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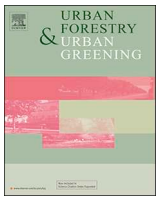

Applying 'action situation' concepts to public land managers' perceptions of flowering bee lawns in urban parks

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ABSTRACT

As urbanization increases, so do the demands on public parks to serve multiple aesthetic, recreational, and ecological functions. Decisions about vegetation selection and management on parkland are complex and must reconcile the values of diverse user groups. Public land managers serve a key role in this decision-making process, though their perspectives are not well understood. We apply Ostrom's 'action situation' concepts from the Institutional Analysis and Development (IAD) framework to four focus group discussions with public land managers about the possible implementation of flowering bee lawns (turf areas seeded with low-growing flowers) to support pollinators. The 33 participants represented 24 local park departments throughout the Minneapolis-St. Paul metropolitan area. The public land managers' descriptions highlight the intertwined roles that the public, elected officials, and maintenance staff play as stakeholders in vegetation change decisions. Participants' narratives also illuminate the dynamics governing the decision to adopt a novel vegetation type on parkland and the strategies public land managers use to negotiate these situations. The anticipated prevailing public opinion of flowering bee lawns varied across communities, yet there was similarity across park systems in the kinds of tensions and dynamics they expected (e.g. pressure to reduce maintenance costs, growing public concern for bee conservation, public fears of bee stings). They responded with three strategies; most common was an active effort to educate the public and elected officials. In contrast, some advocated a more discreet approach, experimenting with flowering lawns at low-visibility sites where the public would be unlikely to notice. Finally, a third approach, not mentioned as frequently, was to promote flowering lawns as an effort to reduce mowing or the use of herbicides. Our findings shed light on public land managers' understandings of the complex socio-ecological landscape that they must navigate to effect vegetation change.

1. Introduction

Urban green infrastructure on public land is essential for ecological function (Derkzen et al., 2015; Mexia et al., 2018) and human well-being (Chiesura, 2004; van den Bosch and Sang, 2017). Turfgrass lawns are ubiquitous on urban parkland throughout North America, Europe, and elsewhere (Hedblom et al., 2017; Ignatieva et al., 2015; Stewart et al., 2009; Wheeler et al., 2017). Rooted in centuries-old Western landscape design traditions, grass lawns have a long history as material manifestations of orderliness, mastery over nature, social status, and moral virtue (Blaine et al., 2012; Byrne, 2005; Nassauer et al., 2009; Robbins and Sharp, 2003). In the USA in particular, the famed Fredrick Law Olmsted and other early landscape architects left a legacy of parkland with large expanses of lawns that is still visible today (Cranz, 1982).

The potential for lawns to affect ecosystems positively or negatively is largely determined by management practices, which can vary widely (Wheeler et al., 2017). High input lawns maintained with herbicides, fertilizers, irrigation and frequent mowing have high aesthetic value (Ignatieva et al., 2017; Yang et al., 2019; Yue et al., 2017), but result in ecosystem disservices, such as intensive water use, nutrient runoff, and low species diversity (Fissore et al., 2012; Robbins and Sharp, 2003). Low-input lawns reduce fertilizer use and mowing (Hugie and Watkins, 2016) and often contain spontaneous species that can provide forage for pollinators (Larson et al., 2014; Lerman and Milam, 2016), though they have a limited role as reservoirs or corridors for native species (Wheeler et al., 2017). Globally, there is increasing interest in lawn alternatives to reduce ecosystems disservices and to support insect pollinators and biodiversity more broadly. These alternatives include, for example, grass-free forb-only lawns (Smith et al., 2015) and 'rough grass' in the

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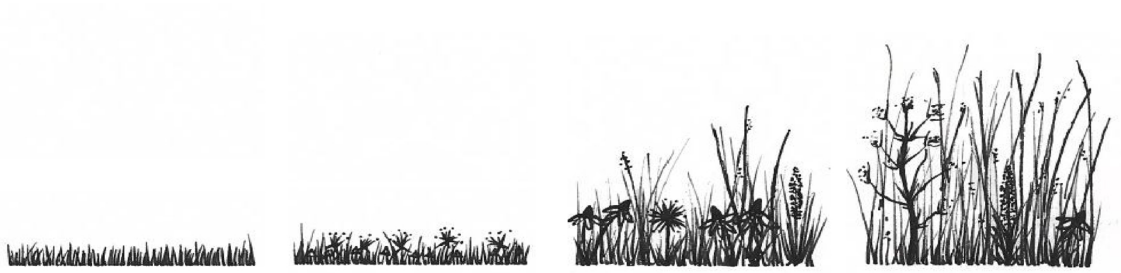
Table 1
Comparison of key characteristics of lawns, flowering lawns, and other lawn alternatives (Modified from Ramer, Nelson, Spivak, Watkins, & Wolfin, 2019; Ramer, Wolfin, et al., 2019) by Joseph Nowak III. Note: (a) Table entries are brief summaries rather than comprehensive definitions. There can be variation in each category. (b) Flowering lawns, urban meadows, and native grasslands tend to be substantially better sources of bee forage relative to traditional turf lawns.



