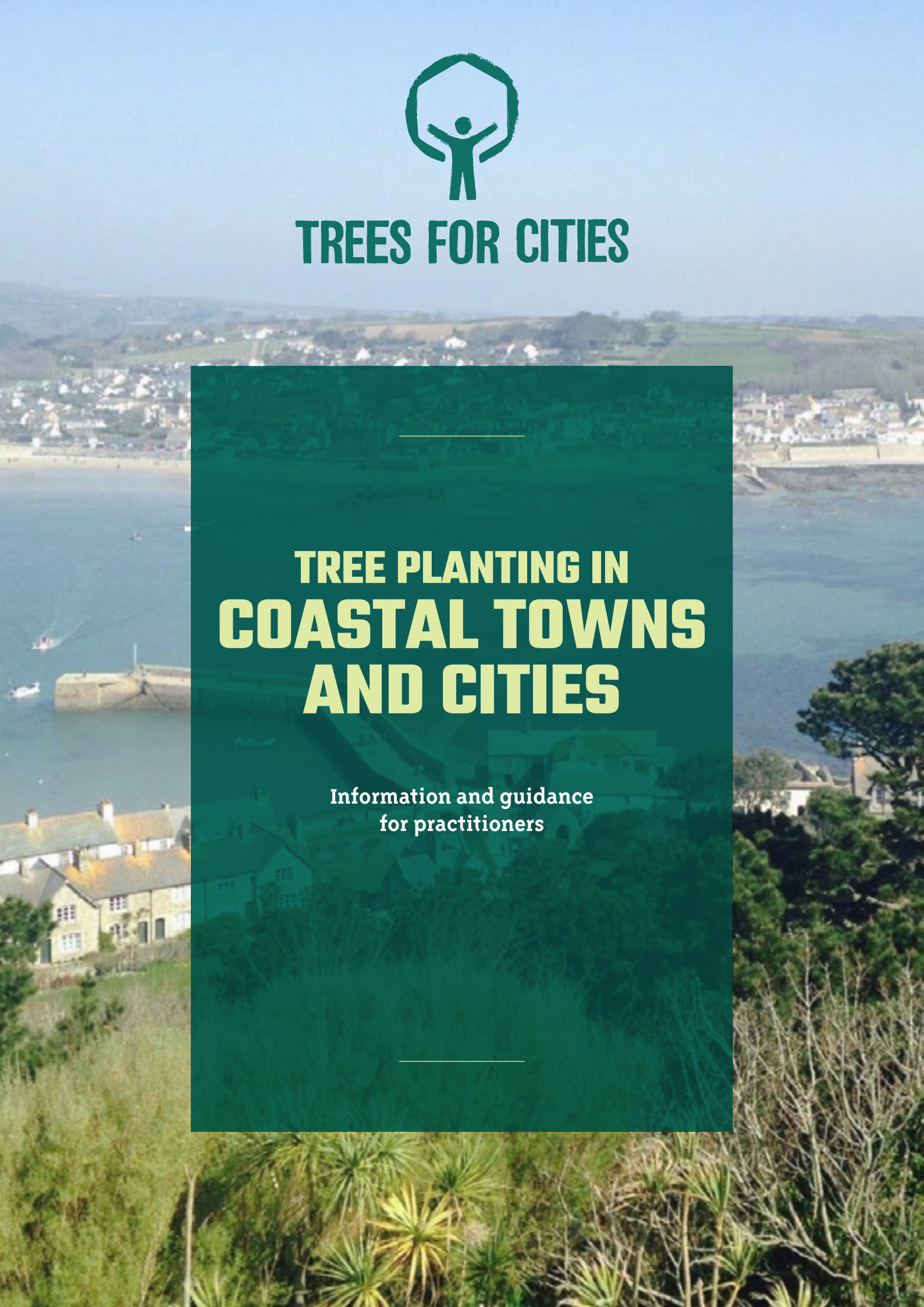


TREES FOR CITIES

TREE PLANTING IN COASTAL TOWNS AND CITIES

Information and guidance
for practitioners

CONTENTS

CASE STUDIES

SUMMARY

UK coastal towns and cities are areas of important environmental, commercial, and cultural interest, and frequently represent locations of key moments in our shared history.

Socially, coastal towns and cities offer complex circumstances to the communities living there such as a strong reliance on tourism revenue and high levels of deprivation. Ecologically, they are incredibly diverse, with unique, but commonly harsh, environments and microclimates.

Well-placed, well-planted and well-chosen trees can offer many benefits to coastal urban communities, helping to improve their lives, places, and wellbeing. However, the socioeconomic and environmental backdrop associated with coastal urban areas adds challenges to tree establishment, growth, and longevity, which all too often are seen as limitations or barriers to new tree planting.

Additionally, in affluent coastlines or those of particular interest, the drive for added value of properties sold with a 'view' or to retain the place's identity may hinder significant expansion of tree cover.

Currently, there is little information available to support tree planting endeavours in coastal urban areas. This document fills that gap and provides much needed guidelines on strategic planning and tree selection to those wanting to implement a vision for coastal tree planting in their local area.

We show that, if thoroughly planned, tree planting in coastal towns and cities is both possible and advantageous to local people.

In addition this document will:

- Explain the social-economic challenges faced by coastal communities
- Highlight approaches through which more tree planting could help improve residents' live. To explain those approaches, we suggest a framework for delivery that focuses on improving place, increasing visits and growing goods and services
- Share real-life coastal examples where benefits have been increased through new tree planting
- Describe the environmental factors which affect tree growth in coastal urban areas, the symptoms shown and how they are likely to change with climate change
- Propose a way to prepare tree strategies for coastal locations and which aspects should be considered in the planning phase
- Suggest a way to zone the coastal influence in your local area and techniques that can be used to minimize risks
- Provide guidance on which trees may be suitable for selected planting sites
- Recommend the creation of an aftercare plan to ensure tree planting is successful.

1. INTRODUCTION

1.1. Defining the coastal urban forest

In this report we have adopted the following definition of coastal area: 'That part of the land that is affected by its proximity to the sea (...) in which processes that depend on the interaction between land and sea are most intense [1].'

Consequently, we define coastal urban areas as those towns or cities that border the sea and so are most influenced by its presence or those that are situated towards the mouth of estuaries and thus also experience similar conditions.

Currently there is no accepted definition for the coastal urban forest, or indeed a coastal forest.

We define the coastal urban forest as all the trees within urban realms that are significantly influenced by the sea.

Within coastal urban areas the impact that the sea has on their trees is not equally shared, and whilst we expect this impact to reduce with distance from the coastline, the rate of decline will depend on complex local factors.

1.2. Current tree canopy cover

It is evident that there is a coastal gradient of urban tree canopy cover, with a decrease in cover frequently observed with increasing proximity to the coast.

In 2017, a baseline tree canopy cover survey of 283 towns and cities in Great Britain[2] found that of the 40 towns and cities with the lowest tree canopy cover, 30 of these were coastal. The outcome of this study led the (Urban) Forestry Woodland and Advisory Committee to recommend a target of at least 15% of cover for coastal urban areas, which is lower than the 20% target suggested for other towns and cities.

More recently, a UK-wide canopy cover survey was conducted at ward-level and completed by citizen scientists (this time also including shrub coverage). This survey found the average canopy cover of coastal urban areas to be 13%, compared with 17% observed in non-coastal urban areas (Table 1).

It also found that there are often substantial differences in canopy cover distribution within a town or city, with cover often being lower in wards with higher levels of deprivation (Figure 1).

1 Sorenson and McCreary (1990).
2 Doick et al. (2017).

Table 1.
Canopy cover data based on Forest Research's canopy cover WebMap.[3]

	CANOPY COVER (%)
All UK wards	14.2%
UK Coastal wards only	11.6%
UK Urban Wards only	17.2%
UK Coastal and urban wards only	13.0%

A new initiative from the Nature Based Solutions Institute is encouraging cities to adopt the 3-30-300 rule[4] whereby everybody should be able to see 3 trees from their home, live in a neighbourhood with at least 30% tree (or vegetation) canopy cover, and be no more than 300 metres from the nearest green space.

This may not be achievable target for all coastal towns and cities in the UK but suggests they ought to aspire to plant, in a successful way, as many new trees as possible.

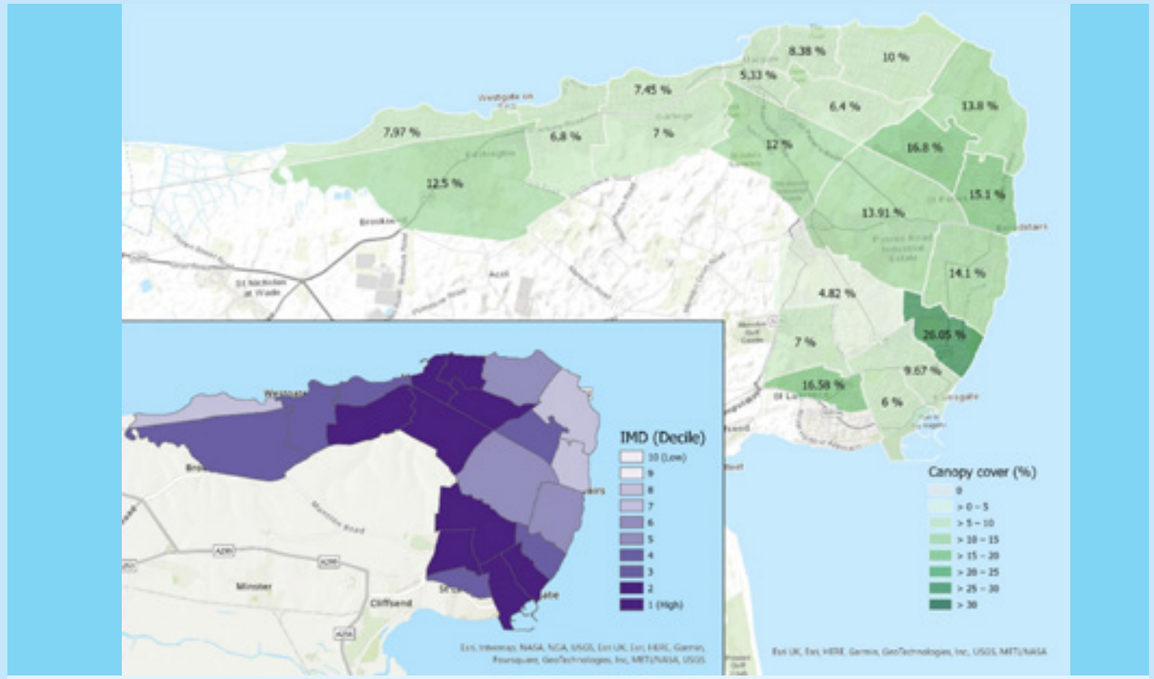


Figure 1. Canopy cover compared to the Index of Multiple Deprivation (IMD) for wards in Thanet (Source: www.gov.uk/government/statistics/english-indices-of-deprivation-2019).

3 Based on Area weighted mean of wards - GB Ward Canopy Cover WebMap (www.arcgis.com).
4 Nature Based Solution Institute (www.nbsi.eu).

CASE STUDY 1:

SETTING A TARGET FOR SOUTHEND-ON-SEA AND BACKING IT UP

In January 2021, Southend-on-Sea Borough Council adopted a new tree policy, which explicitly recognises the multiple roles of trees in mitigating climate change.

Southend-on-Sea currently has 12% canopy cover; the strategy sets a target of 15% canopy cover, which is realistic considering the local challenges.

To reach this target, an additional 1km² of canopy will need to be planted; this will take many years to plant, establish and grow. The strategy describes in detail how this tree planting target will be achieved, funding sources and communication plans.

The council has adopted a twin pronged approach. First, public land holdings have been considered for their potential to plant trees. Second, a community engagement programme has been created to encourage residents, businesses, schools, charities and other groups to consider tree planting on their land.

In the first year of implementing this strategy, the Council planted more than 1200 trees and 7000 shrubs in the 2021/22 planting season.

1.3. Current coastal urban forest structure and composition

Whilst the tree canopy cover of coastal towns and cities is often lower than that of inland urban areas, the overall tree diversity and the tree species present within them are comparable.

This was demonstrated in a review of the current state and sustainability of several coastal and inland towns and cities using data that was made available through i-Tree Eco surveys[5].

The key characteristics of all coastal urban forests reviewed in that work, as well as others that have been subject to recent i-Tree Eco surveys, are presented in Table 2.

In urban areas, it is important not to rely too much on a certain tree species to ensure that the tree canopy cover will not be compromised by future risks such as climate change or tree pest and disease attacks.

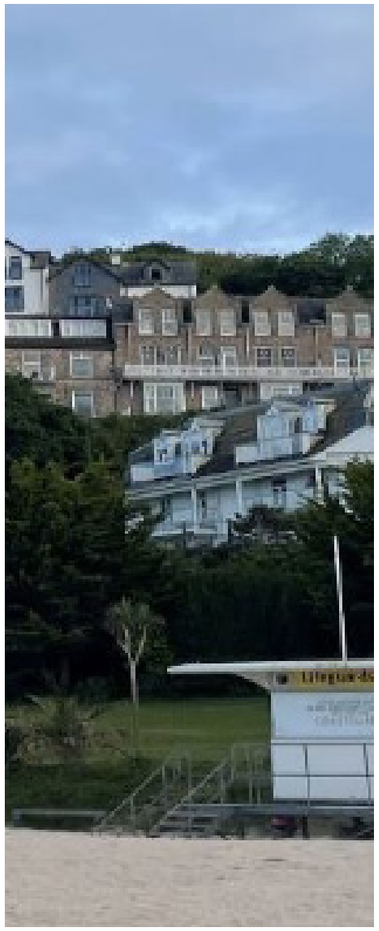
The more species planted within a town or a city, the more diverse its urban forest is, and so the more chances there are that many of its trees will thrive even if conditions change. That review scored the diversity of each urban forest evaluated using the 10:20:30 rule popular with urban foresters that states no species should exceed 10% of the population, no genus should exceed 20% and no family should exceed 30%[6].

Only London's urban forest complied with this rule; each of the other urban forests assessed in the review were considered to fail against this rule, inland and coastal alike. The same trend was observed in the coastal towns and cities that were more recently surveyed (Table 2).

According to the i-Tree Eco survey data, the most common tree species in coastal areas are the same as those present inland: Sycamore, Birch, Ash, English oak, Hawthorn, Holly, Leylandii, Alder, Beech, and Goat willow. It is surprising that a species difference is not observed since coastal urban areas are significantly influenced by the sea and inland areas are not.

