on the disruption of ESw as illustrated through the water cycle and community-experienced climate changes. Within this intersection of ESw, communities of southeastern Michigan, and the Metroparks, this study asked:

(1) In what ways, if any, are community members experiencing climate changes within the region, and throughout the Metroparks?

(2) How is water framed within these observations, and specifically, what water ecosystem services are discussed?

These questions winnowed the broad dataset that emerged from the focus groups for a more directed analysis. The following inquiry informed the Metroparks' CAP and has application for other regional climate planning efforts (parks and beyond).

Methods

Data Collection

We collected data from focus groups, to foster facilitated discussion around a shared topic (Morgan, 1996). Our aim with this qualitative, participatory method was to bridge scientific research and community voice and effectively gather in-depth information from multiple participants (Morgan, 1996; O.Nyumba et al., 2018). Eighteen focus groups, totaling 203 participants, centered Metroparks community members (n=118 attendees) (visitors: n=7 groups; partner organizations: n=1 group) and staff (n=10 groups, 85 attendees). These were hosted October – December 2022, using in-person and virtual (Zoom) modalities for greater accessibility. Each focus group was facilitated by two or more members of the research team. Visitors (local community members who have visited a Metropark) could choose to attend either a geographically assigned focus group based on their home location or most visited Metropark location. Partners attended a single, virtual focus group. All received a 2023 Metroparks Annual Pass for attending. Staff could choose to attend an in-person focus group based on their Metroparks district or a virtual focus group based on their Metroparks department. These categorizations allowed people with similar job descriptions, geographic locations, or recreation identities to have rich discussions about climate change within an affinity group (Krueger, 1994). Focus groups lasted 2 hours for community members, and 2.5 hours for staff, each including a lead-in 30-minute engagement with Metropark interpretive staff about climate change within the

Metroparks. To encourage in-depth discussion, in-person groups were capped at 12 participants with an average of 8 attendees, and virtual groups were capped at 50 participants with an average of 15 attendees (Krueger, 1994).

A semi-structured focus group guide was used, tailored slightly for visitor, staff, and partner audiences. For visitor and staff participants, the first discussion surrounded their most treasured experience in the Metroparks. This gave participants an opportunity to share special memories, experiences, or activities that they value. The second discussion surrounded climate changes they have observed in the region (defined as Livingston, Macomb, Oakland, Wayne, Washtenaw counties – HCMA's main service area in southeastern Michigan) and the Metroparks. These observations were discussed and then participants were polled to identify each group's three most concerning climate changes at the regional and Metroparks levels. The third question differed by audience. Visitors were asked to reflect on what they would like to see preserved, maintained, and/or enhanced in the Metroparks in 50 years. This visioning question was to gauge values and how the CAP could perpetuate these values in the future. Staff were asked to identify actions they would feel invested/enthused in undertaking in their work at the Metroparks to enhance organizational climate action. Partner organizations were asked the same types of questions as staff, adjusted slightly to respect their external and regional involvements.

Data Analysis

Artifacts generated during the focus groups – physical and virtual sticky notes with text, hardcopy and digital group lists, and polling in both formats – comprised the data. Additionally, all focus groups were voice recorded for data preservation and validity (O.Nyumba et al., 2018). Using Nvivo (1.7), a qualitative data analysis software tool, the first author coded the focus group artifact data for major themes, using pre-identified and emergent coding structures (QSR International Pty Ltd., 2020).

This chapter focuses specifically on the climate observations of visitors (n=7), as staff had differing observations that were specific to their expertise. To make the concept of climate change more approachable to participants, generate nuanced conversations, and gather data of greater specificity than "climate change" as a broad topic, climate changes were asked at discrete scales by focusing discussion on first the regional level and then narrowing to concerns specifically on the Metroparks. This also aligned with the Metroparks' needs for processing and understanding data for their CAP. To simplify the copious data collected for this paper, we

hereon combine Metropark and regional climate data. Due to the nature and context of this inquiry, recreation and recreation infrastructure are correspondingly pronounced as discussion topics.

After an initial round of coding of visitors' climate observations (n=451) for types of resources mentioned (following the coding structure of Schiappa et al., 2023), a pronounced theme surrounding water emerged, accounting for 63.6% (n=287) of the focus group data. While temperature changes and seasonal shifts were most pronounced throughout discussions, the proportion of climate observations focused on water is a substantial highlight, especially in a region as water-oriented as southeastern Michigan. This also stood out as relevant given the little mention of water as a resource in CAPs pertaining to the same region as these community members (Schiappa et al., 2023, also Chapter 2, Table 3 of this work). Given the breadth of how climate changes related to water were noticed and shared in the focus groups, we focused additional coding on these 287 water-related changes mentioned. Especially as these mentions had the potential to present an opportunity for the Metroparks' CAP to perhaps center community concerns in ways not captured in other CAPs in the region. Using this sub-set of climate observations we organized the coding along the water cycle and then applied the adapted ESw framework previously introduced to understand them at a more holistic level. This analysis was validated through consistent check-ins with the second author and exhibited no major discrepancies.