	TRADITIONAL TURF	BEE LAWN	URBAN MEADOW	NATIVE PRAIRIE
DESCRIPTION	Managed for turfgrass species, though without herbicides, may have unintentional forb spp. (Ignatieva, Eriksson, Eriksson, Berg, & Hedblom, 2017)	Mix of low-input turfgrasses and low-growing forbs selected to provide bee forage (Lane, 2016)	"Naturalistic, unmown grassland with or without flowering forbs." (Southon et al., 2017)	Dominated by grasses, often with diverse assemblage of forbs. (Blair, Nippert, & Briggs, 2014)
VEGETATION HEIGHT	5-11cm (Cornell University, 2018)	5-11cm (Lane, 2016)	5cm-100cm (Southon et al., 2017)	15cm-300cm (Blair, Nippert, & Briggs, 2014; Oregon State University, 2018)
MOWING FREQUENCY	1-6/month (Cornell University, 2018; Yue et al., 2017)	1-3/month (Lane, 2016)	1/month to 1/year (Southon et al., 2017)	0-2/year (Minnesota Department of Natural Resources, 2004)

UK (Hitchmough, 2009), urban flower meadows and naturalistic grasslands in France (Shwartz et al., 2014), the UK (Hitchmough, 2004; Southon et al., 2017), Sweden (Ignatieva, 2017), USA (Helfand et al., 2006), and China (Jiang and Yuan, 2017; Yang et al., 2019). Despite this growing interest, while developing park design concepts, decisionmakers must balance the potential ecological benefits of lawn alternatives with the interests of diverse stakeholder groups regarding recreational uses, aesthetic preferences, and maintenance requirements (Madureira and Andresen, 2014). Public land managers are key actors shaping the adoption of alternatives and additional research is needed to better understand managers' perspectives (Barnes et al., 2018; Shams and Barker, 2019). Here, we examine public land managers' descriptions of how they would navigate the adoption of flowering bee lawns in public parks to support bee pollinators.

1.1. Flowering bee lawns

As a general concept, flowering bee lawns are composed of a mix of turfgrasses and low-growing flowers, kept short by mowing and designed to provide high-quality bee forage (Ramer, Nelson, Spivak, Watkins, and Wolfin, 2019). The forb species suitable for flowering lawns will vary by climate, but they must be able to survive mowing disturbances, compete with (but not outcompete) turfgrasses, and bloom at low heights as well as provide bee forage. As an example, flowering lawn trials in the Upper Midwest of the USA contained self-heal (*Prunella vulgaris*), creeping thyme (*Thymus serpyllum*), Dutch white clover (*Trifolium repens*), and ground plum (*Astragalus crassicarpus*) mixed with Kentucky bluegrass (*Poa pretensis*) or fine fescue (*Festuca* spp.) grasses (Wolfin, 2020).

Flowering lawns differ from other lawn alternatives in important ways (see Table 1). While low-input lawns can support a diverse assemblage of pollinators (Larson et al., 2014; Lerman and Milam, 2016), preliminary research suggests that flowering lawns—with forb species deliberately selected for their forage characteristics—can support still higher bee diversity (Wolfin, 2020). Furthermore, flowering lawns are mowed more frequently than meadows or other taller vegetation, which preserves open sightlines as well as recreational uses such as walking. Grass-free lawns—as the name suggests—do not contain grasses, reducing mowing by half, but leading to an uneven walking surface (Smith and Fellowes, 2015).

1.2. Urban parks & public land managers

Urban parkland can provide a wide array of environmental and social benefits in cities, such as stormwater infiltration, erosion control, carbon sequestration, biodiversity, aesthetic benefits, recreational uses, and improved mental and physical health (Chiesura, 2004; Madureira and Andresen, 2014; Mexia et al., 2018). While many of these functions may successfully co-exist, decisionmakers must recognize potential conflicts and carefully weigh tradeoffs during the process of designing parks and selecting park vegetation (Madureira and Andresen, 2014). There is considerable research focused on park visitor preferences to inform these decisions (e.g. Hoyle et al., 2017a; Jiang and Yuan, 2017; Lindemann-Matthies et al., 2010; Southon et al., 2017; Todorova et al., 2004). However, public land managers have received less attention in the literature despite their crucial role.

What is a 'public land manager'? Drawing on Jansson and Lindgren (2012), we employ a definition of landscape management that encompasses all aspects of developing and maintaining urban greenspace. Public land managers are engaged in the "technical and biological aspects, but also human relations and organizational aspects" (p.142) of park management. They help to bridge multiple levels and timescales of management, including the strategic level that involves formulating longer-term goals as well as the operational level that involves day-to-day maintenance.

Recent research has examined public land managers' vegetation preferences (Barnes et al., 2018; Hofmann et al., 2012; Hoyle et al., 2017b; Nam and Dempsey, 2019; Özgüner et al., 2007; Shams and Barker, 2019) and management approaches (Lindholst et al., 2018; Randrup et al., 2017; Randrup and Persson, 2009). We seek to contribute to this literature by applying concepts from Ostrom's Institutional Analysis and Development (IAD) framework to examine the action situations land managers must navigate to adopt lawn alternatives, such as flowering lawns.

