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ENTS310

# The Future of Invasive Plants in Northfield

## Introduction

Invasive species pose severe threats to ecosystems and biodiversity. While the city of Northfield has begun making plans and taking steps to combat invasive animals--in particular the emerald ash borer--invasive plants have not received similar attention. Despite several invasive plant species creating problems in Northfield, the city has no plan for dealing with this threat.

The goal of Northfield's invasive plant strategy should be to limit the spread of invasive plants currently in Northfield and the surrounding area and prevent future invasions, all without draining the city's limited budget and resources. Limiting invasion would have two primary purposes. Firstly, Northfield is home to beautiful high-quality natural lands, and invasive plants pose a threat to those ecosystems. Preserving the native ecosystems is beneficial for tourist attraction, recreation, and education. Secondly, many invasive plants can inhibit agricultural production. Since much of Northfield's land and the surrounding area is farmland, protecting agriculture from invasive species has extra importance compared to in more urban areas.

This proposal presents policy recommendations for developing a system to manage invasive plants over the next twenty years. The plan has three key points: acquiring staff and funding, developing an invasive plants database, and providing education to encourage public engagement. The first step is essential in order for Northfield to take any action in later stages of the plan. The second allows the city to monitor current invasive plants and potential future threats in order to best develop plans for removing and restoring Northfield's natural ecosystems. The third will spread awareness to promote civic engagement so that ordinary Northfield residents

can take steps to prevent the spread of invasive plants on their own and the city will not have to rely on paid staff for every component of invasive plant management. All of these steps call for improving coordination between the city of Northfield, volunteers, nonprofits, and other governments.

**Current Status**

Northfield currently hosts numerous species of invasive plants that cause varying degrees of harm ("Invasive Plants" 2020a). These plants include buckthorn and honeysuckle trees, which have been blocking native vegetation. These trees are widely spread within Northfield already, particularly along the Cannon River and in the Carleton Arboretum, preventing native plant growth in these areas. Buckthorn can also host agricultural pests such as soybean aphids. Considering the harm that agricultural pests could potentially cause to the farms in and around Northfield and the importance of Northfield's natural lands, the spread of buckthorn must be controlled. Some plants can cause more direct harm: wild parsnip widely inhabits roadsides in Northfield and the surrounding region. These plants are toxic to humans and domestic animals and the sap can cause burns when in contact with skin in sunlight. Another current invasive, poison hemlock, is not as commonly found as many other invasive plants, but like wild parsnip it is highly poisonous. It poses an additional ecological threat because it can displace native vegetation along streams, fields, and roadsides. Controlling invasives is therefore important for public safety as well as protecting agriculture; these examples are just a sample of the many plants currently encroaching on Northfield's ecosystem. Out-of-control invasive plants can also pose a threat to Northfield's natural ecosystem, which can endanger the natural landscapes that

attract tourists and college students as well as providing recreational opportunities for Northfield's residents.

Northfield currently does not have a plan for managing invasive plants: the only invasive plant city policy that exists is the Noxious Weed Ordinance, which was updated in February 2020 to include invasive plants as part of the weed regulation ("Ordinance No. 1010 | Code of Ordinances | Northfield, MN | Municode Library" n.d.). The update to this ordinance prohibits any of the species listed in Minnesota's Noxious Weed Law as well as Amur Cork Trees. If one of these species is found on a Northfield resident's property, the city public works director is responsible for sending a notice requesting that the landowner have the plant removed. In the case of noncompliance, the city would remove the plant at the owner's expense. However, this ordinance is not thoroughly enforced.

Much of Northfield's invasive species policy relies on the Noxious Weed Law for the state of Minnesota. This ordinance more thoroughly classifies invasives into various categories based on their threat and lists what actions should be taken for each category ("Minnesota Noxious Weed List | Minnesota Department of Agriculture" n.d.). The "Eradicate List" includes plants that are not currently spread throughout Minnesota and should be completely destroyed (above and below ground) if they are found; the above-mentioned poison hemlock falls into this category. Harmful plants that cannot be easily eradicated, such as wild parsnip, fall under the "Control List": these plants have established themselves throughout the state and the Noxious Weed Law mandates that measures be taken to prevent them from spreading. The policy also lists "Restricted Noxious Weeds," which are prevalent in Minnesota but cannot be easily controlled. The Restricted Noxious Weed list includes buckthorn and honeysuckle. The sale and distribution of the plants on these lists is currently illegal, though the state likely does not enforce this rule

very stringently. However, many of these plants have spread so widely that removing each individual plant would be impossible, especially because the average person does not know when they come across a plant that requires removal. Managers at the Carleton Arboretum take measures to manage invasive plants, but invasive plants not under the jurisdiction of the colleges are not being controlled as well.

