

Lund Trust

ANALYSIS OF POTENTIAL OPPORTUNITIES FOR URBAN
GREENING IN ENGLISH CITIES

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1. Summary

As people throughout the globe confront simultaneous climate and biodiversity crises, placing sustainability at the centre of how cities expand and adapt provides an enormous opportunity for the health and well-being of billions of people, both now and in the future.

Environmental disparities decrease people's ability to enjoy and enhance their lives, hence society's ability to innovate and tackle the most urgent matters. The COVID-19 pandemic has highlighted these disparities, emphasising the significance of adequate air quality and access to urban green spaces for physical and mental well-being.

City councils, communities, and charitable organisations can pave the path for an inclusive, resilient future. Therefore, this report focuses on England's urban areas where Lund Trust could potentially use its resources to help drive environmental improvements. We do this by deep diving into our hypothesised framework that can be used and further enhanced when assessing potential investment opportunities.

2. Definitions & Case Specific background knowledge

Key word(s)	Description
Urban Green Space:	<p>Natural plant-covered places in which water may permeate the soil and vegetation. The word "green space" may describe various environments, from maintained parks to fully undeveloped woods. It may include playing fields, well-managed surroundings, and relatively natural landscapes. Frequently uncoated permeable surfaces (e.g., soil, grass, parks and so on)</p> <p>Alternative terms: urban parks; urban green vegetation; urban green cover; green infrastructure; greening of buildings.</p>
Green Infrastructure	<p>The term "green infrastructure" describes the planned incorporation of green spaces into urban areas to benefit residents and the local ecosystem. This larger definition often encompasses initiatives like making existing structures more environmentally friendly. (e.g., rooftop parks, street greening by planting trees or plants).</p>
PUAs	<p>Essentially, PUAs are clusters of municipal administrations that behave similarly to a single city—initially created by the Department of Communities and Local Government as a research instrument to enable comparison across different regions. The goal was to generate a list of less subjective areas than the current council boundaries, allowing us to include largely autonomous but neighbouring cities (such as Southampton and Portsmouth) as distinct entities.</p> <p>Therefore, we have utilised PUAs in our research since they provide a standardised statistic for contrasting youth and CO₂ emissions throughout the UK. This differentiates them from urban areas and combined authority geography.</p>

<p>Youth</p>	<p>Lund prioritises youth in its new business endeavours. However, since there is no agreed definition of youth (UN, 2018), we have utilised third-party youth data to drive our research. Specifically, we combined two age groups (0-17 & 18-29). Since Lund’s ambitions are to improve urban greening in cities with high youth concentration, we consider combining those two demographic categories into one to be appropriate for the purpose of this analysis. A city with the highest youth concentrations would be assigned a score of 1.</p>
<p>Carbon dioxide (CO₂)</p>	<p>Carbon dioxide (CO₂) is a naturally occurring gas transformed by photosynthesis into organic compounds. In addition to being a by-product of fossil fuel burning and biomass combustion, it is also produced by land-use changes and industrial activities. In our analysis, we use CO₂ emissions per capita because it allows comparing PUAs in the least subjective way possible.</p>
<p>Context of English cities</p>	<p>According to the Field in Trust's (2020) research, in 2020, 2.69 million British people were not living within a ten-minute walk of green space. Within the next three years, this number will rise by 6.46%, amounting to an additional 174,000 people who lack access to a nearby park or green area. Primarily, their research indicates that Southwest and West Midlands are below the minimum standard of green space provision, whereas East and South-East manage to meet the minimum criteria. As English cities expand, it is vital to ensure that sufficient local green space is supplied. This is where Lund can take immediate action and directly impact local communities' well-being.</p>
<p>Problems in English cities</p>	<p>It's no secret that cities are the beating hearts of our economies, cultures, and civilisations. Cities contain around 54% of the world's population and use approximately 70% to 75% of their resources while taking up just 2% to 3% of the Earth's land area (GOV.UK, 2021). Such a dense concentration of people and activities leads to several environmental issues:</p> <ul style="list-style-type: none"> - Polluted Air - Flooding - Heat Island effect <p>Additionally, the broader ecosystem is impacted. Water is extracted, which might have a negative impact on ecosystems located farther upstream. The water that comes from cities is carried via catchments and eventually ends up in the ocean. The manufacturing of commodities that are consumed in cities and the emissions of carbon that these production processes produce affect the climate of the whole planet.</p> <p>Around the globe, efforts are made to clear land for agricultural use and to extract natural resources, both of which result in the destruction or degradation of biodiversity and ecosystems. The current degree of urbanisation and exploitation of the world's natural resources threatens the integrity of the planet's systems. This further jeopardises the vital functions that ecosystems offer to human beings. Modifications can be made in urban areas to improve resource and energy efficiency, provide cleaner air, land, and water, along with the creation of better environments for people and animals both inside the PUAs and internationally.</p>

3. Introduction

3.a Client

Lund Trust is a charitable fund of Lisbet Rausing and Peter Baldwin. It is a sister charity to Arcadia, which helps protect endangered cultures, nature and promotes open access (Lund, 2021). Since 2001, Lund Trust has given over £75m to over 440 organisations around the UK and internationally.

