Grow your own: A Review of the Environmental and Social Impacts

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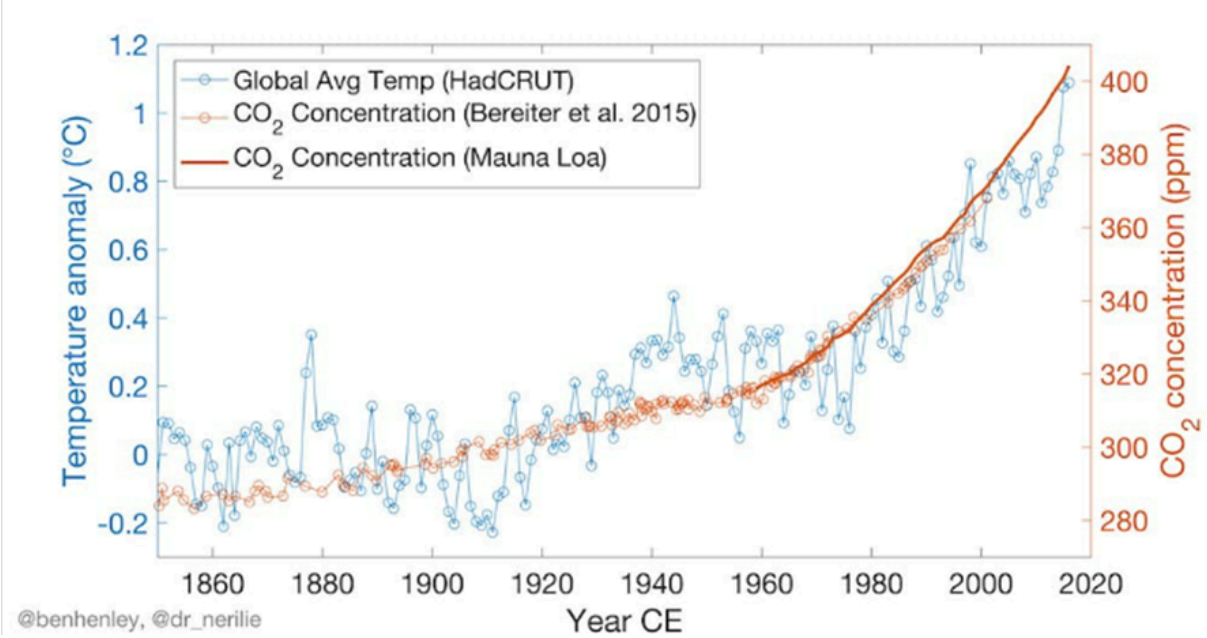


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The average global temperature has risen by 1.2 degree Celsius since 1750 [1] as the carbon dioxide concentration has increased from 280 parts per million in 1750 to 421 parts per million in May 2022 as measured at the NOAA's Moana Lua Atmospheric Baseline Observatory [1](Figure 1). This graph shows the exponential rise in atmospheric carbon dioxide which directly correlates to a 1.2 degree rise in average global temperature. This is the context within which this analysis of the impact of 'Grow Your Own' is set which shows the scale of the climate crisis with the global target of keeping global temperatures below 1.5 degrees not going to be met due to the lack of action on all scales, from locally to internationally. All of these scales are critical in mitigating climate change. For example, international agreements are crucial in ensuring that national governments can cooperate in order to reduce global emissions as seen in the annual COP conferences. However, local mitigation of climate change is also essential, for both holding governments to account and for directly mitigating the effects of climate change and the loss of biodiversity.

Grow your own schemes can be part of these local solutions through increasing the carbon content of the soil compared to lawns or waste land and through increasing biodiversity by supporting a wider range of insects and other biodiversity through increasing the diversity of plants present in a habitat. Although, local initiatives are often very small scale and therefore, have a very small impact on a global scale, they can increase awareness of climate change and drive local and national governments to mitigate climate change. Local initiatives such as Grow Your Own can also have social benefits which means these schemes should be pursued despite the limited environmental impacts. This report written for Abingdon Carbon Cutters and One Planet Abingdon will analyse the impact of Grow Your Own initiatives over four key areas: carbon emissions, food security, biodiversity and social impacts.