Much of the responsibility for invasive plant management in Rice County falls under the Rice County Soil and Water Conservation District (SWCD). The Rice SWCD is a subdivision of the state government that is capable of providing technical and occasionally financial support for controlling and removing invasive plants ("Invasive Plants" 2020b). However, they are also very limited with a small staff and much of their work is directed towards private landowners. The Cannon Valley Noxious Weed Collaborative Group, a relatively new organization, takes some local action against invasive plants as well. The Noxious Weed Collaborative is made up of four townships and focuses their energy on removing wild parsnip from roadsides (Cannon Valley Noxious Weed Collaboration, n.d.). While these efforts are an important first step in providing a local invasive plant strategy, this organization is still relatively small and has not worked on other invasive plants.

There are several strategies for approaching invasive plant removal once the threat has been identified. The best of these approaches depends on many factors, including the severity of the infestation, the type of plant, the resources available, the plants' life stage, and the effects on non-target organisms. These strategies fall into six main categories: manual control, controlled burns, mechanical control, chemical control, biological control, and cultural control ("Control Methods | Wisconsin DNR" n.d.). Manual control involves hand-removing each individual plant either by pulling them up (recommended for small or young plants), covering them to block light

access for a growing season, or flooding them. Controlled burns call for experienced people to plan fires in sections of forest to clear many non-native woody plants. Mechanical control involves mowing and cutting. Another option is chemical control, where land managers apply chemical herbicides to kill the plants. In biological control, other organisms (including animals, fungi, or diseases) are introduced to control the invasive plants--often this approach takes the form of releasing goats to eat weeds that many other herbivores cannot handle. It could also involve introducing organisms from the native range of the target species. Lastly, there is cultural control, whereby the environment is manipulated to prevent invasives from taking hold, such as by creating a large canopy if the target organism is shade-intolerant. Clearly, some of these strategies require more resources than others: while some plants can be hand-removed by ordinary people, other plants call for equipment and trained experts. For most of the smaller invasive plants that could be problematic for Northfield, manual control (arguably the least costly) is recommended. However, multiple approaches in combination are usually the most effective way to manage invasive plants in a cost-effective manner.

**Research**

Most invasive plant management research studies strategies for land managers rather than policymakers. Currently, research is lacking when it comes to invasive plant management policies in small towns like Northfield. Some studies and plans in larger, often non-U.S., cities can provide some limited insight into strategies Northfield can adopt. For example, numerous studies on invasive plants have found that areas with larger human impact are more susceptible to invasion compared to undeveloped land with rich biodiversity. In particular, roads can act as

vectors that bring invasive plants into new ecosystems (Vardarman, Berchová-Bímová, and Pěknicová 2018). Cities can consider regions that are more susceptible to invasion in their zoning codes to prevent the spread of plants in natural lands.

Though scientific publication on the effectiveness of local government invasive policy remains thin, numerous states and localities have already developed plans for combating invasive species. The Michigan Department of Natural Resources created a "Framework for Action" to counter the threat of invasive plant (Higman and Campbell 2009). The plan includes six goals: leadership and coordination, assessment and research, prevention, early rapid response, long-term control, and education and outreach. In particular, leadership and coordination are important in ensuring that action is cost-effective. By putting effort into monitoring and taking action against invasive plants when they first appear, cities can save themselves the much greater cost of repairing their ecosystems later on. Michigan's Framework for Action also include plans for determining which sites get treatment when resources are limited; considerations are the value of the site, threat posed by the invasion, extent and abundance, feasibility of control, and available resources. Other steps included in the plan include collaboration between states and removing barriers to cross-jurisdictional action.