3.b Business Challenge

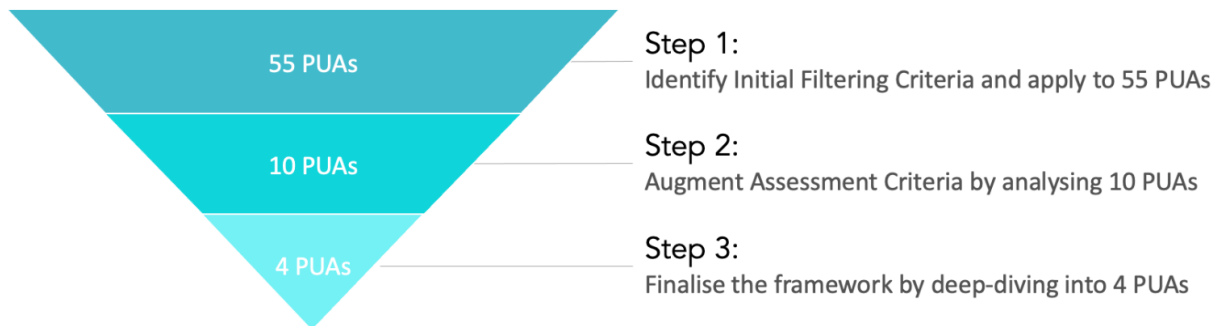
Lund Trust is expanding its reach from helping the disadvantaged, educating individuals, and supporting cultural institutions and previous Greening projects to focusing on Urban Greening initiatives. The challenge is understanding which English cities need the most help and coincide with Lund Trusts' values.

3.c Specification (Scope)

The client, Lund trust, has requested a general framework that can be used as a lens and a steppingstone for their organisation to identify the correct English cities to invest in Urban Greening Initiatives. This primary task for Lund Trust is to effectively spend £2 million annually in developing Urban Green spots through multiple possible, reliable organisations.

4. Methodology

Framework Methodology



We employed the following methodology (summarised in the diagram above) to construct the framework requested by the client in the specification. Wholistically, we applied a funnelling approach, starting with a broad focus and then zooming in on the most relevant PUA's and urban greening investment features to identify core criteria for the final framework.

First, we started with a pool of 55 English PUA's to analyse and find the best ones that would benefit from Lund Trust's investment and fit with Lund's strategic priorities. We identified three initial sorting criteria to narrow down our scope of potential candidates. The three initial criteria explained in section (4.a) are: high young population proportion, acute CO₂ emissions per capita, and high deprivation of urban green spaces.

Second, applying the filtering criteria to the 55 PUA's, we achieved a more focused pool of 10 potential candidates, small enough so that we could start a high-level analysis of their characteristics. Our target was to identify the common trends and desirable features among these 10 PUA's that characterise a good investment target. Additional relevant assessment criteria were identified to fortify the framework, namely Local Authority Commitment, Funding Opportunities, and Projects, explained in section (4.b).

Third, having analysed the 10 PUA's and constructed a hypothesis framework, we ensure it is robust, empirically supported, and applicable across cities. For this, we deep-dive into four specific PUA's of the 10, explained in section (4.c). We confirm the hypothesised framework and its metrics and outline the measurements that can be found when we apply the framework to cross-city analysis.

After our evaluation, we deliver two outcomes: the final framework and the profile of the 4 PUA's, whose details can be found in the Appendix. Subsequently, we finalise our report by recommending the most critical criteria in the framework and the city that Lund Trust should consider for their upcoming urban greening investment, found in section (5). Final remarks

address the report's limitations and suggest future research avenues and potential framework enhancements.

4.a How do we filter preliminary English PUAs where urban greening would be most significant?

According to the report's specification, Lund Trust prefers to focus on urban greening projects that significantly impact young people's lives. Aligning our analysis with Lund Trust's preferences, we obtain the first initial filtering criterion, namely 'Youth'. This criterion is measured as the percentage of the young population aged 0-17 and 18-29. There is no standard agreement on the definition of 'youth'; hence, combining both age groups encompasses families with young children (0-17-year-olds) and young adults (18-29-year-olds). Providing green space to families educates future generations to appreciate, engage, and support urban greening, leading to a long-term commitment. The 18-29 age category includes students; hence, large student cities like Cambridge and Oxford are outliers.

The social benefit of urban greening is to increase social welfare. The presence of parks and trees in the vicinity of hospitals and residential areas has improved emotional wellbeing, physical mobility and health, community engagement and improved mental health due to its stress-relief properties. This leads to better motivated and active communities, with especially prominent benefits to families, students, and young adults. For example, researchers at Field in Trust (2018) quantified the social benefits of urban greening in monetary terms. Specifically, they have discovered that parks and green spaces reduce GP visits, saving the NHS £111 million annually. In addition, the annual monetary benefit (gained from using local green space) to an individual amounts to £30.24 per year.

Urban greening also addresses climate emergencies caused by climate change specific to urbanised areas. Urban areas increasingly suffer from climate emergencies like the heat-island effect, flooding, and worsening air pollution. Urban greening proved to help address these emergencies, assisting with permeable surfaces to prevent surface flooding and providing shade to guard against overheating with measurable results¹ and absorb harmful pollutants like CO₂ to improve air quality.