Chapter 3 describes environmental conditions that are common to coastal areas, and how these should be considered in tree species selection. Other factors including latitude, altitude and elevation will also influence the suitability of different trees and so should also be considered.

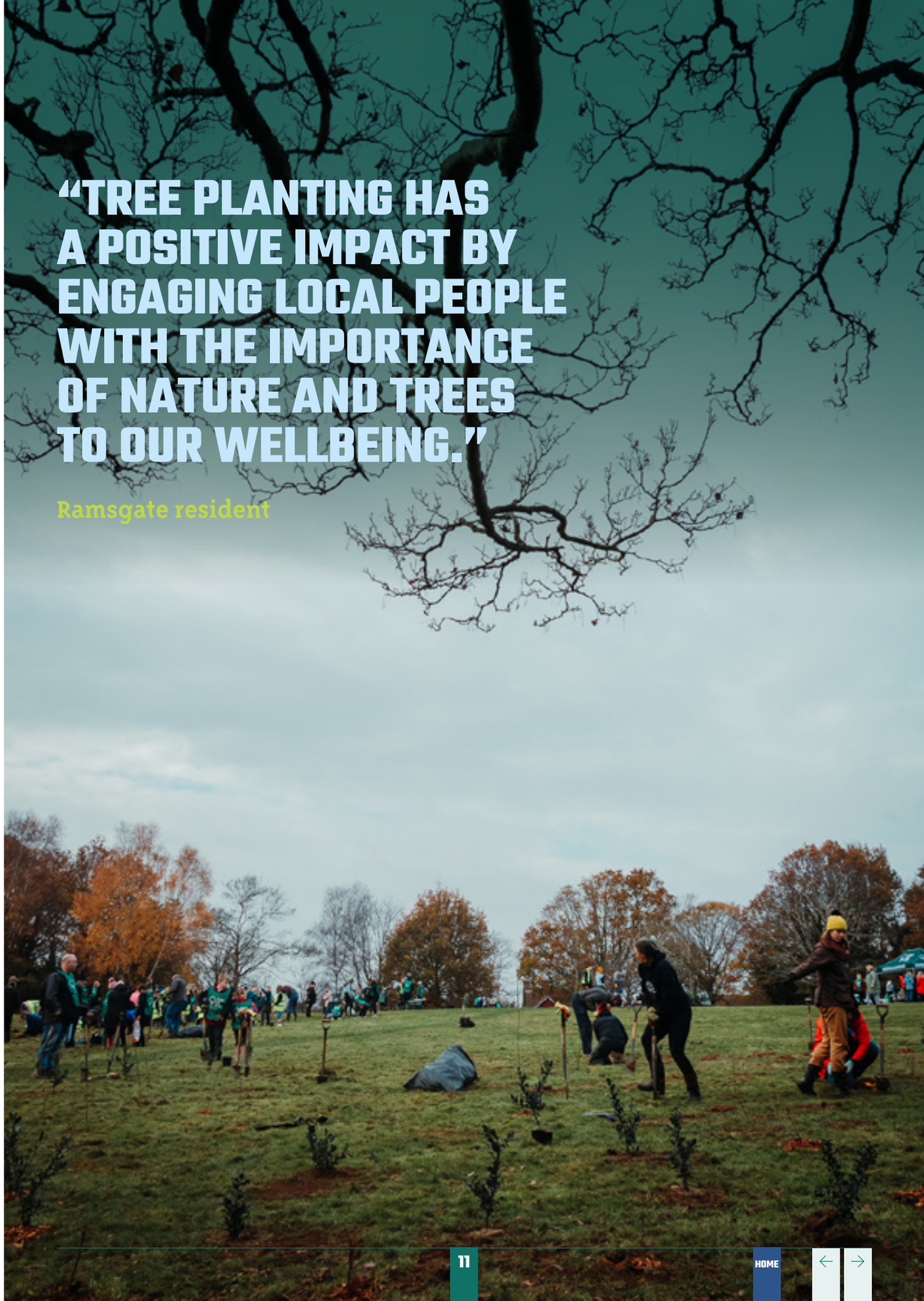
Given the need for tree species diversification and suitability to coastal microclimates, it is important that coastal areas prepare and adopt a local tree planting and management strategy. Further information on this is provided in Chapters 4 and 5. The overarching strategy should consider both public and private trees, as these collectively contribute to the total species diversity of an urban forest.



5 Vaz Monteiro et al. (2019).
6 Santamour (1990).

Table 2.
Summary of key findings from i-Tree Eco surveys carried out in coastal towns and cities.

LOCATION	COUNTRY	YEAR OF SURVEY	ESTIMATED TREE CANOPY COVER	TOP 3 MOST COMMON SPECIES AND THEIR PERCENTAGES FROM THE TREES ACCESSED	TOTAL NUMBER OF TREE SPECIES RECORDED
Bexhill	England	2021	16%	Quercus robur (English oak) - 19% Fraxinus excelsior (Common ash) - 9% Ilex aquifolium (Holly) - 8%	81
Southampton	England	2016	19%	Quercus robur (English oak) – 11% Acer pseudoplatanus (Sycamore) – 11% Ilex aquifolium (Holly) – 9%	103
Torbay	England	2010	12%	Cuprocyparis leylandii (Leylandii) – 14% Fraxinus excelsior (Common ash) – 12% Acer pseudoplatanus (Sycamore) – 10%	102
Belfast	Northern Ireland	2021	13%	Fraxinus excelsior (Common ash) – 11% Acer pseudoplatanus (Sycamore) – 9% Fagus sylvatica (Common beech) – 5%	105
Edinburgh	Scotland	2011	17%	Acer pseudoplatanus (Sycamore) -12% Ilex aquifolium (Holly) – 11% Betula pendula (Silver birch) – 8%	50
Bridgend	Wales	2014	12%	Fraxinus excelsior (Common ash) - 15% Crataegus monogyna (Hawthorn) - 14% Salix caprea (Goat willow) - 10%	60
Cardiff	Wales	2017	19%	Fraxinus excelsior (Common ash) - 11% Acer pseudoplatanus (Sycamore) – 10% Fagus sylvatica (Common beech) – 8%	73
Newport	Wales	2019	12%	Cuprocyparis leylandii (Leylandii) - 14% Betula spp. (Birch) - 8% Crataegus monogyna (Hawthorn) - 8%	59
Towns of the Vale of Glamorgan	Wales	2021	13%	Fraxinus excelsior (Common ash) - 11% Acer pseudoplatanus (Sycamore) - 9% Crataegus monogyna (Hawthorn) - 8%	59
Swansea	Wales	2014	16%	Alnus glutinosa (Common alder) - 17% Salix caprea (Goat willow) - 13% Betula pubescens (Downy birch) - 11%	88



2. THE CASE FOR INCREASED TREE COVER IN COASTAL URBAN AREAS

The towns and cities found on the UK coastline are uniquely characterised by their size, location, history, heritage, population dynamics, development, and by past and current industry. These locations are often described as being the "end-of-the-line". The coastline creates a sharp edge, both reducing the area from which to seek support and to search for opportunities.

Many services stop at or fall short of the coast, while the same search distance accesses a smaller land area when compared to inland areas.

As such, coastal urban areas are diverse, yet they often have more in common with one another than their nearest inland neighbour. This chapter describes some of the challenges those coastal urban areas face, and how planting trees could help alleviate their impact.

Most coastal towns and cities have grown around ports or harbours, born out of the need for fishing or to transport goods. Active ports such as those in Southampton, Great Yarmouth, and Barrow-in-Furness, remain a crucial part of UK's economy, with over 95% of trade passing through them each year[7].

However, many coastal urban areas experienced a noticeable shift away from fishing, trading, and shipping in the 19th Century when they were connected by rail. Instead, these towns and cities became popular places to visit, particularly those with accessible beaches, and hence were developed into seaside resorts for tourists.

Some of these resorts declined in favour with increased accessibility to overseas holidays, whilst others have grown in popularity for UK and international visitors. This trend may be set to continue given extreme summer temperatures in mainland Europe due to climatic changes. This shift in industry and employment has resulted in a variety of challenges for residents of such coastal urban areas.

7 ONS (2020)

2.1. Socio-economic challenges faced by coastal communities

Population dynamics

Many coastal communities are characterised by an ageing population – a higher proportion of people over the age of 65.

This is driven in part due to the inward migration of older people wanting to retire to the seaside, and an out-migration of young people looking for work opportunities that are not available locally. In 32% of the smaller seaside towns in England and Wales, the population is declining .

An aging population places additional pressures on healthcare services and poses challenges for the local economy; higher proportions of retirement-age residents result in reduced workforce capacity and can lead to loss of opportunities. For example, prior to Covid-19, 28% of businesses in coastal areas said they were planning to retire or sell in the next 5 years[8].

The outward migration of younger people from coastal urban areas further contributes to a reduction in workforce capacity. University and college leavers are often part of this out-migration as they look for job opportunities which utilise their new skills. Meanwhile, in some coastal towns and cities such as Blackpool and Morecambe, there is an influx of vulnerable young adults attracted by low-cost housing. These vulnerable young adults often have complex medical needs, placing additional strain on local healthcare providers, and limiting their engagement with local employment opportunities.

Employment

Employment opportunities for residents of coastal towns and cities tend to be more limited than those in inland towns and cities. Generally, there are fewer opportunities for full-time work (approximately 31% of residents work part-time[9]) and hourly earnings are 7-8% lower for residents of seaside towns than the English average[10]. As a result, those living and working in coastal towns are more likely to have to supplement their part-time work with another job or find full-time employment elsewhere, leading to a decline in the local workforce.

Tourism is a key source of employment in many coastal areas. On average, it constitutes 15-20% of all employment in coastal towns but can exceed 50% in some popular seaside destinations such as St. Ives, Whitby, and Newquay[7]. As a result, work is highly seasonal, with many businesses in coastal towns generating most of their annual turnover in July and August alone.

The reliance on tourism to fuel the local economy can make coastal communities vulnerable to the impacts of change or unprecedented events, because of their dependency on a small subset of goods and services at certain times of the year. This risk can lead to periods of low productivity, a reduction in the amount of investment in the local area, and poses challenges for retaining employees.

Employment opportunities, aside from tourism, are often dominated by the public sector. Employment outcomes are improved where anchor institutions exist; largescale employers tied to the local community by identity, resources and relationships, which provide stable high quality jobs.

The geography of coastal urban areas can result in accessibility issues; the 'end-of-the-line' location can cause problems for transportation, digital connectivity and accessing basic services such as health provision. Wider societal changes to remote working and a digital economy therefore present a significant opportunity for future employment in coastal areas.

8 National Coastal Tourism Academy (www.coastaltourismacademy.co.uk/coastal-tourism).
9 ONS (2014).
10 Beatty, et al. (2008).

Deprivation and social mobility

Effects of historical changes, population dynamics and employment challenges have led many residents of coastal towns and cities to experience lower incomes, poorer health, poorer housing, low educational attainment, and barriers to accessing green space.

As a result, coastal towns and cities are often more deprived than inland urban areas. 43% of residents in small seaside towns live within the top third of English neighbourhoods with the highest unemployment deprivation - this is almost double the population in non-coastal towns[7].

These same effects can also be seen in the UK's pattern of social mobility. In 2016 the Social Mobility and Child Poverty Commission created an index to compare the ability of children from disadvantaged backgrounds to succeed at school and to then obtain a decent job, based on information such as on early learning outcomes, educational attainment, salaries, and home ownership. They concluded that "coastal areas and industrial towns are becoming real social mobility cold spots". This pattern can be seen in Figure 2.

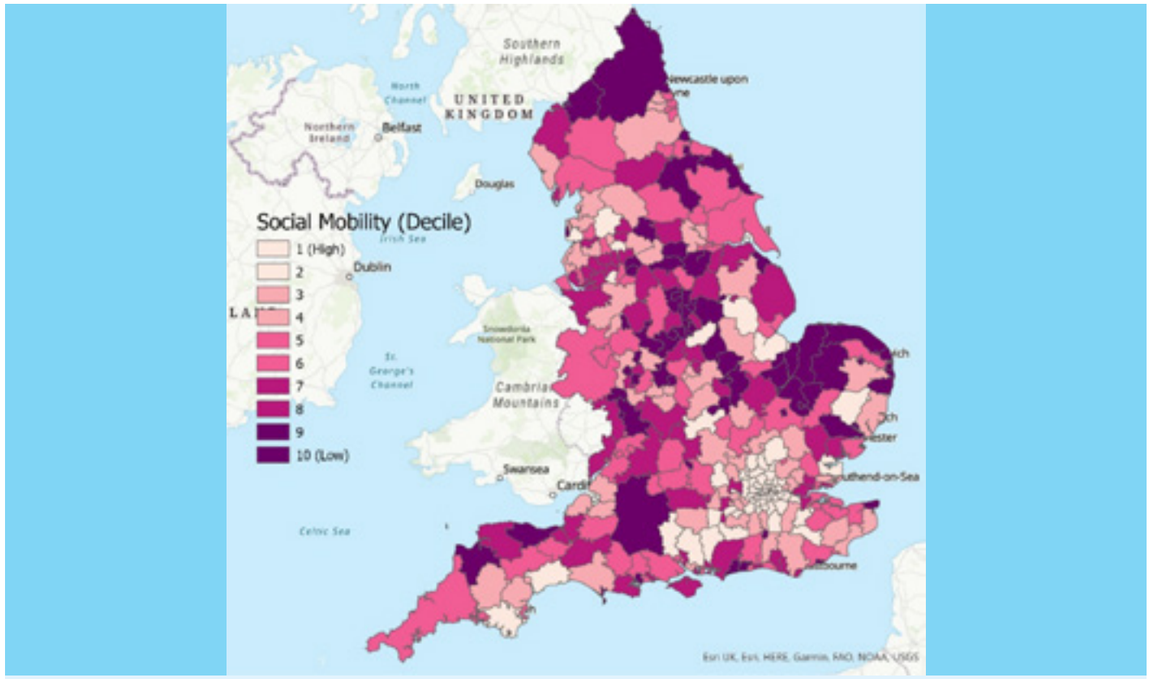


Figure 2. Social Mobility Index for England
(Source: www.gov.uk/government/publications/social-mobility-index).

