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"Not in their front yard" The opportunities and challenges of introducing perennial urban meadows: A local authority stakeholder perspective

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ABSTRACT

The growing evidence base for the benefits for people and wildlife of nature-based solutions to managing urban green infrastructure lacks research investigating land manager perspectives on their implementation. To address this gap, we explored UK local authority manager perceptions of the challenges and opportunities of introducing perennial urban meadows to prioritise biodiversity and aesthetics. This was co-produced as an experiment in urban greenspaces with Luton Parks Service and Bedford Borough Council 2013–15. We conducted semi-structured interviews with the eight stakeholder managers involved to identify key factors impacting on the perceived feasibility of future urban meadow establishment in other areas. All managers identified three dominant factors (*aesthetics and public reaction, locational context,* and *human resources and economic sustainability).* Additional factors (*local politics, communication, biodiversity and existing habitat* and *physical factors*) varied in importance according to personal values and managerial role. Support for future meadow introduction and a desire to overcome the economic challenge of the disposal of meadow arisings were related to manager biocentricity. Managers were aware of changing public values leading to increasing acceptance of a messier urban aesthetic. They perceived perennial meadows as a realistic alternative to amenity mown grass that in specific contexts could increase local biodiversity and enhance aesthetics if implemented in consultation with the public and local councillors. Our findings have relevance for the wider implementation of such nature-based solutions to urban GI management: Changes in management practice such as the introduction of perennial meadows have significant political, strategic, economic and practical implications and cannot be viewed purely as a technical challenge.

1. Introduction

Urban populations experience nature predominantly through their interaction with green infrastructure (GI) i.e. mosaics of interconnected, often multifunctional green spaces such as parks, gardens and incidental green spaces. The need for urban GI to foster physical and psychological well-being is now one important focus of urban planning policy in the UK and elsewhere (for example, Glasgow and Clyde Valley Green Network Partnership, 2016; Greater London Authority, 2015). Such policy also recognises the need for resilience of ecosystem services in the face of accelerating urbanisation and climate change (e.g. EU Biodiversity Strategy, 2017). Throughout Europe and elsewhere, urban GI is managed predominantly by local authorities, but many of these are facing major budget reductions – for example, one third of urban park managers in the UK have had budget cuts of over 20% in just two years, with 90% facing some funding cuts (Heritage Lotter Fund State of Public Parks Report, 2016). Local authorities are thus looking for alternative management options and are increasingly drawn towards 'nature-based' solutions that harness ecological processes, are cost effective and also deliver environmental and social benefits (European Commission Research and Innovation Policy, 2016). Examples of these approaches include urban forest concepts, flood alleviation wetlands and meadow management of urban grasslands.

In the UK approximately two-thirds of urban GI is managed as closely mown amenity grass used primarily for recreation (Forestry Commission, 2006). Even where the species composition of urban grassland communities is relatively diverse, frequent mowing restricts plant structural diversity, and in turn limits invertebrate diversity and abundance (Garbozov et al., 2015). Mown amenity grassland also generates high maintenance costs associated with frequent mowing.

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Fig. 1. Experimental meadow sites in contrasting urban contexts in Luton and Bedford. With the exception of (d) Urban park, all were adjacent to housing.

One alternative to this intensive management regime is the introduction of perennial urban wildflower meadows. These consist of managed grassland vegetation that contains perennial forbs and grasses and is cut once or twice a year. Potential benefits of introducing perennial meadows include a reduction in mowing frequency, an increase in habitat provision (Buri et al., 2013), nectar and pollen for invertebrates (Baldock et al., 2015; Garbuzov and Ratnieks, 2014; Harmon-Threatt and Hendrix, 2015) and aesthetic value for site users (Garbozov et al., 2015; Southon et al., 2017).

Despite the growing evidence base for the value of nature-based solutions for people and wildlife (e.g. Baldock et al., 2015; Garbozov et al., 2015; Southon et al., 2017), there is little research focusing on the challenges and opportunities experienced by local authorities attempting to implement these approaches to GI management. We address this

gap by exploring stakeholder manager perspectives on the introduction of perennial meadows in different urban contexts carried out as part of a larger scientific research project into urban biodiversity. This was a practical experimental initiative co-produced in public urban green-spaces with stakeholders from Luton Parks Service and Bedford Borough Council. We use a series of in-depth, semi-structured interviews with the key local authority managers involved in the planning, implementation and maintenance of the experimental meadows to identify their perception of the physical, ecological, contextual, human, political and economic factors influencing the feasibility of managing areas of urban GI as perennial meadows.

For some time there has been an awareness of the need for conservation management decisions to be based on human, social, economic and management factors, as well as ecological evidence (Brechin et al., 2002; Knight et al., 2011). There have been arguments for a cross disciplinary 'public ecology' (Robertson and Hull, 2001) reaching beyond biology into sociology, economics and philosophy, as well as law and education which determine the governance and implementation of conservation. Further, Knight et al. (2011) call upon ecologists to engage the complex 'hodgepodge' of politics. Some recent research applies this thinking to urban GI management decisions, exploring the structure of greenspace partnerships and collaborations at the local spatial scale (Svendsen and Campbell, 2008), networks involved in decision-making (Holt et al., 2012) and cross-sector partnerships (Mathers et al., 2015; Dempsey et al., 2015). Ives and Kendal (2014) explain how the management of ecosystems might be enhanced with a greater understanding of the values of key stakeholders including park visitors, the general public and decision-makers. Research in psychology has shown that underlying values influence people's immediate and short-term perceptions and attitudes (Rokeach, 1973; Schwartz, 1992) and are reliable predictors of behavioural intentions; although barriers exist between these intentions and actual behaviour (Ajzen, 1991). Studies (Schultz, 2001; Stern et al., 1995) have provided evidence that different environmental value orientations referred to as Biocentric (nature-centred), Social Altruistic (human-centred) and Egoistic (self-centred) can be identified as predictors of both behaviours and attitudes (Ives and Kendal, 2014).