Hence, urban greening can have Lund's desired significant and immediate benefits to the areas that suffer most from these climate emergencies and have the worst urban greening deprivation. Therefore, we took CO₂ emissions per capita (tonnes) as the second variable to measure the severity of the climate emergency in English cities. Similarly, we utilised the Urban

¹ During the heat-island effect, the air is cooler in the parks, being 1 degree Celsius lower than in the non-green urban areas (Lund Trust, 2021)

Green Space ranking to measure the degree of urban green space deprivation (cities are classified A-E, with E being the most deprived) (*Friends of the Earth, 2020*).

Once we established the aggregate filtering criteria, we applied them to 55 PUAs. Subsequently, we ranked them in a standardised manner to distinguish areas that would benefit the most from urban greening investment (see *Figure 1*).

Figure 1. Standardised Rankings

Aggregated Ranking				
PUA(s)	Youth Percentage (rank)	Urban Green Space Rating (rank)	CO2 Emissions per Capita (rank)	Final Ranking (equally weighted aggregate)
Slough	7	1	2	3.3
Cambridge	2	3	11	5.3
Oxford	1	7	10	6.0
Leicester	5	5	12	7.3
Leeds	6	16	1	7.7
Bristol	11	9	5	8.3
Manchester	20	2	4	8.7
Coventry	3	8	16	9.0
Liverpool	13	6	9	9.3
Southampton	9	4	17	10.0

Cities ranking highest (score of 1) on the 'Youth' criterion have the highest proportion of young people. Conversely, cities ranking the highest on the 'CO₂ emissions per capita' and 'Urban green space rating' have the highest air pollution in terms of CO₂ and are the most deprived of urban green spaces, respectively.

4.b How can we augment the assessment criteria to achieve a more comprehensive framework?

The three filtering criteria helped us narrow our focus from 55 initial PUAs to 10 preliminary PUAs. However, these criteria are not exhaustive nor accurate enough to enable meaningful city comparison and thus had to be augmented to gain a more comprehensive framework.

To identify additional criteria indicative of a good urban greening investment potential and comparable across cities, we analysed the 10 PUAs from a high-level perspective. Our data sources included local authorities' strategic reports, budget allocations, project briefs and other academic papers.

After the qualitative analysis, we identified additional relevant criteria that encompass the desirable features of a target for Lund's investment: Local Authority Commitment, Funding Opportunities and Projects.

Local Authority Commitment criteria has the metrics of short-term and long-term strategic goals and the priority rank they assign to urban greening. This information can be found in local authority strategic reports across the ten cities and is likely present in all English cities. The long-term strategies of PUAs are aligned with the UK's commitment to reach net zero by 2050, most of which stretch to 2035-40. Meanwhile, the short-term strategies delineate how successful the council is in meeting these climate goals in terms of commitment, budget allocation, and engagement within environmental and urban greening projects. Suppose urban greening, generally under the umbrella term of "Environmental" efforts, is assigned a low rank. In that case, this indicates that the council is not dedicating sufficient resources to meet its goals, and thus, there is likely a funding gap that Lund Trust can fulfil.

Funding Opportunities criteria analyses the budget allocation and funding mechanisms for urban greening projects and thus complements the Local Authority Commitment criteria. Predominantly, detailed budgets are set for one year in the future; hence the reports found had the period of 2022-23. Proportions of the total council budget are allocated to different sectors. We were able to quantify and identify the volume of spending for Environmental and/or urban greening initiatives, compare them to other industries, and measure its proportion of the total council budget. Furthermore, we recognise that council funding is just one funding mechanism. Therefore, we also identify alternative funding sources such as Voluntary Sector Involvement, Multi-Agency Funding, Planning and Development Opportunities (further information could be found in the Appendix, Figure 5).

Lastly, Projects is the final criteria added within this analysis, aiming to present a case study approach to analysing real and empirically tested feasibility of investing in urban greening projects in each city. Large projects are characterised by their sizeable strategic scope, ability to synthesise multiple small-scale projects in partnership with the local authority or national and international agents, as well as by their capacity to facilitate urban greening investment. The number of projects depends on the city's size, with larger PUAs having a vast amount of ongoing and potential urban greening projects.

Synthesising the initial filtering criteria, identified in (4.a), with the augmented assessment criteria of (4.b) we derive a hypothesis framework presented below (Figure 2) to be validated in (4.c):

Figure 2. Hypothesised Framework

Hypothesised Framework	
Criteria	Proxy
Youth	Young population proportion
Environmental need	CO2 emissions per capita
	Urban green space ranking
Local Authorities' Commitment	Long term targets
	Short term targets
	Priority rank
Funding Opportunities	Period of current budget
	Budget allocation proportion
	Main funding mechanisms
	Proportion of funding from similar charitable organisations
	Gaps in funding (met vs unmet needs)
Project	Size of greater city region
	No. of projects
	Main project(s)

However, additional criteria would be significant to include in future analyses but were out of scope for this report. Additional criteria identified at this stage were Community Engagement, which is indicative of a population’s willingness to engage with the urban greening site both during construction and afterwards such as usage and maintenance; and Operational Effectiveness, which looks at how effective Lund Trust’s investment will be managed, its likely benefits, due diligence to guard against financial misconduct such as ‘greenwashing’, and other barriers to investment like the costs of complex stakeholder management, especially in larger cities.