A project from the University of British Columbia in 2006 created a decision-making tool for the city of Burnaby, in order to help with making decisions regarding land management and invasive plants (Suderman, n.d.). Most of the suggested steps in decision-making involve determining risk and identifying other stakeholders involved. After determining the costs and benefits of taking action against invasive plants, the next steps include planning for revegetation and monitoring. This tool can help city governments consider all the factors involved for making

good decisions when determining whether or not an invasive plant problem merits action and what kind of action should be taken.

Most actual scientific research regarding invasive plant management emphasizes using ecology to form strategies for managing outbreaks. In particular, there is a significant amount of research on Ecologically-Based Invasive Plant Management (EBIPM). This approach differs from previous frameworks by providing an ecological basis for management, and includes a study of the local history and ecology rather than simply removing the harmful plants quickly and easily. They present five steps for management based on ecological principles. The first step is to complete a rangeland health assessment, followed by identifying causes of invasion, then using principles to guide decision making, then to choose appropriate tools and strategies, and finally to design and execute a plan using adaptive management.

To test EBIPM's effectiveness, the authors of one study performed a case study using three different sites with varying disturbance levels and soil types. Because different sites can require separate approaches, they emphasize the importance of adaptive management, a strategy that allows managers to respond to uncertainty. The authors found that EBIPM can increase the change of restoration success by 66% compared to traditional weed management (Sheley et al. 2010). Another study presents an example of EBIPM being applied in Park Valley in Utah (Morris et al. 2011). Because of years of heavy grazing and fire exclusion, the native grasses had declined and unwanted sagebrush cover had increased by the 1970s. EBIPM considers the successional management framework, relating how different causes of succession can be applied to these ecosystems. Based on the results from approaches in Park Valley, the three main conclusions are the importance of land-use history, community involvement, and realistic

expectations. These considerations would be important as Northfield comes up with management plans that will need to consider how to best protect ecosystems in the long term.

Invasive plant management strategies also are most effective when collaboration between different interests occurs. A study of Invasive Plant Management (IPM) efforts in southwest Alberta indicates that collaborative IPM was necessary to bring rural and conservation land managers together (Graham 2019). As the plants do not understand human property boundaries, the approach to addressing them must include multiple populations as well. However, this approach is resource intensive. Similar to the region in this study, Northfield's population includes farmers whose interest in invasive plants stems from agricultural threat. This research could also indicate that greater involvement from the Northfield community as a whole is necessary.

Even when the necessary management techniques are clear, addressing invasive plant threats continues to pose several challenges for city policymakers. Firstly, the resource requirement to properly monitor and remove invasive plants can be draining for many locations. Secondly, rousing public support for strong invasive plant management can prove difficult. Additionally, invasive plants do not lie within human-made jurisdictional boundaries, meaning that a successful strategy will need to include entities outside of Northfield. A successful invasive plant management policy will need to take these challenges into consideration and provide a plan for overcoming them.

## Plan for the Next 20 Years

### Staff and Funding

Before the city can take any meaningful action against invasive plants, they will need greater staff, funding, and resources. The initial part of this plan would therefore require several (expecting fewer than three) years to hire new staff and obtain grants to fund invasive species projects.

The first staff member to hire would be a volunteer coordinator. Planning volunteer events would mean that fewer paid staff are necessary to carry out invasive plant removal and the city would be able to handle problems in a more cost-effective manner. Boosting voluntary citizen engagement could potentially be a way of managing invasive plants without entailing extra costs to an already limited city. A volunteer coordinator would serve to further projects aside from invasive plant removal as well.

Aside from a volunteer coordinator, the city would need to hire 2-3 land managers and a GIS specialist. The land managers could be seasonal positions, with emphasis on the times of year when invasive plants spread most easily, usually in the fall and spring. These staff members would not only be responsible for removing invasive plants but for protecting native ones and ensuring the health of the city's landscape. The GIS specialist similarly would have responsibilities not only with mapping invasive plant locations but with other city planning projects as well.

In addition to hiring more staff, the city must obtain funding for invasive plant projects before it can take any substantial action. There are numerous federal and state grants that can provide localities with funding for invasive plant projects. Grants can include those provided by the Minnesota Department of Agriculture or the USDA. These grants helped to provide funding for projects like the Cannon Valley Noxious Weed Collaborative's wild parsnip removal.

