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"My little piece of the planet": the multiplicity of wellbeing benefits from allotment gardening

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Abstract

Purpose

Participation in urban horticulture (UH) is increasing in popularity, and evidence is emerging about the wide range of social and environmental benefits "grow your own" can also provide. UH can increase mental and physical wellbeing, as well as improve nature connectedness, social capital and community cohesion.

Approach

This study focuses on allotments, which is one of the dominant forms of UH that takes place in the United Kingdom. 163 volunteers in England and Wales participated in keeping a year-long allotment diary as part of a citizen science project investigating activities on allotment gardens. This study examines the unprompted comments that 96 of these gardeners offered as observations when visiting their allotment plots.

Findings

Participants recorded high levels of social and community activities including the sharing of surplus food produce, knowledge exchange, awareness and interaction with wildlife, emotional connection to their allotment, appreciation of time spent outside and aesthetic delight in the natural world around them.

Originality

At a time when waiting lists for allotment plots in the United Kingdom are on the rise, and allotment land is subject to multiple pressures from other forms of development, this study demonstrates that these spaces are important sites not only for food production but also health, social capital and environmental engagement.

Keywords

Urban horticulture; wellbeing; allotments; citizen science

1. Introduction

Urban horticulture (UH) is an area of research becoming increasingly relevant to policy; it has been highlighted by The Intergovernmental Panel on Climate Change as a potential way to ensure food security in an increasingly globalised world (Mbow *et al*., 2019), and recent research has demonstrated that there is a promising level of yields potential from expanding UH land in cities (Edmondson et al., 2020; Mcdougall et al., 2020). However, food provision is not the only benefit of UH. Participation in UH also has the potential to increase wellbeing in a number of ways.

Two prominent British gardening organisations, Sustain (https://sustainweb.org) and Garden Organic (https://gardenorganic.org.uk) have publicised this with the message that UH can

provide multiple benefits for both physical and mental health (e.g. increasing fruit and vegetable consumption, increasing overall activity levels, increasing social interactions, and reducing stress levels; Schmutz *et al.*, 2014). A systematic review of occupational health literature (Genter *et al*., 2015) found that allotment gardening, a key form of UH in the United Kingdom, provided similar wellbeing benefits to more formal therapy gardening groups, and a meta-analysis by Soga *et al.* (2017a) found across-the-board positive benefits of gardening on health. Gardeners' own opinions support these findings, with recreation and mental health coming top of a list of reasons that 144 gardeners in Philadelphia participated in food growing (Blair *et al.*, 1991). In Tokyo, a survey of 332 people found that those who participated in allotment gardening reported better physical and mental health than those who did not (Soga *et al.*, 2017b). Results from the European Quality of Life Survey also support these findings, where people who grew their own food reported feeling happier than those who did not (Church *et al.*, 2015). These wellbeing benefits of UH have been found to occur even after a single gardening session (Wood *et al.*, 2016), and for a number of different groups of people, such as refugees (Harris *et al*., 2014); prisoners (Richards and Kafami, 2008); and school groups (Ohly *et al.*, 2016). However, the review of research specifically on allotment gardening (Genter *et al.*, 2015) found that there was a paucity of studies of individual allotment gardeners in comparison to those participating in group gardening sessions, and recommended that further investigation is needed in the research to explore the impact of everyday allotment gardening for individuals.

More broadly, there is an established evidence base of the benefits of spending time outdoors, and developing nature connectedness, on physical and mental wellbeing (Martin *et al.*, 2016). Doctors' surgeries in Scotland have piloted 'prescribing' outdoor activities to treat mental and physical health complaints (Fleischer, 2018). The idea of a 'nature deficit disorder' (Louv, 2005) has become a popular lens through which to discuss the lack of nature

connection amongst children and adults in the twenty-first century. This is particularly an issue in urban areas, which present an obvious challenge for people to connect with wildlife and greenspace when contrasted to the lives of people living in rural areas; indeed, rural dwellers experience less life stress in childhood as a result of their nearby access to greenspace (Wells and Evans, 2003). The British population is forecast to be 90% urban by 2050 (United Nations, 2019), meaning that barriers to nature connectedness specifically faced by city dwellers are relevant topics for most of the population. It is as important for people to experience wildlife in their 'own backyards' as in a holiday or tourism setting (Curtin, 2009), suggesting that spaces within urban areas where people can encounter wild animals and birds are particularly precious. The psychological benefits of spending time in green spaces in urban areas also increases as biodiversity (or perceived biodiversity) increases (Fuller *et al.,* 2007).

The wellbeing benefits of nature connectedness become even more important when placed in the context of the state of mental health in the UK. The OECD estimated in 2018 that mental health problems cost the UK over one billion Euros per year, or 4% of GDP (OECD, 2018). Against this general background, there can additionally be marked increases in demand on mental health services generated by specific national or global pressures, as demonstrated by the current coronavirus crisis, which is expected to directly cause at least half a million more people in the UK to experience mental ill health (NHS Providers, 2020). Metal health in the UK worsened by an average of 8.1% during the first two months of lockdown and social distancing (Banks and Xu, 2020), and with the impacts of lockdown particularly acute in urban areas, long-term mental health impacts for city dwellers may be severe.