4.c Validating the hypothesis and reaching a final framework.
Deep-dive analysis of the 4 cities

We conducted a detailed analysis of the four cities, starting with Slough being the smallest, then Liverpool, Leeds and Manchester being the biggest in terms of population size. We found that these cities have a high population of youth, poor urban green space ranking and high levels of CO₂ emissions. We analysed the local authorities’ commitment to greening urban areas, funding opportunities and the projects in each city towards urban greening.

Based on the proposed framework, **Slough** out of all PUAs was ranked the worst in terms of availability of green space (with 58% of neighbourhoods being deprived of access to green space). In addition, they have a large proportion of youth living within the Borough, which aligns well with the new strategic direction of Lund Trust. Furthermore, the council suffers from a financial deficit and would require an additional £17million of funding (Slough Council,

2022). From the analysis, the council looks committed to its climate action and would provide a good investment opportunity if Lund were to move forward.

Liverpool is a city located in the Northwest of the UK with a high percentage (41%) of the youth population and high levels of CO₂ emissions (ranked 9th in the assessment criteria with 4.02 tonnes of CO₂ emissions per capita). However, after conducting in-depth research, we identified that Slough and Leeds are in much dire need of a potential investment over Liverpool.

This stems from two reasons. Firstly, Liverpool has many projects running successfully to green the city and a potential investment will not effectively make a substantial difference. Secondly, 64% of the area in Liverpool is already surrounded by green spaces. Hence, the primary focus of projects is to preserve and maintain the green spaces rather than create new ones. This approach does not align with Lund Trust's mission because they target investments that would facilitate the establishment of new green spaces rather than maintain them.

Leeds targets carbon neutrality by 2050 (Leeds City Council, 2022), with short-term targets such as achieving 85% carbon reduction by 2030. Urban Greening falls within the environmental focus of the council and is orientated around increasing tree planting and enhanced green space. However, Leeds has experienced a 50% cut to its urban greening budget from the government as a result of austerity measures (University of Leeds, 2019). Financial aftershocks from COVID-19 have further exacerbated the situation.

In addition to this gloomy financial outlook, according to our framework Leeds ranks the worst for Carbon Dioxide emissions per capita and lies within the top 5 worst cities for our aggregated framework including youth population and urban green space ranking.

The success of projects in Leeds is measured by the councils KPI's, the "Parks and Green Spaces Strategy 2022 to 2032" report outlines hectares of trees planted and the number of parks, at or above, Leeds quality park standard as the key metrics. This can be incorporated into the White Rose Forest project, as the plan is to plant 2 million trees as part of the 2025 action plan (White Rose Forest, 2022).

Manchester aims to mitigate climate change in the city region and is determined to become carbon neutral by 2038 as they comply with international commitments (Authority, 2022).

During the Pandemic, the Government has used a considerable portion of their budget for greening initiatives towards a Pandemic relief fund, thus allowing the green projects to fall

behind whilst impacting the social health of the people in the surroundings (Carvalho Aguiar Melo and de Sousa Soares, 2020).

Since Greater Manchester (GM) is one of the major cities in the UK, they seem to have sufficient projects and funding availabilities for future projects compared to the other English cities analysed within the framework.

The full profile of each city can be found in detail in the *Appendix section* below.

Confirmation of the hypothesis and the metrics used to apply it across cities.

By deep-diving, we tested our hypothesised framework 's application in the cross-city analysis and gained empirical support for it. The criteria and their metrics have been confirmed as accurate indicators, and additional key measures that exemplify each metric have been identified that can be found across English cities. Hence, the validated framework (Figure 3) can be used as a standardised lens to assess English cities in need of Lund Trust's urban greening investment.

Figure 3. Validated Framework

Validated Framework		
Criteria	Metrics	Measure
Youth	Young population proportion	% of people aged 0-29
Environmental need	CO2 emissions per capita	Tonnes
	Urban green space ranking	A-E
Local Authorities' Commitment	Long term targets	End of long-term period Strategic goal
	Short term targets	End of short-term period % of short-term target to be met
	Priority rank	Rank of urban greening priority in council short-term strategy
Funding Opportunities	Period of current budget	Current year
	Budget allocation proportion	Volume of funds by source % of council total budget allocated to urban greening
	Main funding mechanisms	Volume of main contributions by funding mechanism
	Gaps in funding (met vs unmet needs)	Yes or No
		(Yes if published in official documents) (Yes if 'Priority Rank' is low and 'Budget Allocation' is low)
Project(s)	Size of greater city region	No. of population
	No. of projects	No. in official sources
		Self-calculation
	Main project(s)	Nr of mentions in official documents
		Partnership with council
Council-owned strategic project		

5. Findings and Recommendations

5.a What city would best benefit from Lund Trust investment in urban greening and why?

After applying our standardised framework and deep diving into each city on the shortlist, we derive that Leeds is the city that requires investment the most out of all English cities analysed.

Specifically, following a thorough investigation, it was shown that Leeds had significant budget shortages as well as lacked behind on environmental issues, making it clear that financing would be most beneficial to this city.

Of our predetermined sample of 4 cities, Leeds emits the most Carbon Dioxide emissions per capita at 4 million tonnes of CO₂ per annum. At this rate, Leeds is bound to use its allocated carbon budget by 2029 and thus seemingly unlikely to meet its carbon targets by 2030 (Sudmant, 2020). Furthermore, Leeds was identified as a crucial city for investment, ranking 5th across all three filtering criteria out of 55 PUAs, placing Leeds in the top strata of English cities.