Our study builds on this earlier research by identifying the tangible physical and ecological factors influencing the management of urban GI for biodiversity and aesthetics, as well as engaging with the complex contextual, human, political and economic factors influencing the feasibility of introducing perennial meadows from a stakeholder manager perspective. We address the following research questions: 1) What do urban greenspace managers perceive as the key factors determining the opportunities and challenges of managing GI as perennial urban meadows? 2) Does perception of the relative importance of these factors vary between individual managers based on their values and their managerial role?

2. Methods

2.1. Background: the urban BESS meadows experiment

Working in collaboration with local authorities in Bedford and Luton, two medium-sized towns 50–80 km north of London, UK, we established experimental perennial meadows at seven sites between 2013 and 2015 (Figs. 1 and 2). Sites were deliberately chosen to represent varied urban contexts and housing densities (Fig. 1). Apart from one urban park (Fig. 1(d)) these sites were all incidental green spaces adjacent to where people lived or worked. The experiment involved establishing a set of meadow plots with different heights (short, medium and tall) and levels of floristic diversity (no flowers, some flowers, many flowers) at each site (Fig. 3). After the removal of existing amenity mown grass and rotovation of the topsoil, plots were sown with native perennial meadow forbs and grasses. The plots were maintained using different mowing frequencies for the different height treatments, for two years. Using questionnaire surveys of users of the greenspaces where the meadows were sown, and other greenspaces nearby, Southon et al. (2017), showed that these meadows increased the site satisfaction of users of the green-spaces, and all meadow treatments were preferred to the treatment representing short mown amenity grassland (no flowers, short). Site users' preference also increased with floral diversity and the most preferred meadow was the high diversity, medium height treatment (many flowers, medium). Users considered the types of urban meadows that they believed to be of high wildlife value the most attractive, and were generally prepared to tolerate the appearance of the taller plots, even during the winter, when aesthetic value was low, in exchange for high aesthetic value in the summer and biodiversity benefits. However, for such plantings to be introduced at significant scales and to be a consistent component of urban landscapes, there are a range of social, economic and practical constraints that need to be considered, particularly from the perspectives of the managers responsible for implementing them. It is from this perspective that we focus on the experimental meadows in this qualitative paper.

2.2. Scoping to identify interview themes

An initial scoping survey was carried out to identify the themes which would underpin subsequent semi-structured interviews with the local authority stakeholder managers involved in the urban meadows experiment. The scoping involved qualitative content analysis, (after Mayring, 2014) of the field notebooks of the researcher who had worked in the key bridging role between academics and local authority managers throughout the course of the meadows experiment (December 2012-September 2015). This analysis revealed eleven initial themes that informed an interview guide (after Bryman, 2012). This comprised a list of issues to be addressed in each interview: i) physical site issues, ii) weather, iii) technical maintenance issues, iv) residents and site users, v) councillors and local politics, vi) internal council organisation and communication, vii) government spending cuts, viii) plot aesthetics and public preference, ix) biodiversity-related goals, x) locational context and xi) the economic implications of introducing meadows.

2.3. Semi-structured interviews

To identify and explore the factors defining the opportunities and challenges inherent in introducing perennial urban meadows as perceived by local authority managers, semi-structured interviews (after Jorgensen et al., 2007; Dempsey et al., 2015) were held with all eight of the parks and greenspace managers (PGMs) who had been involved in the experiment. The initial eleven themes derived from the scoping exercise described above were used as deductive categories. The use of a semi-structured approach based on the interview guide allowed greater insight into the managers' personal perspectives than would have been possible with a prescriptive list of questions. All managers were asked two initial open questions: First, "Do you think you could now take yourself back to your first involvement with the meadows experiment?" and then, "Can you try to describe your experience of the local authority's involvement from then until now, talking about what you see now as the high and low points you experienced as you went along?". This allowed managers to emphasise themes and events which had been particularly important to them at specific points in time during the experiment (2013–2015). As interviewees focused on specific events, outcomes or stages in the process of the experiment, insight was provided into how they understood and framed the issues. The interview guide was then used to raise additional themes, (as described above) facilitating flexibility and allowing the interviewer to respond to the interviewee's observations spontaneously, in a 'conversation with a purpose' (after Mason, 2002). Themes were addressed in varying order with each interviewee, according to the flow of the conversation.

Fig. 2. Experimental site before and after the introduction of perennial meadows. Amenity mown grass was replaced by seeded perennial meadow composed of native forbs and grasses.

All managers who had been involved throughout the course of the experiment (five managers: PGM1, PGM3, PGM6, PGM7, PGM8) or who became involved during its course (three managers: PGM2, PGM4, PGM5) were interviewed, to gain as wide-ranging a perspective as possible from managers working in different roles and local authorities (Bedford and Luton). Because some managers 'inherited' the experiment from predecessors, they were certainly not predisposed to react positively to the urban meadows. In the interviews the managers drew on personal experience of different forms of 'contact' with the public: unplanned face-to-face encounters whilst working out in public sites; planned meetings or consultation events; telephone calls and emails, or opinion delivered second hand via local councillors and elected members of parliament. Managerial roles fell into three main categories: ecological (environmental management & related public engagement: PGM1, PGM2, PGM8), operational (management of staff maintaining greenspace: PGM3, PGM6) and strategic (development & implementation of local authority greenspace policy: PGM4, PGM5, PGM7). Interviews took place in Bedford and Luton in November and

Fig. 3. Three heights (tall, medium and short) combined with three different percentages grass/forb (no flowers, some flowers, many flowers) to produce the nine experimental meadow treatments.