1.3. Ostrom's IAD framework & action situations

Ostrom's IAD framework is a powerful tool for analyzing the governance of public goods and common-pool resources at multiple scales (Ostrom, 2011). It has been used in wildly diverse contexts such as rural soil conservation in Ethiopia (Nigussie et al., 2018), urban forests in Switzerland (Wilkes-Allemann et al., 2015), and waste governance in Mexico (Jiménez-Martínez, 2018).

The 'action situation' is at the core of the IAD framework. It highlights the critical elements involved in resource governance and the rules that configure the interactions between them (Ostrom, 2011). The main elements include the actors involved in management, their roles, and the range of actions they may, must, or must not take. The action situation also emphasizes what information must be shared or kept secret, the ability of an actor to take action with or without prior permission from others, shared understandings of the kinds of resources or geographic areas that can and cannot be used, and any rewards or penalties for certain actions.

Here, we extend the IAD framework to urban parkland management. While not a traditional common-pool resource, urban greenspace is increasingly theorized as a form of commons (Bravo and Moor, 2008; Foster, 2011; Parker and Johansson, 2011). First, it is difficult to exclude people from using public parkland, fulfilling the *non-excludability* criteria of common-pool resources. Second, park use is *rivalrous* because overuse and crowding can reduce the ability of other park visitors to enjoy the resource. Furthermore, the physical design of parks, such as built infrastructure and the types of vegetation, can enable or preclude particular uses of parkland. For example, it is difficult to play soccer amid restored prairie and bird-watching is less successful on a playground. There are, of course, some distinctions between urban parklands and the type of common-pool resources from which Ostrom's work emerged. Notably, park visitors' livelihoods do not depend on use of the resource, the group of resource users is not strictly bounded, and many park visitors use the resource without taking part in the management (Parker and Johansson, 2011). Furthermore, rather than a collective management arrangement, government is primarily responsible for the planning, design, and maintenance of parkland in our study, though often with some degree of public participation. Despite these differences, the IAD framework remains a useful lens to analyze the dynamics actors must navigate to manage parklands as a common resource.

1.4. Research questions

We apply the action situation to public land managers' descriptions of the anticipated benefits and challenges of adopting flowering bee lawns. This close reading can shed light on public land managers' understandings of the complex socio-ecological landscape that they must navigate to effect vegetation change. In particular, we ask:

- What are the action situation elements and rules that shape the decision of whether public land managers might implement flowering bee lawns?
- How do land managers think strategically about the implementation of an alternative vegetation type, in particular, flowering bee lawns?

Fig. 1. Forb species in trial flowering lawns in Upper Midwest USA: (a) *Trifolium repens*, (b) *Prunella vulgaris*, (c) *Thymus serpyllum* and (d) *Astragalus crassicarpus*. Photos byUniversity of Minnesota Bee Lab.

Table 2
Guiding Questions for Focus Groups Discussions.

1	*What are some of the different kinds of vegetation you and your staff maintain?*
2	*What vegetation management challenges do you encounter in your day-to-day work?*
3	*What interactions with pollinators do you (or your staff) have during your work in the parks, if any?*
4	*What benefits do you think flowering lawns could provide in the parks that you're responsible for? (List as a group, then individually rank top 3)*
5	*What concerns do you have about flowering lawns in the park you're responsible for? (List as a group, then individually rank top 3)*
6	*From your perspective, what do you think could be challenges for implementing or establishing flowering lawns? (Are the challenges similar to the ones you find with implementing other types of vegetation? Are there challenges with implementation that would be unique to flowering lawns?)*
7	*What maintenance challenges do you think there could be with flowering lawns? (Are these maintenance challenges similar to the ones you'd have with other types of vegetation? Are there challenges with maintenance that would be unique to flowering lawns?)*
8	*How would you suggest the park deal with these implementation or management challenges?*
9	*Are there other important factors that we haven't discussed yet?*
10	*If you had one minute to give advice to the University of Minnesota Bee Lab about how to encourage cities or counties to create more flowering lawns, what would you say?*

2. Methods

As part of a larger interdisciplinary flowering lawn research project that also investigated bee diversity and park visitor perceptions (Ramer, Nelson, Spivak, Watkins, and Wolfin, 2019), we conducted focus group discussions with public land managers in the Minneapolis-St. Paul (MSP) metropolitan area of Minnesota, USA. We chose to use focus groups because they are useful for providing an in-depth understanding of a topic embedded in a specific context and discovering key factors influencing participants' perception of a topic (Krueger and Casey, 2015).

2.1. Site description

The MSP region—with a population of 3.1 million people—is located in the Upper Midwest and is characterized by a temperate continental climate with warm summers and cold winters. Representing nearly 10 % of the total land area, the region's 74,740 ha (184,690 ac) of parkland supports vegetation ranging from highly-manicured turf to minimally-managed forest, though detailed data regarding vegetative cover are not available. The parkland is spread across a patchwork of 182 municipal governments, seven county parks departments, and one regional park system (Metropolitan Council, 2019a, 2019b). The local government units vary widely in terms of population, land area, amount of parkland, budget size, governance structure, and the number of staff dedicated to parkland management (Metropolitan Council, 2019a).

2.2. Recruitment and data collection

We recruited public land managers from regional and county park systems as well as municipalities with populations >1,000. Managers with publicly-available contact information (n = 104) were recruited in random order until we obtained five to ten participants for each focus group, reflecting ideal group size (Krueger and Casey, 2015). Thirty-three public land managers representing twenty-four park systems participated in a total of four focus group discussions.