For instance, a report called 'State of UK Public Parks' reveals that Leeds has had its core funding for parks and green spaces cut by 50% against a backdrop of austerity. COVID-19, rising inflation, and interest rates have further strained the Leeds City Council's capacity to invest. The council allocated only 5.33% of their budget to the environment, seemingly contrasting with its 2025 strategic priorities where meeting carbon neutral targets is ranked 3rd, behind social equality and a strong economy.

This highlights how funding for urban green spaces is being neglected in an area that needs it the most. For instance, the White Rose Forest Project aims to plant over 2 million trees to combat carbon emissions and increase tree canopy cover, however, is underfunded by the government and thus seeks external investment and Lund Trust might provide. Moreover, this would help achieve the second KPI mentioned earlier regarding hectares of trees planted, as the council commits to planting 50 hectares of trees every year till 2045.

5.b How can Lund Trust use the final framework to effectively invest in urban green spaces?

Lund Trust can re-weight the three initial criteria based on their priorities. The aggregated score was calculated using an equal weighting system for the youth, CO₂ emissions per capita, and urban green space ranking. If Lund wished to prioritize the youth criteria, they could weigh youth at a higher proportion to provide a skewed output of cities.

Moreover, after we applied our filter system, we narrowed down the potential cities from 55 to 10. Even though Leeds was picked because of funding shortfalls and environmental concerns, it would be up to Lund to choose among ten nominated cities. Lund may want to orientate a project around their other values, such as culture and heritage or disadvantaged people, in which case they could consider other cities.

5.c Limitations and Further Research

While our framework is robust and identifies various opportunities for urban greening within English cities, the report has limitations.

Firstly, the report had tight time limits and specifications, with the sample space constrained to only English cities identified as 55 PUAs, and with the report starting at a base-level knowledge of the industry.

Secondly, the initial filtering criteria of carbon emissions, youth population and green space rating used to shortlist PUAs from 55 to 10 constantly evolve. For instance, in Leeds, CO₂ emissions per capita were 5.1 tonnes in 2018 and 4.9 tonnes in 2019 (Department for Business, 2022). Thus, while the framework for identifying cities is currently accurate, the inputs will likely change with time and provide different shortlists of cities. Thirdly, the framework could be strengthened with additional criteria identified in our research (in 4.b) that were out of scope for this report. Criteria like Community Engagement and Operation Performance would be insightful to measure the community's likely green space usage and conduct due diligence, respectively.

Furthermore, although our final framework has an empirical basis and track record of being applied cross-city to gain significant insights relevant to Lund Trust's objective, it has not been validated by industry expert reports. Organisations specialising in urban greening investments analysis might have curated frameworks and criteria that could be incorporated into the final framework. For example, a report produced by the Natural Environmental Science Programme uses biophysical, management, and social domains as urban greening indicators (Figure 4, Appendix) (CAUL Hub, 2019). However, the initial criteria were decided based on Lund Trusts' preference for engaging in projects orientated around the environment and young people, for which Lund spent \$159k and \$1.17m, respectively, in 2021 (Lund Trust, 2021).

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Appendix

Figure 4. Natural Environmental Science Programme framework (CAUL Hub, 2019)

Domain	Variables	Characteristics
Biophysical	Biodiversity	<ul style="list-style-type: none"> - Species counts - Threatened species counts - Native vegetation cover/habitat area - Ecological corridors connections
	Urban forest	<ul style="list-style-type: none"> - Tree canopy cover - Age- and size-class distributions - Useful life expectancy - Above ground visual assessments of health and risk
	Thermal effects	<ul style="list-style-type: none"> - Building energy use - Precinct temperatures
Management	Planting	<ul style="list-style-type: none"> - Numbers of plants and different species planted - Numbers of plants removed vs planted - Maintenance activities
	Green space quantity/quality	<ul style="list-style-type: none"> - Amount of open space (area; area/population) - Distance to park and park size - Green space features - Satisfaction with maintenance of green spaces
	Budget	<ul style="list-style-type: none"> - Cost of management activities and interventions - Proportion of budget allocated to climate change initiatives
Social	Engagement	<ul style="list-style-type: none"> - Number of volunteers - Length of volunteer engagement - Number, type and range of community events held in the space - Budget for social or community engagement

	Health	- Mental and physical health and wellbeing indicators
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Figure 5. Funding Mechanisms (CABE, 2006)

