DOVETAIL PARTNERS

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Environmental Justice and Ecological Care in Ramsey County Parks

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INTRODUCTION

Plants can tell a lot about the environment and the community they are in, as well as explaining its history. Moreover, the care given to these common spaces can be reflected in how they are used and the roles they play in each community. The term urban green spaces can be used to refer to land totally or partially covered with trees, shrubs, and other vegetation (USGBC, n.d.). This can include forests, meadows, parks, lawns, rain gardens, and others, which can contribute to reducing the consequences of urban sprawl and enhancing the lives of the people that they interact with (Li et al., 2024). This enhancement of the livelihood of people is through Ecosystem Services (ESs) that have been demonstrated to regulate the climate, air purification, cultural benefits, public health, etc (Russo et al., 2025). It has been demonstrated that communities with greater access to green spaces had less stress and higher life satisfaction compared to those with less access or less extent of green areas (White et al., 2013).

Ramsey County located in the Upper Midwestern region of the United States in Minnesota, is part of the Minneapolis Saint Paul metropolitan area. The county includes mainly Saint Paul areas as well as other suburban communities. Because my personal proximity and knowing the county contains highly urbanized neighborhoods alongside parks, lakes, and other public green spaces, this was an important setting for studying how urban green spaces interacts with different communities. In Ramsey County, ensuring public health, social well-being, and fair distribution of green infrastructure across all its neighborhoods has been an ongoing evolutionary process (Baehm et al., 2017).

Despite all of the benefits that urban green spaces have and the importance of having them in all communities, they depend partly on the condition, maintenance, restoration, and monitoring of those spaces. This includes tracking invasive species, which are non-native plants or organisms that aggressively spread and damage local ecosystems. By outcompeting native flora, they reduce biodiversity and weaken the environmental benefits of urban parks. While native species foster habitat resilience and ecosystem health, invasive species threaten these benefits by degrading overall site quality. If urban green spaces serving historically underserved communities receive less ecological monitoring or restoration attention, problems like invasive species may be less documented and therefore less likely to receive the attention needed to keep these spaces fulfilling their role in providing ecological and social benefits across communities. Equitable sustainable design therefore requires not only access to urban green spaces, but also equitable and fair investment in the ecological quality of those spaces. In this way, native planting becomes not just an ecological technique, but a form of equitable public investment improving habitat, landscape resilience, environmental quality, and the quality of green spaces available to communities.

These concerns lead to the question: How do invasive-species monitoring, ecological conditions, and environmental-justice characteristics vary across Ramsey County parks, and how can these patterns help identify where future urban green space monitoring, restoration, and investment may be most needed?

DATA PROCESSING

This analysis was done using public secondary data from Ramsey County Parks, Minnesota, records of terrestrial invasive plant species, and state neighbourhood social equity characteristics to examine how ecological monitoring and environmental-justice conditions vary across the county's urban green spaces.

Minnesota Terrestrial invasive-species observations: Terrestrial Invasive Species data were obtained by the Minnesota Department of Natural Resources multi-divisional effort to collect consistent information across all DNR-administered lands (Terrestrial Invasive Species Observations, n.d.). Point records of terrestrial species were joined with Ramsey County park polygons from this dataset; three summary measures were calculated: Invasive records (total number of observations in each park); Species Richness (number of unique invasive species observed); and Observation dates (number of distinct dates in which observations were made).

Ramsey County and Park Boundaries: The boundaries of the county and park polygons of were cleaned and standardized so that each park could be associated with invasive species along with the social characteristics of the people living around them. It is important to mention that the invasive species dataset shouldn't be interpreted as a complete list of invasive species in every park, but rather as a record of where invasive species were observed based on availability of effort, which varied from park to park. For this reason, parks without records were displayed separately in the maps, and observation effort was explicitly considered in the upcoming statistical analysis.

Social Equity Considerations: Neighborhood characteristics were obtained from the Metropolitan Council's Equity Considerations dataset. The variables used were the proportion of residents below 185% of the federal poverty level, the population identified as BIPOC, the households without a vehicle, an income measure, tree canopy coverage, and environmental justice designated census tracts.