Figure 1: Showing the historic atmospheric levels of carbon dioxide in parts per million alongside the global average temperature change. [2]



There are three ways which Grow Your Own schemes can reduce the carbon emissions of a community. These are by directly reducing the emissions from food consumed by the community by growing more vegetables locally and therefore reducing the requirement for food to be imported from abroad, reducing carbon emissions from transport. Indirect emissions are also likely to be reduced through these schemes as they can raise awareness of the climate emergency and therefore, may prompt people in the community to make other climate friendly choices such as using the car less or taking the train instead of flying. These decisions are likely to reduce the carbon emissions of a community by a greater extent than the direct emissions decrease from locally sourced food.

Grow your own schemes can also increase the soil carbon content which is one of the main ways of sequestering more carbon from the atmosphere. Soils already contain 38000 gigatonnes of carbon globally and have the capacity to store significantly more carbon. Soils are by far the largest terrestrial store of carbon and therefore, increasing the carbon content of soils will allow for climate change to be mitigated at a significantly higher rate. This can also be done relatively easily by implementing different farming techniques and planting different plants to increase

the soil carbon content and the soil health of the area. However, due to the nature of Grow Your Own schemes which tend to encompass small community gardens or allotments the effect of this is likely to be small with the main opportunity for sequestering carbon in soils coming from changing commercial farming practices. However, it is still important as many local projects nationally can still have an impact and further raise awareness reducing indirect carbon emissions and influencing government decisions on farming regulations which could encourage farmers to farm their land to increase the soil carbon content in order to mitigate climate change. Therefore, although the direct reduction in carbon emissions may be small, local initiatives such as Grow Your Own are still crucial in mitigating climate change.

Grow your own schemes are also linked with food security. This is typically linked to ideas from World War II where the general population was encouraged to grow their own vegetables in their gardens to reduce the amount of food that needed to be imported as imported food had to be imported by boats which were vulnerable to attacks from German U-boats. However, this took place over 80 years ago and due to the accelerating rate of globalisation which has led to the ever-decreasing friction of distance, food imports have risen significantly since WW2 due to changing lifestyles and diets. This means the UK is now unlikely to ever become completely self-sufficient in food production as the expectations and diets of the UK population now include imported foods very regularly. The share of homegrown food consumed in the UK has steadily declined since 1990 to 55% in 2019[3] and is likely to continue to do so despite local Grow Your Own projects. However, it is possible that extreme circumstances such as another war in Europe could lead to ‘Dig for Victory’ style campaigns returning leading to skills gained from these Grow Your Own initiatives being essential for the food security of the UK. However, this is highly unlikely to occur.

Grow your own Survey Outline and Limitations

A survey on the subject of Grow Your Own has been conducted by One Planet Abingdon Climate Emergency Centre and Abingdon Carbon Cutters as part of Abingdon Town Council's Green Forum which has been running for several cycles including focuses on sustainable transport and waste. The Grow Your Own survey collected 59 responses with 24 questions asked over a range of topics including the reasons why respondents did or did not grow their own vegetables, skills gained from growing vegetables and demographic questions including age and gender. These questions allow a range of conclusions to be made as well as policy recommendations to be made. However, there are limitations with the survey which means any conclusions made from the survey may not be relevant to the general population.

There is significant bias present in the respondents of this survey as they are likely to be predominantly people that are already engaged with the climate emergency and the organisations that created the survey. As this survey was advertised in the Abingdon Climate Centre, at stalls promoting the climate crisis and through networks of residents that are already climate aware, this means the survey is highly unlikely to be representative of the general population. Furthermore, as this survey was conducted and publicised by local organisations in Abingdon, the respondents are also from Abingdon and therefore the results from this are representative of climate aware people in Abingdon. However, this survey is still useful for assessing the opinions of this group of people and for developing policy suggestions for the previously mentioned organisations to promote grow your own initiatives.