Results & Discussion

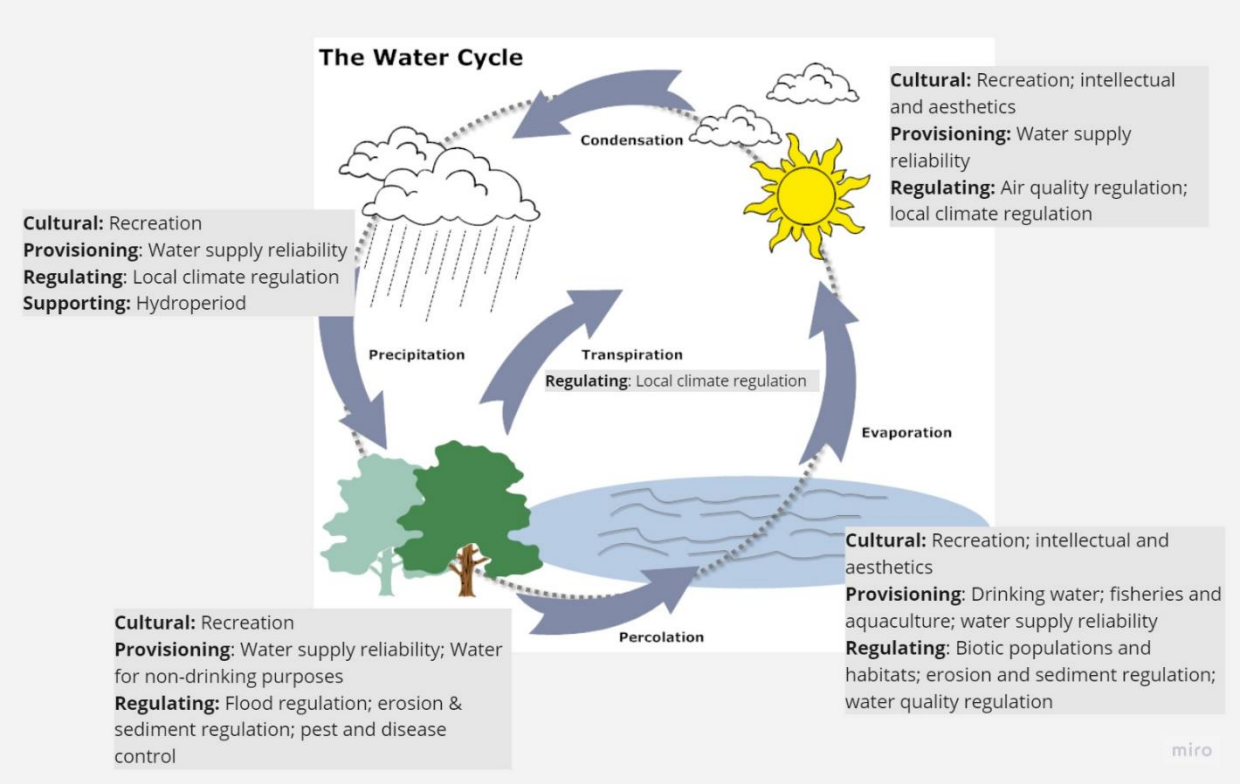

Figure 5. Water Ecosystem Services (ESw) pictured within the water cycle. Assumed within this depiction is that the water cycle itself is an all-encompassing supportive service.

In an intermediary round of coding, 26 specific climate observations were coded for within the water-related changes mentioned in the focus groups (Table 5). These 26 codes were grouped into seven emergent categories. The most common of these was changes in precipitation, accounting for 26.8% of water-related changes. Within this precipitation group, the lack of snow and/or ice in the winter months made almost half of these changes (45.5%). Flooding (22.0%) was the next most common change observed, followed by impacts to recreation (19.2%).

Table 5. List of 26 climate observations specific to the water cycle, grouped into seven categories (gray rows). Category percentages represent proportions of the total number of water-related observations, whereas specific observation percentages represent within-category proportions.

Climate Observations	Total (n=287)	Total (%)
Precipitation	**77**	**26.8**
Lack of snow / ice	35	45.5
Intense rain (when it happens)	16	20.8
Drought conditions	10	13.0
Cyclical winter weather patterns (e.g., repeated freeze-thaw)	8	10.4
Intense snow (when it happens)	4	5.2
More rain	3	3.9
Cyclical rain patterns	1	1.3
Flooding / Water Level Predictability	**63**	**22.0**
Increased flooding concerns	25	39.7
Flooded trails/ paths	18	28.6
Stormwater management issues	12	19.0
Fluctuating water levels	8	12.7
Recreation / Recreation Infrastructure	**55**	**19.2**
Impacts to winter recreation	20	36.4
Degraded conditions for ice-based recreation	14	25.5
Degraded conditions for water-based recreation	8	14.5
Crowding at or stress to water bodies / water facilities	5	9.1
Impacts to summer recreation	5	9.1
Ice on trails / paths	3	5.5
Water Quality	**40**	**13.9**
Decreased water quality for biodiversity / natural processes	23	57.5
More algal blooms	10	25.0
Closures of water facilities / natural water bodies	7	17.5
Biodiversity	**34**	**11.8**
Changes to flora / fauna	30	88.2
Dead / down trees	4	11.8
Erosion	**10**	**3.5**
Erosion along trails / paths	8	80.0
Erosion along waterbodies / shorelines	2	20.0
Human Well-being	**8**	**2.8**
Public health concerns	6	75.0
Diminished air quality	2	25.0
Totals	**287**	**100.0**

We then applied the adapted ESw framework to identify general and specific services perceived as impacted by climate changes (Table 6). One additional supporting service – *hydroperiod* – is identified in this context, to honor specific observations noticed by many community members. Hydroperiod is "the characteristic seasonal fluctuations of wet and dry conditions" (Brauman 2007) and a key service underlying predictable precipitation patterns and ecosystem processes. The following discussion and interpretations relate to this final round of coding for ESw, organized for clarity and application within stages of the water cycle. The codebook used for this can be found in Appendix II.