**Invasive Plants Database**

Over the next twenty years, we can expect that new invasive plants will be introduced to Northfield and the surrounding area. Some of these novel species will be relatively harmless while others could potentially pose even greater threats than the species already present. Therefore, Northfield needs to pay attention to invasive plants that enter nearby locations to better prepare for future unknowns. The first step would be to compile a public database of invasive plants currently present in Northfield. Right now, a list exists for invasive plants in Minnesota and in Rice County, but there is no such compilation for at the city level. Within this list of plants, the ones that could potentially be the most harmful should be identified, as well as the ones that have become the most widespread. The database should also catalogue invasive plants that have been identified in surrounding areas--including those in other parts of Minnesota and in neighboring states. Many state and local governments currently keep track of plants that could become problematic in the future due to being found in nearby jurisdictions. Frequently checking these lists for nearby jurisdictions, as well as keeping contact with other state and local governments regarding invasive plant appearances, is necessary to keep updated information about what invasive plants are coming close to making an appearance within Northfield's boundaries. The currently existing resource most similar to this plant database is EDDMaps, which tracks the spread of invasive plants closely and could be useful in creating Northfield's plant database ("EDDMapS Species Distribution Maps - EDDMapS" n.d.). EDDMaps verifies each plant sighting and provides exact coordinates and often images associated with each plant. As Northfield's staff and resource capabilities expand, a useful addition would be creating a similar map but more specific to the city, as the widespread nature of EDDMaps can make it more difficult to use for the city level. As Northfield would need to know which specific locations

within the city have experienced invasion, the city should be able to track invasive plants with more detail.

**Planning and Prioritization**

Numerous studies have found that monitoring and early detection of invasive plants is key to preventing uncontrollable spread. Once Northfield has collected information about what invasive plants are currently present and which ones could enter Northfield's boundaries in the near future, it is important to develop a plan for monitoring so that swift action can be taken should a new invasive plant appearance occur. Because both monitoring and removing invasive plants can be resource-intensive, Northfield should follow a system of prioritization to determine which outbreaks receive attention. In the first few years, while Northfield still lacks resources to control widespread outbreaks, this system of prioritization would determine which plants and which locations get addressed at all. However, as Northfield's capabilities expand, this system of prioritization would serve more of a purpose in determining which locations receive passive restoration and which receive active restoration.

The first step in prioritizing would focus efforts and resources on the plants most harmful to Northfield's ecosystems. Not every non-native plant causes massive damage and resources should only be directed to the ones that have the potential to significantly interrupt native growth.

After determining which plants present the greatest threat, another consideration is which locations need the greatest protection. Because developed land is highly susceptible to invasion and Northfield's agricultural land and natural land could suffer the most in the event of a novel invasive species, efforts should focus on buffer zones between developed and undeveloped land. Currently, most of Northfield's natural land includes the Carleton Arboretum and the St. Olaf

natural lands, which are managed by the colleges. However, creating a buffer in the Northfield-controlled space near these lands could help prevent the spread of invasive plants on the natural lands (Vardarman, Berchová-Bímová, and Pěknicová 2018). Much of the area surrounding the natural land is used for agriculture, and therefore is also at risk of being harmed by invasive plants. Future plans for development need to consider this boundary between developed and undeveloped land and the potential consequences for thinning that boundary.

Due to the resource-intensive demands of removing invasive plants and restoring native vegetation, cities need to prioritize which plants and which locations should receive their attention. Some locations require only passive restoration--the removal of invasive plants--while others require active restoration, which calls for the additional re-introductions of native species. Due mainly to Northfield's small resource capacity, most management would involve passive restoration. In the initial stages of this plan, Northfield would use its prioritization system to determine which plants and locations even get addressed. However, as Northfield's invasive-removal capabilities improve and as invasive plants continue to take root in new locations, the city will place greater emphasis on prioritizing which locations receive active restoration. A study, conducted in Cape Town, provides a framework for identifying which regions need active restoration and how to prioritize them (Mostert et al. 2018). The prioritization is based on the ecosystems services and social considerations afforded by different spaces. In Northfield, important ecosystem services threatened by invasive plants include the recreational amenities in the high-quality natural lands as well as food production in agricultural lands. Vegetation located near the Cannon River can also impact flooding. Therefore, active

restoration plans should prioritize these areas, even if infestations in other locations are more severe.