Health and wellbeing

In England's coastal towns and cities, there is a disproportionately high proportion of the population that suffer with poor mental health, physical illness or diseases such as coronary heart disease and chronic obstructive pulmonary disease (COPD). The Director of Public Health in Hull summarises the problem as "far shorter lives are spent in far poorer health"[11].

The skewed age profile and level of deprivation are both significant contributory factors. For example, obesity increases with deprivation due to inactive lifestyles and poor diets.

However, even after accounting for these factors there is a 'coastal effect' to the prevalence to disease compared to inland areas (Figure 3).

Other contributing factors may be linked with the fact that coastal urban areas have fewer medical staff on average than inland communities, partly because a large portion of their catchment area is occupied by the sea. This means residents must travel further to access healthcare which often leads to a delay in diagnosis and treatment.

Also smoking in coastal areas is often higher than inland communities and some coastal areas report problems concerning excess drinking and substance abuse.

More information is available at the Health and Wellbeing Opportunity Mapping for England.

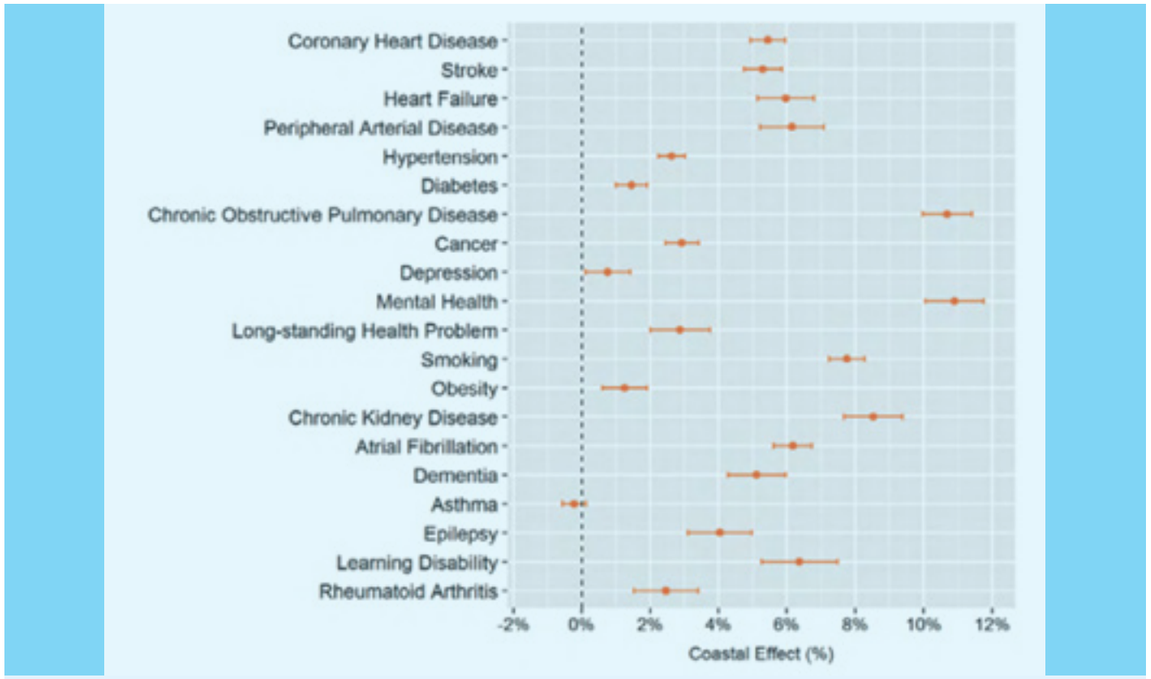


Figure 3. Estimates of the "coastal effect" on the number of patients on selected GP disease registers: 2014/15 – 2018/19
(Source: Whitty, 2021).

11 Whitty (2021)

Once socio-economic and demographic issues in coastal areas are resolved, these areas have potential to have better health outcomes than their inland neighbours.

Some diseases, such as asthma (Figure 3), have a lower incidence rate near the coast. Mental and physical health can also be improved through better access to outdoor space for recreation and mindfulness.

In coastal communities, mental and physical health issues are often a cause of economic inactivity.

Many health determinants are also economic determinants, and vice versa; high quality stable jobs are key to positive health outcomes, and if these are absent or limited, this can create a negative feedback loop which can be difficult to escape.

Reducing health inequalities and improving the health and wellbeing outcomes for the community is therefore of key importance in developing a sustainable and productive economy.

2.2. The benefits that trees can offer to coastal urban communities

Trees and green spaces can be part of the solution to the complex interaction of economic, health, education and housing issues in coastal urban areas.

Traditionally forestry in the UK has been for timber and wood products. In the 1990s, in part as a response to Rio "Earth Summit", we started to look holistically at the benefits trees provide, also known as ecosystem services.

Figure 4 presents some of the provisioning, regulating, supporting and cultural benefits that trees can bring to coastal towns and cities.

The 2014 UK National Ecosystem Service Assessment (NEA) estimated that woodlands provided £3.3 billion of value to the UK's economy and society. Timber products accounted for only £225 million of the total, whereas recreation related to trees generated £516 million for the UK economy; the average spend on woodland recreation visits in England being £1.18. In this report we seek to introduce new ways to maximise existing benefits and propose avenues to gain a wider range of benefits acquisition in coastal urban areas.

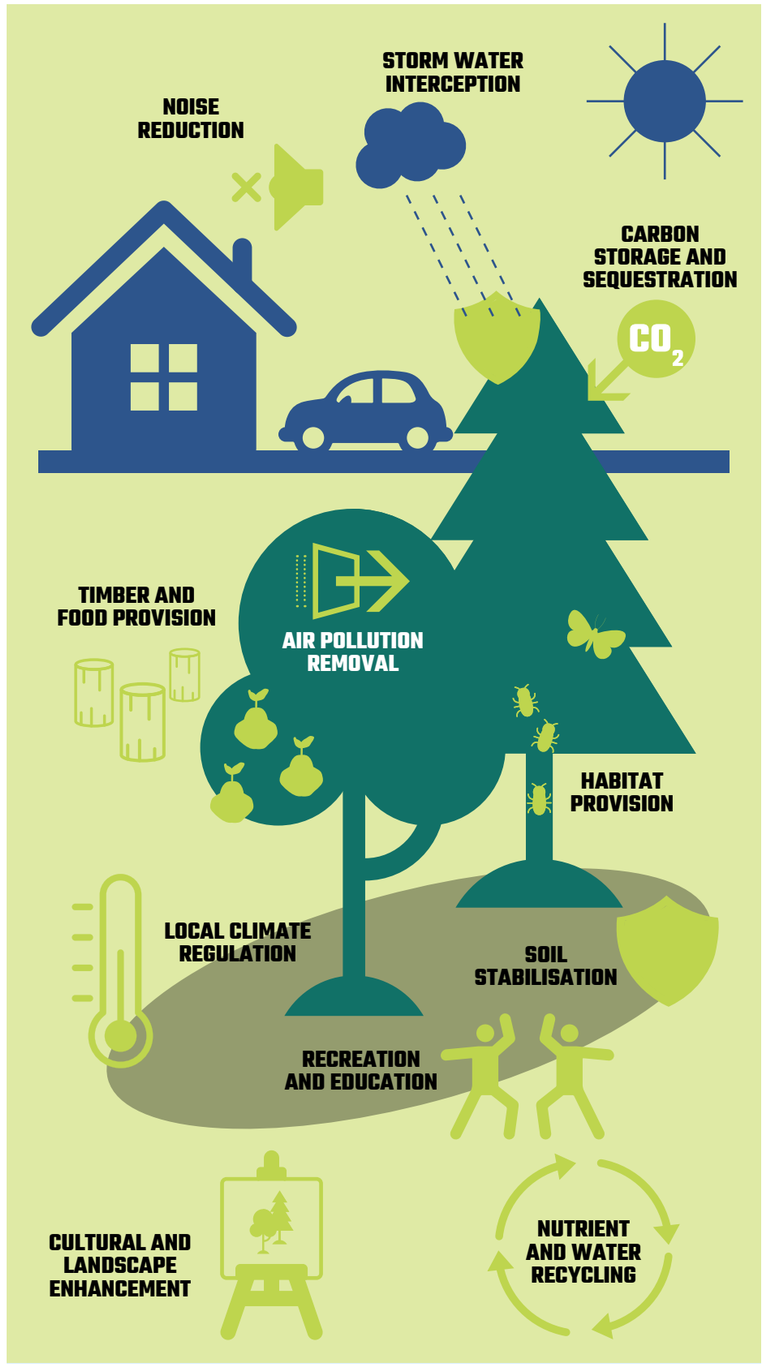
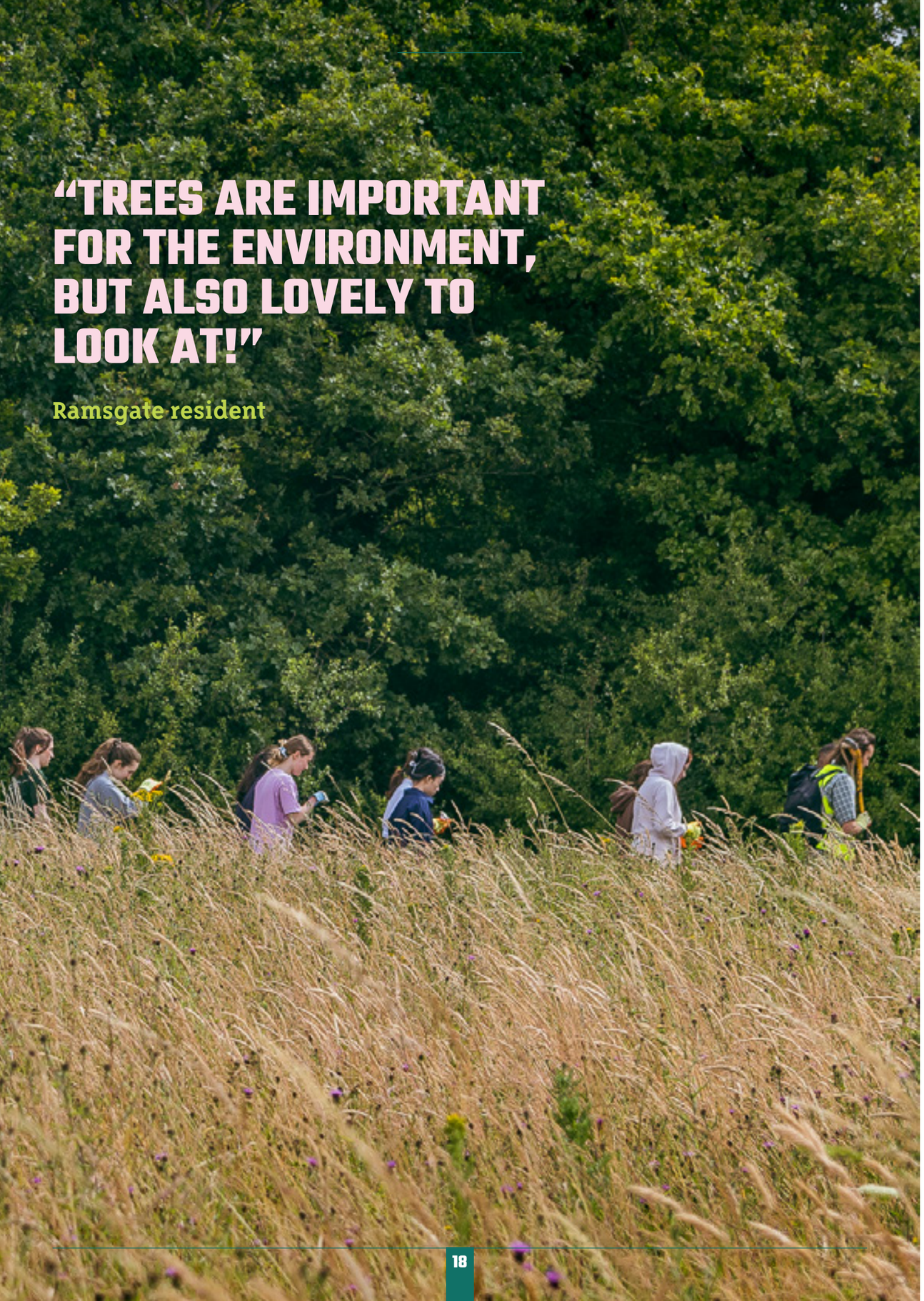


Figure 4. The benefits that trees can bring to urban communities.



2.3. A framework for Ecosystem service improvement

We do not propose that planting a single tree, or a few spatially distributed trees could significantly boost the local economy or improve residents’ lives and wellbeing. Instead, we argue that targeted tree planting designed to combat local issues can compound to make significant change.

For this purpose, we have created a simple framework to illustrate how trees could help mitigate the social-economic challenges described. This framework separates our suggestions into three categories focusing on how to improve place, increase visits and grow goods and services, although some of those suggestions could cross-over between categories.

Improving place covers approaches to improve the local environment and the social-economic conditions for the community. In this category, we propose ways to break the cycle of economic inactivity which causes deprivation, and which in turn leads to poor health and education outcomes. We concentrate on planting that could improve those, while creating a shared community identity.

This would reduce out-migration and encourage in-migration of skilled workers and so more investment from businesses where skills are more important than location. These could then grow into future anchor institutions.

Increasing visits covers tactics to increase visitor numbers and the quality of each visit. If successful, coastal areas would have more visits, of a longer duration, and bringing a higher spend, then tourism seasonality could be attenuated.

This could be achieved through improving the existing infrastructure and developing new visitor attractions centred around trees. Communities are planting trees in shared areas, like squares and promenades, to create event spaces.

Planting trees within shopping centres have been shown to both improve the customer experience and increase retail spend[12]. Planting trees for shade in readiness for climate change would further make coastal urban areas even more attractive places in the summer. Also, focusing on trees that are attractive during the autumn, winter and early spring could provide ‘out of season’ tourism.

Growing goods and services covers the direct benefits trees can provide such as timber production, green jobs, provision of shade and flood risk management.

For example, we suggest ways to make it economically viable to grow timber in coastal areas, which could create jobs in tree management or skilled jobs in downstream industries e.g. furniture makers.

12 (Wolf,2014)

Table 3.
Framework for creating change through tree planting.