Table 6. List of 13 adapted Water Ecosystem Services (ESw) applied to the community-identified climate observations, grouped into four ecosystem services categories (gray rows). Category percentages represent proportions of the total number of ESw, whereas specific ESw percentages represent within-category proportions.

ESw	Total Instances (n= 266)	Total (%)
Regulating	**158**	**59.4**
Flood regulation	53	19.9
Biotic populations and habitats	28	10.5
Water quality regulation	28	10.5
Local climate regulation	19	7.1
Pest and disease control	17	6.4
Erosion and sediment regulation	11	4.1
Air quality regulation	2	0.8
Cultural	**51**	**19.5**
Recreation	48	18.3
Intellectual and aesthetics	3	1.1
Supporting	**39**	**14.9**
Hydroperiod	39	14.9
Provisioning	**18**	**6.9**
Water supply reliability	11	4.1
Fisheries and aquaculture	6	2.3
Water for non-drinking purposes	1	0.4
Totals	**266**	**100.0**

Precipitation & Condensation

Various ESw were represented across the coding structure of climate changes discussed, with precipitation the most prominent across focus groups. Comments concerning lack of snow and inconsistent snow were common and appeared in all but one focus group. These changes were coded as hydroperiod and is where the differentiated supporting service is most pronounced. Changes to the hydroperiod represented 14.9% of all ESw expressed.

With the Metroparks focus of this work, recreation was understandably a common service disrupted in participants' lives; precipitation was often mentioned in tandem with recreation. Precipitation as a disrupter to recreation was talked about as (1) the inability to recreate in the winter due to lack of snow, or (2) the inability to recreate in general due to uncertainty of weather patterns. Heavy and extreme rains often reduced the ability to plan for or engage in recreation, and also damaged essential infrastructure to do so safely. The popularity of water and winter recreation sports in southeastern Michigan made this a prominent conversation point. Participants consistently discussed the decreasing ability to ski, skate, ice-fish, or snowshoe throughout the region. These observations accounted for two-thirds (67.2%) of all recreation observations (Table 5). Expected hydroperiod also intersected often with recreation. For example, instances in which expected precipitation patterns impacted recreation habits was illustrated by a participant:

> "I put the [comment] 'less snow = less recreation = sad'. You know something that was important to me was going cross-country skiing or taking my kids to go sledding and we haven't been able to do that much in the last couple of years, or like someone said earlier, it's a very specific time frame. You sort of have to wait for the weather and say 'OK we can go you know now that we know that there is snow right now' versus planning two months out in advance like we could before."

Cycle stages and observations are interdependent and impacts to precipitation have particularly lasting effects to the rest of the cycle. With limited rain and snow, percolation and runoff also become limited, and waterbodies and groundwater risk low water levels. This is represented in the other ESw identified within precipitation, including water supply reliability and local climate regulation. Figure 5 represents the interconnectedness of the ESw throughout the water cycle. Condensation of water vapor in the atmosphere is also related and provides local climate and air quality regulation effects. However, the process of condensation into precipitation is again interlinked with the hydroperiod and its changes. Disruption of a region's hydroperiod leads to

shifts in expected precipitation patterns, and therefore an overall disruption to the cycle's stability.

Percolation & Runoff

As rain and/or snow hit the ground, the water cycle enters into a new stage – percolation and/or runoff. Within this stage, rain and snow (or snowmelt) is absorbed into the groundwater or runs off into the surrounding watershed. As previously mentioned, with a lack of precipitation this stage's functionality becomes limited. The ESw identified in this stage include provisioning, regulating, and cultural ES (Figure 5).

Flood regulation, erosion and sediment regulation, and pest and disease control are specific and essential regulating services within the percolation stage. A prominent observation by participants was in the increase of intensity of storms and rain when it does occur. One participant shared:

> "…this region was so horribly impacted in 2014 by the floods, [and now] we're seeing with the high winds. It seems like in this region there's more power outages which I don't remember happening years ago. The extreme flooding and winds we didn't have to deal with before."

This concentrated influx of rain overwhelms stormwater infrastructure, creating flooding throughout neighborhoods, into backyards, and often backups into basements. This can also cause erosion along roadsides and trails, which was another common ESw discussed (4.1%). Flooding and attention to stormwater management have become increasingly prevalent throughout southeastern Michigan, due to increasing development and outdated infrastructure (Carmichael et al., 2019; Sampson et al., 2019). Participants confirmed these issues through personal experiences shared, such as backyards and basements flooding at unusual times or rates throughout the year. As flood regulation is an essential and natural function in the region, the disruption in this system poses high-level concerns for the health of natural ecosystems and the well-being of the neighboring residents. Regionally, many initiatives have been implemented to improve stormwater management and mitigate these increasing concerns (i.e., OHM & HCMA, 2019; SEMCOG, 2020). Yet, stormwater management is not a prominent theme within regional CAPs (Schiappa et al., 2023), potentially due to difficulties distinguishing the primary cause as climate change or developmental issues in the region (though these can both be present and are inherently linked, e.g., Figure 4).