December 2015. This was after the end of the meadows experiment (September 2015) but before the release of a summary stakeholder report on findings (January 2016), and publication of detailed academic findings on greenspace users' aesthetic reactions to the meadows (Southon et al., 2017). Although some of the interviewees (PGM1, PGM4, PGM7, PGM8) had attended early stakeholder meetings in 2013 and 2014 where some preliminary findings were reported, they had limited awareness of the final formal research findings in relation to the meadows.

All participants agreed to take part in the interviews on the basis that their anonymity would be preserved, but gave their consent for interviews to be recorded and transcribed in full. Interview data were analysed by qualitative content analysis. Interview transcripts were initially coded according to the initial eleven themes which were then revised in the light of the interview content, leading to revision and rationalisation of categories and the identification of final key themes as discussed in the results (after Mayring, 2014).

3. Results and discussion

3.1. What are the key factors defining the opportunities and challenges of managing green infrastructure as perennial urban meadows?

Revision and rationalisation of the eleven initial interview themes revealed seven key themes or factors influencing the opportunities and challenges of introducing perennial wildflower meadows as perceived by our urban parks and greenspace managers': *i) Aesthetics and public reaction ii) Spatial context, iii) Human resources and economic sustainability, iv) Local politics, v) Communication, vi) Local biodiversity and habitat value and vii) Physical factors affecting establishment and maintenance.*

3.1.1. Aesthetics and public reaction

A key motivation for local authority involvement in the meadows experiment was to gain a greater understanding of public reaction to the aesthetics of urban meadows, including preferences for specific meadow mixes (Fig. 3). In the interviews managers were asked how, at the beginning of the experiment, they expected the public would react to the meadows and which of the nine treatments they thought would be most preferred. In responding, managers drew on extensive previous experience with the public, as described above.

PGM1 had anticipated a mixed reaction, whereas PGM3 and PGM6 had expected a negative reaction initially, because people were more familiar with close mown grass and a tidier urban aesthetic. There was also the perception (PGM6) that the 'framing' of an area of long grass or meadow with close mown grass and the cutting of desire lines allowing pedestrian access could enhance public acceptance through an 'aesthetic of care' (Nassauer, 2011).

> *Some people would love it and some people would hate it. You know that there are those who like places neat and tidy, and those that are enjoying seeing the colour and the added wildlife interest* (PGM1).

> *People expect to see the areas where we put them* [the meadows] *as short mown grass and nice tidy, you know, municipal grass cut areas* (PGM3).

> *If you're going to leave an area of long grass against a footpath make sure you cut a metre of maintained shorter grass against that footpath. People see that, "oh it must be intentional…they've cut round it"* (PGM6).

Another manager (PGM7) was aware that public opinion had gradually been changing over recent years and had expected a positive reaction. The council had previously received many appreciative comments about the introduction of annual meadows on roundabouts prior to our experiment:

> *We had numerous people phoning in and sending emails saying how wonderful it* [meadows on roundabouts] *was… There's a lot of people out there that are very supportive of the wildflower meadow landscape* (PGM7).

This manager also had the perception that people who were less environmentally aware and had less direct contact with the countryside would respond more positively to colourful annual meadows, as on the roundabouts, than to native perennials that were used in our experiment:

> *I do think that the people that might not have that environmental awareness would gravitate more towards the 'pictorial meadows'* [colourful annual meadows, without grasses] *side than perhaps grassland* [native perennials] *at the outset* (PGM7).

With one exception, managers expected the public to prefer more floral over grassy mixes, as was later confirmed by our questionnaire surveys (Southon et al., 2017). Managers drew on their experience of working in high profile public sites for many years, concurring that the average member of the public values colour over form and texture in an urban planting scheme:

> *They are always going to go for something that's got more colour… The landscape architects will come up with form, texture and all that sort of stuff, you know, all the arty farty the* […] *technical stuff, but what people really want to see is colour, and your average* [person] *walking down the street doesn't know a ragged robin from a geranium, all they see is it's red, and they see red flowers, they're not stopping to look at it from a botanical point of view, they're just passing by and, "oh that's pretty."* (PGM3).

Before being made aware of the formal academic findings which indicated a preference for the highly florally diverse medium height plots (Southon et al., 2017) all managers expected that the public would prefer the short or medium-height meadow mixes over tall ones, which grew to over 1m. From their experience with the public, managers felt that with the exception of those with a heightened environmental awareness, people did not like to see long vegetation, especially after the flowering season, because this was considered untidy.

> *The longer the vegetation is the less people like it, so I suspect that in general people prefer a shorter perennial turf, maybe one that's cut two or three times a year, that is kind of flower rich, that doesn't look long and ragged and tatty by the end of the growing season* (PGM8).

3.1.2. Spatial context

Meadows were established in a range of locations across Bedford and Luton as described, (Fig. 1). Local authority managers were keen to understand better the role of these contextual factors in successful meadow establishment, particularly spatial relationships with people's homes. Without exception, managers concurred that this was a dominant factor influencing public reaction to the meadows and thus willingness to accept meadow establishment, and that lessons learnt during the experiment would be invaluable in informing future management decisions. On reflection, all managers were convinced that perennial meadows were most appropriate in semi-rural parts of urban areas, in marginal areas adjacent to woodlands and neighbourhood parks, but that sown perennial meadows would be incongruous in a formal park setting, particularly if space was limited. There was the perception (PGM1, PGM2, PGM3, PGM6) that in high profile formal settings it was important to provide multifunctional green spaces to meet the needs of users with different values and interests; an area of meadow should not dominate the space.

> *What you don't do is stick it…plonk it in the middle of formal parkland* (PGM1).