To estimate the local population with potential park access, an 800-meter buffer was applied to each park boundary as a standardized neighborhood scale. These buffers were intersected with census tracts from the Equity Considerations dataset. When a buffer overlapped multiple tracts, characteristics were aggregated using population-weighted averages: the population within the overlapping area was used to weight each tract's demographic and environmental metrics. This approach made it possible for each park to be assigned a surrounding neighborhood profile.

METHODOLOGY

Count Regression models were key to examining relationships between invasive-species observations, effort on observations, park size, and surrounding socioeconomic and environmental characteristics. Positive truncated Poisson regression was used to analyze the relationship between parks and invasive species observations using only positive observation counts. Effort on observation was measured by quantifying the number of distinct survey dates per park, holding park size constant. Lastly, we tested social equity variables to discover whether community demographics had a relationship with how frequently a park was surveyed.

More positive-truncated Poisson models to analyze what influences the total number of unique invasive species per park. After controlling for park size and survey frequency, this last one ended up being more important because the probability of documenting additional species increases as the park is surveyed more frequently. Finally, we evaluated equity and environmental metrics to see if they explained species diversity beyond sampling effort, finding that although these models indicate statistical associations, they don't mean direct causation.

As a last step of the methodology, a three-criterion screening measure was developed for the final map to identify parks where multiple potential needs overlap. Parks received one point for each of the following conditions:

- Environmental Justice (EJ): At least 60% of surrounding residents live in designated EJ census tracts.
- Tree Canopy: Tree canopy coverage is below the median of all analyzed parks.
- Monitoring Effort: Invasive species survey frequency falls within the lowest 25% (bottom quartile) of visits.

This approach is aimed at highlighting places in need of additional monitoring, ecological restoration, or equitable green space investment. However, this is simply a general approximation and shouldn't be interpreted as an official priority management designation.

RECORDED INVASIVE-SPECIES PATTERNS

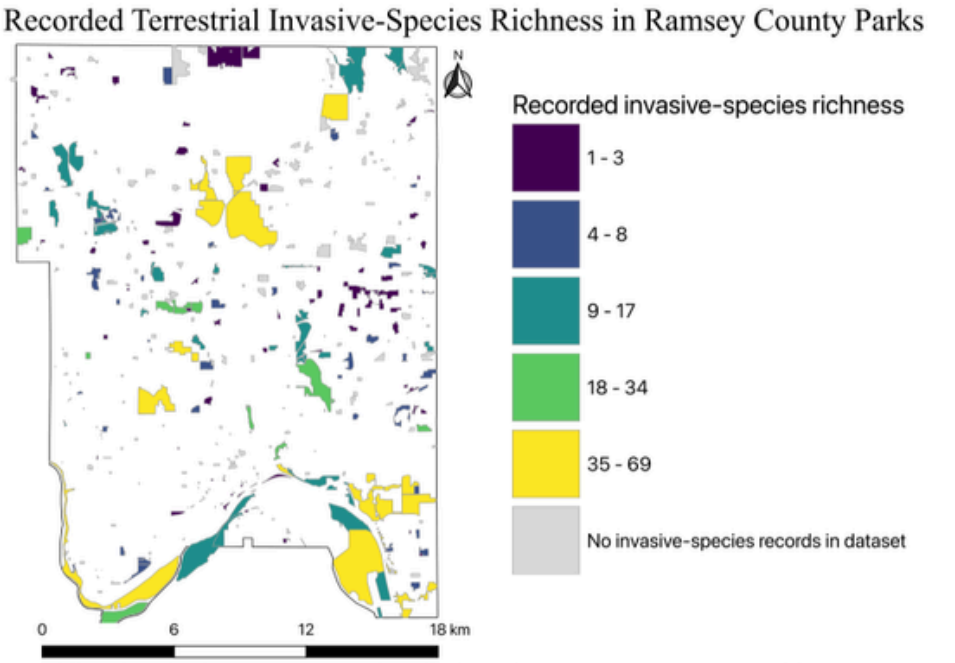

Figure 1. Observations of terrestrial invasive species across Ramsey County parks. Recorded invasive-species richness represents the number of unique invasive species documented at each park. Recorded richness is based on the observation efforts at each site, meaning it shouldn't be interpreted as confirmed absences.