Evaporation & Transpiration

The next stage in the water cycle is evaporation and transpiration, where water transforms from a liquid to a gas from droplets or as it is pulled from plant leaves, respectively. We heard a few disrupted ESw and prominent themes. Indeed, 7.1% of regulating services were related to local climate regulation, including tree health and summer heat patterns. ESw provided by healthy evaporation processes include air quality regulation and water supply reliability. Regarding impacts, respondents expressed concern behind tree diseases and deaths, which ultimately impacts the process and extent of transpiration. A necessary and natural greenhouse gas, water is essential for atmospheric health and a correspondingly regulated climate. Examples include humidity patterns, seasonal temperatures and fluctuations, and natural cooling effects from ecological factors such as expansive tree canopy. Transpiration in green spaces and urban parks has also been shown to assist a region in naturally regulating its microclimate (Grizzetti et al., 2016). In urban locations such as metro Detroit, this process can help mitigate urban heat island effects and provide relief to residents, hopefully avoiding health concerns.

An Outcome of Water Cycle Disruption

Although not an official stage of the water cycle, the health and quality of relevant water bodies in the region was a major, emergent theme. This health and quality hinges on a stable water cycle (see Figure 4) and thus we discuss it separately. Two ESw were expressed at equal rates, sharing placement as the second most commonly perceived regulation ESw and accounting for 30.0% of all ESw: habitats and populations of biota and water regulation. These also commonly overlapped and are interlinked. If water quality regulation is not maintained, population health and strength of habitats for biota become imperiled. Prominent examples included all observations related to maintaining native aquatic plants (e.g., duckweed - *Lemnoideae*) and amphibians and reptiles (e.g., frogs, turtles) as wetlands and ponds are altered/lost with the changing climate. These observations were often phrased as concern about increasing encroachments of invasive species or changes to algal growth in water bodies.

Water quality was also linked closely within cultural ES, specifically recreation. Recreationists were concerned about bacteria in the water and related health risks with swimming and fishing. Even water-peripheral recreationists expressed concerns, such as a golfer sharing:

> "Occasionally, the [golf] ball ends up in the water, and [I have] the thought of 'when I fish it out, do I need to get sanitizer for my hands?' The water looks very good, but with all the things we hear about how the water and the streams get all messed up, there is a slight concern that sometimes comes into my head now."

Another ESw intertwined with these two services was fisheries and aquaculture, within the provisioning ES. Fisheries and aquaculture in this context was often expressed in a recreational sense, as recreational fishing is a major pastime in Michigan, with revenues of nearly $2 billion (GLBN, 2020). Although not the most discussed service, it was mentioned six times and was often phrased with uncertainty about water safety for fish health or related admissions of discomfort eating caught fish. There were also mentions of depleted fish stock, reducing the ability to fish recreationally.

Pests and disease control – specifically water-reliant pests and water-borne diseases – also result from water cycle disruption. This includes such concerns as an overabundance of insects (e.g., mosquitoes) that are reliant on water for laying eggs or *Escherichia coli* (E. coli) contamination. Although both are natural elements of ecosystems, shifts in population sizes and expected seasons can affect ecological health and human well-being in pronounced ways throughout the region. Impacts to recreation, the ability to recreate, and human and animal health exemplify how dysregulation of these services may have lasting ecosystem effects.

Implications

Community-expressed climate changes and voiced concerns centered water resources as a focus of disrupted regional systems. Water and the sustainability of the water cycle is critical for the region and beyond. Focus group responses corroborated the arguments made in Schiappa et al. (2023), including that water should be a key resource of focus in climate action planning and community and social related goals should be more closely aligned. Our findings reveal the interconnectedness of water as a resource for southeastern Michigan via community-sourced ways. Planners and scientists have the opportunity to position water as a motivator when framing the future of ecosystems and human well-being, especially in places like Michigan, where water courses through the state's identity. Intersections with water are unlimited, and human

relationships with this essential resource are consistently in flux. Reliance on water transcends provisioning needs such as drinking water or irrigation but is an important resource in amorphic ways such as social well-being and sustainability of important infrastructure. As climate change continues to shift resource availability and ecological patterns, considering innovative solutions on multiple scales and within varied contexts could ensure stronger preparedness. Our findings use community data and ESw concepts to further support this concept, and the necessity in attending to our supporting ES. This study focused on community concerns and experiences regarding climate change. Plans focusing on community-voice more specifically could bridge the gap of managerial actions and community action, by centering community needs in addition to jurisdiction-related agendas. Currently, CAPs throughout the region are missing this bridge, and our findings could help build the gaps that exist (Schiappa et al. 2023).