Managers also concurred that the dominant public expectation was for a tidy aesthetic directly in front of their homes and that it was

inappropriate to establish perennial meadows in this context. This view was related to previous experience with the public:

> *The last thing you can do is go into a built-up housing environment with linear, narrow verges, leave it long, and don't expect any feedback from the general public. As soon as we get behind on their cutting regimes in the spring or in the summer the first complaints are coming from those dense housing areas, because visually people find it unacceptable. Open their front door, "I pay my council tax, I don't want to see long grass"* (PGM6).

This perception was reinforced by public reaction during the experiment. The range of contexts where meadows were introduced (Fig. 1) included areas at the front of housing, (e.g. Fig. 1(b)) where residents looked out directly onto the meadow plots. In the case of another site not shown here, meadows had been introduced within a very narrow (25m) strip of amenity grass and this site was withdrawn from the experiment in August 2014 due to negative public reaction. Most managers (PGM1, PGM2, PGM3, PGM6, PGM7 & PGM8) perceived that these very negative responses belonged to a vocal minority of residents, yet in retrospect this location was acknowledged as inappropriate. This applied particularly in the case of the tall plots:

> *There were some people that not unexpectedly didn't like the plots, didn't want them where they were, didn't want them outside the front of their house ···I think were just too close to people's front doors and houses* (PGM2),

> *The shorter ones they're not as in your face, they're, you've still got the insects, you've got bees, the butterflies on it, but it's not, you know, if you look out of your front room window you can't necessarily see something, whereas with the others, with the teasels and the thistles where they were as tall as a man it does hit you in the face a little bit.* (PGM3).

The lack of any vocal negative response at site 1(a), where meadow plots were located at the back of housing at one side behind a fence, and a road and raised grass bank between the front of housing and the plots at the other side, suggested that extremely close proximity to the front of housing was the main issue. Yet managers (PGM1, PGM2, PGM3, PGM4, PGM5) felt that, despite some challenging exchanges with the public, they had no real regrets about placing the meadows in these contexts. It had afforded a better understanding of the specific role of locational context which could be applied elsewhere:

> *Ideally we wouldn't have put it near them houses but at the same time we wanted to see what reaction that* [generated]*… it sticks out like a sore thumb, you know, but I can understand* [why this was done] (PGM5).

Our managers' perceptions are consistent with findings from some earlier research. Nassauer (2011) indicates that in front of their homes people like to see 'cues to care' communicating the idea of 'stewardship' such as mown strips and the trimming and pruning of shrubs, that neatness in urban planting is a prerequisite for attractiveness, and that cultural norms in residential areas may affect people's perceptions and behaviour, as residents aim to 'keep up' with their neighbours (Nassauer et al., 2009). Zheng et al. (2011), also working in the USA, observed that people in general prefer a neat environment. In a study by Qiu et al. (2013) within four contrasting habitat zones of a Swedish park, participants directed negative comments towards the 'wild-looking' woodlands with the highest biodiversity value, and positive ones towards the ornamental park habitat with the lowest biodiversity value. Recent research in the UK has indicated that herbaceous planting most natural in structure was perceived as the least neat, least attractive, least interesting, least colourful and least complex of three typologies of planting structure, (Hoyle et al., in press). Our managers' perception that the most appropriate context for perennial meadow planting would be at the edge of a town, or by a river was consistent with findings from this research. Yet our findings also indicated that managers (PGM6, PGM7) were aware of changing public attitudes in the UK and an increasing acceptance of messier, less formal 'meadow-style' plantings amongst the public in general. This concurred with evidence from our previous on-site surveys (Southon et al., 2017) which found that meadows increased the site satisfaction of green-space users. These surveys were not conducted at the site which had been withdrawn from the experiment.

Managers expected that site users would prefer the more floral to the dominantly grassy meadow mixes, and the short or medium height plots over the tall ones. These expectations were partially supported by results of on-site surveys in Bedfordshire (Southon et al., 2017), which showed an overall preference for the medium height high diversity plots, and concur with findings from research conducted in other contexts. Flowers have been shown to elicit positive emotions (Haviland-Jones et al., 2005) and several preference studies focusing on floral meadows have produced high scores for areas of species rich wildflower meadows, (Akbar et al., 2003; Lindemann-Matthies and Bose, 2007; Strumse, 1996). Previously cited recent work ((Hoyle et al., in press)) indicated that herbaceous planting in public spaces and institutionally-owned gardens with flower cover over 27% was considered significantly more attractive than that with a lower percentage flower cover. Todorova et al. (2004) investigated public attitudes to different treatments used under street trees in Sapporo, Japan, a specifically urban context. Findings indicated a preference for neat, brightly coloured low-growing flowers over soil, grass, or shrubs. The expectations of our managers were consistent with perceptions of participants in the Japanese study who considered taller flowers less appropriate in the context of an urban streetscape. The Japanese findings also concur with the expectation of one manager (PGM7) that people who were less biocentric (after Ives and Kendal, 2014) would gravitate towards more brightly coloured, 'pictorial meadows', annual meadows dominated by flowering forbs, containing no grasses. Appreciation of bright colourful flowers has been attributed to their role as an indicator of a resource-rich environment in evolutionary theory (Heerwagen and Orians, 1995). Nevertheless, this may be overridden by a complex socio-cultural 'learnt' response. For example, in some contexts, bright flowers might be rejected because they represent non-native planting imported during a European colonial past (Kendal et al., 2012; Zagorsky et al., 2004).