The demographics that responded to this survey are also more likely to be those that already engaged in growing their own food as indicated by the higher than average 85% of respondents stating that they grow their own fruit or vegetables. Therefore, the high percentage of respondents (63%) that state that they would like to see a communal growing space in their neighbourhood may not reflect the interest that would be present from people that do not grow their own food already. This reflects the general lack of engagement present in the topic of grow your own, especially among young people. Furthermore, with 53% of respondents being over 55 and 83%

being female, this clearly illustrates the bias present in the respondents of the survey. Other demographics such as financial status are not included in this survey which may be relevant to the responses as the rise of grow your own in the UK is associated with an increase in the practice from older, middle-class households which are the group most represented in this survey. Therefore, the attitudes of other groups are likely to differ from the respondents of this survey. However, without data on the economic and social status of the wider Abingdon population, it is not possible to compare the demographics of the respondents to the wider population of Abingdon. However, it is a useful survey in analysing the attitudes towards grow your own as well as the potential impacts that it has on people and the community.

Grow your own – Carbon Emissions Impact

There are three main aspects to the impact of grow your own schemes on carbon emissions as indicated earlier: decrease in direct carbon emissions, decrease in indirect carbon emissions through increased awareness and behavioural change and increase in soil carbon content sequestering carbon from the atmosphere. Each of these are important and significant on a global scale however with local initiatives increasing awareness of the climate crisis leading to changing attitudes to climate change is often the most powerful way of reducing local carbon emissions.

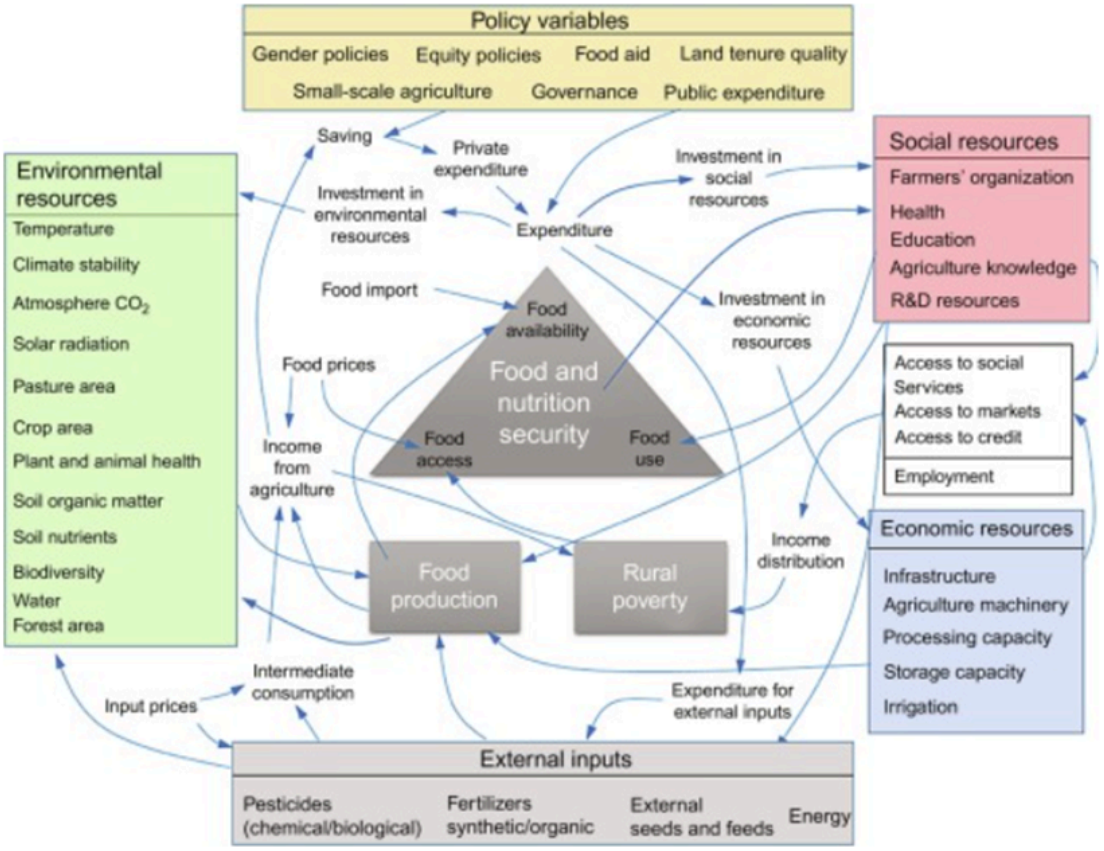
Changing perceptions of climate change and raising awareness of the impacts of climate change can be implemented into a grow your own initiative through education whilst undertaking the project as well as general awareness generated by the project being present within the town. This can influence people's decisions not directly related to the initiative such as choosing to use their car less or taking the train instead of flying. This can save hundreds of kilograms of carbon dioxide from being emitted into the atmosphere by each person which if this affects a whole community could lead to a decline of hundreds of tons of carbon dioxide emitted. Compared to the 37 billion tons[4] of carbon dioxide that is emitted every year from anthropogenic (human) causes, this may seem insignificant. However, it is through behavioural changes on a national and international scale combined with government intervention that will lead to the decline in global emissions. Therefore,