The observations from these focus groups offered insight into southeastern Michigan residents' lived experiences and the transcending connections water provides across resources and contexts. Observations are often small-scale by necessity, yet the suite of observations reported provided insight into changes impacting multiple scopes, scales, and terrestrial and aquatic ecosystems in the region. Regardless of whether observations were actually tied solely or primarily to climate changes is moot, as community experiences are valid perceptions, especially in these discussions about climate action and should be acknowledged, communicated about, and considered in CAPs as such. This study provided strong examples of valuable community input that helps piece together a picture of climate changes, and specifically water-related events, transpiring across a region. These observations and facilitated discussions emphasized the importance of including community voice in planning efforts, to not only ensure robust involvement but as fuller recognition of concern and understanding of the immediate impacts being experienced. Climate action focuses both on mitigation and adaptation techniques, but by not attending to communities' most pressing experiences, adaptation to climate change may not be as effective as assumed to be. This community engaged-research enhanced the co-production of climate knowledge across the region, to learn about climate-associated experiences beyond the Metroparks' managerial lens and strengthen the park system's resulting CAP. Community members had an opportunity to lend their voice and be a part of the issue identification and subsequent planning process, of which they are often not given the opportunity to engage.

This work highlights how community observations may assist in framing of CAPs'

water-related actions beyond current, limited expressions. Our findings further provide insight into community concerns, namely water's natural state, cycle, and human intersections. Previous climate analyses found that, when water was prominent (e.g., Deetjen et al., 2018; Lambrou and Loukaitou-Sideris, 2022), it was often framed as conservation of a public utility instead of as residents' concerns across the water cycle. This has led to water being highly regulated above and below ground (Crank and Asher, 2023). Although access to water as a utility is important for human well-being, the health of our natural ecosystems gets stifled in the climate planning conversation while being equally important. These findings show natural water resources as of distinct concern to residents of a highly urbanized and industrialized region, not constraining the topic to merely commercial use. The attention to stormwater infrastructure may be the only element of climate planning congruent with our qualitative findings. While HCMA considers the resources and strategies to center in their planning process, water could act as a touchstone to the CAP's purpose and transcend all its goals and actions. As an extensive resource utilized and valued in various ways, considerations to the conservation of such should be attended intently and thoughtfully.

These focus groups led us to conclude that water is an essential part of southeastern Michigan communities and their leisure time. As planners and scientists consider climate change and mitigation and adaptation techniques, water can act as a strong and purposeful motivator to enact progress. This common and important resource provides a shared purpose in locations such as southeastern Michigan, whose identity is often rooted in the phases of water throughout the seasons. Ultimately, nothing is as transcendent and essential as water, and this common purpose could promote the needed collaborations and motivations to enact sustainable change for a better, healthier, tomorrow.

Limitations

We acknowledge two limitations. First, there is difficulty separating changes due to climate change versus the intensity of development on the landscape. As these go hand-in-hand, uncoupling their relationships may warrant further study and community communication. As previously mentioned, data were drawn from resident perceptions, and though we recognize that these discrepancies, couplings, and nuances in "actual" causes may not have been defined by residents in the suite of "climate" changes they noticed, we do not necessarily view this as a limitation. Second, the context of the focus groups within the Metroparks and on climate change may be construed as unnatural and inspired by the topic of the event and the opening interpretive presentation (O.Nyumba et al. (2018). Though we recognize this may have disproportionately emphasized recreation concerns, this was the study context and deepened our critical thought on the water cycle's critical but lesser emphasized connections to leisure and well-being.

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‘’**Chapter 4:** Conclusion

Overall, this research inquiry explores perspectives and considerations of natural resources, specifically water, in climate planning efforts. It also examines the potential role of parks in contributing to climate planning and actions meaningful at multiple scales – the park system and region. Use of qualitative methods (i.e., content analysis and focus groups) and multiple theoretical frameworks (i.e., recreation amenities framework and ecosystem services), identified these resources and jurisdictions as essential additions within the climate conversations happening in southeastern Michigan. The preceding chapters support four main takeaways, as outlined below:

(1) The efforts towards climate action planning in southeastern Michigan, while robust, focus heavily on commercial and managerial actions and goals. These often overlook important considerations such as natural resources, specifically water. Climate changes discussed at-large within the literature and across scientific findings did not clearly align with the climate actions being pursued within these plans.

(2) Climate action plans must be attentive to multiple spatial and temporal scales, while ensuring goals not only address managerial initiatives but also emphasize community and social actions. Planning efforts should also extend beyond the concrete boundaries of a jurisdiction. Especially in this context of park and city, each party has the ability to complement efforts and approach a unique suite of actions that are attainable and natural for each to approach.

(3) Supporting these overarching literature and findings, residents of southeastern Michigan consistently mentioned water, at all stages of the water cycle, as climate observations prevalent in their recreation habits and daily lives. These changes were prominent as they represented 63.6% of all observations discussed across seven visitor focus groups. From changes in precipitation patterns (e.g., lack of snow in the winter) to concerns over water quality in the surrounding lakes and ponds, water was a regular theme discussed in climate change dialogue in focus groups hosted across the region by the Huron-Clinton Metroparks. Of the 451 observations coded across focus group discussions, the majority

(4) Using an adapted water ecosystem services framework, focus group data identified key water ecosystem services (ESw) being disrupted across the water cycle. Defined as disrupted ESw, these findings support the argument that attention to water resources should be a key component of climate planning.