	RATIONALE	OUTCOMES	ECOSYSTEM SERVICES
Improving place	Developing a happy, healthy, and skilled workforce and thriving community.	• Improving health outcomes • Increased skills/education • Relocation of businesses to the area • Creation of Anchor institutions • Preventing out-migration of workers • In-migration and return of workers • Ready for the digital economy	• Health • Nature and landscape connections • Social development and cohesion • Education and learning • Cultural significance
Increasing visits	Creating reasons to visit the area; increasing time and money spent during each visit.	• Improving the existing infrastructure • New recreational experiences • Reducing seasonality • Increasing visit duration • Increasing spend per visit • Planning for climate change	• Recreation and tourism • Microclimate regulation and improvement of thermal comfort
Growing goods and services	Maximise economic and ecologic value from trees	• Creating a new timber business model • Creating nature-based solutions • Maximising provisioning and regulating benefits to society • Creating jobs in forestry	• Wood provision • Economy • Wind/ noise protection • Air pollution attenuation • Flood mitigation

2.4. Case studies for Ecosystem Service improvement

Many groups are already trying to benefit the local community and stimulate its economy through tree planting. Using our improvement framework: improve place, increase visits, and grow goods and services, we have identified several case studies showing how benefits can be delivered on the ground (Table 4).

We have not limited the list to case studies based in coastal locations where we feel techniques could be transferred successfully. In some cases, trees may deliver benefits in conjunction with other resources, in all examples trees make a significant contribution to the solution.

The list of case studies is not exhaustive, our approach instead is to highlight existing approaches and inspire communities to solve local issues using thoughtful, inventive tree planting plans. We only include schemes where benefits will be shared equally or benefit the most vulnerable.

For example, an increase in house prices is often cited as a benefit of tree planting, but may be problematic for those not owning their own house.

Table 4.
Case studies for creating change through tree planting.

IMPROVING PLACE

Racecourse Estate, London Borough of Ealing

Racecourse Estate is a 1960s housing development on the site of an old pony racing track in Northolt. Typical of the period, it was developed with plentiful open space but few trees. Through a volunteer-led i-Tree Eco survey carried out in 2018, this location was identified as high priority to increase tree canopy cover. Over 4 years, Trees for Cities worked with the community to deliver against a masterplan of clustered landscape enhancements, including planting large canopy trees, orchards, bulbs, natural play areas, food growing and open space improvements. This resulted in planting of 230 standard trees and 1,000 whips and establishing a new estate Greening Group, which was set up to liaise with the council on future improvements and concerns. As a result of this project, TfC identified Critical Success Factors through lessons learnt which can be used to support future estate greening projects.

Themes: Recreation, Community; Health, Urban

Torbay Tree trail

Torbay Council, the NHS clinical commissioning group, Hi-Line and Treeconomics, have developed an interactive experience based around trees and nature. The initiative encourages Torbay residents to improve their physical and mental health through exercise and engaging with nature. The i-Tree Trail, hosted on the Curio App, allows people to view information about the trail and its trees, in addition users can add unmapped trees that surround the trail.

Themes: Health, Coastal

NHS Forest

The NHS Forest aims to transform their healthcare sites to maximise health, wellbeing, and biodiversity benefits. Projects vary according to site and can range from peaceful gardens for rest and recovery, woodland orchards and meadows that store carbon, habitats for wildlife, to growing fruit and vegetables. Many case studies are available on the NHS Forest website.

Themes: Health, Various including Coastal

Mayfield park

Mayfield Park is a public-private venture on the banks of the river Medlock; Manchester's first new public park in over a century. The 6.5-acre site, derelict since the 1980s, has been developed with reference to its industrial past; the site now includes 140 trees of 58 species as well as thousands of other plantings. Designed as a "sequence of spaces", with play areas, walkways, quiet zones and habitat provision for biodiversity.

Themes: Recreation, Community; Biodiversity, Urban

IMPROVING PLACE

Allestree Park

A former golf course in Derby which bridges the urban fringe and the rural landscape, Allestree Park is the UK's largest urban rewilding project with plans to create diverse habitats such as wetland, scrubland, and community orchards. The projects aim to restore ecosystems through minimal intervention; letting natural landscape processes dictate. The park also hopes to reintroduce species like water vole and harvest mice.

Themes: Recreation, Biodiversity, Health, Urban

The Orchard Project

A national charity advocating for and supporting local communities to plant orchards in urban areas across the UK. As well as planting new orchards, the charity helps to restore veteran orchards, (see the Traditional Orchard Survey) and runs education events for a variety of groups, including with schools. Orchards also make excellent wildlife habitats for a range of species and foster community cohesion.

Themes: Community, Biodiversity, Various

England's Community Forests

England's Community Forests aim to create healthy spaces where humans, trees and nature freely interact. Community forests aim to make towns and cities attractive places to live and work, foster community cohesion, improve health and wellbeing, and improve local biodiversity. Various case studies are available on the website, include coastally based community forests: Plymouth and South Devon Community Forest, Northeast Community Forest, Cumbria Coastal Community Forest and Humber Forest.

Themes: Recreation, Community, Biodiversity, Economy, Jobs, Various including Coastal

INCREASING VISITS

Sidmouth Arboretum

The Arboretum seeks to protect and promote the Sidmouth's treescape as an asset to the tourist industry. Initially the Arboretum aimed to capture Sidmouth's trees, it has continued to enhance the town's treescape through regular tree planting and tree giveaways. The Arboretum also promotes improved health outcomes through its Tree Walks.

Themes: Health Community, Coastal

INCREASING VISITS

Queen's Green Canopy 'Tree of Trees' Sculpture

Thomas Heatherwick designed the "Tree of Trees" sculpture as part of the Queen's Green Canopy, celebrating The Queen's Platinum Jubilee. The sculpture was constructed using 350 native British trees, materials from local producers and reclaimed metal. The trees making up the sculpture were distributed for planting through the United Kingdom. The Queen's Green Canopy (QGC), planted over a million trees during its first season, between October 2022 and March 2023.

Themes: Culture, Community, Urban

SEE MONSTER

The art installation was opened to the public as part of the Unboxed: Creativity in the UK festival. The installation was created from a decommissioned North Sea offshore platform and incorporated a wild garden of plants, grasses and trees, amphitheatre, and a waterfall. The See Monster used repurposed industrial materials and nature to highlight future solutions to climate issues. All materials were recycled with the plants being used to create a new park on the sea front. It has been estimated that 500,000 people visited during the See Monster's 2-month tenure providing a £20 million boost to the local economy.

Themes: Culture; Community, Economy, Coastal

Culbin Forest

Deforestation had led to widespread desertification characterised by moving sands, a fire in 1939 further damaged the site. Acquired by the Forestry Commission in the 1920s, specialist species and techniques were used to restore the site to a mosaic habitat of tall pines, coarse ground cover, grasslands, and sand. Culbin Forest is now a destination tourist forest, SSSI, hosts populations of crested tits and Kentish glory butterflies.

Themes: Recreation, Biodiversity, Coastal

GROWING GOODS AND SERVICES

Hill Holt Wood

Community woodland run as self-sustaining social enterprise. Hill Holt Wood offers a wide range of educational courses, including pathways for young adults to vocational skills. Hill Holt is a working woodland and former students continue to work in green jobs at the site; their forestry services now manage more than 100 acres of woodland. The wood is freely accessible to the local community and offering a range of services including themed guided walks.

Themes: Education, Jobs, Rural

GROWING GOODS AND SERVICES

YesMake

YesMake use the circular economy to recycle felled councils' trees, which would otherwise become biofuel, into timber for use in community projects. YesMake emphasises sustainability in their adoption of low-carbon technologies and use of recycled timber when creating community spaces. YesMake also specialise in running workshops and natural play spaces.

Themes: Community, Economy, Urban

Fallen and Felled

Fallen and Felled repurpose felled hardwood urban trees into timber for furniture makers, architects and designers. Fallen and Felled aim to reduce the UK's reliance on imports of hardwoods. They also support downstream industries to produce high quality wood products, simulating the local economy.

Themes: Economy, Jobs, Urban

Watchet Esplanade, Somerset

Watchet harbour ceased commercial operation in 2000; subsequently it has been converted into a marina. In 2006 West Somerset council secured European funding to redevelop Watchet Esplanade into shared community space, incorporating: tourist information, markets, shops and live events. During redevelopment the esplanade's infrastructure was improved, including planting eight Evergreen Oaks. Watchet Esplanade has since become a focal point for the town, hosting markets, street fairs, seasonal events and being made available for bookings by the public.

Themes: Recreation, Community, Economy, Coastal

NPO Mori wa Umi no Koibito - The Forest is a Lover of the Sea

Shigeatsu Hatakeyama, an oyster farmer from Kesennuma in Japan's Miyagi Prefecture, engaged with local foresters to reafforest upstream land to improve water quality. Subsequent research by Katsuhiko Matasunaga, Hokkaido University, found that the decomposition of leaves in water provided key nutrients for plankton and actually increased yields for local fisheries.

Themes: Economy, Education, Non-UK Coastal

Cool Towns, Margate

Margate, a coastal resort in Kent, planted trees to alleviate concerns around flooding and climate change. During previous flood events, wastewater treatment plants were overwhelmed spilling sewage onto local blue flag beaches. Margate, like many towns, also has issues related to climate change, for example in July 2019 a local medical practice closed for 3 days due to heat impacts. It was decided to implement nature-based solutions using EU Interreg Cool Towns funding. First, stormwater was diverted from the sewage system into the George V Park where flood water was retained and absorbed using soakaways. Second, street trees were planted in heat vulnerable areas to provide shade and cooling through evapo-transpiration.

Themes: Flooding, Climate Change, Coastal

CASE STUDY 2:

A PLANTING SCHEME FOR VISITORS AND LOCALS IN KING GEORGE'S WALK, HAYLE

King George's Walk is a 'linear botanical garden' - a planting scheme designed around a multi-use pathway, which is adjacent to a road that sits next to a tidal pool.

Trees are a predominant feature of the garden, with numerous species providing the 'skeleton' around which the rest of the herbaceous and shrub planting is formed.

The stretch of walkway is popular with families, cyclists, dog-walkers and tourists. It is a particularly popular route during hotter days as there is plenty of shade offered by the trees.

Notably, it is bookended by two small coffee shops, which benefit from regular passing trade due to its popularity with visitors.

The gardens provide plentiful opportunities to sit and enjoy the surroundings, and are also interspersed with many interesting features; koi carp ponds, sculptures, boats, water fountains, interesting quotes, hopscotch, bug hotels and giant spiders! It is a prime example of considered green infrastructure design, benefiting people in a variety of ways and contributing to local businesses.

3. ENVIRONMENTAL CHALLENGES FOR COASTAL URBAN TREES

Having a good understanding of local environmental conditions and how these may affect trees is a crucial part of the planning process for new tree planting.

A good understanding of local environmental conditions is also a key consideration for managing trees into the future, given the changes that are projected under our changing climate.

Coastal environments present particular challenges to the establishment and growth of trees.

This chapter describes the different environmental conditions associated with coastal areas, their effects on trees and the impacts of the future climate.

3.1. The coastal climate

The UK climate is influenced by the sea that surrounds it, and air masses travelling from different areas of the globe can significantly change the temperature and amount of precipitation received by large territories (Figure 5) .

Within these, the scale of influence from the significant air mass varies with aspects such as proximity to the sea, latitude, longitude, altitude, land morphology, vegetative cover, and the built environment.

As such, the environmental challenges that trees can experience can vary considerably across the UK.

In coastal areas, increased wind speeds and higher levels of salt deposition (whilst not individually unique to coastal areas) can work in combination to limit tree growth and can pose challenges for growing healthy, long-lived trees.

Figure 5. Direction of different air masses arriving to the UK (Source: www.bbc.co.uk/bitesize/guides/zpykxsg/revision/3).

Wind exposure

Coastal areas experience higher wind speeds than those in low inland areas as the sea surface produces less friction to the passing air than the land, causing the wind to speed up.

This is particularly felt in the Western and North-western coasts due to the prevailing direction of the winds reaching the UK (Figure 6). Coastal locations also bear the brunt of the impact of storms – powerful cyclonic systems associated with low pressure which bring strong winds to the UK.

The topography of the coastline can further change the speed at which the maritime wind flows through a region, although the effects are normally only felt locally.

For example, steep cliffs, ridges, and escarpments can act as obstacles to the maritime wind and accelerate its speed in the areas around their crests.

In the same way, the presence of large sandy dunes will normally lead to a reduction in wind speed at the bottom of the dune and nearby beach area and to an acceleration at its top.

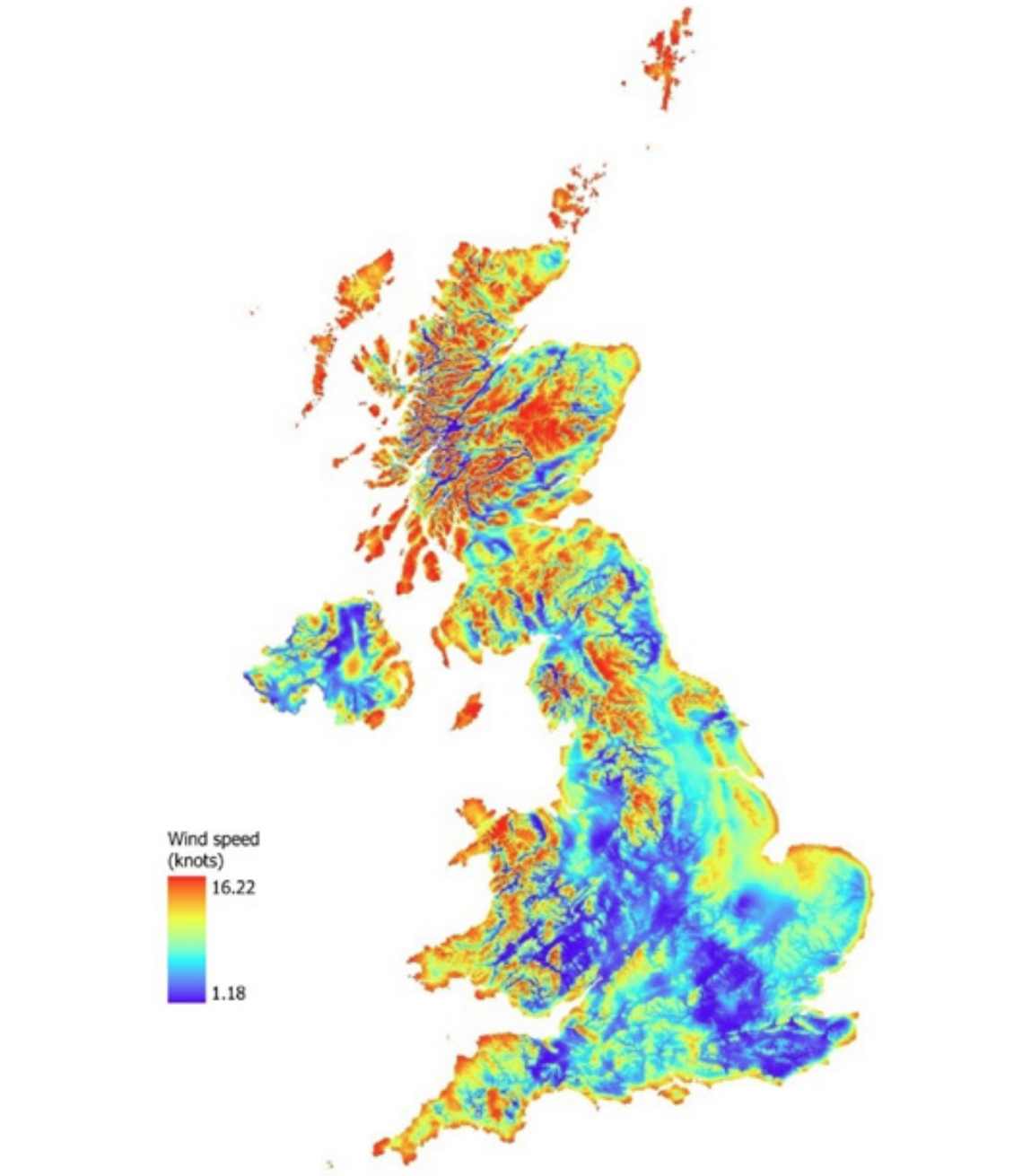


Figure 6. Average (30 years - 1991-2020) wind speed at 10m above the ground (Image derived from data available at Met Office, 2018).