Focus groups were held at the University of Minnesota Bee Lab during September 2018 and each discussion lasted approximately 1–1.5 h. Because it is a relatively new concept for most participants, each focus group began with a brief definition of flowering lawns and an overview of the recommended forb species for the region, accompanied by photos (Fig. 1). A discussion guide of ten key questions was used to facilitate the focus groups, which provided structure for the

discussions while allowing the flexibility to explore emergent themes (Table 2).

2.3. Data analysis

All focus group discussions were audio-recorded, transcribed, and then analyzed using NVivo version 12. A semi-open, iterative coding strategy was used to code for action situation concepts vis-à-vis public land managers (see Appendix A). First order codes were organized by the *positions* that participants identified as key stakeholders: the public, elected officials, maintenance staff, and managers themselves. Second order codes were then organized around the range of *actions* that actors in each position may, must, or must not take. Sub-codes reflect emergent themes (see Appendix B).

Focus group methodology is not designed to measure prevalence of a particular view in a population, therefore we do not report frequency counts or percentages to avoid inappropriate attempts to project patterns to the population or assumptions about the relative importance of themes based on frequency alone (Krueger and Casey, 2015). Instead, we seek to offer an exploratory analysis of public land managers' perspectives on flowering lawns in the MSP metropolitan area.

3. Results

3.1. Action situation

When asked about anticipated benefits and challenges of adopting flowering bee lawns in their respective park systems, participants described action situations defined by three stakeholder groups: the public, municipal staff, and elected officials. While participants anticipated widely differing degrees of support for flowering lawns in their own communities, participants predicted remarkably similar dynamics in the decision-making processes.

3.2. The public

Land managers described an intense pressure to be responsive to public input on vegetation and identified complaints as a primary factor shaping maintenance practices. For example, one participant reported that despite a department-wide goal to reduce herbicide use, they will spray certain lawn areas if they receive public complaints. Another participant described his department's biggest challenge as the "public calling in to say 'this is ugly'… and everyone has a different opinion on what it should look like and what would be nice" (FG1), reflecting the difficult task of balancing conflicting opinions within a community.

Participants described substantial differences between communities in terms of public perceptions of vegetation. For example, public pressure had driven some participants to eliminate herbicide use altogether. Meanwhile, in other communities, public pressure had led participants to spray all park lawn areas. The way participants described their sensitivity to public complaints also varied. For example, one participant described tolerating complaints about a reduced mowing regime until community members eventually seemed to accept the change. However, others agreed that it took "just one call to the mayor" (FG2) or other top official to halt new management practices.

With respect to flowering lawns in particular, most participants predicted that park visitors would have divergent opinions. On the one hand, land managers anticipated public opposition based on fears of bee stings, the appearance, or the cost of implementation. For example, one participant predicted that park visitors would complain and say "'my kid is allergic, you can't have that [flowering lawns] in the park'" (FG4). Furthermore, participants feared that if park users assumed that the bee-friendly forbs were weeds, they might accuse park staff of neglect or "not doing their job"(FG4). Another participant summed up all of these concerns, saying "So while I think there are a lot of benefits to it, that's really a challenge we're gonna have to face: to spend city money to grow 'weeds' that are going to attract bees. That's three strikes against you" (FG4).

On the other hand, several participants described growing public support for pollinators and biodiversity generally. One participant reported "I had a voicemail this summer from cutting down our alfalfa 'cause we were doing weed management…This guy left me at least a forty-minute dissertation about pollinators and bees…" (FG1). Another described being surprised by the level of controversy and unfavorable newspaper coverage that emerged after maintenance staff mowed down a patch of milkweed (*Asclepias* spp.), the host plant for the monarch butterfly (*Danaus plexippus*). In a few municipalities, community groups had even volunteered labor and funds to install and maintain pollinator conservation projects, such as mason bee houses or pollinator gardens.

3.3. Elected officials

Public land managers must adhere to directives from elected officials, such as the mayor or city council members. However, the direction of influence is often two-way, as elected officials often rely on public land managers for recommendations when formulating policy. Furthermore, land managers can often exercise discretion during implementation.

All participants described pressure from elected officials to cut park maintenance budgets. Participants described mowing turf as the single greatest use of staff hours and a primary target for cost cutting. One participant explained, "We're always being challenged with doing more with less and, quite honestly, about the only way in the summer we're gonna be able to cut staff is if we can cut a hundred acres out and take a mower out of service" (FG1).

While participants identified cost reduction as the dominant pressure from elected officials, this concern could be superseded by public complaints. For example, one participant recounted that the city council sought to steeply reduce the budget in the wake of the 2008 recession and eagerly agreed to his proposal to discontinue mowing in several low-use park areas, but reversed course when they received complaints. The participant explained, "Even in that extreme example where we had a budgetary problem…council's position…was 'I don't care what we said or what we approved or what we told you we were going to do, go mow it! I don't want to hear it; I don't want to have that call again!'" (FG3)

Less frequently, participants described instances where elected officials directed land managers to seek ways to meet environmental goals, such as preventing erosion, reducing CO_2 emissions, or increasing biodiversity. Elected officials in some communities had adopted pollinator-friendly resolutions directing city agencies to protect and support pollinators (Appendix C contains examples). Several participants whose communities did not yet have pollinator-related resolutions expressed a perception that they are a growing trend, and they are "coming to everyone soon" (FG2).