by pioneering a grow your own initiative with follow up assessments of the impact, this could lead to an increased rollout of these initiatives nationally or internationally. A scheme for having community gardens within 15 minute walk of 80% of citizens in New York has already been considered.[5] Therefore, despite Abingdon community gardening potentially having a very small impact on national or global emissions, the impact it may have over time as an indicator of what can be done to change behaviour in the general population may lead to it having a significant wider impact in the long term as a pioneer project. In the survey conducted by Abingdon Carbon Cutters and One Planet Abingdon 36% of respondents indicated that they engaged in grow your own in order to reduce their carbon footprint or reduce transport emissions. This indicates that within the general public, there is a belief that these projects can make a significant difference on this which for each individual is true but relative to the national carbon emissions, grow your own has a very small effect on reducing direct carbon emissions.

The direct reduction in climate emissions from grow your own initiatives are derived from the reduced food miles that the food is transported from source to consumption if food is grown locally. There are many aspects of the food system summarised in figure 2 below that have reduced carbon emissions if food is grown locally. For example, reduced transport on planes, ships or lorries in order to transport food to communities will reduce direct carbon emissions. The average lorry in the United States of America emits 223 tonnes of carbon dioxide per year[6] which means if even 5 trucks are removed from the roads due to decreased demand due to increased local growth of food, this would remove over 1000 tonnes of carbon dioxide being emitted into the atmosphere. Each lorry can carry up to 30 tonnes of food in one trip whereas a community garden will produce a fraction of this amount in one year. Therefore, in order to tackle direct carbon emissions from transport, making the transport more efficient will decrease carbon emissions by a significantly greater amount than community gardens. This is only one aspect of the food system that will have decreased carbon emissions from local food growth however it illustrates the scale of food consumption in the UK and therefore how community gardens and other grow your own projects will have a minimal effect on direct carbon emission reduction. However, over a national scale this could reduce direct carbon emissions but again compared to the national carbon emissions in the UK of 512

million tonnes[7] in 2022 this is still a very small effect. Therefore, the direct carbon emission reduction from these projects is very small which means the indirect carbon emission reduction by raising awareness of climate change and increasing pressure on national governments to make top-down carbon reduction actions which will make a significantly greater difference. For example, one return flight from London to New York would add 1.956 tonnes[8] to an individual's carbon emissions which means that if 110 people in the UK choose not to take this flight each year, this would achieve the same reduction in carbon emissions as removing one lorry from the road. This process is also being accelerated by the rise of home working and online meetings. Therefore, increasing these behavioural choices will have a significantly greater impact on reducing carbon emissions than reducing the direct carbon emissions from food production.

Figure 2[9]: Indicates the complexities of the food supply system and therefore how carbon dioxide emission reductions can come from many areas within the supply chain.