3.1.3. Human resources and economic sustainability

At a time when parks departments' budgets were being cut dramatically in the UK another key motivation for local authority involvement in the meadows experiment was to gain understanding of whether managing grassland as urban meadows could save costs and at the same time provide an aesthetically acceptable management alternative. Councils were already reducing the frequency of grass cutting to save costs on labour and fuel:

> *It came at quite an apt time with the council looking at service reductions in the way of cutting costs. One of those costs cuts has been to reduce the frequency of grass cutting throughout the town from seventeen grass cuts at the height down to where we are now, between six and eight, so this was seen as a worthwhile experiment to be involved with, if we could put some positive spin onto having longer areas of grass within the town* (PGM6).

However, there was a perception amongst all managers that, during the meadows experiment, their maintenance costs increased due to complex, time-consuming mowing regimes including the need to mow around experimental plots:

> *As it is, someone's now got to go with a smaller mower and cut round the individual plots so from their point of view it's made work, from the mowing, so from the guys' point of view it's a pain in the neck* (PGM3).

Maintenance staff were also diverted from other tasks during the site preparation phase and whilst mowing plots. However, managers (PGM1, PGM2, PGM3, PGM6) were aware that this was largely a result

of the experimental design itself, rather than the feasibility of introducing meadows in the future, which could be done on a larger scale with less frequent or complex mowing regimes. Positively, there was the perception (PGM1, PGM6, PGM7) that the experiment had provided the opportunity for grounds maintenance staff and apprentices to gain valuable new skills:

> *We had a couple of our apprentices then working on the scheme, expanding knowledge and understanding but some good experience for them, and I think they thoroughly enjoyed it* (PMG6).

However, there was one universal perception amongst managers: the argument that the overall annual costs of managing urban grasslands as perennial meadows instead of close mown grass would cut costs was a myth. This is because when grass is cut frequently the relatively small volume of arisings (cut vegetation) from an individual cut can be (and are) left on the surface to break down, whereas the annual cut of an urban meadow generates a large volume of arisings at one point in time that cannot be left to decompose so must be removed and disposed of to ensure low fertility soil for meadow growth. These cuttings are also unsuitable for use as fodder when generated in an urban environment, as described:

> *The cheapest way* [in terms of overall annual maintenance costs] *to cut grass is to cut it frequently. It's the physical removal and disposal of the arisings, through obviously volume, so you've got diesel costs…., certainly if it's a warm wet summer, the volume that you've got to take away, you've got to do something with it. A lot of urban areas are going to be filled with… dog excrement basically, litter, tin cans, bottles, so a lot of that the farmers are reluctant to put it in for animal feed* (PGM6).

Managers were aware of the need to develop innovative methods of disposal including the introduction of a biomass furnace to consume arisings (PGM6), different mowing regimes using shorter perennial species generating a small volume of arisings (PGM6) or economic sponsorship schemes with seed companies (PGM3). The call for a sound business case for the implementation of perennial meadows (PGM1, PGM4, PGM5, PGM6) reflected the fact that ultimately in the local authority context meadows could not be 'sold' purely on aesthetics and biodiversity:

> *Money is always going to be at the forefront of anything going forward.* (PGM4),

> *What is needed is a sound business case. It's the pounds and the pennies need to be put down there so you can demonstrate that it's option 1, 2 or 3 costs this amount of money and these are the pros and these are the cons, so you can make a clear case, rather than…what we can't say is, 'oh this is a nice thing to have, it looks very nice, it's good for wildlife'* (PGM1).

The emphasis placed on economic sustainability is unsurprising where urban local authorities are under increasing economic pressure. Managers cited the opportunity to reduce costs as one of their major motivations for involvement in the meadows experiment, but the view that emerged was that the cost of disposal of arisings would be the major barrier to the wider establishment of perennial meadows in an urban context.

3.1.4. Local politics

There was the perception amongst all managers that local politics, involving public interactions with councillors and elected Members of Parliament had a significant bearing on developments during the meadows experiment. They agreed that political awareness was always a prerequisite for the effective management of urban green spaces, particularly if this involved a dramatic change in management practice such as the transformation of areas of amenity grass into perennial meadow:

> *You can't have this without there being a political angle, no matter how much you might want to, because people will have an opinion* (PGM2).

This was felt most acutely in Bedford where meadow plots had been established in a narrow zone of amenity mown grass directly outside the front of people's homes, where, as described, the site was withdrawn from the experiment due to opposition from one vocal resident who rallied support from neighbours and approached the local councillor. The timing of this coincided with local elections:

> *Instead of just being an academic study, there was a political angle to it as well… one resident contacted us directly but also went through the local councillor, and the local councillor obviously felt like it a serious enough issue to come back to us via management to say, "look, can we get rid of these plots because they're not popular locally?". We didn't want to remove them, but it was a political angle that we couldn't avoid* (PGM2).

Most managers (PGM1, PGM2, PGM3, PGM6, PGM7, PGM8) were of the view that councillors would be influenced by pressure from a vocal public minority. There was also a strong perception (PGM1, PGM2, PGM3, PGM6, PGM8) that elected members of parliament and councillors who were initially positive about a project were fickle and prepared to change their position in the quest for public votes:

> *They* [elected members] *would see it as a positive and a way forward, until they get a lot of complaints from ward councillors and their ward, and then it would be seen as a negative.* (PGM6).

However, many managers (PGM4, PGM5, PGM6, PGM & , PGM8) were of the view that it was crucial to engage elected members and councillors because this would facilitate a positive relationship with the public. Once convinced of the value of a project, the member would champion or 'sell it'. Managers implementing nature-based solutions to GI management such as meadow introduction were also aware of the politically persuasive power of scientific evidence:

> *Members have really believed in the environmental projects and believed in the officers to move them forwards, so… it'll be promoted, it will be considered in meetings* (PGM5),

> *We were trying to get a lot of information so that in the future we could be informed when we were saying to councillors perhaps let's put a meadow area here, we would have all the answers* (PGM7).