Impacts of wind

Trees that are planted in windy spots will adapt to their recurrent wind exposure over time by changing their structure or morphology to reduce the drag. Common indicators that a tree is being affected by recurrent wind include reduced growth, bending of the trunk, re-shaping of the crown (usually along the axis of the prevailing wind), scorching and shedding of leaves, and loss of small branches. These changes do not normally impact on the tree's overall health but can make it challenging to achieve the height and form desired from amenity trees.

However, in windstorms and wind gusts, trees can be significantly damaged and damage the built structures that surround them. This is particularly likely to happen if the wind comes from a direction that is different from the prevailing one. Trees that are in poor health or decayed, are in their establishment phase, or that belong to a species which is susceptible to wind impact are more prone to cause damage.

Strong wind speeds can also indirectly impact on trees by increasing the water demand from the air and acting to accelerate the development of water deficit stresses.

Edwards and Holmes (1968) noted that inland trees growing in windy sites display the same adaptative strategies to those planted near the coast, but they are less prone to show significant damage.

As such, coastal communities are at greater risk from tree damage in high wind events.

Salt exposure

Coastal areas are subjected to higher concentrations of salt-laden wind than inland locations. Sea salt particles formed by the breaking of waves are sprayed by the wind flowing through the land.

These salt particles can remain in the atmosphere as aerosols or they can be deposited onto surfaces. Salt deposition mostly occurs in the area within 500 m of the coast[13] and can create significant damage by corroding coastal built infrastructure.

Impacts of salt

Trees in coastal areas can therefore be exposed to both high levels of salt aerosols and salt that is deposited on their leaves and in the soil around the trees. The sodium and chloride ions within salt particles can be absorbed from the leaves and soil, causing stress, or even becoming toxic to the tree. Trees experiencing salt stress exhibit a range of symptoms:

- Chlorosis (yellowing of leaves and needles)
- Leaf/needle necrosis
- Reduced cold hardiness of leaf and flower buds
- Premature leaf senescence
- Dieback of new shoots, leading to restricted growth
- Salt burn - browning of leaf margins.

Sensitivity to salt will vary between species, but it is important to recognise that other, additional stresses such as drought or tree pests/diseases, coupled with salt exposure, can make it difficult for even the more tolerant tree species to survive.

Identifying site-specific conditions and challenges is therefore of particular importance for planning new tree planting in coastal areas. Chapter 4 provides further insight.

3.2. Soil condition and saline water immersion

Soils in coastal environments often make for poor growing mediums. Some are likely to be occasionally or frequently immersed by seawater or have naturally high groundwater while others are high in sandy components, free draining and have low fertility[14]. Furthermore, the high accumulation of salt causes the soil aggregates to break down and with time makes coastal soils less aerated and less permeable.

It also makes those soils more alkaline, and if a high pH is reached this can reduce the availability of important nutrients to the tree or instead make the level of other nutrients toxic.

The lack of soil structure, permeability and nutrient availability in soils linked to coastal environments is likely to be exacerbated in urban areas where many soils contain a mixture of manmade materials.

Impact of soils and saline water immersion

High concentration of salts below ground can affect trees directly through absorption (as explained above) but also indirectly. The osmotic pressure is increased in saline soils, making it much harder, if not impossible, for roots to uptake water causing stress. Along with the effects of alkalinity, poor soil structure, compaction and lack of fertility, this hinders the growth of trees and in extreme cases causes its death.

Flooding or waterlogging of the soil with saline water surrounding trees can aggravate stress further. Flooding relates to occasional, short-lived immersion of the soil with water during storms and should not have a lasting impact on the trees. Waterlogging, however, relates to prolonged and recurring immersion of soil with water and can seriously affect trees as roots will not be able to access much-needed oxygen.

3.3. The changing climate

The most recent UK Climate Projections[15] indicate that:

- All areas of the UK are expected to be warmer, especially in summer.

In the high emission scenario, average temperatures increases are expected to be between 1.3°C and 5.1°C in summer, and 0.6°C to 3.8°C in winter.

- Hot summers are expected to become more common. By 2050, there will be a 50% to 60% chance of experiencing a summer as warm as 2018, which until 2022 was the equal-warmest summer on record.

- Both the frequency of hot spells, and the maximum temperatures, will increase. In the high emissions scenario, hot summer temperatures will increase between 3.8°C and 6.8°C.

- Rainfall across the UK will continue to vary with season and location. On average we are likely to have drier summers (and therefore more frequent droughts) and wetter winters.

- Despite drier summers, the intensity of heavy summer rainfall is likely to increase, which will increase the frequency and severity of surface flooding, especially in urban areas.

- Sea level will rise around the UK, although it will be less in the north (up to 0.9 m in Edinburgh by 2100) and more in the south (up to 1.15 m in London by 2100)[16].

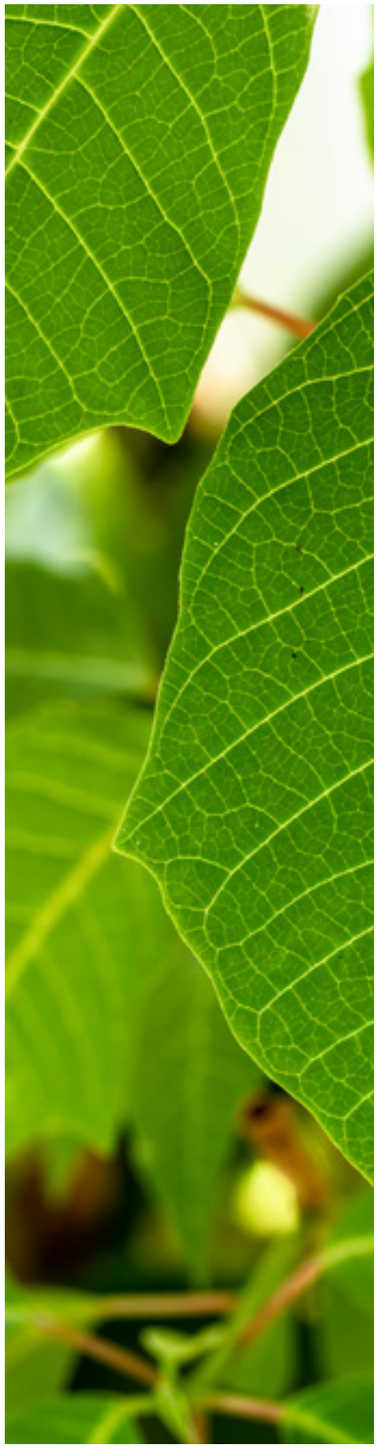
- The expected effect of climate change on future wind speed is very uncertain. Different climate models produce contrasting trends for wind speed, and the results vary between different geographic regions[17]. Appendix 1 includes more information on the predictions of different models and a case study showcasing how to climate match regions with a similar climate to the climate projection for your town or city.

What does the changing climate mean for new coastal urban tree planting?

- In the summer months, increased temperatures and reduced rainfall mean that it is going to be increasingly important to incorporate drought tolerant trees into new plantings. This is especially true in coastal urban areas whereby the local environmental conditions can further hinder soil moisture availability.

- Increased intensity of rainfall throughout the year leading to surface water flooding could wash salt and other surface debris into tree pits – leading to higher accumulation of salt within the soil surrounding the trees.

- Sea level rise poses a substantial risk to many coastal areas. It is highly unlikely that many of the trees grown commercially will be able to withstand saltwater inundation.



13 Malloch (1972)
14 Cranfield Environment Centre – Soilscapes (www.landis.org.uk/soilscapes/index.cfm).
15 Met Office (2022)
16 Met Office (2018)
17 Outten et al. (2021)

4. PLANNING NEW COASTAL URBAN TREE PLANTING

The planning phase should consider where and why to plant, what species, and their aftercare to ensure establishment and healthy long-term growth. There is already a wide choice of literature on best practices in new urban tree planting (see useful links at the end of this document) and this chapter does not aim to replace this. Rather, key points are drawn out for the process below (Figure 7).

1. UNDERSTAND YOUR CURRENT URBAN FOREST STRUCTURE, COMPOSITION, AND DISTRIBUTION

2. IDENTIFY POTENTIAL FOR NEW TREE PLANTING USING PHYSICAL AND SOCIAL DATA

3. DETERMINE PRIORITIES FOR NEW TREE PLANTING AND DEVELOP A STRATEGY FOR DELIVERY INCLUDING COMMUNITY ENGAGEMENT

4. EVALUATE LOCAL SITE-SPECIFIC FACTORS THROUGH SITE VISITS AND COMMUNITY ENGAGEMENT, AND PLAN PLANTING FOR COMMUNITY BUY-IN ACCORDINGLY

5. IDENTIFY RESOURCES NEEDED FOR PLANTING, AFTERCARE AND LONG-TERM MANAGEMENT INCLUDING CAPACITY TO ENGAGE COMMUNITY AND SUPPORT VOLUNTEERS

Figure 7. A process for planning new tree planting.

4.1. Understanding your current urban forest

Before beginning to plan or to plant your coastal urban forest it is critical that you have a full understanding of your current tree resource. This normally includes information on:

- The extent of your current coastal urban forest (i.e. tree canopy cover)
- Species composition
- Condition of trees
- Age profile of trees
- Social-economic challenges within your area (e.g. deprivation, vandalism) – see Chapter 2
- Environmental challenges relevant to your area (e.g. wind, Salt, flooding) – see Chapter 3
- Abiotic and Biotic threats (e.g. climate change, tree pests and diseases)

There are a few methods that can be employed to help gain further insight into your coastal urban forest, and these are presented in Table 4. Where budget and resource availability allow, using such methods in combination can be very beneficial in providing the required depth of information.

Particular attention should be given to methods that capture existing tree health and condition, as these are likely to feed into more useful and informed guidance on future planting and management.

“IT WAS SUCH A LOVELY EVENT, SO CASUAL AND CHILLED WHICH MADE IT MORE ENJOYABLE. THE DEMONSTRATION WAS USEFUL AND THE TEAM WERE HELPFUL TOO MAKING SURE WE WERE ABLE TO DO IT. I REALLY ENJOYED THE DAY AND WOULD LOVE TO TAKE PART AGAIN!”

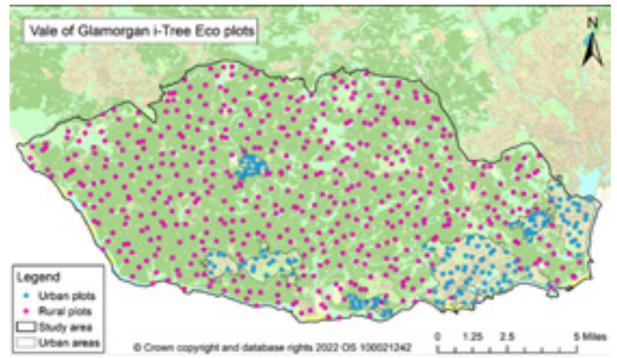
Stockton-On-Tees resident at a Trees for Cities community tree planting day

Table 4.
Methods that could be used to understand current urban forest characteristics

METHOD	PROS	CONS	FURTHER INFORMATION
i-Tree Eco projects	• Gives an overview of urban forest structure and composition, as well as calculated benefit delivery • Many already undertaken in coastal areas around the UK – widely used and recognised	• Can be expensive • Can take approx. 1 year to complete full project • Doesn't capture all trees	i-Tree Eco Projects - Forest Research
Canopy cover data	• Helps to identify areas lacking in tree cover • A variety of datasets available, some free (e.g., the UK urban canopy cover webmap)	• Doesn't give information about urban forest characteristics (e.g., species, age) • Proprietary datasets can be expensive	UK Urban Canopy Cover webmap
Existing records and inventories	• Existing data, so cheaper and more readily available • Fairly quick analyses can be done in-house, as and when required • Can provide good depth of information • Comparison of inventories with other coastal towns/cities with similar conditions could be helpful in identifying what trees do well in the prevailing conditions	• Data availability typically limited to public trees only, so no info on many private trees • Data may be old • Details are often limited, constraining the types of analysis that can be done and benefit gained	Treezilla contains over 1million trees, including some imported tree inventories providing lots of local information, including Edinburgh, London, and Portsmouth https://treezilla.org/
Site visits and surveys	• More information captured on trees and sites • Desk based data can be ground-truthed • Readily tailored to what you want to know	• Expensive depending on level of detail and/or repetition • Time consuming	

CASE STUDY 3:

SURVEYING TREES ACROSS THE VALE OF GLAMORGAN



The Vale of Glamorgan Council commissioned an i-Tree Eco study to better understand tree cover across the county and to inform target setting that would be implemented as part of a new tree and woodland strategy.