Community gardens and other grow your own projects can also have an influence on the soil carbon content of land through implementing methods of increasing the soil carbon content such as reducing disturbance of the soil and planting perennial plants. Perennial plants are present for longer in the soil and therefore provide greater structure to the soil and transfer more carbon from the atmospheric store of carbon to the soil store of carbon through photosynthesis and then the growth of root systems. Soil carbon stores are also less volatile than other carbon stores which means if the management techniques are maintained for long periods of time the carbon can be stored in the soil for the long term. However, the impact of this increased soil carbon content will again be insignificant compared to the national carbon dioxide emissions particularly as grow your own projects are typically at an extremely small scale such as a small patch of a garden. Therefore, the main benefits from this method of mitigating climate change will come from commercial farmers adopting these practices such as ending deep ploughing.

One method of increasing soil carbon content is by increasing the plant diversity present which is positively correlated with increased soil carbon content.[10] This can be easily implemented in most gardens where there is typically a monoculture of grass making up a lawn which can be relatively easily diversified by creating a wildflower meadow. Although this is not ‘grow your own’ specifically, it is another aspect of local methods of mitigating climate change that can be easily marketed alongside grow your own initiatives. This can also be implemented by councils such as through implementing ‘No Mow May’ and through planting wildflower meadows in order to provide a large diversity of flowers when it is most critical for insect populations in May and therefore help support urban populations of insects. Therefore, the impacts of these initiatives on species biodiversity is likely to be significantly greater than the impact on soil carbon content. This is due to the scale of the problems as biodiversity can be increased locally whereas carbon dioxide concentration in the atmosphere is a global problem which means locally climate change cannot be ‘reversed’.

However, the impact of grow your own initiatives on soil carbon content is very small relative to national emissions. For example, using regenerative farming practices in the Stonehill Community Garden could lead to 1 tonne of carbon being sequestered

into the soil every year. Although this is a significant amount of carbon, as it equates to 3600 miles of driving an average petrol car, the changes in travel behaviour could lead to a significantly greater decline in carbon emissions in the long term, especially if alternative technologies such as electric cars are adopted at a higher rate. Furthermore, it has been estimated that 0.76 tonnes of carbon dioxide is sequestered every year per acre by cover plants which are typically used in vegetable patches which corresponds to 33 kilograms of carbon dioxide per metre squared. There are roughly 23 million gardens in the UK with 87%[11] of people wanting to bring more wildlife into their garden. Therefore, if grow your own can be advertised effectively in order to increase the percentage of people in the UK that have a vegetable patch from 28%[12] to just 30%, this could sequester 1.3 million metric tonnes of carbon dioxide every year or 0.25% of the United Kingdom's annual emissions. Clearly, this estimate has a very high error within it due to the assumptions made such as assuming the average size of a vegetable patch as 6 m^2 however it does illustrate the scale of the carbon that could be sequestered in gardens. Therefore, although this is a small percentage, it can have an impact on national carbon emissions alongside other local projects that may have similar impacts.

In terms of reducing carbon emissions and therefore mitigating the effects of climate change, grow your own initiatives have the capacity to be a part of the solution for this at a national scale. This is through the combination of reductions in carbon emissions directly from the food supply chain, indirectly through increased awareness and behavioural change and by increasing the soil carbon content using grow your own projects. Therefore, this aspect of the impact of grow your own is significant which is reflected in the opinions of respondents in the survey associated with this report where 34% of respondents mentioned reducing their carbon footprint. However, the analysis of the reduction in carbon footprint indirectly caused by behavioural change from grow your own projects is extremely hard to measure and assess the effectiveness of. Despite this, grow your own initiatives can make up part of local projects to mitigate climate change.

Grow your own: Impact on Food Security

Historically, grow your own initiatives have been associated with promoting national and local food security particularly within wartime such as the ‘Dig for Victory’ campaign by the British Government during World War II. This campaign led to 18% of vegetables by value being produced in gardens and allotments across the UK during this period. However, this was a period of national emergency which led to significantly higher uptake from the general population of the grow your own initiative than is likely to be present in the modern day despite many scientists viewing climate change as a greater international emergency than World War II was in terms of the potential for people to die. Therefore, it is highly unlikely that 18% of vegetables produced in allotments or gardens will ever be reached again in the twenty first century. However, demand for allotments has been rising in the UK with more than 75000 people on allotment waiting lists in 2013[13] indicating that demand is rising to take part in these projects although historically demand for allotments is still far lower than the peak demand present in the 1950s. It has been estimated that grow your own makes a small but significant contribution to local food security in urban areas such as Sheffield where approximately 3% fruit and vegetables consumed in the city is grown on allotments. This could be increased to 15% by converting just 10% of the land identified as suitable for grow your own projects into land to grow vegetables. This means local grow your own initiatives could have a significant impact on the national food security of the UK.