### Native Vegetation Planting

Based on research regarding how best to prevent the spread of invasive plants, one step Northfield should take would be to encourage more native vegetation planting. Gardens full of native vegetation in both homeowners' yards and on public lands has been shown to make invasion from non-native species more difficult, even if native gardens could seem less attractive than traditional suburban lawns. For public spaces, the city should plant only native vegetation. Ensuring native plants dominate in land not controlled by the city could prove more difficult. Most, but not all, of the studies they use have found at least some evidence that revegetating can help prevent invasions (Schuster, Wragg, and Reich 2018). This evidence is much stronger for grasslands when both the native and invasive plants in question are herbaceous. For woody plants, there are some studies that find revegetating as effective in preventing invasion, but the evidence is much weaker and the number of studies far fewer than for herbaceous plants. With revegetation, speed is important--the native plants need to establish themselves before invasive plants can grow enough to block their light source. In other cities that have formed invasive plant policies, planting native vegetation is an important part of the plan. For example, the city of Eugene, Oregon has prepared lists of banned plants, discouraged plants, and native alternatives to planting ("Native and Invasive Plant Policies | Eugene, OR Website" n.d.). The Greater Northfield Sustainability Collaborative's website provides a list of native planting options in Northfield, a resource that could be made more accessible as native planting options become more popular.

### Collaboration with Nonprofits and Other Governments

Since a city government, particularly one for a small town, cannot carry out all of these actions alone, Northfield should expect to form partnerships with organizations dedicated to ecological preservation and invasive species management, as well as other state and local governments. In creating Northfield's invasive plant database and prioritization system, the city should communicate with governments and conservation organization in other jurisdictions, as invasive plants do not abide by human-made boundaries. This communication will better prepare the city for future invasive plant appearances and protect other towns from plants taking root in Northfield. Across the Midwest, Cooperative Invasive Species Management Areas (CISMAs) were created to combat the spread of invasive species by engaging local interests across different types of land ownership ("Indiana CISMAS" n.d.). They can partner with government agencies, non-profits, and citizen groups as well. These projects can help spread awareness through educational events and help private landowners develop a plan to manage invasive plants on their property. This approach provides another opportunity to boost citizen initiative without draining city resources.

Working with nonprofits could play an important role in engaging the public about fighting invasion. For example, Huron Pines is a Michigan non-profit that provides a strategic plan for countering invasives. They work with public and private landowners to identify invasive plants and develop strategies for removing them. The main steps in their Strategic Plan are Prevention, Inventory and Monitoring, Control, and Restoration. They also highlight the importance of public engagement and planting native species ("Invasive Species Program" 2016).

For Northfield, lack of public engagement is likely a large reason why the city has not passed substantial invasive plant policies, indicating that creating citizen involvement will likely be an essential step in forming effective policies to limit invasive plants. Minnesota has several CISMAs, though not quite as large and active as those in other states. Currently, the Rice SWCD fills a similar role to a CISMA, though its purpose is much broader than invasive plant strategy.

### Education and Awareness

Because the lack of public engagement proves such a large barrier to policy creation and enforcement, another main goal of Northfield's invasive plant plan should be to bring more awareness about invasive plants to Northfield's residents. If the public is more informed, the city would not need as many resources to actually remove invasive plants, as people would be taking preventative measures on their own. Additionally, more awareness could bring future attention and support to more aggressive invasive plant action, which could help with bringing updates to invasive plant policies in the future. To get the public involved and interested in invasive plants, it needs information and education. Other cities have worked with non-profits not only to develop strategies for invasive management, but also to educate the public.