In the above context, and with the additional recognition of its potential role in increasing food security, particularly in urban areas (Edmondson *et al*., 2020; Mcdougall *et al.,* 2020), it is timely ever to investigate the potential opportunities to ameliorate poor mental health, and

95 engage in physical activity and connection to nature, that are presented by participation in
96 UH. Allotments are a key form of UH in the UK (Crouch and Ward, 1997; Acton, 2015),
97 with around 330,000 allotment plots nationwide (Campbell and Campbell, 2013). They cover
98 a land area of 135 km^2 across the country. Plotholders rent their allotment plot for a yearly
99 fee, and most plots consist of a patch of land (approximately 250 m^2) adjacent to other plots,
100 forming allotment sites, which can vary in their size depending on the number of plots.
101 Allotments are predominately owned by local authorities, with, in many cases, individual
102 allotment societies renting the land and letting plots out to tenants, although some privately-
103 run sites also exist. Allotments were originally conceived as a means to widen access to food
104 production for urban dwellers (Crouch and Ward, 1997), and plotholders are legally obligated
105 to maintain minimum cultivation levels of fruit and vegetables on their plot. However, many
106 allotment gardeners also grow ornamental plants and have space on their plot for relaxation,
107 such as garden chairs and tea making facilities.

108 Although widely recognised as an important opportunity for people to benefit from growing
109 their own food, particularly in urban areas, there has been relatively little systemic research
110 into the practices, resource use, and personal benefits derived from allotment gardening. Here
111 we report some of the results from a UK-wide citizen science project, which involved
112 gardeners keeping year-long allotment diaries, recording a range of things such as time spent
113 on different activities and water and fertilizer use, but also included an opportunity for
114 recording unprompted notes. These notes are the focus on this analysis, and overall they
115 provide a positive picture of the impact of allotment gardening on mental and physical
116 wellbeing. Our findings add to the growing evidence base suggesting a strong link between
117 allotment gardening and a spectrum of benefits for the individual, such as community
118 cohesion, mental health and nature connectedness, and specifically address the research gap

identified by Genter *et al.* (2015) concerning a lack of data on individual, as opposed to community group, allotments.

2. Methods

Allotment gardeners across the UK were recruited through online and in-print advertising (primarily Facebook, the MYHarvest website at https://myharvest.org.uk, and the Royal Horticultural Society magazine). In total 437 people, all of whom were individual allotment gardeners, signed up to complete a year-long (2018) allotment diary from all four constituent nations of the United Kingdom. Ethical approval was given by the University of Sheffield (Application 01284) for the project, and participants consented to the use of their data in this research project, and agreed that they could drop out of the project at any time if they so wished. They were asked to detail the amount of time they spent on their plot, resources used such as water or compost, and planting and harvesting activities. At the end of the year, participants were sent a stamped addressed envelope to return their diary pages, which were then scanned (so that originals could be returned to those who had requested this) to and data extracted manually. 163 participants returned their diaries, forming a geographical distribution across England and Wales. Unfortunately, no diaries were returned from Scotland or Northern Ireland.

To the best of our knowledge, none of the allotment gardeners responding to this study were engaged in more formal horticultural therapy, but all practiced allotment gardening for the primary purpose of the production of fruit and vegetables, as is typical (and indeed, legal obligated) in the United Kingdom. Participants were not directly asked about wellbeing, but on each diary page (corresponding to a visit to the allotment) there was a space specifically for ‘Notes’ which participants could use for any thoughts or observations they wanted to

make. Ninety-seven of the 163 participants chose to write spontaneous observations and thoughts in this section for at least some of their allotment visits, giving 342 entries in all. We extracted the text of the Notes section for these entries. Participant start dates spanned late 2017 to early 2018, and as a result the full year was slightly varied in actual dates for each participant. The extracted Notes span a date range of 27 December 2017 to 25 February 2019. Two entries were undated notes written at the end of the participants' diaries.