3.4. Maintenance staff

Maintenance staff conduct the day-to-day tasks necessary for maintaining public parkland including turf mowing, applying fertilizers and herbicides, forestry activities, maintenance of ornamental plantings, invasive species control, and restoration plantings, though specific duties varied across municipalities. Often, staff also monitor site conditions and respond to public feedback in the field.

Participants described several staff-related barriers to adopting flowering lawns, including (a) anticipated opposition from maintenance staff, (b) difficulty of changing established routines, and (c) a knowledge and training gap. Some participants stated that many maintenance staff personally preferred the uniformly-green lawn aesthetic, and may actively resist the introduction of forbs into turf. Additionally, even if the staff did not object to flowering lawns, participants were concerned it would still be difficult to alter existing mowing and herbicide

application routines. An exchange between three participants illustrates their past experiences with attempts to change management practices:

> Participant A: *I've been on that path [reduced mowing] for years and gone so far as to actually staking out these no-mow areas…It serves no purpose. The mow crew, some of which because they're seasonal and inexperienced, they venture into those areas because they forgot that we haven't mowed them for years or it's their first time out. Or we have some staff…that are just compelled to mow—*
>
> Participant B: *It looks like crap, that's what they say*.
>
> Participant C: *It's the same thing [for us]…Planning [Department] puts together these mowing exhibits…and it's all color coded and you hand it to the maintenance staff, and you come back and this one section is mowed and I'm like, 'Well, why was that mowed? It's not supposed to be*.' (FG3)

Lastly, participants described staff as well-versed in turf management, but unfamiliar with the forbs recommended for flowering lawns, making it difficult for staff to monitor establishment or conduct spot control of invasive species without additional training. One participant described the challenge in financial terms:

> *my staff is for the most part professional turf experts, they're not [flowering lawn experts]. So, it's learning and education, and what's the first thing a city council member wants to cut every year in the budget? It's training. So then how do you develop a staff that can get it?* (FG1)

The relative importance of these factors in each park system seemed to be mediated by variation in existing herbicide use and the degree of contracting out for maintenance tasks versus hiring staff directly. First, herbicide practices ranged from blanket use on all turf areas in some communities to a near ban of herbicides in others. Broadcast herbicide application is incompatible with flowering lawns, so for park systems in the former category, adopting flowering lawns would represent a substantial change in practices, adding complexity and room for error. Second, some participants represented smaller towns that did not directly employ maintenance staff, but rather contracted with private companies to maintain parkland. These communities were reliant on the offerings and expertise of private companies, shaping the ability of small towns to adopt new kinds of vegetation and practices.

3.5. Land managers: tradeoffs and strategic action

Public land managers must weigh tradeoffs of lawn alternatives, such as flowering lawns, in the face of uncertainty about cost, vegetation performance, and public perceptions in their communities. Land managers highlighted potential benefits including increased bee forage, positive public feedback, reduced maintenance time and cost (from reduced mowing, herbicides, and fertilizers), and increased environmental benefits (from reduced herbicides, fertilizers, and irrigation). Managers identified potential downsides as negative public comments, the perception of 'neglect of duty' resulting in loss of trust in the manager and/or the department, increased complexity of maintenance operations, and increased cost (for staff training, establishing bee lawns, and replacement if it is unsuccessful).

In the face of these possible tradeoffs, participants articulated three main strategies for adopting flowering lawns. The most common approach discussed by land managers was to educate stakeholders about flowering lawns to win advance support for the change. This would involve addressing anticipated concerns about aesthetics and risk of bee stings through signage, programming, staff training, newsletter announcements, and social media. One participant explained: "…the education piece will go a long way for the people who want to complain about all the weeds and… [to] just understand what we're trying to do… just getting out in front of it and get some good P.R. [public relations or publicity] on it before you implement it" (FG2), emphasizing the importance of a pre-emptive education campaign.

Many participants saw winning public support as key to including flowering lawns on parklands, more so than land managers' recommendations. One participant explained "Things get done if it comes from the public. If it comes from us [staff], it's not as successful" (FG3). Others focused more on winning the support of elected officials:

> Participant D: *I think getting buy-in from council or an administrator for what you're doing and them giving you a little bit of time to get it established*.
>
> Participant E: *I would agree, I would suggest that, for me anyway… making the time to communicate what we're going to do in this new initiative or get approval from the park board or council such that it was sanctioned and it didn't unravel for you after you made the investment to establish these areas*. (FG3)

However, others recognized that winning initial support from elected officials was no guarantee of ongoing support. A third participant added, "I've had issues even going that route, though. You know, the park commission says, "oh great" and [it] turns to a crap show later on because they [the residents] complain to the mayor or whoever" (FG3).

Once flowering lawns are established, several public land managers recommended ongoing education efforts such as incorporating signage as a signal that vegetation choices were intentional and not the result of neglect. This 'proactive education' strategy would seek to harness growing public concern over pollinator health and emphasize the benefits to bees. In doing so, participants believed that flowering lawns could be promoted as evidence of their departments' environmental innovation and leadership. Participants saw the formal pollinator-friendly resolutions as lending further institutional support.