This included trees in both rural and urban settings, resulting in a huge resource to survey. To reduce the financial burden of undertaking a full i-Tree Eco survey across the whole county, the key urban areas of focus were highlighted for a full survey (which included ecosystem services analysis). A scaled-back survey was then developed for the remaining areas (i.e. rural countryside). This approach enabled cost-effective collection of the required information needed for the development of the tree and woodland strategy.

The data was analysed as two separate i-Tree Eco projects: one for urban, one for rural. Using the software allowed easy extrapolation of the plot data for both surveys to the whole county level. Analysis of the data for the rural area included: estimated tree canopy cover, where trees were in relation to different land uses, species composition and diversity, structural diversity, tree condition, and possible impact of different pests and diseases. A similar approach could be developed for other towns or cities that have variable geographic coverage, or perhaps don't need the detail of a full Eco survey or prefer the higher survey repetition.

For further information on the project, please see
i-Tree Eco Vale of Glamorgan - Forest Research

4.2. Identifying potential for new tree planting

Before investing time in local surveying, many local authorities conduct a desk-based exercise to investigate the potential for new planting. Such an exercise is often called 'opportunity mapping'.

At its simplest, an opportunity map will assess planting locations in practical terms i.e. where you can and cannot plant. These constraints may be due to the land use, ownership, size of planting space, and existing infrastructure.

Such maps can be improved further by combining this information with socio-economic datasets to understand where trees are needed the most and can provide the greatest amount of benefit.

CASE STUDY 4:

UNDERSTANDING THE LIE OF THE LAND, BRIGHTON

Brighton's topography is surprisingly complex with areas a short distance inland from the coastline being already at 175m above sea level.

Additionally, the city is intensively urbanised and its seafront is dominated by five and six storey buildings. The suitability of tree species to a certain area within Brighton is therefore considerably influenced by both the surrounding built infrastructure and topography.

Sheltered spots away from the coast are not restricted in their species choice, whereas planting on the seafront remains extremely challenging. Furthermore, it is hard to identify suitable planting locations for the pool of suitable species due to the complex interactions of local factors.

To overcome these challenges, Brighton council has used detailed opportunity mapping conducted in GIS to identify locations for tree planting. Key inputs to the analysis were: soft and hard landscapes, the local topography and the impact of the buildings.

As discussed in Chapter 2, coastal towns and cities face many socio-economic challenges that could be alleviated by increasing community access to green space.

To this end, the second, more advanced, approach to opportunity mapping can be particularly useful for coastal towns and cities. Bexhill-on-Sea is an example of a local authority which has used this approach (outlined in case study 5).

Opportunity mapping does not replace the requirement for a site visit; it should be followed by a site visit and stakeholder consultation to confirm suitability of the site before planting.

CASE STUDY 5:

DELIVERING A TREE PLANTING STRATEGY FOR BEXHILL-ON-SEA

Through the Forgotten Places programme, Trees for Cities and Treeconomics worked with Rother District Council (RDC) to create a Tree Planting Strategy to focus future tree planting efforts for the benefit of the town's residents. The process has created a blueprint that can be replicated elsewhere as follows:

1) i-Tree Eco survey in Bexhill undertaken by local community volunteers (Treeconomics, summer 2021)

2) Desktop opportunity mapping to gather data on the current coastal urban forest in Bexhill, understand the requirements and define the objectives for new tree planting. Mapped data was used to identify potential tree planting locations against criteria for tree canopy cover, air quality, indices of multiple deprivation, flood risk, population density, and concentration of people aged over 65 years (Treeconomics, winter 2021/22)

3) Consultation with RDC to discuss and "ground truth" the target locations identified and identify constraints and opportunities for planting including: proximity of communities to the site, evidence of active participation, accessibility, scope within sites to accommodate new tree planting, planning requirements (restrictions or support), visual impact (positive and negative), and sense of security (Trees for Cities and Treeconomics, summer 2022)

4) Create a prioritised list of 13 viable open spaces of which three were shortlisted for tree planting in 2022/23. Planting events were held with local community volunteers over the autumn and winter months (Trees for Cities, winter 2022/23)

5) Create Bexhill Tree Planting Strategy with targets set to plant trees across the remaining 10 prioritised sites when funding becomes available (Treeconomics, winter 2022/23).

4.3. Develop a strategy for delivery

Developing a strategy for urban tree planting is a good way of ensuring that new tree planting aligns with desired outcomes at a local and whole-urban forest level, and such an approach will likely yield a better chance of meeting them. A tree planting strategy could be a standalone document or form a dedicated chapter of an overarching tree and woodland strategy.

The Tree Council has compiled a list of local authorities which already have a tree strategy in place, so examples are available to other local authorities which are looking to write or review theirs. Further guidance on developing a tree strategy can be found in the new Defra Tree Strategy Toolkit (2022). A tree planting strategy should aim to achieve the following:

- Describe a vision for the future urban forest and how tree planting will help achieve this
- Establish priorities for the tree strategy, e.g., cross-department working, community engagement, and delivery of benefits
- Determine priorities for new tree plantings, e.g., national, regional and local policy context
- Highlight opportunities for new tree planting in the context of the existing urban forest, people, and the environment
- Set appropriate and realistic targets for tree establishment
- Describe the aftercare plans of newly planted trees
- Outline how new tree planting will engage with and benefit local communities.

It is important to consider stakeholder engagement during the process of developing a new tree planting strategy, as many of the trees in an urban forest will be privately owned. Such involvement can lead to more successful adoption and implementation of the strategy.

4.4. Evaluate local site-specific factors

Understanding coastal impacts in your area

Even within coastal areas, trees can be impacted by the coastal environment in different ways. Trees in unsheltered areas, particularly those placed immediately at the coastline, are often subjected to stronger wind speeds, more intensive sea salt spray and, consequently, they have higher chances of experiencing drought than those that are sheltered by buildings or located further inland. Thinking about zoning can be a helpful way of identifying areas within your town or city which may be more impacted by coastal conditions and help steer decisions on tree species selection and ongoing management. An example of types of zones that can be assigned across your town or city are presented below.

Highly exposed zone

An area that is highly susceptible to the impacts of wind and salt deposition, thus presenting challenges for tree growth and health.

This can include built-up areas, natural areas such as the top of cliffs, headlands, areas surrounding beaches, or streets perpendicular to the coastline. This zone is characterised by poor soils with low water and nutrient retention capacity due deposition of salt and, often, with sandy or clayey nature.

These areas may also be subject to immersion by sea water. Trees planted in these areas are not normally sheltered and so are exposed to high winds. The variety of tree species suitable for growing in such locations is relatively restricted, and extra considerations are required in planting and aftercare (see Chapter 5).

Moderately exposed zone

Areas that still experience a moderate level of exposure, such as those streets or areas behind the sea front that are protected by cliffs, sea defences, buildings, existing trees or other infrastructure.

Trees planted in this area are still exposed to high concentrations of salt in the soil and air. However, the speed at which the wind flows around them is reduced by the surrounding structures. Soils in this area may contain more organic matter and have better nutrient availability than those at the coastline but still offer challenging conditions for the establishment of trees.

Trees that are highly resistant to salt accumulation and drought should be preferred for this area; trees that are very susceptible to wind damage or intolerant to salt accumulation or those that require a lot of water should be avoided.

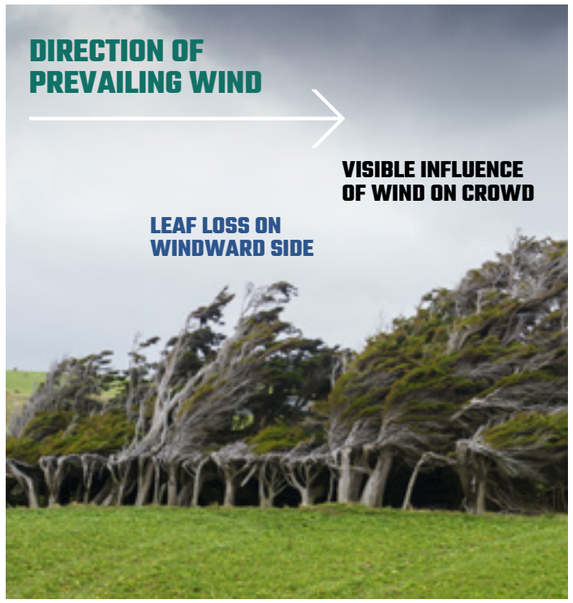
Less exposed zone

More sheltered parts of a coastal town or city which are protected by layers of streets and housing but are still within ca. 500m of the coastline. The concentration of salt and the wind flow are considerably lower than that at the front line, however they may still impact the tree. Soils in this area will normally be less prone to drying out and will be richer in organic matter and have higher nutrient availability than those at the coast.

A broader selection of tree species will be able to thrive in these conditions; trees that are sensitive to salt accumulation should still be avoided.

Unrestricted zone

Areas that are like inland areas – tree condition and growth does not appear to be constrained by the impacts of coastal exposure and as such the selection of trees does not need to consider the tolerance to salt accumulation or resistance to intense wind pressure.



Minimizing risks associated with urban coastal exposure

While coastal environments can be challenging for the establishment, growth, and health of new trees there are ways these challenges can be attenuated. Foremost, the right tree should be picked for the right place and planted in the right way. There are also other tools/ techniques that can be considered to help mitigate some of the environmental factors discussed in Chapter 3.

Staking the tree correctly can help stabilise the tree against wind and deter vandalism whilst the tree is establishing. Ideally 2-3 stakes should be used. Ties should be loosely tied to allow for reactive growth to occur as this will make trees more able to withstand the challenging site in the future. Tree anchors can also be used for the same effect.

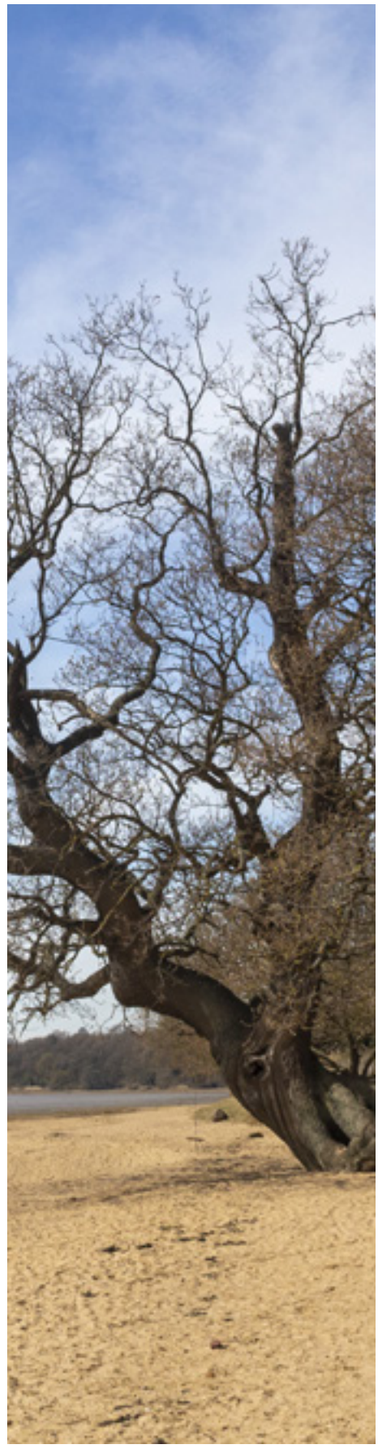
Using shelter belts; fences; sacrificial planting or tall shrubs on the windward/exposed side of newly planted trees could help ensure that trees become established. This can be especially useful when trees are used in prominent locations.

Younger trees are generally more readily able to adapt to their surrounding environment so they may establish quicker in exposed sites.

This should be, however, weighed against other site characteristics such as deprivation level and the character of the location, as smaller trees are more easily vandalised than larger trees and do not create an immediate effect.

Soil condition such as structure, level of salinity, compaction, pH, organic matter content and fertility should be assessed prior to planting to tailor soil preparation to specific improvement requirements.

Applying mulch during planting could be beneficial in reducing the amount of watering needed after planting and may also prevent the build-up of salt in the tree pit. Additional watering apparatus may be needed to mitigate extensive drought



CASE STUDY 6:

TACKLING VANDALISM IN SOUTH TYNESIDE

South Tyneside faces many of the environmental factors common to coastal areas, particularly high winds, which lead to severe wind sculpting of trees (whitebeam is especially affected).

However, vandalism remains the biggest threat to local trees: trees that are planted at great expense, both in terms of time and money, can be reduced to a stump or burned to ashes overnight. Levels of vandalism strongly correlate with distance from light sources and people.

As with most crimes, anonymity is a key enabler. South Tyneside has had success in reducing vandalism by incorporating street lighting within tree canopies. Anecdotally, other councils have had success using three stakes to support new trees, thereby reducing a vandal's ability to bend or break the tree's stem.

In the longer term, South Tyneside Council is seeking engagement with urban planners and developers to tackle the problem through improved design.

Selection of trees for coastal environments

The selection of tree species for the urban environment should consider many aspects beyond species suitability such as amenity value and benefit provision. In exposed sites, however, suitability of species to its environment becomes even more paramount. The wood/root characteristics of a tree species are important factors to consider when planting in windy sites. Trees that have more flexible wood tend to fare better in those places as they are less likely to snap out and pose a health and safety risk. Conversely, trees with shallower roots are generally more likely to windthrow than those with deeper root systems, although this varies with root architecture and planting site. Table 5 provides a list of trees that highlights species' tolerance to salt and other stresses that compound the coastal conditions, such as shade, drought or waterlogging.