These notes described wildlife encounters, non-plot related activities such as participating in communal building projects, social interactions on the plot, use of surplus harvests, and so on. As it was a free space to write in, the comments we received were very wide ranging. Therefore, we then analysed these notes to extract the different broad themes of the texts, coding comments into eleven dominant thematic strands. These categories were deduced a posteriori, after grouping comments together and seeing where dominant themes emerged (a "cutting and sorting" technique, as described in Ryan and Bernard, 2003; Popping, 2016; Vaughn and Turner, 2016). After comments had been assigned a dominant theme, any comment related less strongly to another theme as well as its main one was also given a sub-category so it could be included when analysing the comments theme by theme. Each comment was also coded to be positively, or negatively, related to its dominant theme, where this was applicable (such as negative or positive attitudes towards the weather). For example, "Educating children of visiting family re allotment culture" (09/08; hereon this denotes the date of example comments; see Supplementary Info for full list of comments, dates, and anonymised participant ID) was categorised primarily as 'Social' and secondarily as 'Knowledge', with no positive / negative coding as there was no obvious emotion communicated by the participant in this comment. However, "So very very dry – no rain still, not a lot of pollinators in sight, no bees probably little nectar in such dry weather" (10/07) was coded primarily as 'Weather', secondarily as 'Wildlife', and with a negative associated

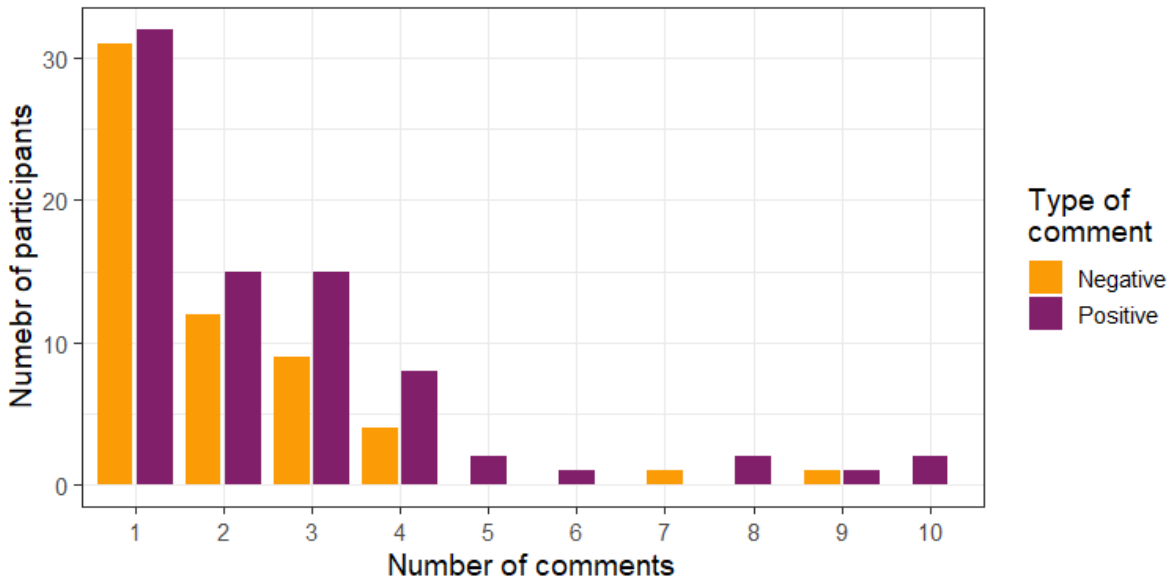
emotion. Coding was carried out by hand in Microsoft Excel and statistical analysis to produce figures was undertaken using R 4.0.0 (R Core Team, 2020).

3. Results

3.1.Overall thematic observations

Some participants had included more notes entries over the year than others, which led to a slight bias in the thematic interpretation of the data. However, as shown in Figure 1, which demonstrates the number of comments per participant per emotion, the bias effect was minimal, with the vast majority of participants noting only one, two or three comments of either emotion (positive / negative) over the course of the year (Figure 1).

Overall, comments related to social activities or expressing emotions were the most common across the aggregation of primary and secondary thematic types (Table 1). Comments related to social activities were the most commonly expressed in positive terms, and comments related to the weather were the most commonly expressed in negative terms (Table 2). On average, there were a median of 6 negative and 13 positive comments made each month. Positive entries started earlier in the year and ended later than negative responses; June and July were the only months with more negative than positive responses, and these months were dominated by the theme of weather in the negative comments (Figure 2). See Supplementary Information for a full list of comments with their associated themes.



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189 **Figure 1.** Graph showing the number of comments received per participant of a negative or positive nature in

190 allotment diaries over the course of the year.