In contrast, some participants advocated a more discreet strategy, in which flowering lawns would be implemented at low-traffic, low-visibility sites where the public would be unlikely to notice a change. Participants explained that this strategy would minimize the risk of complaints and allow for experimentation with management practices while still providing bee forage. Land managers also saw this strategy as leading to faster implementation because it would not depend on a potentially lengthy public discussion and municipal approval processes. One participant asked, "is it easier to ask for forgiveness or permission?" (FG4), clearly implying the former. Other land managers were more cautious and perceived their ability to implement changes without prior approval as limited. They cautioned that failing to seek permission could result in rebukes later on. One participant explained "you may be able to dodge that bullet and [beforehand] say, 'I am going to plug some of this stuff in here, let's give it a whirl, see what happens'" (FG4). Participants sometimes discussed this 'low-profile' strategy as a precursor to the 'proactive education' approach. When used in combination, the former could allow land managers to experiment with new vegetation and gather data. Later, they could use this to present a stronger case to the public and elected officials in the hopes of winning approval for wider-scale adoption.

A third proposed approach was to frame flowering lawns primarily as an effort to reduce mowing or the use of herbicides. One participant explained, "If you promoted this as a low-grow, low-maintenance type turf, as opposed to pollinator habitat—that's a secondary benefit instead of the primary benefit—then maybe you could avoid some of those [complaints]" (FG4). In this case, benefits to bees would be de-emphasized or elided altogether, to avoid triggering fears of bee stings. Instead, the financial costs and negative environmental impacts of traditional turf would be emphasized. This strategy was notably less popular; only two participants expressed interest in this strategy.

Regardless of approach, participants expressed a desire to have prepared talking points for responding to anticipated public complaints. Participants stated that information from trusted third parties, such as a research university, would provide additional authority to their education efforts. Furthermore, participants saw talking points as a way to

reduce the burden of responding to complaints and to maintain a consistent message with the ultimate goal of shifting public perceptions over time.

4. Discussion

The present study builds on literature in three areas: applied insights for urban commons theory, the use of Ostrom's IAD framework, and the role of public land managers. First, the present study provides an empirical grounding for the emerging literature that theorizes urban public lands as commons (Bravo and Moor, 2008; Foster and Iaione, 2016; Shah and Garg, 2017; Steed and Fischer, 2008). Following Foster and Iaione (2019) and Parker and Johansson (2011), we seek to extend the considerable body of research inspired by Ostrom's work by applying action situations from the IAD framework to a relatively novel context: urban parks as commons.

Additionally, we build on research by Barnes et al. (2018) about the key role public land managers play in the adoption of more sustainable vegetation by demonstrating *how* they strategically navigate this role while embedded in a complex web of relationships with other actors. Furthermore, a close examination of public land managers' accounts allows us to elucidate the link between the elements and rules of the action situation, and the specific strategies that public land managers may employ to balance anticipated tradeoffs when considering the adoption of alternative vegetation.

Previous research in Germany and the UK suggests that public land managers tend to hold favorable views towards naturalistic vegetation styles in terms of the environmental impacts and the maintenance required, but adoption is constrained by the perceived dominance of public preferences for more formal styles (Hofmann et al., 2012; Hoyle, Jorgensen, et al., 2017; Nam and Dempsey, 2019; Özgüner et al., 2007; Shams and Barker, 2019). Similarly, our research found that public land managers viewed public preferences—particularly complaints—as a dominant influence in the decision-making process. This suggests that, as a group, land managers may be hesitant to adopt vegetation styles too far outside what they perceive as socially accepted norms. However, participants' accounts also revealed that sensitivity to public complaints varied among individuals. Future studies should examine land managers' tolerance of complaints, and whether this varies according to personal temperament, past experiences, or the level of support they believe they can count on from elected officials.

Our research suggest a few practical applications for the adoption of flowering lawns and other lawn alternatives, particularly for land managers in Minnesota and the Upper Midwest. First, participants reported wide variation in the extent of herbicide use on turf. Flowering lawns would represent a substantial change in management practices for turf managed with herbicides, but a relatively minor change for low-input turf. (However, this may vary by site and existing practices. For example, Ignatieva's (2017) research in Sweden indicates that establishing flower-rich meadows requires the removal of grass clippings to restrict fertility.) Avoiding a major change in practices would prevent the need for staff retraining, though it would not substantially reduce mowing costs. Other lawn alternatives such as grass-free lawns or meadows may be a better option if the main goal is to reduce mowing costs, though these alternatives come with other maintenance and staff training costs (Hitchmough, 2004; Hoyle, Jorgensen, et al., 2017; Smith and Fellowes, 2015).

Second, if flowering lawns are adopted, participants suggested education campaigns and on-site signage indicating that forbs are intentional in order to pre-empt complaints about perceived neglect or poor management. While park visitors frequently do not read interpretive signs, they do often notice them (Hall et al., 2010; Tubb and Tubb, 2003). Simply the presence of signage may function as a 'cue to care' that increases social acceptance of alternative vegetation (Nassauer, 1995, 2011; Nassauer et al., 2009).