Ultimately, to avoid conflict with the public and councillors, managers saw the need for a strategic approach involving public consultation, councillor engagement and careful location of meadow areas.

3.1.5. Communication

During the interviews three main lines of communication were discussed:1) between individuals in different roles within the local authority, 2) between the local authorities and the public, and 3) between the local authorities and elected members of parliament.

Weaknesses in internal communication between individuals in different roles within a local authority proved a barrier to the effective implementation of the experiment, such as when communicating the details of the mowing regimes. There was the perception among Bedford managers (PGM1, PGM2, PGM3, PGM4, PGM5) that internal communication problems had contributed to the cutting of some experimental plots at inappropriate times:

> *It was a challenge to make sure they were cut at the right times and we didn't achieve that on quite a few occasions…there was a lot of problems with communication between people doing the cutting* (PGM2).

This appeared to be compounded by the extra layer of communication necessary because as is increasingly common in the UK, some mowing was being done by an external contractor so the immediate 'control' was lost. Van Marissing et al. (2006) note that the challenges of good communication relate to both its nature and direction, with

one-way dissemination of information proving insufficient (Mathers et al., 2015). There was the feeling amongst managers who had come into post during the experiment (PGM4, PGM5) that the project had been poorly communicated to maintenance staff working on the ground, and to themselves:

> *The information I had at the time was limited… certainly across some of the areas in grounds maintenance there has been quite a negative view of this for some time. I don't truly know how it was sold to them in the first place.* (PGM5).

These challenges were not apparent in Luton. This is likely to have been because there was just one experimental site to be managed, in contrast to six in Bedford, and in Luton the same managers remained in post throughout the project. Two Bedford managers acknowledged that weaknesses in communication during the experiment had highlighted broader communication issues within the local authority. These weaknesses stemmed from the loss of supervisory staff due to funding cuts, yet they provoked a positive outcome: an additional layer has since been built back into the supervision of maintenance staff on the ground:

> *One of the things we* [did] *through the restructure was build the supervision back in across the grounds maintenance side. There was a swathe taken out through various savings and people leaving* (PGM5).

All managers expressed the view that public consultation, information and engagement was essential for the successful establishment of urban meadows. They reported extensive exposure to public opinion from face-to-face encounters (PGM1, PGM2, PGM3, PGM6, PGM8), telephone conversations with members of the public, (PGM7), or delivered second-hand via local councillors (PGM4, PGM5). These managers had spent significant amounts of time dealing with a small number of vocal members of public, or councillors who were responding to public pressure. During the experiment there was some initial public consultation via councillors, followed by the installation of temporary on-site signage once site preparation began, prior to the erection of more durable signs in June 2014. Four managers (PGM2, PGM3, PGM4, PGM5) thought that in retrospect there had been insufficient public consultation or information provided on key sites next to housing:

> *I think probably one of the failings in the first place was lack of information, probably more on our part to elected members and people like that…and a lack of information out on site as to what was actually happening and what we were trying to achieve because certainly the first year we had a lot of negative feedback* (PGM3).

All managers concurred that in general on-site signage would facilitate public understanding and acceptance, and one (PGM7) observed that as soon as the permanent signage went up in June 2014, phone calls to the council about what was happening within the spaces stopped. As well as providing as much visual and explanatory information about biodiversity and conservation benefits, this could be used to manage public expectations about the appearance of the meadows after flowering:

> *You need to be very clear about what you are going to be trying achieve, and probably what it's going to look like, photographs, and as much visual information as you can get because that's really what people want to see so they can decide, "is this something we want to do?". [It] depends how you want to sell it I suppose, but being honest about [that] there will be a flowering period but [that] there will be a time when it looks like a mass of weeds to the layman out there…explaining, that still has a lot of wildlife benefit* (PGM2).

Our questionnaire surveys (Southon et al., 2017) also gauged public reaction to seasonal change in the meadows. Significantly more site users were willing to tolerate the appearance of meadows outside the flowering season when provided with information on their biodiversity and aesthetic benefits when in flower, and possible cost savings. This supports the observation that '*people are accepting a lot more through austerity*' (PGM6), and confirms the value of effective communication and public information, as advocated by our managers. Previous research focusing on place-keeping partnerships between local authorities and friends' groups involving members of the public (Mathers et al., 2015) identified '*communication*' as 'the linchpin of effective place-keeping partnerships'. In the case of friends' groups, which were the focus of Mathers et al. (2015), members probably had a heightened interest in managing greenspace and may have been more biocentric (after Ives and Kendal, 2014) than the average member of the public.

Effective communication with councillors and members was viewed as a prerequisite for engagement, as discussed above. Some managers (PGM4, PGM5) advocated day-to-day contact via email and regular face-to-face briefings, whereas others (PGM7, PGM8) emphasised the need for evidence to support future changes in management practice.

3.1.6. Local biodiversity and habitat value

There was a strong perception amongst most managers (PGM1, PGM2, PGM3, PGM6, PGM7, PGM8) that the introduction of perennial meadows in an urban context provided an opportunity to increase local plant and invertebrate (mainly pollinator) diversity and that this was an important priority:

> *We all know that bees are on the decline so anything from that point of view, it's, preserving something that we are losing. Wildflower meadows… anything that we put back's got to be a benefit and the bigger scale you can do it probably the better* (PGM3).

Several managers (PGM1, PGM2, PGM8) expressed the view that before sowing new areas of perennial meadow there was scope for conducting surveys of indigenous plant species diversity and allowing some 'natural' regeneration as this would provide the advantage of avoiding problematic weeds. The view that any 'introduced' meadows should avoid or be at a significant distance from sites of existing conservation value was expressed strongly by a minority (PGM7, PGM8) who were concerned about the risk of introducing potentially invasive plant species, although all experimental seed mixes used only species native to the UK.