Table 5.
Trees suitable for coastal environments. All species have been observed to have good vitality in urban coastal environments. Evidence for salt tolerance (aerosol and soil) is taken from the plant use literature and experience but does not have a graded scale for tolerance; blanks indicate that no evidence is available. Shade drought and waterlogging tolerance is consistent with TDAG's tree species guide[18].
*** = Native to the British Isles; Bold = particularly useful for more exposed coastal conditions**

GENUS	SPECIES	AEROSOL SALINITY TOLERANCE	SOIL SALINITY TOLERANCE	SHADE TOLERANCE	DROUGHT TOLERANCE	WATERLOGGING TOLERANCE
Acer	buergerianum			Moderately tolerant	Moderately tolerant	Moderately sensitive
Acer	monspessulanum			Partially tolerant	Tolerant	Sensitive
Acer	negundo			Partially tolerant	Moderately tolerant	Moderately tolerant
Acer	**pseudoplatanus**	Yes		Tolerant	Moderately sensitive	Moderately sensitive
Acer	tataricum			Moderately tolerant	Tolerant	Moderately sensitive
Acer	tataricum subsp. ginnala			Partially tolerant	Moderately tolerant	Moderately sensitive
Acer	x zoeschense	Yes	Yes	Partially tolerant	Moderately tolerant	Moderately tolerant
Ailanthus	altissima	Yes	Yes	Partially tolerant	Tolerant	Moderately sensitive
Alnus	cordata			Partially tolerant	Tolerant	Moderately tolerant
Alnus	incana	Yes	Yes	Partially tolerant	Moderately sensitive	Moderately tolerant
Alnus	x spaethii			Intolerant	Moderately tolerant	Moderately tolerant
Amelanchier	canadensis			Partially tolerant	Moderately sensitive	Moderately sensitive
Araucaria	araucana			Partially tolerant	Moderately tolerant	Moderately sensitive
Betula	lleghaniensis			Partially tolerant	Moderately sensitive	Moderately sensitive
Celtis	occidentalis	Yes	Yes	Moderately tolerant	Moderately tolerant	Moderately sensitive
Cercis	siliquastrum			Moderately tolerant	Tolerant	Sensitive
*Crataegus	laevigata			Partially tolerant	Tolerant	Sensitive
***Crataegus**	**monogyna**	Yes	Yes	Intolerant	Tolerant	Sensitive
Crataegus	x grignonensis			Intolerant	Tolerant	Sensitive
Crataegus	x lavallei	Yes	Yes	Moderately tolerant	Moderately tolerant	Sensitive
Crataegus	x media			Partially tolerant	Tolerant	Sensitive
Crataegus	x persimilis	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Cupressus	macrocarpa			Intolerant	Tolerant	Sensitive
Elaeagnus	angustifolia	Yes	Yes	Intolerant	Tolerant	Sensitive

18 Hirons, and Sjöman, (2019)

GENUS	SPECIES	AEROSOL SALINITY TOLERANCE	SOIL SALINITY TOLERANCE	SHADE TOLERANCE	DROUGHT TOLERANCE	WATERLOGGING TOLERANCE
Eucalyptus	globulus			Intolerant	Moderately sensitive	Moderately sensitive
Euonymus	europaeus			Moderately tolerant	Moderately tolerant	Moderately sensitive
Ginkgo	biloba	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Gleditsia	triacanthos	Yes	Yes	Intolerant	Tolerant	Moderately tolerant
Hippophae	**salicifolia**			Intolerant	Moderately tolerant	Moderately sensitive
*Ilex	aquifolium			Moderately tolerant	Tolerant	Sensitive
Ilex	Nellie R. Stevens'			Moderately tolerant	Tolerant	Sensitive
Ilex	x altaclerensis (group)			Moderately tolerant	Moderately tolerant	Sensitive
Ilex	x aquipernyi 'Dragon Lady'			Moderately tolerant	Moderately tolerant	Sensitive
Ilex	x koehneana 'Chestnut Leaf'			Moderately tolerant	Moderately tolerant	Sensitive
Juniperus	communis	Yes	Yes	Intolerant	Tolerant	Moderately sensitive
Juniperus	virginiana	Yes	Yes	Intolerant	Tolerant	Sensitive
Koelreuteria	paniculata	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Maytenus	boaria			Partially tolerant	Tolerant	Sensitive
Morus	alba	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Olea	europaea			Partially tolerant	Tolerant	Sensitive
Ostrya	carpinifolia	Yes		Partially tolerant	Moderately tolerant	Sensitive
Picea	sitchensis	Yes		Moderately tolerant	Moderately sensitive	Sensitive
Pinus	**nigra**	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Pinus	pinaster			Intolerant	Moderately tolerant	Sensitive
Pinus	pinea			Partially tolerant	Tolerant	Sensitive
Pinus	radiata			Partially tolerant	Moderately tolerant	Sensitive
*Pinus	sylvestris	Yes	Yes	Intolerant	Tolerant	Moderately sensitive
Populus	**alba**	Yes	Yes	Partially tolerant	Moderately sensitive	Sensitive
Populus	x canadensis			Intolerant	Sensitive	Moderately sensitive
Populus	nigra	Yes	Yes	Partially tolerant	Sensitive	Moderately tolerant
*Populus	tremula			Partially tolerant	Moderately sensitive	Moderately sensitive
Populus	x canescens	Yes	Yes	Partially tolerant	Moderately sensitive	Sensitive
Prunus	lusitanica			Partially tolerant	Moderately tolerant	Sensitive
Prunus	sargentii			Partially tolerant	Moderately tolerant	Sensitive
Pyrus	calleryana	Yes	Yes	Intolerant	Tolerant	Sensitive

GENUS	SPECIES	AEROSOL SALINITY TOLERANCE	SOIL SALINITY TOLERANCE	SHADE TOLERANCE	DROUGHT TOLERANCE	WATERLOGGING TOLERANCE
Pyrus	communis			Partially tolerant	Moderately sensitive	Sensitive
Pyrus	salicifolia			Intolerant	Moderately sensitive	Sensitive
Quercus	cerris	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Quercus	**ilex**			Moderately tolerant	Tolerant	Sensitive
Quercus	petraea	Yes	Yes	Partially tolerant	Moderately tolerant	Sensitive
Quercus	frainetto	Yes	Yes	Moderately tolerant	Tolerant	Moderately sensitive
Quercus	rubra	Yes	Yes	Partially tolerant	Moderately sensitive	Sensitive
Robinia	psuedoacacia			Intolerant	Tolerant	Sensitive
Sequoia	sempervirens			Tolerant	Moderately tolerant	Sensitive
Sequoiadendron	giganteum			Partially tolerant	Moderately tolerant	Sensitive
*Sorbus	aria	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Sorbus	**intermedia**	Yes	Yes	Partially tolerant	Moderately tolerant	Sensitive
Sorbus	latifolia	Yes	Yes	Partially tolerant	Tolerant	Sensitive
*Sorbus	torminalis	Yes	Yes	Partially tolerant	Tolerant	Sensitive
Styphnolobium	japonicum			Moderately tolerant	Moderately tolerant	Sensitive
Syringa	reticulata	Yes	Yes	Intolerant	Tolerant	Moderately sensitive
Tamarix	**gallica**			Intolerant	Tolerant	Sensitive
Tamarix	**ramosissima**			Intolerant	Tolerant	Sensitive
Tamarix	**tetandra**			Intolerant	Tolerant	Sensitive
Taxodium	distichum			Partially tolerant	Moderately sensitive	Tolerant
Thuja	occidentalis			Tolerant	Moderately tolerant	Moderately sensitive
Tilia	cordata			Tolerant	Moderately sensitive	Sensitive
Tilia	tomentosa			Moderately tolerant	Moderately tolerant	Sensitive
Ulmus	'Fiorente'	Yes	Yes	Partially tolerant	Moderately tolerant	Moderately sensitive
Ulmus	New Horizon'	Yes	Yes	Partially tolerant	Moderately tolerant	Moderately sensitive
Ulmus	'Rebona'	Yes	Yes	Partially tolerant	Moderately tolerant	Moderately sensitive
Ulmus	'Regal'	Yes	Yes	Partially tolerant	Moderately tolerant	Moderately sensitive
x Cuprocyparis	leylandii			Intolerant	Tolerant	Sensitive
Zelkova	serrata	Yes	Yes	Partially tolerant	Moderately tolerant	Sensitive

CASE STUDY 7:

EXPERIMENTING WITH TREE SPECIES SELECTION IN BLACKPOOL

Due to a harsh coastal environment, Blackpool Council has had mixed success when attempting to diversify the tree species it plants.

Whilst a tree species may in theory suit the local environmental conditions, they often struggle to establish.

By keeping a detailed record, Blackpool Council has managed to improve its understanding of which trees thrive in their local environment.

Many UK native species are not suited to Blackpool (notable exceptions being willow, poplar and sycamore), whilst many exotic species are (including gingko, elm and lime).

The council also found that trees grown in nurseries located in sheltered inland zones are not sufficiently acclimatised to their coastal environment.

Consequently, the Council has started growing their own trees to establish hardiness to the local climate from a much younger age.

4.5. Other pre-planting considerations

There are many other factors to consider when planning new tree planting, some of which are particularly relevant for coastal and/or urban areas. Further considerations may include:

The character and design of the wider landscape

It is important to consider the aesthetics, character, and history of the area. Trees should add to the beauty of the wider landscape and help retain or improve the sense of place for locals and tourists.

They should frame, not obstruct, panoramic sea views or distinctive built infrastructures like ports and docks. Therefore, it is important to consider the projected size of a tree, as well as its main features.

The benefits that are most needed

The potential benefits provided by trees in coastal towns and cities, mentioned in Chapter 2, should be considered during the planning phase of tree planting. Planning will help ensure that tree placement delivers the benefits you seek, and will not have opposing effects (e.g. by planting trees to buffer from the wind, but not to hinder ventilation of streets or screen views).

How and when to engage with local community and stakeholders

People can have strong views about having trees planted close to their homes; negative and positive.

Negative views can be exacerbated when trees are proposed for exposed sites and coastlines. This can occur especially where people might perceive that new trees would damage buildings and structures, block views to the sea, or alter the heritage characteristics of a place.

The success of a new planting scheme can be bolstered by strong community/stakeholder involvement and support.

Early engagement with those can be useful in demonstrating the need for more trees to help address climate crisis or enhance benefits, assure people that steps have been taken to attenuate risks, and improve planning and design so that conflicting interests or beliefs are considered.

The process can also help identify local tree champions to help deter vandalism and maintain the trees e.g. by watering in hot periods33.

The local sites where trees will be placed

In addition to zoning your town or city to differentiate the impact of sea on the microclimate and soil, other local site conditions should be factored into decision making and species choice. These may include drainage; proximity to infrastructures, buildings and roads; light conditions and complex urban micro-climates[19].

The availability of resources

Planting trees in exposed areas can be expensive. Nursery stocks may have a small number of suitable trees available (both in terms of species choice and size), which can lead to increased prices. Additional tools and resources used to minimise coastal challenges will also add to the expenses. It is important to consider these requirements when budgeting for delivery against the funding available.

Local sponsorship or a tree adoption scheme may help raise additional funds, where required.

19 Forestry Commission England (2018)

CASE STUDY 8:

COLLABORATION IN WIRRAL ON A GRAND SCALE

Wirral Council has been successfully planting street trees for some time. Ten years ago, it rolled out its Wirral Green Streets programmes that led to several hundred trees being planted.

Today, that has been partially superseded by funding from the Urban Tree Challenge Fund. This is because the Council has been collaborating with The Mersey Forest Partnership to undertake tree planting and secure funding.

The partnership includes seven neighbouring local authorities and three national landowners: the Forestry Commission, Natural England and the Environment Agency.

This landscape scale collaboration brings onboard the expertise usually unavailable to a single local authority and has allowed the Council to undertake activities previously considered 'nice to have', such as strong community engagement, and has led to better planting outcomes

"I'M GLAD I JOINED IN. I FELT LIKE I GAVE SOMETHING BACK TO THE ENVIRONMENT WHICH IS A NICE FEELING."

Stockton-On-Tees resident at a Trees for Cities community tree planting day

5. DELIVERING TREE PLANTING FOR LONG-TERM SUCCESS

Tree planting is not a success if the tree does not establish and grow. The way in which tree planting is delivered can impact tree longevity. For example, poor planting practice can affect tree vitality, whilst engaging with the local community early can help reduce tree mortality.

The establishment phase, ranging from 5 -7 years after planting, should always be viewed as part of the tree planting process.

Having a plan to monitor, manage and maintain newly planted trees is key to successful establishment.

The challenging conditions facing coastal urban trees further reinforces the need for a thorough and costed aftercare plan prior to starting tree planting.

5.1. Importance of ongoing community engagement

Urban streets and green spaces can be contentious because they are used and appreciated by large numbers of people, all of whom are stakeholders. Unlike rural landscapes, planting trees in urban spaces may have a lengthier process to follow to achieve approval, not only by the formal landowner, but also the land users, both passive and active.

Carrying out good community engagement early in the planning process will enable a smoother run in getting trees planted and thriving. All too frequently we see trees failing, often due to apathy, neglect and vandalism. However, where communities actually want trees, and where they have been involved in planning as described, then there is greater chance trees will thrive and the spaces around them will be utilised positively. Communities can then continue to benefit from both the direct and secondary benefits that trees bring to a neighbourhood.

Active community participation in tree planting delivers:

- Greater understanding of why trees matter
- New experiences of planting and protecting trees
- Positive interaction with nature
- Positive connection with local open spaces
- Understanding of how to interact / use open space to gain maximum benefits
- Ownership by communities and buy-in for future
- Positive interactions within a community, helping to galvanise neighbourhoods and connections with other wider networks
- Improved relationship with shared spaces through planned events and activities.

5.2. Key stages for good community engagement

STAGE ONE

Community mapping

A desktop exercise where neighbourhood hubs and forums, environmental groups, “friends of” organisations and parks community groups, schools, businesses, charities, community centres, clubs etc are identified within close proximity to a specific site, no further than a 1km radius to focus on very local groups.

This process can expand further to identify groups on the fringes of this radius, or with a wider neighbourhood reach and include boundaries for local authorities, boroughs, town, district and parish councils, and networks that may be focused on larger strategic landscapes or catchments that follow natural curtilages.

Local environmental charities will be identified and their support gauged. Local digital forums and websites are useful resources for direct contact.

Consider:

- Setting up monitoring and evaluation processes based on the projects’ objectives
- The planned scale and scope of consultation based on the time and resources
- Ensuring equality, diversity and inclusion throughout the programme
- Defining target demographic e.g. youth, older people, established networks
- What gaps in information can be plugged by local knowledge
- Planning methodologies. surveys, interviews and focus groups
- Recording baseline evaluations – what the site is like currently, its community use and attitudes towards the site.

STAGE TWO

Community outreach – Introducing the project

Stage 2 begins before any assumed design intervention or species selection, but can be carried out alongside physical site based scoping exercises. This stage actively seeks local interest from groups, awareness of skills and availability, and early buy-in to support a tree or woodland planting project.

Part of this process is also to identify issues or conflicts that are not apparent at surface level so they can be picked up and addressed early. This will enable a smoother design process and potentially a clearer pathway to a successful scheme.