Funding Mechanism	Description
Traditional local authority funding	Standard local and national government taxation structures allocate funding to green infrastructure maintenance and interventions. There are a range of additional tax-related measures, however, that can provide specific support and additional income for these activities, such as location-specific taxes or business levies.
Multi-agency public sector funding	Given the wide-ranging benefits that good green spaces can deliver, it can be possible to access funding from a range of government departments and public
Taxation Initiatives	Funding from local taxes can be directed specifically towards the management and provision of green space. Tax incentives, such as tax credits or reductions, are another tool to encourage investment in local regeneration and the development of green spaces and the public realm. Under this approach, tax credits or reductions in taxes can be used as a means of stimulating local investment.
Planning and development opp	Wider development, often private, can fund green infrastructure, whether directly or through levies raised through planning legislation.
Bonds and commercial finance	As well as voting to increase neighbourhood taxation, constituents can vote to allow the local authority to issue bonds as another method to fund urban green space. Based on their assets, financial management plan and corporate position, local authorities can receive loan funding from bonds that can be repaid over a period of up to 30 years. Repayments can be funded through property taxation, commercial revenue streams and general taxation or sales taxes.
Income-generating opportunities	In green space sites, business opportunities such as sponsorship and the management of sports facilities, restaurants, cafés, festivals and events are other ways in which private sector funding can be sourced. One way of accessing funding
Endowments	Proved to be an extremely successful way of securing a long-term, protected source of income. An endowment is an asset that generates income: the income, or part of it, is used to fund the green space while the capital remains invested. An endowment could take the form of an investment in the stockmarket which generates interest,
Voluntary sector Involvement	The voluntary and not-for-profit sector is an important stakeholder in urban green space development at the neighbourhood level. Voluntary and not-for-profit organisations can provide an important resource by contributing additional labour, providing public stewardship of green space and assisting in community development and outreach.

Case Studies

The Four Cities' Full Profiles

SLOUGH

The difficulties produced by urbanisation in the twenty-first century must be addressed if we are to confront the climate crisis and establish a sustainable economy. The figures in many urban areas are particularly concerning. For instance, on average, Slough has less than 12 square meters of green space per person.

Slough Borough Council announced a climate change motion in 2019, acknowledging the rising necessity for emission reductions and climate adaptation efforts throughout the borough. Their main ambition is to be carbon neutral by 2040, with a stretched target of 2030.

Following that, they have deployed a Climate Change Strategy and Action Plan which focuses on achieving the following objectives:

- Reducing emissions from estate and activities
- Promoting sustainable modes of transportation and inducing behavioural modifications are all strategies for lowering transportation-related emissions.
- Supporting municipal services, citizens, and companies to adapt to the consequences of climate change by lowering resource use, improving recycling, and decreasing waste.

Adopting such an approach would not have any apparent effects on the environment. However, the goal of the policy is to make the whole borough carbon neutral. Therefore, the proposed activities would have ecological consequences. Reduced emissions of carbon dioxide, a major contributor to global warming, will be the most immediate and obvious outcome.

To achieve this, Slough Borough Council has requested funding for the fiscal years 2018-2019 to 2022-23. Following their significant budget gaps, the Secretary of State has approved £307.119 million in capitalisation directions. Specifically, in 2022/23, the council expects to spend around £67 million on children's and adult services and an additional £39 million on universal services including waste reduction, leisure and library facilities, emissions reduction, and climate change activities.

The borough's capital programme for the years 2021/22 through 2026/27 is estimated to cost £219m. Estimates indicate that grants and other funding sources will cover £202m of the programme, leaving the council with a borrowing cost of just £17m.

Figure 6. Slough's emission sources

Emission Sources	Percentage from total (%)
Building & facilities	57.7
Transport	30.8
Industrial processes	10.9
Waste Management	0.7

As Figure 6 depicts, Slough’s main emission sources come from Buildings and Transport. Therefore, their immediate priority is to address those areas first since they would contribute to the most CO₂ reductions. However, this is not to say that other environmental activities are of less importance. For instance, the council pursued the woodland project with the main ambition of reducing high levels of contamination (Batchelor, 2021). To date, 8585 native trees have been planted which in turn have captured eleven tonnes of CO₂ along with improving biodiversity and reducing susceptibility to flooding (see Figure 7).

Figure 7. Slough's past and current projects

Environmental Challenges	Key policies	Case studies (Project)	Main Goals of the Project
Flood risk	The Protecting Suburbs Strategy (2016-2030) aims to incorporate more green infrastructure across Slough for communities. The strategy highlights the need for greater amounts of green areas across the borough to counterbalance the small garden sizes, which are a consequence of dense housing layouts.	Slough has the least amount of tree canopy in Berkshire and falls short of the national minimum aim of 20 per cent tree cover. Throughout 2020 and 2021, across 31 locations, A. Slough's Digital Urban Forest is a component of a statewide effort supported in part by the Forestry Commission (DEFRA).	Improve Air quality; Reduce flooding; Improve carbon capture; provide education and training opportunities; increase biodiversity.
CO ₂ → high temperatures	The Slough Carbon Management Plan 2020-2030 utilise the Upton Court Park Jubilee Wood to highlight the importance of nature-based solutions. The plan raises the importance of Sustainability Impact Assessments for new buildings constructed in terms of air, water and land pollution.	Slough Woodland Project - Upton Court Park was used between the 1940s and 1970s as a site for tipping waste and suffered accordingly from high levels of contamination. This project sought to reverse this environmental decline by creating this new woodland and creating an oasis for wildlife in an urban location. A total of 8,585 native trees were planted on the site. Initiated in 2013, the woodland has sequestered 11 tonnes of CO ₂ . As the woodland growth accelerates with age, this is forecast to reach over 700 Tn after 25 years and over 1,300 tonnes after 50 years. Funded by the council themselves.	Improving opportunities for physical activity and improving the health and wellbeing of users; The project also restores former landfill areas that otherwise would have harboured higher levels of pollutants, and once the trees are established will help to remove air pollution from the nearby M4 motorway; The project also hosted a Tree planting event for local schoolchildren, giving them the opportunity to plant trees and learn about woods and trees.
Water shortages	Parks and Open Spaces Strategy is a full ten-year strategy for the maintenance and development of Slough's parks and green spaces.	The Salt Hill Project works with local communities in Slough to improve surroundings and generate a cleaner, healthier watercourse. The project has received over 400 hours from volunteers working on Temple Wood renovation and taught over 1,600 children the importance of wetlands.	Educate young people; prevent water contamination.