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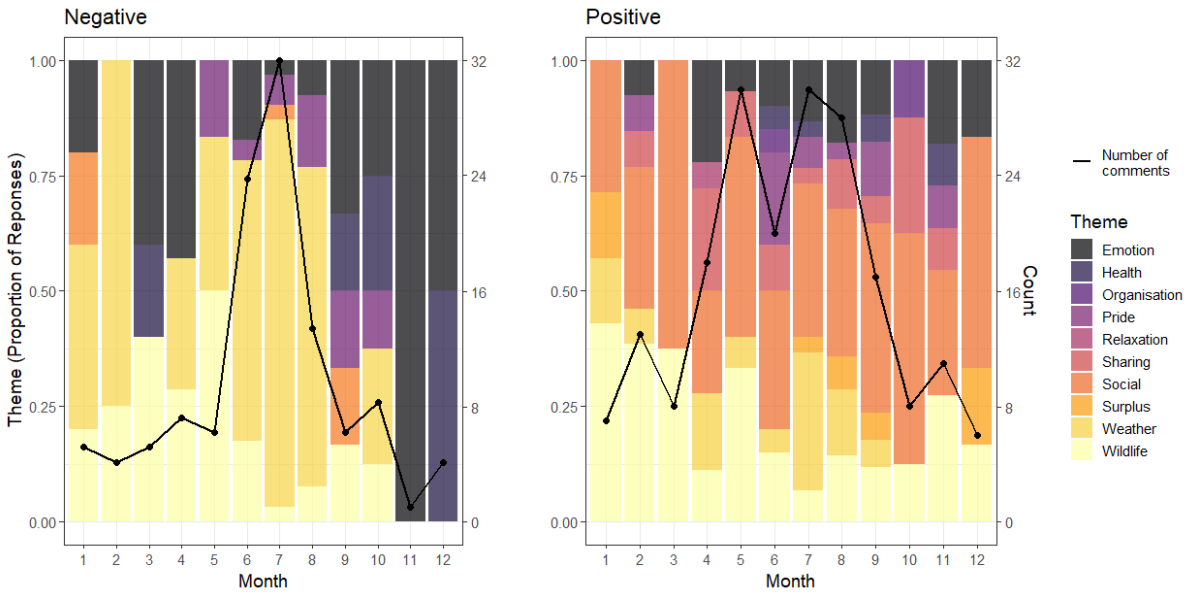

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193 **Figure 2**. Graphs showing the count, and distribution of themes, within negative and positive notes made in

194 allotment diaries for each month of the year.

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196 **Table 1.** Thematic analysis of notes written in allotment diaries over the course of a year.

Theme	Number of entries, primary theme	Number of entries, secondary theme	Total number of entries associated with theme
Emotional	44	22	66
Health	10	3	13
Knowledge	4	5	9
Organisation	19	11	30
Pride	12	3	15
Relaxation	4	1	5
Sharing	18	10	28
Social	86	11	97
Surplus	6	9	15
Weather	83	11	93
Wildlife	56	9	65

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199 **Table 2.** Analysis of positive or negative emotions associated with different primary themes of notes written in

200 allotment diaries over the course of a year.

Theme	Positive comments	Negative comments
Emotional	25	19
Health	4	6
Knowledge	0	0
Organisation	2	9
Pride	11	0
Relaxation	1	0
Sharing	18	0
Social	71	3
Surplus	6	0
Weather	23	60
Wildlife	39	17

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3.2.Specific themes and examples

Comments related primarily to the Emotional theme comprised 13.1% of responses. They generally captured a spontaneous observation of a participant's emotional response to their presence on the plot, for example, "A lovely morning: just right to be down on the allotments!" (18/11). Positive comments such as this were 57% of the Emotional theme; the other 43% were negative. The negative responses were often related to outside influences, such as "Dictatorial council inspected the allotments!!" (31/03), or "Today was a sad day. I helped [a fellow plotholder] to bury his pet dog at the bottom of his allotment" (16/06).

Primarily health-related responses made up 3% of responses. These were often related to physical health, both pertaining to events occurring in the course of allotment gardening, such as "Hurt my back :(" (25/03), or general health consequences of gardening, such as "Who needs the gym!! I'm 70 next year!!" (16/06). Mental health was also discussed, always in positive language, such as "The plot is my safe place. It is my mental health balancer" (31/12). Negative health-related comments were all to do with accidents while gardening, such as the above participant who hurt their back, and positive comments were more general and related to the overall benefit of having an allotment for physical and mental health.

The theme of knowledge made up 1% of responses, either through advice such as "Hoe when you can't see a weed and you will never see a weed" (08/05) or uncertainty such as "Still not sure about funny courgettes, if they're squashes or not. Only time will tell" (11/08). All these comments were neutral emotionally, not positive or negative.

Organisation-related responses were 6% of the total. These were defined as comments primarily relating to the organisation of allotments at a site-wide level, such as participation in community events or the management of a site and involvement in committee activities. Committee activities ranged from annoyance such as "As a member of the committee -

covered a vacant plot with tarpaulin to prevent weeds spreading. Also tidied up a bit of rubbish. It's amazing what some plotholders dump!" (20/05) to positive engagement such as "Allotment Association Working Party with 5 helpers" (14/01) and "Helped sort out seed potatoes in the shop = main reason for visit. Put up notices re volunteers for working party, shop opening & shop rota" (13/03). Of these comments, 81% were negative and related to having to deal with outside influences on the plot, such as the local council or new rules, suggesting that people have a strong sense of plot ownership and personal space that they do not like to be interfered with.

Comments on the theme of Pride were another 3% of responses. These were intrinsic observations or external validation from competition results, and all were positive comments. For example, "Autumn show 4 bunches herbs - 3rd, carrot - 2nd, sweetcorn - 1st place, melon - 1st place, sugar snap peas - 3rd. Proud day :)" (08/09) and the more general "Allotment looking good" (02/11).