Managers' perceptions of the extent to which the public understood, cared about, or prioritised biodiversity and urban wildlife varied. There was the general perception that some members of the public had a heightened knowledge about and concern for biodiversity. Two managers (PGM1, PGM4) thought it was not a high priority for most people. PGM4 was of the view that for people with average to lower incomes, biodiversity was less important than the economic priority of feeding their family:

> *If you work in* [supermarket X]*, if you work in a factory and you're, day to day trying to put food on the table, it's not probably your first priority.*

Other managers (PGM6, PGM7) highlighted a change in public awareness of biodiversity, especially about pollinators, due to media attention, as well as an increasing acceptance of areas of grassland managed for biodiversity. This was also linked to an awareness of increasing austerity for local authorities and the need to accept wilder, less intensively managed spaces because councils lacked the resources to mow grass as frequently as in the past:

> *I think the times are changing, I think people are accepting a lot more through austerity, but also through a knowledge of biodiversity, pollinators, it's a lot more in the public, people are a lot more aware so people are becoming more tolerant* (PGM6).

This observation supports findings from earlier longitudinal research which showed that society's values for productive forest uses declined, whereas biocentric and spiritual values increased (Bengston et al., 2004; Xu and Bengston, 1997), as well as the results from our on-site surveys (Southon et al., 2017). Two managers (PGM2, PGM8) felt they were more biocentric than the average member of the public,

Table 1
Summary: The emphasis placed on 'key factors' by individual stakeholder managers (Strong/some/none)

		Key Factors						
Manager identifier	Manager role	Aesthetics and public reaction	Spatial context	Human resources and economic sustainability	Local politics	Communication	Local biodiversity & habitat value	Physical factors affecting establishment & maintenance
PGM1	Ecological	Strong	Strong	Strong	Some	Some	Strong	Some
PGM2	Ecological	Strong	Strong	Strong	Some	Some	Strong	Some
PGM3	Operations	Strong	Strong	Strong	Some	Some	Some	Some
PGM4	Strategic	Strong	Strong	Strong	Strong	Strong	None	None
PGM5	Strategic	Strong	Strong	Strong	Strong	Strong	None	None
PGM6	Operations	Strong	Strong	Strong	Some	Some	Some	Some
PGM7	Strategic	Strong	Strong	Strong	Some	Some	Some	Some
PGM8	Ecological	Strong	Strong	Strong	Some	Some	Strong	Some

because of their ecological backgrounds:

> *I personally can understand and appreciate the benefits. We've got areas that we leave over the winter for all sorts of different reasons and to a lot of people they'd look like a messy bit… "oh why haven't they cut that?", but we know it's useful for a whole range of wildlife to have overwintering areas, you know for feeding and for shelter, but I'm perhaps coming from a relatively, privileged is the wrong word but… I'm coming from a background where I can understand that* (PGM2).

Although a particularly strong emphasis was placed on *'Biodiversity and habitat value'* by specific managers, (PGM1, PGM2, PGM8), and others considered it important, (PGM3, PGM6, PGM7), two managers, (PGM4, PGM5), did not place emphasis on this. This reflects both their broader strategic roles in the local authority (Table 1), as well as personal values, discussed in 3.2.

3.1.7. Physical factors affecting establishment and maintenance

There was a consensus amongst the managers involved in the establishment phase of the experiment (PGM1, PGM2, PGM3, PGM6, PGM8) that physical factors during this phase including weather, underlying climate, soil type and the presence of weed seed in the soil had a bearing on both initial meadow establishment, and ongoing maintenance. There was the perception that frozen winter soils followed by waterlogging had impeded site preparation (PGM1, PGM3) and that particularly dry summers as experienced in 2013 would shorten the flowering season for meadow plant species (PGM2, PGM3). In contrast, longer term climate change was associated with a potentially longer growing season, (PGM1, PGM2), and the opportunity for possible extended flowering. One manager, (PGM8), highlighted the distinction between longer term climate change trends and short term localised weather, emphasising that climate change was problematic and difficult to plan for in terms of adapting urban vegetation management, because it was impossible to predict the exact nature of the change.

The experimental meadow sites encompassed a range of soil types including clay dominated (Bedford), gravel (Bedford) and calcareous soils (Luton). There was the perception that for optimal meadow establishment and growth the plant species sown should be matched with soil pH and moisture content, yet two managers observed that during the experiment there had been unpredictable results (PGM1, PGM2) with no clear evidence as to which soil type produced the 'best' result. In one case establishment was effective on clay soil, whereas in two other cases poor drainage and dominant weeds were problematic on the same type of soil. Managers (PGM1, PGM2, PGM3, PGM6, PGM8) concurred that indigenous weed seed in the soil was a real challenge to effective establishment, and that less fertile alkaline soils should provide the greatest chance of success, because in these conditions the threat from competitive weeds would be minimised:

> *… if we had a site where the soil was not very fertile, not going to produce a lot of weeds then that might also indicate to us that we could try something here…and probably make it easier for us to do it well without encountering as many problems…there was usually a weed bank in the soil and sometimes that was a big problem, that overtook what had been sown in spite of best efforts to protect the plots* (PGM2).

This was also considered important for aesthetics in relation to the perceived public expectation of tidiness:

> *The weed is a key of course. As soon as everything's infested then it's very difficult, (a) because it's difficult to maintain and (b) particularly for urban spaces…it does look quite a mess* (PGM1).