Furthermore, having grow your own projects in urban areas provides greater access for people to these projects, amplifying the social benefits discussed in this report, as well as providing ‘biodiversity islands’ in urban areas. However, in order to benefit from the food security aspect of these projects, it will require more than encouraging homeowners to grow their own vegetables in the garden as community led projects such as the Stonehill Community Garden and others will be required as well as larger council led projects in public spaces. Increasing the scale of these projects will lead to the decline of many of the factors that are preventing people from undertaking grow your own projects at the moment. For example, allotments can

cost up to £300 per year to rent as well as purchasing seeds and other equipment and the estimated 150 hours per year it takes to maintain. Therefore, by having community led projects, each of these are shared between many more people which means it is much easier for new people to engage in grow your own projects and therefore is where policy should be heading in this area with regards to increased engagement. If this occurs then the food security aspect of grow your own projects will become much more significant on a national scale rather than as an addition to the local people that run the allotments. Other social benefits could also be derived from more large-scale projects such as having a sufficiently high yield to donate a portion of the vegetables grown to local foodbanks to increase the quantity of fresh produce which they are able to give out to supplement tins and other long life goods which are regularly given out by these organisations.

According to the survey conducted for this report, 15% of respondents that engage in grow your own do this as they are worried about food security particularly in the future with threats to national food security from climate change. Therefore, this suggests that people may be willing to engage in grow your own in order to increase food security as well as to reduce direct carbon emissions. This may be an important aspect of advertising these schemes in order to increase engagement which will then increase the benefits gained from the scheme and reduce the significance of the factors reducing engagement such as time and financial commitment.

Therefore, the impact on food security from grow your own projects has the capacity to be significant if both national and local governments prioritise them in policy decisions particularly in town planning with more public land assigned to these projects. This would allow the percentage of vegetables consumed from these projects to grow and reduce the requirement for many vegetables to be imported from abroad. However, there is a limit to the extent that food security can be increased by grow your own projects as the modern diet contains many fruits and vegetables which cannot be grown in the UK such as avocados, which means without using heated greenhouses which have high carbon emissions, these fruits and vegetables will still need to be imported from abroad. However, in a time of national emergency parallel to that seen in World War II with a blockade on trade, having the infrastructure and skills to be able to grow essential vegetables would be

boosted by increasing the abundance of local grow your own projects which would have a material impact on the food security of the nation. However, this is an unlikely scenario despite the current political climate and therefore, the benefits of grow your own projects on food security are minimal but having the capacity to be significant. Therefore, again the social benefits and the reduction of carbon emissions are more significant than the benefits from increased food security, although these benefits are worth discussing and being aware of in time of national need.

Food security is therefore another major reason as to why people engage in grow your own as reflected in the survey where 15% of those who engage in grow your own do so for this reason. Grow your own has the capacity to have a significant impact on improving the food security of the UK although it is unlikely to do so unless there is a time of great national need such as a war in Europe. Therefore, this aspect of the impact of grow your own is less significant as it provides a supplement for the local communities that engage in these projects rather than significantly boosting national food security. However, the skills gained from these projects could become essential if another national emergency akin to World War II occurred again. Food security is an important reason to discuss in analysis' of grow your own however, as it is a priority for many members of the population.

Grow Your Own- Social and Biodiversity Perspectives:

It's vital that we consider the social side of the "Grow Your Own" coin. Growing crops, whether in a private or community garden, has been evidenced to provide a wealth of health and well-being benefits[14]. For example, gardening increases opportunities for physical activity at levels accessible to all ages, leading to lower risks of obesity and higher life expectancy[14]. Furthermore, the presence of community gardens and allotments in the UK has been proven to increase fruit and vegetable consumption throughout the year in residents that use these spaces, as well as improving understanding of how food is grown[14].