Another 1% of comments were on the theme of Relaxation. For example, visiting just to spend time on the plot – "Just looked around" (30/06) – or satisfaction after hard work - "Pooped now. Time for a beer!" (20/04).

The theme of Sharing occurred in 5% of comments. These were always related to having surplus produce, or social connections: "Left all my dahlia tubers in a box near the allotment gates with a note saying 'For anyone who wants them'" (22/05), "The "April" cabbage seed I planted are ready to move on. I will have far more than I need so will share!" (19/09), and "Brought tray of green broccoli plants from home to plot greenhouse. Gave some away to plot neighbours" (21/04). Along with the Social and Surplus categories, Sharing related comments demonstrate the networks of free exchange and mutual help that exist as part of having an allotment. All Sharing comments were positive.

Social observations were the most dominant form of response, with primary-type Social comprising 25% of observations. Mostly this was related to chatting and socialising with fellow plotholders, such as “Cut a cucumber for a friend on another plot. Drank a bottle of sparkling apple juice and had a laugh with two fellow allotmenteers!” (08/07) and “Spent too much time talking and not enough gardening! Must try harder tomorrow” (12/11). There were also incidents of bringing non-plotholders onto site such as “Took a walk around the allotment site to show a friend the place and just to enjoy it in its spring glory!” (05/05) and contributing to the wider community such as “Spent the morning 11am-1300 at my old allotment site encouraging them to vote” (28/10). Of these comments, 96% were positive.

The theme of Surplus related to having surplus produce and made up 2% of responses, such as “Didn't pick veg because too much waiting in the kitchen to be eaten already!” (28/08). This also connected to sharing of such produce, including in the wider community, such as “Spinach and loads of courgettes which we put outside the house "Help Yourself!"” (06/07). All such comments were positive.

Weather was the second most dominant category for the primary response type, with 24% of entries discussing the weather. The allotment survey was conducted in 2018, where record-breaking heatwaves and drought hit the United Kingdom during the summer, which may explain a heightened and more emotional focus on the weather than would otherwise be expected. For example, “No-one can remember when it last rained”, “No rain for at least two months” (24/06 and 18/07, from the same participant), and “RAINED AT LAST!!” (30/07). Weather was most often talked about in negative terms due both to the effect of the drought on crop productivity but also structural damage to plot items such as greenhouses in autumn and winter storms. Negative comments about the weather made up 72% of occurrences.

Wildlife was the dominant theme in 16% of responses. These were of varying emotions, such as "B****** squirrel. It had all my cobnuts & 80% of my apples" (14/10). When wildlife was not interfering with the plotholders' gardening, observations were mostly made of animal behaviour, such as "Two seagulls fighting over scrap of food. A crow joined in like a boxing referee. The gulls fought so much they dropped the food and the crow nipped in and stole it! You had to be there" (04/05) and "Fox sitting at gate – resident on site" (14/01). 70% of comments about wildlife were positive.

4. Discussion

Here, we have uncovered the different ways that allotment gardeners interact with their growing space through unprompted thoughts and observations related to several key themes. These themes demonstrate that whilst the overarching purpose of allotment gardening is one of food production, co-benefits for participants' nature connectedness, social capital and mental wellbeing also arise as strong themes. Previous research, demonstrating that participation in UH can improve quality of life, is therefore supported by our findings here; and there is no evidence that the benefits uncovered in this paper do not occur more widely in other UH contexts. Further to this, we have also found that the benefits of allotment gardening have the potential to extend beyond the gardeners themselves, with participants talking about friends and family visiting and helping on their plots, as well as the potential to share surplus produce amongst the wider community. Overall, our results confirm the findings of Genter *et al.* (2015) that "Allotment gardening provides stress-relieving refuge, contributes to healthier lifestyle, creates social opportunities, provides valued contact with nature, and enables self-development". This study has demonstrated that these findings of Genter *et al.* on allotment gardening groups also apply to individual allotment gardeners.

The observations offered by participants in this project fell broadly into two categories: interactions with other humans, and interactions with the natural world.

Interactions with other humans were generally spoken of in positive terms, except for negative interactions with outside authorities such as the council, or when plotholders were dealing with vandalism or break-ins at the plot. Most interactions, however, demonstrate that allotment gardeners have strong social links with other members on their sites, participating in knowledge exchange regarding plot management practices, free sharing of tools, surplus produce and seeds, and participation in activities related to the organisation of the site. Many plotholders spoke of bringing friends, children or grandchildren onto their plot to help them with food growing activities, and a large amount of the time spent on allotments is shown by this study to be involvement in social activities such as chatting and sharing cups of tea.