Managerial Implications

These findings inform the Huron-Clinton Metroparks climate action planning process as highlighted in Chapter 1. As a part of a collaborative effort, these data have been used to structure workshops and discussions to define the goals, actions, and framework of their forthcoming plan. The distinct phases that are represented in Chapters 2 and 3 allowed Metroparks staff and leadership to identify ways in which they could complement and extend current climate efforts and learn more about the lived experiences of their visitors in the Metroparks and neighbors in the surrounding communities. Chapter 2 specifically provides insight on what climate action is occurring in the jurisdictions surrounding the park and illuminates how to envision and structure their own plan. By utilizing this analysis, the Metroparks may approach the planning process well-informed and well-equipped to create their own unique and notable plan.

Chapter 3 outlined insight into community observations within the Metroparks and throughout the surrounding region. The focus on climate observations discussed by community members in focus groups allowed for in-depth analysis and robust discussion surrounding climate changes in southeastern Michigan. These findings complemented those of Chapter 2, providing complementary viewpoints to jurisdictional planning by considering community-lived experiences in regard to climate action planning. Overall, this chapter utilized focus groups to include community voice in the climate conversation and learn more about how climate changes were causing disruption and/or displacement in southeastern Michigan outdoor recreationists' lives.

Although this study was focused contextually on the Metroparks of southeastern Michigan, these findings and study methods could be transferable to other regional parks engaging in this type of project and that rely heavily on water as a part of their identity. Climate action plans are not prevalent within regional or urban / urban-proximate parks but are projected to quickly gain traction (Rega et al., 2022; Schottland, 2019). This thesis highlights an example for other parks as they engage in similar research studies or navigate similar inquiries. Indeed, it emphasizes the need to examine the importance and conditions of water across the water cycle and perhaps not just where there is the most pronounced impacts or identity. Water is a common thread through almost all protected areas and regional needs, and the weight of water's importance should be considered regardless of context, region, or jurisdiction.

Research and Theoretical Implications

Beyond the utilization of these data for use in the Metroparks' climate action plan, this study expanded on multiple theoretical frameworks. Chapter 2 expanded upon what climate action planning looks like, and how it could be framed in a new setting. Michigan climate action is prevalent and happening quickly, and this chapter illuminated this innovative network of plans in a sensitive region. This chapter also expanded upon work done by researchers such as Berke et al. (2015) and Woodruff et al. (2022), by discussing the importance of scale and efforts towards plan coordination. Chapter 2 also expanded on a traditional recreation amenities framework by extending it to new scales and including more inclusive aspects (Manning, 2022; Perry et al., 2020). Using an adapted framework for this climate plan content analysis, successfully applied a traditional recreation framework within a city jurisdictional context, allowing for results and findings to be easily transferable across authorities. This study used community as a fourth element to the traditional three 'folds' (managerial, social, and resource) of this framework, first introduced by Perry and colleagues (2020). The addition of community to this framework allowed for the human dimension of climate change to be centered and brought forward within the analysis and was necessary for a comprehensive analysis. Using these findings in a recreation setting created a more inclusive definition and understanding of community, viewing it across scales and contexts within a geographic region.

Chapter 3 has its own suite of theoretical implications that complement those of Chapter 2. One expanded the use of focus groups in a climate change and parks setting, and act as a valuable example of community-engaged research. While not the first time these methods were used in this context (e.g., Ernst & van Riemsdijk, 2013; Frazier et al., 2010) this study extended its use into southeastern Michigan and with a focus on the Huron-Clinton Metroparks. The community engagement process used throughout this study added to the co-production of knowledge and provided a voice to residents and park visitors in the climate planning process. These Metroparks are beloved and used by passionate recreationists, so the focus groups were largely well-received with enthused participation. This chapter also utilized the ESw framework in a novel way compared to other traditional studies. ESw is largely used for economic studies and analysis of water resources (e.g., Brauman, 2015; Grizzetti et al., 2016), but this study used it within a social science lens and connected these services to climate change and the health and sustainability of the water cycle. ESw was used in this sense to compel climate action and

discuss the importance of water as a resource when considering climate changes and preparing for the future.

Ultimately, this thesis explored research inquiries pertaining to climate change in southeastern Michigan using a unique combination of qualitative methods and theoretical frameworks. At a nexus of recreation, natural resource management, and regional planning efforts, this research illuminated patterns of current climate action and pathways of next steps within the region. Although in the contextual setting of southeastern Michigan, this approach could be easily taken in other settings and select discussion points could be used in future planning efforts elsewhere, specifically those emphasizing the need to include and prioritize water as a resource in climate action. An outcome of academic-institutional partnership, this research acts as a standalone study while also being informative to park management and planning efforts.

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APPENDIX I: FOCUS GROUP GUIDES

Staff/Park User Focus Group

Welcome from Metropark Staff/Leadership & Background of the CAP
Time: 10 minutes
Who: HCMA
Content (Script): Good morning/afternoon/evening. Thank you for taking time out of you busy day to join us for this Climate Action Plan focus group. I imagine everybody here knows me but just in case I am _____ and I am the _____ of the Metroparks. The purpose of this session is to hear from you as it relates to climate change in and sustainability of our parks. You will be guided through a facilitated process where we hope you will feel free to engage fully, think deeply, ask questions, listen with intention, be open and honest. This session will be recorded for research purposes only and will not be shared with Metroparks staff (including Leadership). When focus groups are completed and the data is collected analyzed, we will share the data with all Metroparks staff. Today's focus group will be led by _____, _____ and _____ . I am going to sign off and let you all get started. Again, thank you for participating.

