2.3 Sustainability and Adaptability

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The City of Madison's Sustainability Plan, which was adopted in August 2024, speaks to the important role that the park system plays in creating a sustainable and resilient community. As the Parks Division works towards implementing specific recommendations from the plan, both sustainability and adaptability principles serve as framework for policies pertaining to stewardship, economic and cultural considerations necessary to sustain a vibrant park system. Specific topics frequently cited as concerns by Madison residents during the public engagement process include the following:

- Climate change and other environmental pressures
- Pollinator decline
- Water quality
- Urban tree canopy
- Invasive species

Climate Change and Other Environmental Pressures

While climate change impacts the entire community, research is affirming that climate change is disproportionately impacting vulnerable communities, highlighting racial and ethnic minorities (United States Environmental Protection Agency, 2021). Those with greater economic, social, and political resources are more likely to succeed in both managing and adapting to future climatic changes (Rudolph et al, 2015). Meanwhile, those in poorer living conditions will become increasingly vulnerable to the adverse effects of climate change, such as heat waves, poor air quality, and flooding. Climate change has the potential to further increase disparities in health outcomes. For example, lower-income neighborhoods that lack trees and green space are at a greater risk of heat-related illness. This necessitates that sustainability and adaptability initiatives recognize, and subsequently emphasize, an additional focus towards assisting these vulnerable and disadvantaged communities.

The effects of climate change have already become apparent in the form of warmer temperatures, increased precipitation, milder winters and air quality concerns. Over the past century, temperatures throughout the state have increased by an average of two degrees Fahrenheit (National Oceanic and Atmospheric Administration, ~~2024)~~2024). By 2050, statewide annual temperatures are likely to be 2-8 degrees above the current averages (Wisconsin Initiative on Climate Change Impacts, ~~2021)~~2021). Lake Mendota, which used to remain frozen for four months out of the year in the 18th century, could experience winters with no ice coverage at all in the coming years (Sharma et al, 2019).

Annual precipitation has increased by five to ten percent in the Midwest over the last half century (United States Environmental Protection Agency, 2016). This trend is anticipated to continue in upcoming years, and the rain events that do occur are likely to be more intense (US EPA, 2016). In 2018, over 11.6 inches of rain fell within~~wit~~ the c~~C~~ity in 24 hours. ~~:~~ A~~a~~s a result, Madison incurred $550,504 in capital expenses and $1.1 million in operating costs related to the flooding. This ~~and~~ led the City of Madison Engineering Division to embark on the process of developing a series of Watershed Studies across the c~~C~~ity to inform a more resilient stormwater system. As experienced during the historic 2018 Madison floods, increased frequency of flooding in Wisconsin can be expected, and parks infrastructure can play a key role in helping address these issues. As an example, a soccer field area, if properly graded, can serve as an additional stormwater storage area for large storms.

Pollinator Decline

Pollinators such as bees, moths, butterflies, bats, and hummingbirds provide vital services to our ecosystems. Between 75 to 95% of all flowering plants rely on these organisms for pollination (Ollerton, Winfree & Tarrant, 2011). Roughly one out of every three bites of food a person eats is a result of pollinators (Klein et al, 2007; Buchmann & Nabhan, 1996), and pollinators are estimated to add $217 billion annually to the global economy (Gallai et al, 2009; Losey & Vaughan, 2006). Additionally, about 75% of the world's food crops rely on pollinators (Harvey, 2016).

Over the last decade, the United States has experienced a dramatic decline in honeybee hives resulting from colony collapse disorder. ~~The State of~~ Wisconsin has lost over 60% of its honeybee colonies since spring 2014-2015. The state's bumblebee and monarch butterfly populations have also decreased in recent years (City of Madison, 2015). Evidence points to a variety of factors, including climate change and habitat decline, as the cause of pollinator decline in Wisconsin.

To call attention to this important issue, the Board of Park Commissioners has begun annually proclaiming its commitment to supporting pollinator health throughout the park system, while also recognizing all volunteers, partners, residents and staff who ~~have~~ contribut~~ed~~ed to creating and maintaining native plantings and rain gardens in order to promote biodiversity and create habitat, which allows pollinators to thrive. Additionally, the City of Madison is annually committing to the National Wildlife Federation's "Mayor's Monarch Pledge", wherein staff identify, implement, and report out ~~on~~ efforts taken to protect and conserve the monarch butterfly and its habitat.

Water Quality

Madison is positioned between the two largest bodies of water in Dane County~~;~~, Lake Mendota and Lake Monona. A~~,~~ ~~a~~s such, monitoring and managing water quality is unquestionably a significant priority for the community. The five Madison lakes ~~themselves~~ include 58 miles of shoreline and 22 public beaches. While Madison's growth as a city has posed problems for the local water quality, recent decades have seen major improvements in pollution reduction and runoff management.

Threats to the health of Madison's waterways stem mainly from the introduction of pollutants, such as phosphorous and nitrogen, both of which often enter the watershed from far outside the city

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limits. Blue-green algae blooms, which can be caused by excess phosphorous levels and warm water temperatures, have plagued Madison's urban waterways for years. These algal blooms decrease water quality and have the potential to cause serious illness. Additionally, harmful bacteria (e.g., E. Coli) and heavy metals drain into Madison's lakes and rivers every year via stormwater runoff. As water quality science advances, additional hazards, such as PFAS (Perfluoroalkyl and polyfluoroalkyl substances), are identified. These pollutants impact not just environmental quality, but also recreational activities and the ability to consume fish safely, which impacts how parks are managed.