Sources: Ramsey County GIS Open Data, Parks 2026 & Minnesota Department of Natural Resources, Terrestrial Invasive Species Observations 2026; Metropolitan Council Equity Considerations (2026); County boundary: Ramsey County/MetroGIS (2021)

As part of the first analysis, this map represents how the distribution Invasive-species diversity was distributed across Ramsey County Parks. Species richness is the number of the different number of unique invasive species observed within each park. As we can notice, it is in a few parks with a bigger area that we find a higher richness, whereas other parks contain a few invasive species or no records. Although park area initially showed a positive relationship with recorded richness, this relationship was no longer statistically significant after observation effort was taken into account. To analyze parks with invasive-species records, a positive truncated Poisson regression was used with park area and observation frequency as the main predictors. In this one, once we included observation effort in the model, park area stopped being significant while the number of observation dates had a positive effect with a p-value of 0.001. Due to this, we know that parks that are more frequently monitored offer more opportunities to find invasive species; in this way, this map reflects observation effort rather than actual ecological degradation.

[2] EQUITY CONSIDERATIONS DATASET. (N.D.). METROPOLITAN COUNCIL. RETRIEVED SEPTEMBER 1, 2026, FROM HTTPS://METROCOUNCIL.ORG

OBSERVATION EFFORT AND DATA INEQUALITY

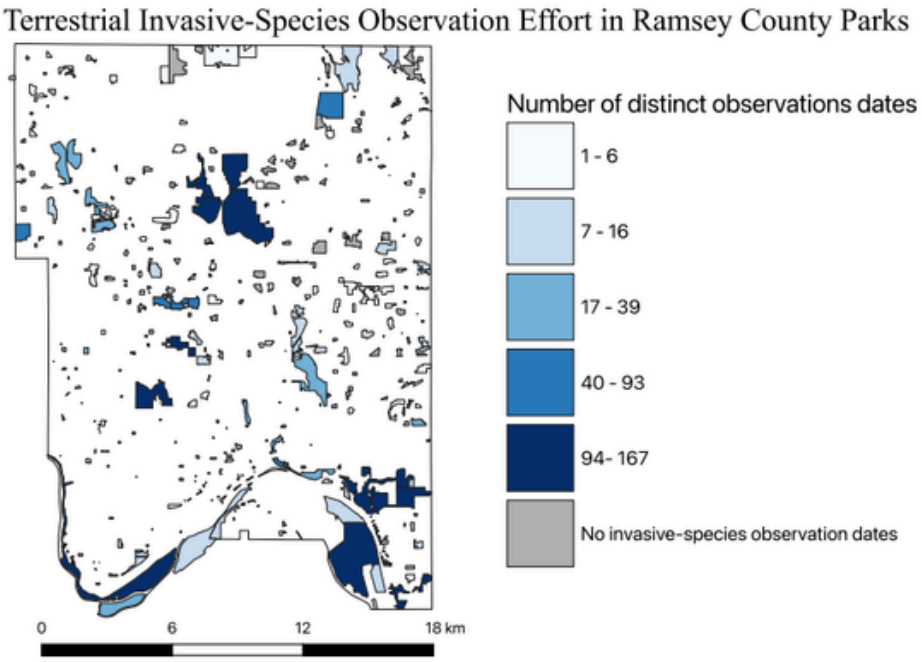

Figure 2. Terrestrial invasive-species observation efforts across Ramsey County parks based on the number of distinct dates on which observations were recorded (thus, the effort put into them).
Sources: Ramsey County GIS Open Data, Parks 2026 & Minnesota Department of Natural Resources, Terrestrial Invasive Species Observations 2026; Metropolitan Council Equity Considerations (2026); County boundary: Ramsey County/MetroGIS (2021)

As was explained before, the biggest predictor was the effort put into recording invasive species across Ramsey County parks. These records include the number of distinct dates on which invasive species were recorded at each park, meaning that the darker a park shape is, the more number of different dates on which invasive species were recorded. As seen, the monitoring was different across parks; some were visited often on many different dates, while others had few or no recorded observations in the dataset. Thus, it is important to mention that the data doesn't represent an even picture of ecological conditions across Ramsey County parks.