This education could start small: creating educational signs and flyers that go up around the city or into people's mailboxes. These informational pamphlets would provide tips for identifying some of the most common invasive plants in Northfield as well as directions for how to remove them. As Northfield's plant management staff grows, the city could organize events to encourage residents to help remove invasive plants. One city-wide event could be a Northfield Invasive Plant Removal Day, which would occur annually or biannually. The city would designate a date where people find invasive plants and remove them together. Prior to the event,

the city would provide information as well as equipment, such as gloves and sheers, and disposal locations. This event could also serve to build community. In a city with two college campuses, events like these would particularly help students get involved with their community.

Another way to get people involved would be to target children. City staff and volunteers would offer to lead activities with elementary and middle school students. These activities could occur in classroom demonstrations, with staff or volunteers visiting schools and finding creative, hands-on ways to teach children about invasive plants. These activities would also include field trips to locations within Northfield where invasive species are present (assuming the plants that children handle are not thorned or toxic). By making children knowledgeable and enthusiastic about invasive plant management, parents would also start paying attention.

### Citizen Involvement with the Invasive Plant Mobile App

The culmination of these different aspects of management and civic engagement would take the form of an invasive plants mobile app for Northfield. This app would serve as a driver of citizen engagement. Though it could potentially serve many other purposes in the future, but this plan will solely discuss its use for invasive plant management. Initially, this app would be very simple, mainly providing information about the different invasive plants and where they are located in Northfield. It would also include a feature for reporting sightings of these plants, as pressing a button on a phone app can feel easier and more user-friendly compared to filling out a survey, making a call, or going to a website—which is how many other invasive plant reporting systems operate. Eventually, this app would include a social element where each person can see how many of their friends are using the app and connect with each other. The social element would allow the user to share what types of invasive plants they see, where they find them, and

when they go on walks or bike rides to look for them. The app would also encourage strategies for invasive plant prevention by providing users with a place to post pictures of the native plants in their yard and sending reminders to wipe mud and seeds off of clothing and bike tires when leaving and returning from natural lands. In the future, this app could also be marketed to attract tourism: when tourists search for information about things to do in the city, they can download the app to keep track of the invasive plants they see as they walk through parks and along the Cannon River.

Many cities have apps to promote civic engagement, but most of these apps--like the ones for the cities Boston, Columbus, or Seattle--primarily function to keep track of minor city disturbances like traffic violations. Cities like Calgary have shown more creativity by producing an app to help people track down lost pets ("8 City Mobile Apps Driving Citizen Engagement" n.d.). The city of Northfield already has a mobile app, which provides information about city resources. Northfield could further design an app that could be useful for promoting invasive plant management as well and help citizens become more connected to Northfield's ecology. EDDMaps has its own app, allowing people to view their data more easily in mobile form. Adding a social component to an app like this could engage citizens in the process of tracking invasive plants too. Northfield could use EDDMaps and these other city apps as a model to build a new app that also keeps track of invasive plants and encourages invasive plant monitoring and removal.

Different aspects of the above plan will take longer to implement. The school and community-wide engagement activities will certainly not even start until after the COVID-19 pandemic has ended and it becomes safe for people to gather in large groups again. Most of this plan can begin within five years. During the beginning of this twenty-year period (1-3 years), the

emphasis will be on acquiring staff and funding, as the rest of the plan cannot occur until this step is completed. Simpler educational initiatives, including spreading informational flyers and newsletters, can also occur during this period. Once Northfield has employees who can work on invasive plants, they can implement the next phases of the plan. The next part would be creating the invasive plant database, which is also important in providing structure for future invasive management. The city can expect to complete the database in the first five years of the plan. The completion of the database will provide the information necessary for creating Northfield's invasive plants app. This app's initial launch can expect to be in the first five years of the twenty-year plan, although this early launch would be a simple version of the app that provides users with information and a "report" button. The next five to ten years of the plan would include the development of community invasive plant events and the starting of annual community removal days. The elementary and middle school programs would also start during this time. The period from 10-20 years would include improving the invasive plants app to include a more interactive, social aspect.

An invasive plant management strategy for the city of Northfield will need to include keeping track of current and potential future invasive plant threats, monitoring to keep track of where invasive plants appear, developing plans to remove these plants from Northfield, and replacing them with native vegetation. By taking these steps to increase public awareness and develop strategies for dealing with invasive plants, Northfield uses these next twenty years to prepare for a more ecologically sound future.

**Proposed Timeline**


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