Physical factors emerged as the least significant factor affecting the feasibility of future meadow establishment for the managers. This might be because these were most important at the beginning of the meadows experiment when sites were being selected and prepared and meadows were being established. A considerable amount of time (3 years) elapsed between the site selection process in December 2012 and the interviews in December 2015. Not surprisingly it appeared that more recent developments including interactions with the public and councillors, featured more prominently than interviewees memories of the early establishment phase. s'. Strategic managers (PGM4, PGM5, PGM7) were remote from this throughout the experiment, as discussed

in 3.2.

3.2. Does the relative importance of these key factors vary between individual managers based on their values and their managerial role?

Three dominant factors were recognised by all managers as integral to the feasibility of future introductions of perennial meadows in urban areas: *aesthetics and public reaction*, *spatial context* and *human resources and economic sustainability*. *Local politics* and *communication* were regarded as important by all managers, although some did not emphasise this as strongly. *Biodiversity and habitat value* was emphasised strongly by three managers, yet was not a priority for two (Table 1).

The varying emphasis placed on the specific factors partially reflected different managerial roles within the local authority: ecological (PGM1, PGM2, PGM8) operational (PGM3, PGM6) or strategic (PGM4, PGM5, PGM7) as well as the point at which managers first became involved in the urban meadows experiment. Operations managers working closely with maintenance staff (PGM3, PGM6) and others who had been involved at the beginning of the experiment (PGM1, PGM2, PGM8) were more aware of physical constraints such as weather, soils and weed seed, as these factors were particularly significant during the site selection, preparation and establishment phases. Two strategic managers (PGM4, PGM5) had inherited roles in the experiment from their predecessors and their roles were remote from the day-to-day maintenance of the experiment. These managers placed a greater emphasis on political factors and the role of elected members (MPs) and local councillors. In their strategic roles they perhaps had the greatest contact with people outside the immediate parks department and saw the meadows experiment in the context of a bigger local authority picture.

However, the varying emphasis placed on the specific factors determining the feasibility of meadow introduction also reflected managers' own personal values, which were often closely related to their roles. Managers with an ecological background (PGM 1, PGM2, PGM8) demonstrated strong biocentric values (after Ives and Kendal, 2014), placing considerable emphasis on the biodiversity value of the perennial meadows, coupled with the need to consider indigenous plant diversity and existing habitat value before their introduction. In contrast, operations managers with a more formal horticultural background (PGM3, PGN6) demonstrated empathy with maintenance staff from a similar background and prioritised a tidier aesthetic, feeling less comfortable with the biodiversity related goals of the experiment. These managers themselves were more focused on achieving practical day–day maintenance tasks. A strategic manager (PGM4) was aware of these different perspectives:

> *I think it's in relation to understanding the ecology side of it, I think X had a greater understanding of that, Y was probably looking at it from a more practical point of view and how it was affecting the areas where he was doing that work.*

However, one of these operations managers (PGM6) did note a significant change in their own personal values and those of others in the local authority, describing a shift towards a more biocentric position with increasing environmental awareness over the last fifteen years. He related this to growing environmental awareness within the local authority in general. This mirrors a reported shift in forest managers' values from 'economic/utilitarian' towards 'life support' (Xu and Bengston, 1997) yet our interviewee acknowledged that the shift to more biocentric management practice also reflected economic pressures which made traditional intensive horticultural practice economically infeasible across the whole borough. A more relaxed mowing regime which supports greater plant and invertebrate diversity is cheaper to sustain than a more intensive one, if arisings are left on the surface (see above). A manager's ability to be conscious of his or her own values and how these influence goal setting, ideals and actions has been recognised as a prerequisite for effective ecological management (Ives and Kendal, 2014). The managers with biocentric values involved in the meadows experiment (PGM2, PGM6, PGM7, PGM8) demonstrated this self-awareness.

4. Conclusions and implications for research and practice

Our findings provide a valuable insight into the opportunities and challenges of introducing urban meadows as perceived by eight local authority stakeholder managers. In-depth interviews following a co-produced perennial meadows experiment revealed seven significant factors had a bearing on stakeholder manager perceptions of the feasibility of future meadow establishment: *aesthetics and public reaction*, *spatial context, human resources and economic sustainability*, *local politics, communication, biodiversity and habitat value* and *physical factors affecting establishment and maintenance* (Table 1). The first three were perceived as dominant. The emphasis placed on specific factors by individual managers reflected both their role within the local authority, and personal values, which were related. Perennial meadows were perceived as a possible management alternative to close mown grass within urban greenspace, if located strategically and in consultation with the public and local politicians. Managers felt that the meadows have the potential to increase local biodiversity and create an aesthetic that is pleasing to the public. The challenge to local authorities is an economic one. Future work must focus on detailed cost benefit analysis of the economic implications of meadow management, as well as new approaches to address the challenge of the removal and disposal of meadow arisings, such as the use of composting, biomass furnaces or shorter perennial mixes that generate a reduced biomass.

Managers were aware of different individual values within their local authority. Those with ecological backgrounds demonstrated highly biocentric value orientations, yet they were self-aware and empathetic towards varying public values. There was clear evidence that both authority-wide and individual values influenced preparedness to advocate future meadow introduction. Biocentricity was related to support for future meadow introduction and positive engagement with opportunities to overcome the challenge of the disposal of meadow arisings. Managers were aware of changing public value orientations and an increasing acceptance of a messier urban aesthetic including taller growing meadows that would support pollinators and higher levels of biodiversity. This contrasted with the previous public expectation for short, manicured amenity grass. Managers were also aware of shifting value orientations within their authorities. Our findings in relation to the Bedfordshire managers' perspectives have relevance for the wider implementation of nature-based solutions to urban GI management. They illustrate that changes in greenspace management practice such as the introduction of urban meadows have significant political, strategic, economic and practical implications for a local authority and cannot be viewed purely as a technical challenge.

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