Participants also demonstrated a high level of engagement with the natural world and wildlife, from comments about the beauty of flowers and being outside, to specific observations about wildlife. When observing wildlife, participants mentioned the same animal (for example, a particular fox or frog) on multiple occasions, which shows that repeated visits to a specific place, such as an allotment, create human-nature bonds that are revisited throughout the year. As may be expected, participants also demonstrated a high level of engagement with the weather and changing seasons. Most comments about the weather were negative, and whilst this may corroborate British stereotypes, it also demonstrates an awareness and connection to the changing weather systems that show allotment gardeners have a depth of knowledge of the effect of weather patterns on their plot productivity, and ability to successfully cultivate their land

The overall benefit of a year spent visiting an allotment, which requires an average of 55 visits, and 190 hours (Edmondson *et al.*, 2020), was mentioned in positive terms in regard to

mental health and time spent outdoors observing and directly participating in activities related to nature and growing. A sense of pride and ownership of successful gardening was a strong theme, showing that food growing can help people feel fulfilled and productive. Overall negative comments about organisation-related activities such as local council involvement with allotments, combined with the positive comments regarding prizewinning at allotment shows, demonstrate that a strong sense of personal ownership is prevalent amongst allotment gardeners.

Allotment gardens clearly provide a multiplicity of benefits for their tenants. However, the number of allotments in the UK has declined by almost two-thirds since the 1950s, with the most deprived urban areas experiencing eight times the level of closures as the least deprived (Dobson *et al.*, 2020). Research has demonstrated that gardening can be an important way for deprived communities to improve mental and physical health as well as create stronger, more resilient community networks (Travaline and Hunnold, 2010; Milbourne, 2012; Poulsen *et al.*, 2014). Our findings add to these by demonstrating that nature connectedness can also be added to the list of benefits for these communities; lower levels of green space access are associated with loneliness (Maas *et al.*, 2009), and more deprived communities in the UK have less access to greenspace (Jones *et al.*, 2009). Improving access to land for UH, not only in the form of allotments but also the broader swathe of soil-based UH such as community gardening projects, could therefore be one avenue to improve the standards of living in deprived urban areas. Further research would be needed to elucidate whether allotment gardening is addressing specific mental or physical health problems, or more generally contributing to overall wellbeing; this would allow policymakers to target horticultural therapy interventions to deal with specific issues. In general, this study should provide valuable evidence to policymakers of the benefits to be gained for communities from maintaining, preserving and increasing access to allotment gardening: it demonstrates a broad

spectrum of issues (such as individual mental health, nature connection and social capital) that are benefited by allotment gardens. As cities expand their urban horticultural activities, this study demonstrates that focusing on co-benefits beyond food production means that urban horticulture can be addressed from a number of policy perspectives, such as physical health, nutrition, mental health and community cohesion.

The findings of this article also present a number of possible future avenues for research. Firstly, the definition of the term ‘horticulture’; here, we have focused on allotments cultivated for fruit and vegetables, but gardeners often also cultivate ornamental flowers. Horticultural therapy literature often covers both the cultivation of fruit and vegetables, and the cultivation of ornamental plants; in future research, investigating whether wellbeing benefits differ between those who do and do not also cultivate flowers could present some interesting findings. Secondly, this project discussed only allotments cultivated privately by individuals or families; a targeted study comparing the wellbeing benefits of allotments for gardeners such as our participants, and other allotment-based projects such as allotments for schoolchildren or refugee communities, could elucidate the specific nature of gardens where wellbeing is maximised, to provide clear evidence to produce policy guidelines to maximise wellbeing on a plot. Using unprompted comments, such as we have done here, has resulted in a non-standardised data set; this is both a limitation and a unique aspect of this study. Further research mirroring the approach of us here where we assess gardeners year-round should involve targeted questions about wellbeing at different points in the year; but also preserve the space for unprompted comments, as many unique observations from participants arose in this way. One way to do this would be to conduct longer semi-structed interviews with gardeners at regular intervals throughout the year; more detailed insight from gardeners rather than the brief entries we have analysed here could provide some interesting results.

In conclusion, the findings of this project echo the statement, "'Local food projects' in urban areas are not really about food, and are best described as community projects with food as the pretext and a vector for social agency and the development of community capacity" (Maye 2019). This was captured by one participant's end of year reflection: "Read back the year's diary. Sat + reflected upon the year. The plot is my safe place. It's my mental health balancer. Peaceful, but sociable, accepting, a place to connect, to disconnect. A place to grow, to write, to accept that things die and turn to compost. To be me without being judged. To eat and share food, drink + friendship. Not tidy or regimented, it changes + develops. It flowers and envelopes blossoms and blooms or freezes and browns. The bird song at all times, the outside industrial noises of the docks, roads, next door's motorbike, generator, chainsaw, rotavator, strimmer, friends, but mostly... it's mine. It's my little piece of earth, the planet. I aim for no chemicals, using rainwater, last year's seeds, cuttings, pots donated, second hand stuff made into plant containers. A calm place to listen, to cry, to eat, to welcome friends, to walk around + know deep in my heart here, I feel connected, balanced (despite the wobbly deckchair) and recharged. I'm drawn here in the winter to the stark bareness of it all. Stripped back to the structure, paths + beds defined, perennials on show, spring bulbs daring to peek out... It's time for soup. Thank you for this diary. It helps me to write so some days you've helped my mental health" (31/12).