By doing a statistical analysis, I confirmed that the effort put into recording invasive species on different dates was related to the park characteristics. Among the parks with observations of invasive species, the strongest positive associations seen were two: the area of the park and the number of different observation dates. This meant that the bigger the park was, the bigger the effort of collecting observations was, and therefore more invasive species were recorded. In simple words, parks that were monitored more frequently had more opportunities to detect invasive species, which makes sense when we look at Figure 1 and notice that the same parks that have higher species richness are the same ones that have more recorded observations on different dates.

Moreover, more statistical models were done to see if there was any relationship between the effort of observations and the socioeconomic or environmental characteristics of the surrounding populations of those parks. Interestingly, the models showed that observation efforts were higher in parks surrounded by areas with higher poverty levels, while median income surroundings with greater tree canopy coverage were associated with lower observation efforts. It is important to mention that the park area variable was controlled in these models and that many of these socioeconomic variables were related to one another, so these findings should be taken only as findings rather than evidence that social characteristics caused differences in monitoring.

[1] BAEHM, D., HANDMAKER, O., KIESER, N., KREITER, E., MCNIEL, D., & SHAVIT-LONSTEIN, N. (2017). CONNECTING AND RESTORING RAMSEY. HTTPS://HDL.HANDLE.NET/11299/193382

Overall, this was the reason why observation effort was taken as a control variable in the analysis of species richness. The uneven distribution of the observation efforts underlines the environmental justice work done to equitably manage urban green spaces in a manner that they are restored and maintained properly over time.

ENVIRONMENTAL JUSTICE AND GREEN-SPACE CONTEXT

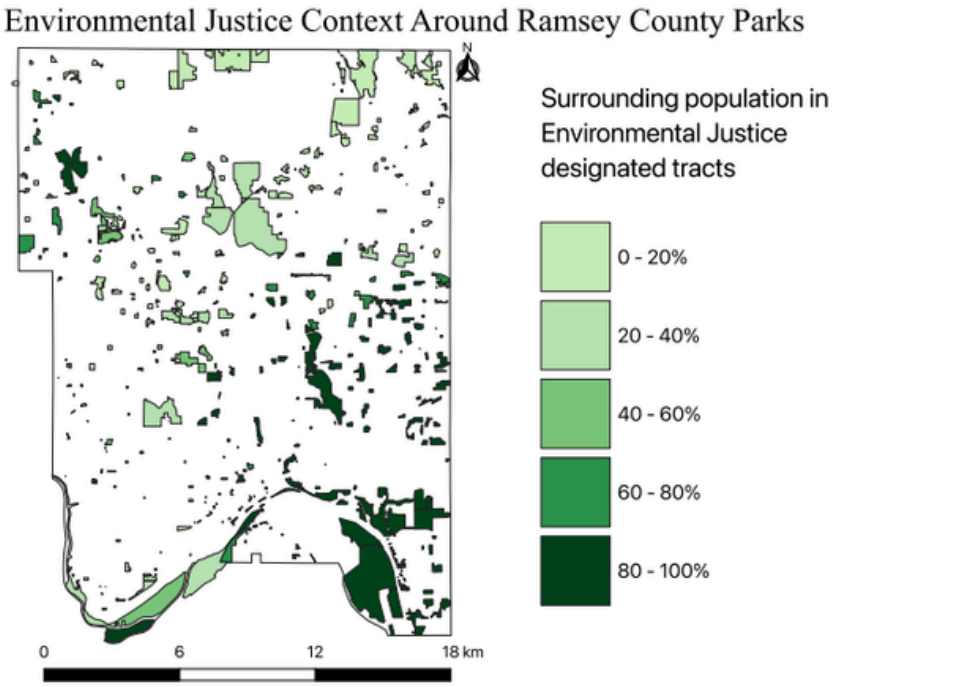

Figure 3. Environmental justice context surrounding Ramsey County parks. Parks classification is based on the estimated share of the population within their 800-meter surrounding area associated with environmentally vulnerable or equity-priority census tracts