The glowing success of projects run by the "Incredible Edible Network" demonstrates just how local "Grow Your Own" initiatives can bring a community together. The

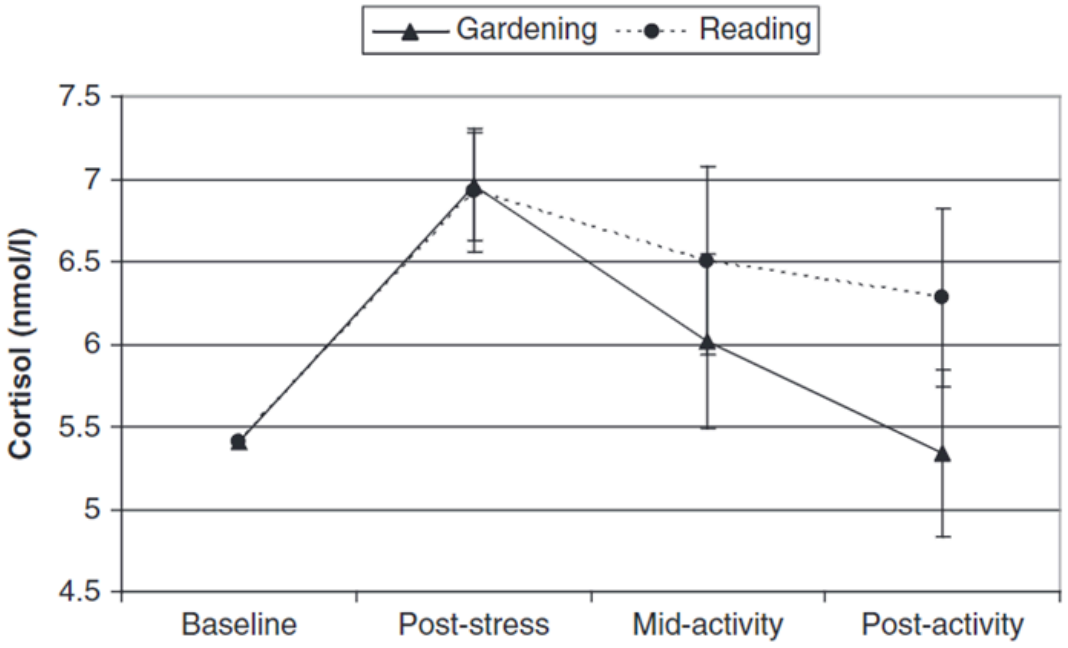
original “Incredible Edible” scheme was established in Todmorden, West Yorkshire, in 2007[15]. Small areas of disused land behind schools and on roadside verges formed a patchwork of vegetable plots, where passers-by were encouraged to help themselves to free produce[15]. Despite this access to free food being cynically labelled as “propaganda gardening”, the project had succeeded in creating a positive “food environment”[16]. This aimed to engage people of all socio-economic backgrounds with the local food supply chain[16]. In fact, a survey carried out in 2013 found that 60% of Todmorden residents felt that Edible Todmorden had increased community pride and made the town more attractive to visitors[15]. Surely this sense of community cohesion is likely to encourage even more people living close by to urban gardening projects to get involved.

Abingdon also boasts sites part of the “Incredible Edible Network” which has swept across the UK[17]. Edible Abingdon involves attractive vegetable and herb beds providing free produce scattered throughout the town; in Abbey Gardens, Abbey Meadow and at the Old Station House[17]. The accessible nature of these miniature gardens means that even Abingdon’s most miniature residents can begin to take an interest in where food comes from.

Moreover, gardening is associated with multiple mental health benefits, including improved mood and a lower risk of disorders like anxiety and depression[18]. A groundbreaking study by Van den Berg *et al.* in 2011 provided some of the first evidence to suggest that gardening, not just spending “restorative” time in nature, has a direct impact on recovery from stress[18]. In this study, participants had to perform the same stress-inducing task, followed by 30 minutes spent either reading or taking part in “light” gardening activities on an allotment such as pruning or planting[18]. Before the stressful task, as well as during and after the relaxing activity, researchers recorded the concentration of cortisol in the participants’ saliva[18]. This hormone is a well-documented biomarker of stress, so was taken to be an indicator of how the participants’ mental state may have altered during the exercise.