As the quote demonstrates, there is a spectrum of benefits aside from food production that allotment gardening can provide: peace, health, social interaction, nature connectedness, commensality, recycling and a feeling of autonomy, pride and ownership of one's allotment plot. In an increasingly disconnected, socially isolated society where the idea of 'nature deficit disorder' in cities is connected to increasing mental health problems (Louv, 2005), this study has shown that the activity of allotment gardening, and by implication other forms of urban horticulture, can play a role in helping people to deal with many aspects of the issues

facing communities in urban areas. Waiting lists for allotments are often long (Campbell and Campbell, 2013), suggesting that increased allotment provision could bring these benefits to many more people than presently provided for.

References

1. Acton, L. (2015). *Growing Space: A History of the Allotment Movement.* Five Leaves Publications, Nottingham.
2. Banks, J., & Xu, X. (2020). The mental health effects of the first two months of lockdown and social distancing during the Covid-19 pandemic in the UK. *IFS Working Paper W20/16.* https://www.ifs.org.uk/uploads/WP202016-Covid-and-mental-health.pdf. (Accessed 12 June 2020)
3. Blair, D., Giesecke, C. C., & Sherman, S. (1991). A dietary, social and economic evaluation of the Philadelphia urban gardening project, *Journal of Nutrition Education*, Vol 23 No 4, pp.161-167.
4. Campbell, M., & Campbell, I. (2013). Allotment waiting lists in England 2013. *Transition Town West Kirby, National Society of Allotment and Leisure Gardeners, United Kingdom*. http://www.transitiontownwestkirby.org.uk/files/ttwk_nsalg_survey_2013.pdf (Accessed 20 March 2020)
5. Church, A., Mitchell, R., Ravenscroft, N., & Stapleton, L. M. (2015). 'Growing your own': A multi-level modelling approach to understanding personal food growing trends and motivations in Europe. *Ecological Economics*, Vol 110, pp.71-80.

6. Crouch, D., & Ward, C. (1997). *The allotment: its landscape and culture*. Five Leaves Publications, Nottingham.
7. Curtin, S. (2009). Wildlife tourism: The intangible, psychological benefits of human–wildlife encounters. *Current Issues in Tourism*, Vol 12 Nos.5-6, pp.451-474.
8. Dobson, M. C., Edmondson, J. L., & Warren, P. H. (2020). Urban food cultivation in the United Kingdom: Quantifying loss of allotment land and identifying potential for restoration. *Landscape and Urban Planning*, Vol 199(103803). https://doi.org/10.1016/j.landurbplan.2020.103803
9. Edmondson, J. L., Cunningham, H., Densley Tingley, D. O., Dobson, M. C., Grafius, D. R., Leake, J. R., McHugh, N., Nickles, J., Pheonix, G. K., Ryan, A. J., Stovin, V., Taylor Buck, N., Warren, P. H., & Cameron, D. D. (2020). The hidden potential of urban horticulture. *Nature Food* Vol 1 No 3, pp.155–159. https://doi.org/10.1038/s43016-020-0045-6
10. Fleischer, E. (2018). Doctors in Scotland can now prescribe nature. *World Economic Forum Agenda,* https://www.weforum.org/agenda/2018/10/doctors-in-scotland-can-now-prescribe-nature (Accessed 29 January 2020)
11. Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). *Psychological benefits of greenspace increase with biodiversity*. Biology letters, Vol 3 No 4, pp.390-394.
12. Genter, C., Roberts, A., Richardson, J., & Sheaff, M. (2015). The contribution of allotment gardening to health and wellbeing: a systematic review of the literature. *British Journal of Occupational Therapy*, Vol 78 No 10, pp.593-605.
13. Harris, N., Minniss, F. R., & Somerset, S. (2014). Refugees connecting with a new country through community food gardening. *International Journal of Environmental*

Research and Public Health, 11(9), 9202-9216. https://doi.org/10.3390/ijerph110909202

14. Jones, A. P., Brainard, J., Bateman, I. J., & Lovett, A. A. (2009). Equity of access to public parks in Birmingham, England. *Environmental Research Journal* Vol 3 Nos.2-3, pp.237-256.

15. Louv, R. (2005). *Last child in the woods: saving our children from nature-deficit disorder.* Algonquin Books of Chapel Hill, Chapel Hill, NC.

16. Martin, G., Clift, R., & Christie, I. (2016). Urban cultivation and its contributions to sustainability: nibbles of food but oodles of social capital. *Sustainability*, Vol 8 No 5, pp.409-427.