Sources: Ramsey County GIS Open Data, Parks 2026 & Minnesota Department of Natural Resources, Terrestrial Invasive Species Observations 2026; Metropolitan Council Equity Considerations (2026); County boundary: Ramsey County/MetroGIS (2021)

Figure 3 represents the population living in a buffer area of 800 meters surrounding the park that is associated with Environmental Justice-designated census tracts which refers to census-defined geographic units that meet specific state or federal criteria for socioeconomic or environmental vulnerability. These designations identify populations facing disproportionate exposure to environmental hazards or systemic inequities, providing a metric to evaluate whether urban green infrastructure is equitably distributed. The buffer range was chosen as a reasonable walking distance from the residents near the parks. The map shows considerable variation across Ramsey County, ranging from parks with little surrounding Environmental Justice population (lighter green) to parks where most or nearly all of the surrounding population is located within designated tracts (darker green).

Because many park buffers intersected more than one census tract, the demographic characteristics were calculated using population-weighted values rather than assigning each park to only one tract. In this way, I aimed to account for a broader picture of the EJ communities that would benefit from each urban green space. Among all of the parks, the median Environmental Justice population share was 61%, indicating that many of Ramsey County's parks are near populations experiencing socioeconomic or environmental vulnerability.

[5] TERRESTRIAL INVASIVE SPECIES OBSERVATIONS. (N.D.). RETRIEVED AUGUST 24, 2026, FROM HTTPS://GIS.DATA.MN.GOV/DATASETS/MINNESOTA::TERRESTRIAL-INVASIVE-SPECIES-OBSERVATIONS-1?LAYER=7

It is important to note that the relationship between Environmental Justice populations and invasive species observation effort was not significant after accounting for park area. Meaning that parks located near environmental justice-designated communities weren't monitored more or less simply because of their environmental Justice classification. Figure 3 is therefore best interpreted as a map of community context rather than ecological condition. A darker green park should not be taken to indicate more invasive species or poorer ecological quality. Instead, it identifies parks that serve or are located near populations already experiencing greater environmental or socioeconomic burdens and that the benefits of an urban green space are more valuable.

PRIORITY SCREENING AND IMPLICATIONS

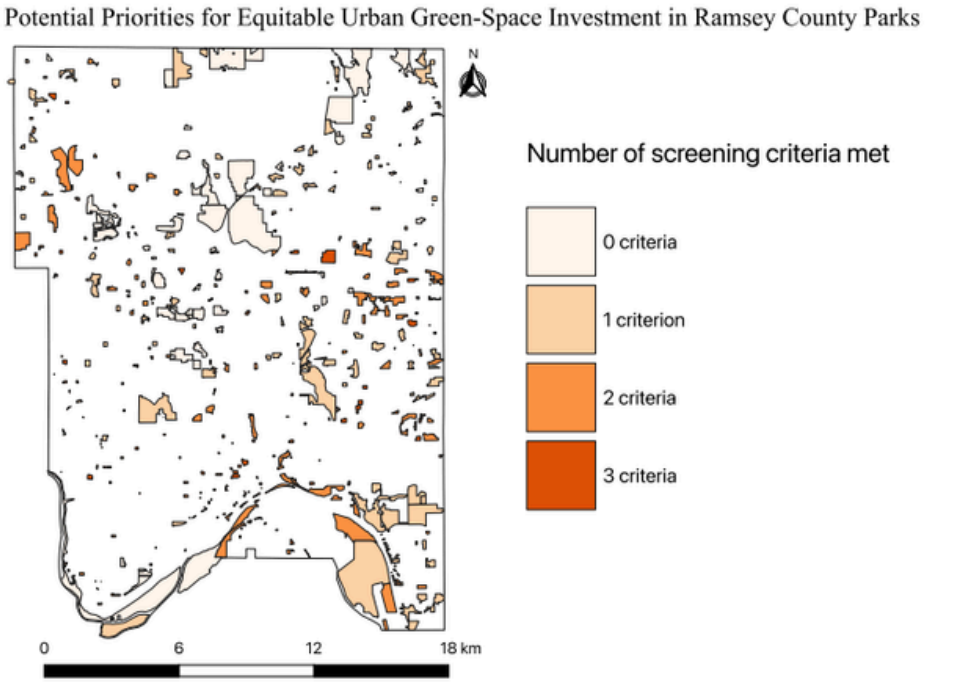

Figure 4. Screening Ramsey County parks for potential equitable green space investment and monitoring. Parks get one point for each of three conditions: higher environmental-justice context, surrounding tree canopy below the median among analyzed parks, and low invasive-species monitoring effort.