Logistics
Time: 5 minutes
Who: Research Team
Content: Share logistics of room (physical and zoom), and set structure for rest of focus group– including a brief agenda *(Script):* Thank you for joining us today! This is a 2 ½ hour event, with a couple of "working breaks" throughout. Please feel free to get up and stretch, get a refreshment, or use the restroom at any time that you would like to.

Research Statement
Time: 5 minutes
Who: Research Team
Content (Script): You are being asked to participate in a research focus group. The purpose of the study is to guide and provide input to the creation of a climate action plan for the Huron-Clinton Metroparks. The intent of this particular data collection is to elicit input from you, the park users, about resources and impacts you may have noticed within the parks or regionally as related to climate change. You will be asked to provide your input on your experiences as well as visions for a climate resilient future. This input concerns topics related to the Metropark you most frequent, as well as the residential region in southeastern Michigan. Your participation in this focus group will take about 2 hours. Your participation is voluntary. You can skip any question you do not wish to answer. You can withdraw or leave the focus group at any time. You must be 18 or older to participate. By remaining in this focus group session, you are consenting to participation in this research. Data from this focus group will be combined with data from the other focus groups and reported in summarized ways by region, department, etc. to the Metroparks, in the Climate Action Plan, and in research presentations. Any questions on this research may be directed to Dr. Elizabeth Perry at Michigan State University. Her contact information was on your invitation and I have it available with me too.

Interpretive Presentation
Time: 20 minutes
Who: HCMA Interpretive Team
Content: Provided by HCMA and differed based on Metropark and Interpretive staff person

Transition to first discussion
Time: 5 minutes
Who: Research Team
Content: Share ground rules and do introductions of Research Team/Participants (if number allows)

- Park User Icebreakers: Name, where you live, and your favorite thing about the Metroparks
- Staff Icebreakers: Name, your position, and what Metropark you work in
- *For Zoom Only:* Instructions on Zoom & how to use Jamboard

First Discussion Question & Working Break
Time: 20 minutes
Who: Research Team
Content: What is your most treasured experience at the Metroparks?
(*Script):* We'll get to lots about climate change, but first we want to hear from you about your favorite times in the Metroparks. This will help us get to know each other and what we enjoy about these special places too. For the next 10 minutes, please feel free to take a break and write down a few of your most treasured experiences at the Metroparks. You can refer to the poster and the papers you received with all of the recreation activities in the Metroparks listed. You also received three post-it notes to write your treasured experiences on. You can put them on the poster wherever you like when you are done writing.

- In-person: 10 minutes to break and brainstorm at the beginning. Use large park poster to attach post-it notes to
- Virtual: 10 minutes to brainstorm at the beginning and take a break. Drop Jamboard link in the chat and have participants add to this

Climate Change Information Presentation
Time: 10 minutes
Who: Research Team
Content (Script): Those are all wonderful parts of the Metroparks you enjoy and hold close. Of course, with the topic of today's session, we know that we love these places and want to support and sustain them for years to come. We'd like to present a short and non-technical overview of climate change and some of the impacts in Michigan, to get us thinking together about changes that you may have experienced or are of concern to you.

- In-person: Pass out packets to follow along on
- Virtual: Share screen as you move through the slides

Second Discussion Question
Time: 25 minutes
Who: Research Team
Content: What climate change impacts have you noticed across the region and within the Metroparks? Of these which most concern you?
(Script): First, let's talk about what changes you have noticed in the region and the parks in particular. Then we'll discuss which of these changes concern you.

For voting:

- In-person: Sticky dot voting; everyone receives 3 dots to vote on flipchart
- Virtual: Research Team creates Zoom poll to vote on based on what participants notice

Third Discussion Question – STAFF ONLY
Time: 40 minutes
Who: Research Team
Content: What actions do you feel like you could take into your daily work load to prioritize the themes we discussed today, and to implement climate action into your role?

- In-person: Put up sticky wall, have staff brainstorm on quarter sheets of paper and then stick onto wall. Together group these together and create categories and groupings that resonate closely with staff.
- Virtual: Present a blank Jamboard, have participant add sticky notes onto Jamboard. As a group, begin lumping the sticky notes to create groupings.

Third Discussion Question – PARK USER ONLY
Time: 15 minutes
Who: Research Team
Content: What do you want to see at the Metroparks that people 50 years from now can experience?

- In-person: Done as large group, recorded on flip chart
- Virtual: Go into breakout rooms and have small group discussion, groups share out to large group

Wrap-up
Time: 5 minutes
Who: Research Team; HCMA
Content: Thank you's and brief overview of what the research team will do with focus group data

- Park User: Collect shipping addresses and optional demographic form for free Metropark Pass

Partner Organization Focus Group

The format of the focus group hosted for partner organization was the same as the staff and park user focus groups. The only thing that differed slightly were the discussion questions asked, that were adjusted to recognize their role and relationship with HCMA. Participants also received free 2023 Metropark Passes as a Thank You. These all utilized Jamboard but were phrased as follows:

First Discussion:

- What do the Metroparks offer that you feel is most treasured for SE Michigan and its communities?