17. Mass, J., van Dillen, S. M. E., Verheij, R. A., & Groenewegen, P. P. (2009). Social contacts as a possible mechanism behind the relation between green space and health. *Health Place*, Vol 15 No 2, pp.586-595. https://doi.org/10.1016/j.healthplace.2008.09.006

18. Maye, D. (2019). 'Smart food city': conceptual relations between smart city planning, urban food systems and innovation theory. *City, Culture and Society*, Vol 16, pp.18-24.

19. Mbow, C., Rosenzweig, C., Barioni, L. G., Benton, T. G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M. G., Sapkota, T., Tubiello, F. N., & Xu, Y. (2019). Food Security. In: *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems* [Shukla, P. R. *et al.* (eds.)]. In press.

20. Mcdougall, R., Rader, R., & Kristiansen, P. (2020). Urban agriculture could provide 15% of food supply to Sydney, Australia, under expanded land use scenarios. *Land Use Policy*, Vol 94, 104554. https://doi.org/10.1016/j.landusepol.2020.104554

21. Milbourne, P. (2012). Everyday (in)justices and ordinary environmentalisms: community gardening in disadvantaged urban neighbourhoods. *The International Journal of Justice and Sustainability*, Vol 17 No 9, pp.943-957. https://doi.org/10.1080/13549839.2011.607158

22. NHS Providers (2020). Coronavirus briefing: The impact of COVID-19 on mental health trusts in the NHS. https://nhsproviders.org/media/689590/spotlight-on-mental-health.pdf. (Accessed 12 June 2020)

23. OECD/European Union (2018). *Health at a Glance: Europe 2018: State of Health in the EU Cycle*, OECD Publishing, Paris/European Union, Brussels, https://doi.org/10.1787/health_glance_eur-2018-en.

24. Ohly, H., Gentry, S., Wigglesworth, R., Bethel, A., Lovell, R., & Garside, R. (2016). A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. *BMC Public Health*, *16*, 286. https://doi.org/10.1186/s12889-016-2941-0

25. Popping, R. (2015). Analyzing open-ended questions by means of text analysis procedures. *Bulletin de Méthodologie Sociologique*, Vol 128, pp.23-39.

26. Poulsen, M. N., Hulland, K. R. S., Gulas, C. A., Pham, H., Dalglish, S. L., Wilkinson, R. K., & Winch, P. J. (2014). Growing an urban oasis: A qualitative study of the perceived benefits of community gardening in Baltimore, Maryland. *Culture, Agriculture, Food and Environment* Vol 36 No. 2, pp.69-82. https://doi.org/ 10.1111/cuag.12035

27. R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org
28. Richards, H. J., & Kafami, D. M. (2008). Impact of horticultural therapy on vulnerability and resistance to substance abuse among incarcerated offenders. *Journal of Offender Rehabilitation, 29*(3-4), 183-193. https://doi.org/10.1300/J076v29n03_11
29. Ryan, G. W., & Bernard, H. R. (2003). Techniques to identify themes. *Field Methods* Vol 15 No 1, pp.85-109.
30. Schmutz, U., Lennartsson, M., Williams, S., Devereaux, M., & Davies, G. (2014). The benefits of gardening and food growing for health and wellbeing. *Garden Organic and Sustain*. https://www.sustainweb.org/secure/GrowingHealth_BenefitsReport.pdf (Accessed 28 January 2020)
31. Soga, M., Gaston, K. J., & Yamaura, Y. (2017a). Gardening is beneficial for health: A meta-analysis. *Preventive Medicine Reports*, Vol 5, pp.92-99.
32. Soga, M., Cox, D. T., Yamaura, Y., Gaston, K. J., Kurisu, K., & Hanaki, K. (2017b). Health benefits of urban allotment gardening: improved physical and psychological well-being and social integration. *International journal of environmental research and public health*, Vol 14 No 1, pp.71-84.
33. Travaline, K., & Hunold, C. (2010). Urban agricultural and ecological citizenship in Philadelphia. *The International Journal of Justice and Sustainability*, Vol 15 No 6. https://doi.org/10.1080/13549839.2010.487529
34. United Nations (2019). Department of Economic and Social Affairs, Population Division. *World Urbanization Prospects: The 2018 Revision. (ST/ESA/SER.A/420).*

35. Vaughn, P., & Turner, C. (2016). Decoding via coding: Analyzing qualitative text data through thematic coding and survey methodologies. *Journal of Library Administration,* Vol 56 No 1, pp.41-51.

36. Wells, N. M., & Evans, G. W. (2003). Nearby nature: A buffer of life stress among rural children. *Environment and Behaviour,* Vol 35 No 3, pp.311-330.

37. Wood, C. J., Pretty, J., & Griffin, M. (2016). A case–control study of the health and well-being benefits of allotment gardening. *Journal of Public Health,* Vol 38 No 3, pp.e336-e344.