LEEDS

Leeds city council aims to reach carbon neutrality by 2030, this aligns with the UK government's net zero strategies which set out policies for decarbonizing all sectors of the UK by 2050 (Department for Business, Energy & Industrial Strategy, 2021) and global initiatives such as the Paris Agreement 2015.

To meet these objectives, the council has outlined a variety of short-term targets. Most notably by trying to reduce carbon emissions by 50% by 2025 (Leeds Climate Commission, 2020). Other short-term targets include switching to 100 percent green electricity, connecting 1,000 homes to low carbon heating and increasing tree canopy (Leeds City Council, 2020).

Unfortunately, core funding for urban greening has taken a sharp decline in recent years as a result of austerity and other related factors. This is highlighted by the 'State of UK Public Parks 2016' which states that core funding for parks in Leeds has been reduced by 50% (Neal, 2016). With the budget cut pre-pandemic, the implications of the pandemic will further cripple funding allocation to urban greening. According to the UK Government, COVID-19 has had a profound impact urban greening funding with a total annual loss of income of up to £8.8 million during 2020.

Leeds City Council Total Budget: £1,293,591,00

- 46.33% (551m) Educations Services
- 21.54% (278m) Adult Social Care
- 12.71% (164m) Children Social Care
- 6.02% (77m) Cultural and Related
- 5.49% (71m) Public health
- Other

Crucially 5.33% of the budget is allocated to Environmental expenditure, totalling £69 million. While the exact figure for external funding is difficult to quantify, the type of funding mechanisms includes multi-agency funding, crowdfunding, green lending, grants and private partnerships. Despite the pre-existing external funding, Leeds city council is seeking to secure further external funding to fill gaps in the greening budget to fulfil aspirations to achieve carbon neutrality by 2030 (Leeds City Council, 2022).

There are various ongoing projects that require additional external funding, most notably the White Rose Project. This project involves planting over 2 million trees in urban areas and along major transport routes (White Rose Forest, 2021). This helps reduce carbon emissions but is also dually beneficial as it increases tree canopy cover, a major objective for the council. Funding is arranged based on the land-owner who sources funding from a variety of mechanisms including the partnership of experts from the Forestry Commission, national park authorities, local government, charities, community groups, and businesses.

Another example is Killingbeck Meadows where the planting of 8,000 trees and the delivery of new ponds and seasonal wetlands will help reduce flooding and provide natural habitats, as part of the Killingbeck Meadows Flood Alleviation Scheme (Richard Beecham, 2020).

Lastly, Aire Park opened in Leeds this year and is described as the "largest new city centre green space in the UK". The green space will sit at the heart of a new development which will also provide homes, offices, and retail space (Richard Beecham, 2022).

LIVERPOOL

The Liverpool City Council, led by Mayor Joanne Anderson, aims to make Liverpool fairer, greener, and brighter with low carbon emissions for the people residing there (Liverpool City Council, 2022). The mayor has already set Strategic plans to achieve the Net Carbon Zero target by 2030. Data shows that Liverpool has a high percentage of youth, and it also shows that it had 5.36 tonnes of CO₂ Emissions per capita in the year 2017 (Liverpool City Council, 2022). This data reflects the importance of taking immediate and effective actions to offset the effects caused by increasing CO₂ emissions. The CO₂ emissions in Liverpool primarily come from buildings, transport, waste, and electricity generation. One of the solutions to reduce CO₂ emissions is planning a green infrastructure and Carbon Sequestration (Liverpool, Green Infrastructure Strategy). Proper green infrastructure planning can lead to benefits such as flood mitigation, summer cooling, bio-diversity etc.

Liverpool City Council's budget 2021-2022 (£1493m) (Liverpool City Council, 2022)

- Community Services £83m,6%
- Regeneration and Economy £54m,4%
- Chief Executive £5m,0%
- City Solicitor £12m, 1%
- Finance and Resources £253m, 17%
- Corporate £239m, 16%
- Audit Services and Health £254m,17%
- Public Health £37m,2%
- Children and Young People's services £556m, 37%

Liverpool City Council has allocated a budget of £30,83,7000 to tackle the Environment issues. Environment concerns have been ranked 5th in Liverpool, and a Liverpool City Council plan 2022-2025 has been developed to make Liverpool sustainable, accessible and greener (Liverpool City Council Plan 2022-2025). Apart from Liverpool City Council, Liverpool City Region, a combined authority, has also set out plans to make Liverpool City Region carbon Neutral by 2040. They have also set out funding options of £500,000 for different scale projects for environmental betterment. Additional injection of £100,000 will be made to improve the natural environment in the Liverpool City Region. This project mainly focuses on a nature-based investment model to restore the environment and biodiversity of Liverpool.