Second & Third Discussion Combined:

- What climate change impacts have you noticed across the region? Of these which most concern you?
- In what way has your organization taken action towards these concerns and/or changes, or is planning to take action?
- In what ways do you think the Metroparks could assist your organization in these actions or planned ones?

APPENDIX II: WATER ECOSYSTEM SERVICES CODEBOOK

Codes	Definition (adapted from FHI Index and Grizzetti et al. 2016)
Regulating	
Flood regulation	Exposure of people and property to floods
Biotic populations and habitats	Species (plant and/or animal) reliant on aquatic ecosystems for survival
Water quality regulation	Natural processing of chemicals, pathogens, nutrients, salts, and sediments
Local climate regulation	Maintenance of natural weather and atmospheric patterns
Pest and disease control	Natural lifecycle and competition of native and non-native water-reliant pests, and exposure to water-associated human and non-human diseases
Erosion and sediment regulation	Degree to which the drainage basin regulates erosion and controls sediment transport and deposition
Air quality regulation	Results from natural transpiration and evaporation processes
Cultural	
Recreation	Outdoor leisure activities
Intellectual and aesthetics	Water ecosystems that inspire or invigorate artistic representations
Supporting	
Hydroperiod	Changes to seasonal precipitation patterns (i.e. snow in winter, rain in summer)
Provisioning	
Water supply reliability	Ability to meet water demand from various sectors
Fisheries and aquaculture	Health and sustainable supply of local fisheries
Water for non-drinking purposes	Use of water resources for other industries such as agriculture or manufacturing

APPENDIX III: INTERNAL REVIEW BOARD (IRB) APPROVAL LETTER

MICHIGAN STATE
UNIVERSITY

45 CFR 46.118 Designation
Revised Common Rule

March 7, 2022

To: Elizabeth Eleanor Perry

Re: Study ID: STUDY00007455
Title: Research Support for Developing the Huron-Clinton Metroparks' Climate Action Plan
Category: 45 CFR 46.118 Designation
45 CFR 46.118 Determination Date: 3/7/2022
Determination Valid Until: 6/20/2022

Grant Title: Research Support for Developing the Huron-Clinton Metroparks' Climate Action Plan
Sponsor: Huron-Clinton Metropolitan Authority
Status: Funded

Office of Regulatory Affairs
Human Research Protection Program

4000 Collins Road
Suite 136
Lansing, MI 48910

517-355-2180
Fax: 517-432-4503
Email: irb@msu.edu
www.hrpp.msu.edu

Your study has been granted a 45 CFR 46.118 Designation.

45 CFR 46.118, Applications and proposals lacking definite plans for involvement of human subjects

"Certain types of applications for grants, cooperative agreements, or contracts are submitted to Federal departments or agencies with the knowledge that subjects may be involved within the period of support, but definite plans would not normally be set forth in the application or proposal. These include activities such as institutional type grants when selection of specific projects is the institution's responsibility; research training grants in which the activities involving subjects remain to be selected; and projects in which human subjects' involvement will depend upon completion of instruments, prior animal studies, or purification of compounds. Except for research waived under §46.101(i) or exempted under §46.104, no human subjects may be involved in any project supported by these awards until the project has been reviewed and approved by the IRB, as provided in this policy, and certification submitted, by the institution, to the Federal department or agency component supporting the research."

Under a 45 CFR 46.118 Designation, you cannot conduct any research that involves human subjects. This means you cannot obtain information or biospecimens through intervention or interaction with the individual and use, study, or analyze the information or biospecimens and you cannot obtain,

use, study, analyze, or generate identifiable private information or identifiable biospecimens. 45 CFR 46.102(e)

Initial IRB Study Submission: When definitive plans have been developed, you must submit to the IRB office an initial study for MSU IRB review and approval or an exempt determination, or you must submit a reliance request for use of an External IRB. No human subjects may be involved in research until there is MSU IRB approval, an exempt determination, or reliance acknowledgement.

Extension of the 45 CFR 46.118 Designation: If you would like to extend the 45 CFR 46.118 designation, you must submit a request to the IRB office that includes whether there have been any changes to the initial request, must provide a confirmation that no research involving human subjects has been or will be conducted prior to MSU IRB approval, an exempt determination, or reliance acknowledgement, and provide an updated date by which you plan to submit a complete initial IRB application for review. Please submit such requests through the Click™ Research Compliance System using the Study you created for the 45 CFR 46.118 designation. Open the Study, and in the workspace, select "Add Comment" and indicate in the Comment that you would like to renew the 45 CFR 46.118 designation. Please be sure to select notification to "IRB Coordinator."

Funding Agency: Some funding agencies or institutes may not accept a 45 CFR 46.118 designation and may require an initial IRB application be reviewed and approved. Please check with the funding agency or institute when appropriate

If You Do Not Intend to Conduct Human Subject Research: Please notify the IRB office through the Click™ study record if you do not intend to conduct the research submitted as part of the 45 CFR 46.118 Designation.

Contact Information: If we can be of further assistance or if you have questions, please contact us at 517-355-2180 or via email at IRB@ora.msu.edu. Please use the IRB number listed above on any correspondence or forms submitted which relate to this study. Please visit hrpp.msu.edu to access the HRPP Manual, forms, etc.