Participants also identified external factors that could facilitate the adoption of flowering lawns on a larger scale, many of which are already beginning to emerge in Minnesota. For example, several nurseries and seed supply businesses are beginning to carry flowering bee lawn seed mixes containing the same forb species discussed with participants (Ramer, Wolfin, et al., 2019). Participants also underscored the benefit of having a trusted third-party source of information. Currently, the University of Minnesota is disseminating guidelines for flowering lawn establishment and providing sample education materials (Ramer, Wolfin, et al., 2019). Lastly, our participants highlighted the importance of having local or state legislation to encourage alternative vegetation. Since 2014, forty-four municipalities throughout Minnesota have adopted pollinator-friendly resolutions (Pollinate Minnesota, 2019). Furthermore, in 2019, the state legislature created the Lawns-to-Legumes program to provide education, design assistance, and cost-sharing for homeowners to convert their lawns to pollinator-friendly vegetation in priority areas for at-risk species (MN Board of Soil and Water Resources, 2019).

There are several limitations of our study. While focus groups can provide rich detail and key insights for a specific context, our participants were drawn from a narrow geographic area and we caution against overgeneralizing our findings to other contexts. Also, despite our efforts to randomize recruitment, there was likely a degree of self-selection bias in our sample, with managers interested in alternative vegetation more likely to participate. Lastly, our findings are based on the accounts of public land managers and solely reflect their perspectives. Future research that includes multiple stakeholder groups, such as elected officials or park visitors, would offer valuable additional insights.

5. Conclusion

Bee habitat and forage is a landscape-level ecological requirement. Targeting individual public land managers is a step in the right direction but may result in an uneven patchwork of habitat and nutritional sources across an urban ecosystem. For an effective expansion of habitat and forage, flowering bee lawns must become accepted as part of new social norms that value (or at least tolerate) alternatives to high-input turfgrass lawns. We must acknowledge that there are many factors driving interest in alternative vegetation, aside from a concern for bee conservation. The tension around limited municipal resources will likely continue as will pressure on urban greenspaces to provide multiple ecological benefits and recreational opportunities. Balancing these tradeoffs is a complex but critical task for managing urban public parklands in ways that promote both human wellbeing and ecosystem health.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Hannah Ramer: Investigation, Formal analysis, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Kristen C. Nelson:** Conceptualization, Validation, Supervision, Funding acquisition, Methodology, Formal analysis, Writing - original draft, Writing - review & editing.

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Appendix A. Action situation: the case of public land managers & vegetation management

Positions	*Public - includes individuals who come into contact with public land mangers through public meetings, phone calls, electronic communications, as individuals or part of an organized group, as park users or park volunteers.* *Elected Officials – includes mayor, city council members, and official boards or commissions that oversee parks and natural resources* *Maintenance Staff – includes staff responsible for day-to-day vegetation maintenance* *Public Land Managers – includes directors of park departments or public works departments, park maintenance managers, park planners, natural resource specialists, turf specialists, and city administrators or other staff responsible for managing parklands (all participants)*
Actions and choice rules	*Managers' understandings of the range of actions that actors in each position may, must, or must not take with regards to vegetation management (including public, elected officials, maintenance staff, public land managers)*
Information about actions and information rules	*Managers' understandings of the information regarding vegetation management that must or should be shared with actors in other positions or that must be held secret from others.*
Control over actions and aggregation rules	*The degree to which managers perceive they are able to make vegetation management decisions independently and the limitations on that ability from actors in other positions (public, elected officials, maintenance staff)*
Potential outcomes and scope rules	*Managers' understandings of the scale and geographic scope of outcomes that can be affected by particular actions.*
Net costs, benefits, and payoff rules	*The benefits and costs managers anticipate as a result of a specific vegetation management decision. Benefits and costs may accrue to any of the positions and/or the resource itself.*

Appendix B. Coding guide

Based on 'action situation' variables from Ostrom (2011) IAD framework, the first tier of codes is organized by the *positions* that public land managers identified as key stakeholders in vegetation decisions. The second tier is organized by managers' understandings of the range of *actions* that each position may, must, must not, or is likely to take.