Project Examples:

1. Liverpool City Council is working with Fields in Trust to protect the parks and green spaces in Liverpool. Fields in trust have been protecting recreational and green spaces in the UK since 1925. After collaborating with Liverpool City Council, the city

is aimed to see 100 green spaces covering 1000 hectares. Fields in Trust have a vision to see 64.1% of Liverpool Citizens within a 10-minute walking distance of green space (Fields in Trust, 2022)

2. The Urban GreenUp is one of the projects funded by European Union's Horizon 2020 programme. The main objective of this project is to renature urban areas in a number of European and non-European partner cities to mitigate the effects of climate change, reduce air pollution and better the water management systems. One of the interventions by Urban GreenUp in Liverpool was the greening of the wall in St Johns. The wall is 65 m in length representing UK's longest wall and it also includes around 20 different plant species. The development of this wall makes the city greener, helps in improving the air quality and acts as an important habitat for wildlife (Urban GreenUP, 2022)
3. The Mersey Forest plan is one of the projects which believes in working together and getting the most from trees. They achieve this target by obtaining funding from different partners and stakeholders. This ranges from local authority partners, grant makers to individual givers. The Mersey Forest Plan is working towards improving the existing woodlands in Liverpool, creating small scale community planting schemes, initiate tree plantations along the main street and local neighbourhoods. This plan by Mersey Forest will make the city more resilient towards climate change, improve individual's health and equate green spaces. (The Mersey Forest, 2022)

MANCHESTER

The aim for mitigating climate change for the Greater Manchester (GM) city region is to get carbon neutral by 2038 as they comply with international commitments (Authority, 2022). Manchester is a major city in the northwest of England with a rich industrial heritage, whereby the council have been committed to multiple short-term targets to reduce emissions, for example to replace fleet vehicles with electric ones. This commitment is to reduce emissions by 35-45% by 2025 (Council, 2022), alongside the commitment to reduce CO₂ emissions from the Council's operational estate and street-lighting by at least 50% by 2025 and set up plans for a further reduction of 50% between 2025 and 2030.

During the pandemic, the government used a significant portion of their budget for greening initiatives towards a pandemic relief fund, thus allowing the green projects to fall behind whilst impacting the health and social welfare of the people in the surroundings (Carvalho Aguiar Melo and de Sousa Soares, 2020).

The total budget for council services is £691m (Council, 2022):

- 61% (£423m) adult social care, children's services and homelessness.
- 15% (£105m) keeping neighbourhoods clean, *green* and liveable and keeping local services like parks and libraries running.
- 11% (£79m) services supporting our 7,300 staff to get on with working for the city and help residents – for example through benefits.
- 1% (£7m) growth and development – attracting investment and jobs and getting much-needed homes built.
- 11%, (£78m) transport and essential contingency funding.

The council put in place £192million of funding to support zero-carbon ambitions (Council, 2022).

Specifically, £76.4m was provided by the council, £65m was secured from the Government, £41m was secured via Greater Manchester Combined Authority, £4.3m from European Union legacy funding, £4.3m from partner organisations such as registered social housing provider One Manchester and £1.1m from Manchester Climate Change Agency.

The council avoided cuts during the past year, however a gap in funding persists, which the council aims to address by considering increasing the council tax by 2.99% (Council, 2022)

Project-wise, The IGNITION project is a ground-breaking assignment with goals to broaden revolutionary financing sources for investment in Greater Manchester's green environment. This investment will assist to build the city's capability to evolve to the increasingly severe impacts of climate emergency (Authority, 2022). This Project is subsidized with the aid of €4.5 million from the EU's Urban Innovation Actions (UIA) initiative, which aggregates 12 members such as local authorities, universities, NGOs and commercial enterprises (Authority, 2022).

Manchester City Council are electrifying domestic heating in a new-build development in West Gorton, Greater Manchester. The affordable houses were equipped with modern, digital and renewable energy solutions that can deliver reductions to energy bills of up to 90% for tenants.

The Greater Manchester City Tree Planting Initiative planted 59,929 trees and involved 12,538 people. It is aiming to plant 3 million trees and bring 2,000 hectares of unmanaged woodland back into community use (Net Zero Hub, 2022).

Project examples: (Moss, 2022)

1. Groundwork's Eco-Streets Competition

Groundwork Greater Manchester held its Eco-Streets competition in the spring of 2021, awarding £6,000 to five neighbourhood organisations to transform an underutilised and unattended part of their community into a creative green space that combats climate change by prioritising NBS. Over 200 expressions of interest and 45 final submissions were received for the competition, which engaged and empowered local communities to develop their own NBS solutions to the climate challenge.

2. Stockport Bus Interchange Green Roof Installation

According to a cost-benefit analysis (CBA) of the proposals for the restoration of Stockport Interchange, a self-irrigating blue-green roof system could result in capital cost savings over storm attenuation tanks while also having broader environmental and social advantages. The CBA found that by reducing the need to dig through polluted soil and rock, employing NBS may save £116,000 in capital costs. Additionally, the CBA calculated that by using NBS to lower the wastewater banding charge, £14,100 might be saved annually.

The Nature-based solutions to the climate emergency: The benefits to business and society report documented: 10–50% increase in willingness to spend on products whilst in the presence of street trees in a central business district; 30– 50% increase in restaurant patronage due to street trees; and 40% increase in commercial trading rates after investment in well-planned greenspace.