Sources: Ramsey County GIS Open Data, Parks 2026 & Minnesota Department of Natural Resources, Terrestrial Invasive Species Observations 2026; Metropolitan Council Equity Considerations (2026); County boundary: Ramsey County/MetroGIS (2021)

Lastly, for Figure 4, I combined the previous analysis into a screening map where ecological and socioeconomic needs overlapped. This map focuses on three main conditions useful when thinking about future monitoring and green-space investment: having at least 60% of its surrounding population associated with Environmental Justice-designated census tracts, having surrounding tree-canopy coverage below the median of the analyzed parks, and having low invasive-species observation effort. Therefore, parks could receive a score between zero and three, with darker colors representing parks where a greater number of these conditions occur at the same time. In this way, the map identifies locations where social vulnerability, lower surrounding tree canopy, and limited ecological information may overlap. These overlapping conditions do not entirely mean that parks with higher scores are the ones with worse ecological conditions, but they indicate places where additional monitoring, restoration, native planting, or other green-space investment could be considered. In this way, the analysis connects ecological monitoring with environmental justice by showing how future green-space investment could consider not only the condition of a park, but also the communities that depend on the environmental and social benefits that the park provides.

[1] BAEHM, D., HANDMAKER, O., KIESER, N., KREITER, E., MCNIEL, D., & SHAVIT-LONSTEIN, N. (2017). CONNECTING AND RESTORING RAMSEY. HTTPS://HDL.HANDLE.NET/11299/193382

LIMITATIONS

Although many variables were used to make appropriate relationships between predictors, there were many limitations important to note. Although the socioeconomic characteristics used in the analysis described a population living 800 meters around the parks, they didn't actually identify who used the parks. Because of this, the surrounding population should be understood as an estimate of the community that may potentially benefit from each green space rather than actual park users. Moreover, the analysis didn't include direct information about park maintenance, and thus the report cannot infer why differences in monitoring or ecological conditions occur.

The final priority map should therefore be viewed as a starting point for identifying possible places that may deserve closer investigation rather than as a definitive assessment of park quality or management needs. Future work could strengthen this analysis by incorporating park visitation data, community surveys, maintenance and restoration management costs, and standardized ecological surveys.

CONCLUSION

Understanding the condition and value that Ramsey County parks have on communities requires looking at both ecological information and the communities surrounding these spaces. The analysis showed that recorded invasive-species richness was strongly influenced by observation effort, meaning that parks which were monitored more frequently had more opportunities for invasive species to be documented. This makes it important to interpret invasive-species datasets like the one used carefully and not assume that parks with fewer observations necessarily have better ecological conditions.

At the same time, the environmental justice analysis showed that many parks are located near communities experiencing socioeconomic or environmental vulnerability. For these communities in particular these parks can play an especially important role in providing benefits such as access to nature, recreation, shade, health, and spaces for community interaction. This is how for the final map these ideas were brought together by identifying locations where environmental justice context, lower tree canopy, and limited ecological monitoring overlap. Rather than serving as a final ranking, this approach can help indicate where additional monitoring, restoration, native planting, or investment may be worth considering.

Overall, equitable green-space management should consider not only whether communities have access to parks, but also the quality, monitoring, maintenance, and ecological resilience of those spaces. Native planting, invasive-species management, and consistent ecological monitoring can therefore be understood not only as environmental practices, but also as forms of long-term public investment. By combining ecological data with information about the communities around parks, Ramsey County can better identify where future restoration and green-space improvements may provide impactful environmental and social benefits.

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