As shown by the graph below, only the group who engaged in gardening saw their cortisol levels return to a baseline level (to the levels they were at before the stress-inducing task) during the experiment[18]. Although both the reading and gardening groups showed a decrease in cortisol levels, only the gardeners showed a

significant decrease in cortisol concentration from the middle of the “relaxing” activity to its endpoint[18]. This may hint at the importance of the length of time spent in a community gardening space, in managing the symptoms of acute stress. Therefore, this research further cements the restorative reputation of places like Stonehill Community Garden in Abingdon[19].



[18]

As well as supporting our mental health and communities, urban green spaces where produce is grown have the potential to enrich local species biodiversity. In fact, Speak *et al.* found that allotment gardens in Manchester had a much higher diversity of plant species than the city parks in the same area in a 2015 study, perhaps contrary to public expectation[20]. The researchers found that the numbers of different flora species grown without human assistance (the spontaneous flora species richness) were significantly greater in allotments compared to city parks[20]. Also, the parks only contained 65% of the total number of different plant species that were found in the allotments[20]. This may be due to lower mowing pressure in allotments giving plant species a better chance of colonising the habitat and establishing themselves[20].

The plant species richness inhabiting allotments has several key implications for local biodiversity. Firstly, these flowering plants form a crucial resource for pollinating

insects, which in turn support crop fertilisation and so small mammal communities which rely on plants for food. These pollinating insects are an important food source for bird populations too. Therefore, the biodiversity benefits afforded by community gardens are felt through multiple levels of the food chain[20].

It's interesting to note that pollinating insects such as bees and hoverflies are classed as "biodiversity indicators" by the JNCC[21]. This suggests that the degree of pollinator presence in an area provides a valuable insight into how functional local ecosystems are. As a result, groups and individuals drawn in by the environmental benefits of "Grown Your Own" should consider methods that combine agricultural and pollinator interests, such as planting high nectar flowers between vegetables.

Conclusions – Grow your own: A Social or Environmental Initiative?

Food security is another major reason as to why people engage in grow your own as reflected in the survey where 15% of those who engage in grow your own do so for this reason. Grow your own has the capacity to have a significant impact on improving the food security of the UK although it is unlikely to do so unless there is a time of great national need such as a war in Europe. Therefore, this aspect of the impact of grow your own is less significant as it provides a supplement for the local communities that engage in these projects rather than boosting national food security significantly. However, the skills gained from these projects could become essential if another national emergency akin to World War II occurred again. Food security is an important reason to discuss in analysis' of grow your own however as it is a priority for many members of the population.

Grow your own initiatives are therefore both a social and an environmental initiative due to the benefits outlined above. There are clear mental health as well as physical health benefits to engaging with grow your own projects as well as these projects acting as a way to increase community cohesion. Furthermore, the greater biodiversity, soil carbon content and food security gained from these projects if they are carried out at a larger scale, gives significant environmental benefits particularly

to urban areas where biodiversity is typically lower. Since each of these aspects of “Grow Your Own” schemes’ impacts has the capacity to combat the national issues mentioned, grow your own has the potential to have a significant difference in mitigating climate change, increasing biodiversity, aiding the mental health crisis and increasing food security.

In terms of methods to progress grow your own projects, using any of these factors could be effective to increase engagement. However, the actions of local government would help these projects increase in scale and therefore effectiveness, as local councils could set aside public land for community gardens. Consequently, many more people in the community having access to them, would mean the benefits of community gardens would be significantly more widespread than with just allotments or in people's gardens. This would also increase engagement by reducing the barriers to entry of grow your own, such as the 150 hour estimated time commitment, the financial commitment of renting an allotment or purchasing seeds and equipment. Justifying these projects can be done on any of the four main areas discussed in this report as each has the capacity to be significant if focussed on by the project. This could also be linked to wider planning schemes such as edible garden cities, which aim to provide sustainable local food systems for new communities through projects such as grow your own.

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