1. The Public – *includes individuals who come into contact with public land mangers through public meetings, phone calls, electronic communications, as individuals or part of an organized group, as park users and park volunteers.*	
1a. Comments about vegetation	**1a-i. Complaints** – *vegetation types that receive complaints, to whom complaints are directed, how complaints are communicated* **1a-ii. Divergent public opinion** – *variation within and between cities* **1a-iii. Land managers' reactions** – *how land managers handle and respond to public comments (e.g. education, change in management, tolerate/ignore)*
1b. Anticipated reactions to flowering bee lawns	**1b-i. Support** – *anticipated reasons for and level of future support* **1b-ii. Opposition** – *anticipated reasons for and level of future opposition*
2. Elected Officials – *includes mayor, city council members, and official boards or commissions that have authority over parks and/or natural resources*	
2a. Flow of influence	**2a-i. Aggregation rules** – *the degree to which managers perceive they are able to make vegetation management decisions independently or need prior permission from elected officials* **2a-ii. Information rules** – *managers' understandings of information that must (or should) be shared with or held secret from elected officials*
2b. Articulated goals	**2b-i. Policy goals** *as described by elected officials as the basis of direction to public land managers* **2b-ii. Relative importance** – *if goals conflict, which is prioritized?*
2c. Anticipated reaction to flowering bee lawns	**2c-i. Support** – *anticipated reasons for and level of future support* **2c-ii. Oppose** – *anticipated reasons for and level of future opposition*
3. Maintenance Staff – *includes staff responsible for day-to-day vegetation maintenance*	
3a. Change in maintenance practices	**3a-i. Aggregation rules** - *Managers' perceptions of the degree to which maintenance staff will comply with managers' directions* **3a-ii. Barriers** *that inhibited change (Assets were also a possible category, but were not mentioned)*
3b. Anticipated reactions to flowering bee lawns	**3b-i. Support** – *anticipated reasons for and level of future support* **3b-ii. Opposition** – *anticipated reasons for and level of future opposition*
4. Public Land Managers – *includes directors of park departments or public works departments, park maintenance managers, park planners, natural resource specialists, turf specialists, and city administrators or other staff responsible for managing parklands (all participants)*	
4a. Weighing net benefits and costs	**4a-i. Benefits** *or rewards may accrue to any actors or the resource itself* **4a-ii. Costs** *or sanctions may accrue to any actors or the resource itself* **4a-iii. Uncertainty** - *information that would influence management decisions if known*
4b. Strategies – based on information rules, aggregation rules, scope rules, payoff rules	**4b-i. Proactive education approach** **4b-ii. Low-profile approach** **4b-iii. De-emphasize bees**

Appendix C. Examples of pollinator-friendly resolutions

Example 1: Dakota County, Minnesota

Resolution In Support Of Protection And Promotion Of Pollinators,

WHEREAS, bees and other pollinators are crucial to the survival and propagation of many plant species and are thus important to ecological and economic health; and

WHEREAS, many pollinators are threatened due to loss of habitat and other stressors in the environment that include exposure to pesticides, pathogens, and parasites; and

WHEREAS, the Rusty Patched Bumble Bee, whose current range includes much of Dakota County, has been officially listed federally as an endangered species; and

WHEREAS, recent research strongly indicates a link between insecticides that contain neonicotinoids and impacts to pollinator species; and

WHEREAS, the Dakota County Natural Resource Management System Plan identifies bees, butterflies and other pollinators and beneficial insect habitat as a Tier I wildlife management activity in parks and a priority in the management of regional greenways and conservation easements; and

WHEREAS, the Dakota County Board of Commissioners finds it in the public's interest to commit the County to a safe and healthy environment through implementation of practices that support pollinator species.

NOW, THEREFORE, BE IT RESOLVED, That the Dakota County Board of Commissioners hereby supports the implementation of practices that promote pollinator species in the development, care, and management of County owned and maintained properties and projects; and

BE IT FURTHER RESOLVED, That Dakota County will promote similar support for pollinator species when acting in partnership with other units of government, agencies, or entities; and

BE IT FURTHER RESOLVED, That Dakota County will seek to avoid, find reasonable alternatives to, and refrain to the greatest extent practicable from, the use of insecticides containing neonicotinoid compounds; and

BE IT FURTHER RESOLVED, That Dakota County will continue to promote and install pollinator friendly plantings when viable and appropriate with a preference for native species of a local ecotype which enhance habitat for native pollinators.

Adopted December 12, 2017

Example 2: City of shorewood

A RESOLUTION ENDORSING " BEE-SAFE" POLICIES AND PROCEDURES

WHEREAS, the Shorewood City Council and Park Commission have undertaken

several work sessions dedicated to the study and understanding of promoting a healthy natural environment through the reduction and elimination of harmful pesticides; and

WHEREAS, bees and other pollinators are integral to a wide diversity of essential foods including fruit, nuts, and vegetables; and

WHEREAS, native bees and honey bees are threatened due to habitat loss, pesticide use, pathogens and parasites; and

WHEREAS, recent research suggests that there is a link between pesticides that contain

neonicotinoids and the die -off of plant pollinators, including honey bees, native bees, butterflies, moths, and other insects; and

WHEREAS, neonicotinoids are synthetic chemical insecticides that are similar in structure and action to nicotine, a naturally occurring plant compound; and

WHEREAS, the City Council finds it is in the public interest and consistent with

adopted City policy for the City to demonstrate its commitment to a safe and healthy community environmentthroughtheimplementationofpestmanagementpracticesinthemaintenanceofthe

city parks, open spaces and city property.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Shorewood:

1 The City shall undertake its best efforts to become a Bee -Safe City by undertaking best management practices in the use of plantings and pesticides in all public places within the City.
2 The City shall refrain from the use of systemic pesticides on Shorewood City property including pesticides from the neonicotinoid family.
3 The City shall undertake its best efforts to plant flowers favorable to bees and other pollinators in the City's public spaces.
4 The City shall designate Bee -Safe areas in which future City plantings are free from systemic pesticides including neonicotinoids.
5 The City shall undertake best efforts to communicate to Shorewood residents the importance of creating and maintaining a pollinator -friendly habitat.
6 The City shall publish a Bee -Safe City Progress Report on an annual basis.

Adopted July 28, 2014.

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