Long-term exposure to these pollutants can increase the risk of serious health conditions, including heart disease, kidney disease, and cancer (Public Health- Madison & Dane County, 2024). Further improvements in reducing phosphorous and other harmful agricultural runoff will be vital towards stemming future algal blooms and dangerous bacteria, particularly as annual precipitation and temperature levels in Madison are projected to increase in upcoming decades.

Urban Tree Canopy

Urban forests provide a variety of benefits to cities, making city trees an especially useful tool for managing the effects of climate change. Urban trees help filter out many common air pollutants, including nitrogen dioxide, sulfur dioxide, ozone, carbon monoxide, and particulate air pollutants. A well-designed urban tree canopy can substantially lower cooling and heating costs during the summer and winter months. This is particularly important in counteracting the urban heat island effect, which occurs when asphalt and concrete absorb and radiate solar heat, causing cities to be five to ten degrees warmer than their surrounding areas.

Urban trees also play a large role in reducing stormwater runoff. According to the U.S. Forest Service, a medium-sized maple tree (16" sugar maple) intercepts 1,550 gallons of stormwater per year. Urban forests are important for the public health of city residents. For example, street trees in urban areas are associated with lower asthma rates among children (Lovasi et al, 2008). The shade created by tree canopy also plays a vital role in protecting residents from harmful UV rays (Heisler et al, 1995). Studies have shown that living near urban forests can reduce physical and emotional stress among individuals (Dwyer et al, 2000; Ulrich, 1984).

There are approximately 101,000 terrace trees on city-owned land according to a comprehensive tree inventory conducted by Davey utilizing TreeKeeper software. ~~11,000 acres of public and private tree canopy in the City of Madison., accounting for 22.4% of the City's entire land area~~. ~~A comprehensive tree inventory of trees on city-owned land was conducted in 2024. As of publishing of this report _____ number of trees are inventoried within Madison's parks, right of way, and stormwater property utilizing the Davey TreeKeeper software system.~~ According to TreeKeeper ~~(method)~~ the city's urban forest provides an estimated $400,000 worth ~~122 worth of annual~~ annual benefits. ~~Table X.X details the various benefits that the City of Madison receives from its urban forest every year.~~ Not only does Madison's tree canopy provide environmental benefits, but the aesthetic value of trees raises property values and can help reduce neighborhood crime (Martinueau, C., 2011).

Invasive Species

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As environmental conditions change, ecosystems begin to shift and natural habitats begin to change, creating opportunities for invasive species to take hold. Invasive plants, insects, and animals threaten the quality of native habitats, by creating potential for competition and disease pressures. Plants such as Japanese knotweed, buckthorn, and garlic mustard compete with and crowd out native vegetation. Invasive species are difficult to remove, often requiring multiple herbicide applications for full eradication. Invasive pests such as the Emerald Ash Borer (EAB) and jumping worms have substantial environmental impacts with significant implications for public health. Studies suggest that the resultant loss of tree canopy from EAB infestations can increase rates of cardiovascular diseases and lower-respiratory tract illness and mortality (AM J Prev Med. 2013).

Economic and Cultural

As Madison Parks prepares for the future, it will be also necessary to sustain and respond to economic and cultural shifts. Both economic and political shifts influence municipal funding mechanisms.

A park system must be fiscally sustainable and adaptable in order to survive economic downturns and politically determined funding changes. For example, the Parks Division utilizes impact fee ordinances to cover the cost of new development; however, these fees are also closely tied to the health of the economy. In situations of economic stagnation, impact fees as currently structured will not be a reliable source of funding new parks. Therefore, diversification of the funding sources that support the Parks Division is an important strategy to support fiscal sustainability.

Demographic Shifts and Cultural Preferences

Additionally, the Parks Division must be able to sustain and adapt to cultural shifts. As noted in the previous sections, the City of Madison is becoming both older and more diverse. Residents of different ages and cultures have distinct values for parks and open space; therefore, these trends have significant implications for park planning. An adaptable, flexible parks system should evolve in conjunction with changes in its user base.

As part of responding to demographic trends, this plan utilized the City of Madison's Racial Equity and Social Justice (RESJ) tool. This tool is designed to "facilitate conscious consideration of equity and examine how communities of color and low-income populations will be affected by a proposed action/decision of the City" (City of Madison, RESJ Tool). The RESJ tool ~~offers a~~ complements ~~to~~ more traditional methods of analyzing planning park projects.

Looking Forward: Adapting Recreational Uses to Climate Change

With the current and future changes to our climate, the way that park users interact with the system will change as well., ~~which the~~ Madison Parks ~~Division~~ is identifying, preparing for, and responding to these changes. ~~anticipating and preparing for.~~ As noted, with temperatures rising in the state, the winter season is beginning to shorten, which prompts residents to desire spring and fall outdoor activities for longer parts of the year. Therefore, installing dark-sky friendly lighted fields and courts to accommodate the extended playing season will be an important investment to make. The Parks Division has already noted a downward trend in the number of ice skating and skiing days, and therefore will shift resources from ski trail and ice rink maintenance to natural area and trail

maintenance to give park users a high-quality outdoor experience in the winter even without ice or ski trails. The Parks Division will also be focusing on strategic species selection, restoring habitats to historic Wisconsin landscapes, but recognizing that species traditionally suited for zones to the south will be able to tolerate and thrive in Madison's new climate.