Consider:

- Planning volunteer recruitment and management. What precisely to we need volunteers to do? What actually needs addressing?
- Creating a marketing and communications plan
- Identifying key messages that we are sending out; who needs to approve content; who are we targeting with the messages?
- Establishing time frames for creating and checking content, production of materials and sharing information at critical stages
- Continuing monitoring and evaluating the community and the site, building the community map, recording attitudes and site activities.

STAGE THREE

Community consultation – Sharing the initial design

Early design ideas can be provided which should not be a surprise to stakeholders. By remaining flexible for further alterations an iterative approach can pick up late feedback and save time later in the programme.

The delivery time frame with events and activities can be plotted and agreed, and the refined design can be shared widely with the public using social media, notice boards, at neighbourhood locations such as libraries, churches, cafes, schools etc.

Consider:

- Using artist's impressions, historic images or other examples of similar sites that have been transformed through tree planting to spark discussion, inspire and reassure
- Using images of suggested tree species to demonstrate scale and impact of what might grow successfully over time in a specific location
- Using a co-design process as a complimentary approach, should time allow, especially for more complex projects to facilitate more immersive community participation in the design process, usually via round table and face to face participation

STAGE FOUR

Event planning and delivery

Events can be designed to bring all community groups together as a standalone spring / summer tree-focused celebration or built around training and the actual planting of trees during late autumn and winter. Having developed a good network through Stage 1 community scoping, invites can be shared widely for participation and prioritisation.

Events should be designed around creation of safe, welcoming, inclusive and seasonal community activities. How these develop will depend on the scale and complexity of each project and the precise needs of a specific place.

Consider:

- Advanced planning for volunteer recruitment and management of planting days
- Ensuring DBS checks are in place with critical staff
- Ensuring publicity material is accessible (plain English, translated etc.), planned, approved in advance and shared through established, mapped networks
- Liaising with the tree suppliers, contractors, skilled workforce, trainers etc. to ensure site activities are coordinated
- Ensuring welfare units and facilities (portaloos, refreshements, , PPE attire etc) tools, establishing roles and responsibilities, insurances, demonstrations/toolbox talks, risk assessments, health and safety, safeguarding, accessibility and site security are in place in advance of, and during the event
- Identifying opportunities to ensure publicity and photo opportunities are planned.

STAGE FIVE

Maintenance, management and use of site

If a community is taken through the above process and has been actively involved in the delivery of a project, they are more likely to want to take care of their revitalised open space, street or park. This can manifest itself through passive interaction and increased footfall, as well as active participation in maintenance, irrigation, pruning etc., all of which can be supported through training, regular hands-on events, site monitoring and reporting as eyes and ears on site. Involving local environment groups early can support future volunteer maintenance and management. Communities may feel inspired to create or become part of their local environment group or Friends of group as a result of participation through the entire project. Other organisations such as schools may wish to use the revitalised open spaces for outdoor education and participation through e.g. Forest Schools, Scouts / Guides activities.

CASE STUDY 9:

ENGAGING COMMUNITIES TO SUPPORT A SUSTAINABLE URBAN FOREST

Trees for Cities' delivery model centres around local communities and has evolved over thirty years of the charity's existence.

This approach involves delivering urban tree and greening projects in areas of greatest deprivation and low canopy cover, reinforcing the "right tree in the right place" ethos, especially when local people are involved in the decision-making process, through planning, planting and aftercare.

Trees for Cities' approach to delivering community focused urban tree planting and greening projects has emerged through tried and tested methods to involve five key stages (described in Chapter 5).

Depending on each individual brief and objectives for a project, as well as delivery timeframe, each of these stages can be adapted and expanded. Whilst success is not assumed, following this kind of well-planned approach creates stronger local foundations for successful outcomes.

1. Community mapping –
identifying your stakeholders & users

2. Community outreach –
Introducing the project to your stakeholders & users

3. Community consultation –
Sharing the initial designs with your stakeholders & users

4. Events planning and delivery –
for planting trees, celebrating the completed project, maintaining community interest and ensuring momentum is in place for long term use and aftercare

5. Maintenance, management and use of site –
ensuring stakeholders and community can be involved passively or actively in the upkeep of new trees
Feedback from a tree-planting day on December 2022 at Bexhill Down:

231 people planted trees, including 2 primary schools, a group of Ukrainian refugees, community groups and young people with special educational needs from a local college. Participants commented on the feeling of 'community spirit'. One attendee commented that coming to our event she realised the "importance of community ownership of a space. I really saw you do that. You see it on CountryFile, but it's great to actually experience it."

Headline statistics from Trees for Cities' 2021-22 planting season:

- 74% of people who attended our community tree-planting events had no prior experience of planting or protecting urban trees.
- 75% of people reported learning something new or developing a new skill after attending one of our events.

- 70% of people reported having new plans to take action for urban trees after attending one of our events.

5.3. Additional maintenance considerations

The highly exposed locations in coastal towns and cities means that newly planted trees are vulnerable to drought. As such additional watering is likely to be necessary to ensure that trees thrive well beyond the establishment phase.

Even trees considered to be drought tolerant are likely to need additional watering.

Volunteers can check on trees, especially during dry and hot periods, and water trees as needed.

Mulching trees will also reduce water loss from evaporation, they may need regular re-application as moisture retention is likely to be an ongoing issue.

Additionally, stakes and tree ties need to be regularly checked in case they have loosened during heavy winds or gusts.

5.4. Monitoring tree health and condition

Monitoring of tree health and condition is important in all tree planting schemes, but particularly those undertaken in exposed sites. Understanding the signs of stress related to coastal exposure is useful for managing coastal trees; symptoms are described in Chapter 3.

These symptoms can also be caused by other stressors, such as tree pests and diseases.

Pests and diseases

Tree pests and diseases can have serious implications for urban forest health and resilience. Coastal areas have additional risk factors for the accidental introduction of tree pests and diseases. Many coastal towns and cities have active ports through which timber and wood products are imported.

The actual risk level is related to several factors, for example, what is being imported, packing material used, pre-treatment of goods and packaging, how goods are unloaded, the proximity to trees and the location of the port. Where wood products remain in their shipping containers to their destination, they represent minimal risk to the town or city.

Whereas wood products left uncovered on the dockside after transportation represents a greater risk; regular inspections and controls can mitigate this risk. The Defra Plant Health Portal contains information on tree pests and diseases, including the risks and measures to prevent their spread. Regular surveying of trees in the vicinity of the port aids early detection of pest and diseases and prevents further spread.

A coastal region's specific climatic conditions may make it more susceptible to particular pathogens. For example, Phytopthora ramorum has a predominantly westerly distribution due to its preference for wet and humid conditions.

The warmer conditions and fewer frost days in the south of the UK make it a more hospitable environments for tree pests and diseases, especially insects and pathogens, from warmer climes.

Some tree pests or diseases can be wind-blown across the channel (for example, Ips typographus); coastal towns and cities in south-east England should be particularly vigilant for windborne tree pests and diseases.

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LINKS AND USEFUL RESOURCES

https://www.treesforcities.org

https://www.tdag.org.uk

https://treecouncil.org.uk

British Standard 8545:2014 Trees: From nursery to independence in the landscape – recommendations

https://cdn.forestresearch.gov.uk/2022/02/7111_fc_urban_tree_manual_v15.pdf

Tree heath

https://planthealthportal.defra.gov.uk

https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources

https://www.observatree.org.uk

APPENDIX 1.

PREDICTIONS FOR WIND SPEED

The range of uncertainty within individual models is large enough to encompass both a decrease and an increase in wind speed across the UK (Robinson et al, 2009; Sexton and Murphy, 2010). However, we can use the central estimates to indicate what is most likely to happen.

In a low-emission scenario with a global temperature increase of 1.5°C, the frequency of windstorms across the UK is expected to decrease (Robinson et al., 2009).

In contrast, for global temperature increases of 3.0°C and 4.5°C, the frequency of windstorms is expected to increase across most of the UK except for south-west and south England (Robinson et al., 2009).

Where windstorms are expected to be more frequent, maximum wind gusts are also expected to increase. These projections for the UK agree with regional findings for northern, western, and central Europe (Ranasinghe et al., 2021).

The latest UK Climate projection (UKCP18) includes local near-surface wind speeds across the UK on a 5 km grid (Met Office Hadley Centre, 2019). These projections were calculated using a high emissions scenario[20].

There is a lot of variability in projected surface wind speed between years (Met Office Hadley Centre, 2019). For this reason, it is better to look at an average rather than to compare individual years and the data are available as 20 year means to facilitate this.

Figure 8 shows the difference in 20-year January mean wind speed between 1980 to 2000 and 2060 to 2080. There is no evidence to suggest that changes in wind speed in coastal locations will be different to inland locations.

Overall, southern and eastern England is expected to experience lower January wind speeds (between 0.4 and 0.7 ms-1 slower), and northern Scotland is expected to experience a slight increase in January wind speeds (up to 0.5 ms-1 faster). It's important to note that the projected changes in wind speed are very small compared with seasonal and interannual variability.

20 Representative Concentration Pathway RCP8.5 is a high emission scenario used in climate modelling (van Vuuren et al., 2011). It includes no policy-driven mitigation, and is sometimes called the "business as usual" or "worst-case" scenario.

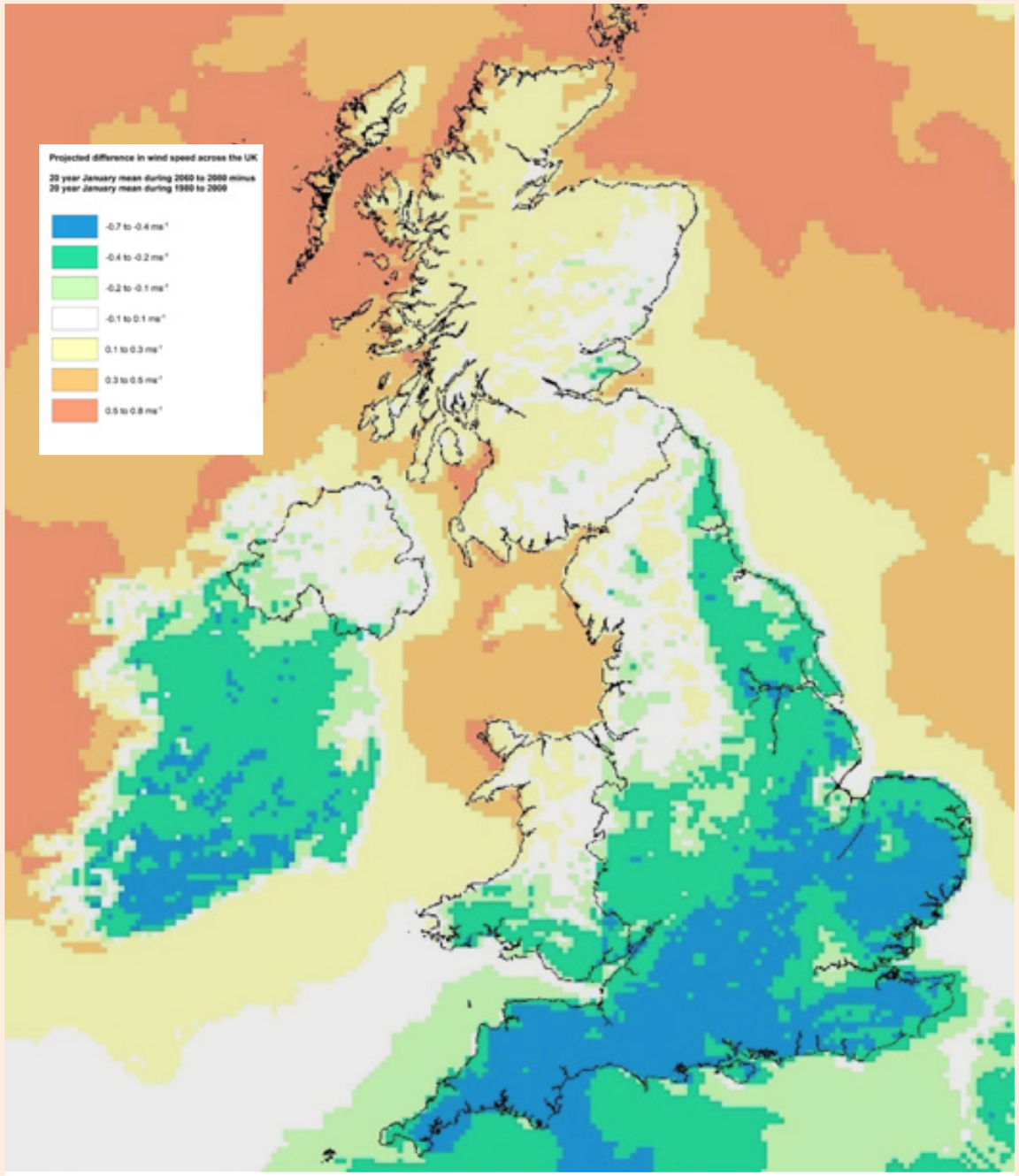

Figure 8. Difference in projected 20-year mean wind speed between January 1980 to 2000, and January 2060 to 2080. Data source: Met Office (2019).

“I FELT LIKE I MADE A DIFFERENCE.”

Hull resident at a Trees for Cities community tree planting day

CASE STUDY 10:

MATCHING STOCKTON-ON-TEES FUTURE CLIMATE

Forest Research's Climate Matching Tool provides a visualisation of regions with a similar climate to the climate projection for any location in Europe.

The method was developed by Broadmeadow et al. (2005) and uses 12 km resolution data for Europe from the UKCP18 Climate Projection (Met Office Hadley Centre, 2018).

The tool uses mean temperature, precipitation, and diurnal temperature range to compare climates. We used this tool to model the future climate of Stockton-on-Tees.

A location was selected in Stockton-on-Tees (Primrose Hill Park) and settings adjusted to include diurnal range, temperature, and precipitation in the climate matching tool. The climate matching tool was used in Advanced mode, with the following settings:

- Region: Europe
- Local climate: 2011-2020; 2071-2079
- Search climate: 2011-2020
- Variables: Precipitation, temperature, diurnal range
- Months: All
- Number of matches achieved: Medium (1,000)

The current climate (2011-2020) and future climate (2071-2079) were both matched (Figure 9 and Figure 10 respectively). The closest climate matches to Stockton-on-Tees current climate are in Durham, Newcastle, Northallerton, Garforth (East Leeds) and Immingham (Lincolnshire).

Figure 9 shows that south-east England's current climate (2011-2020) is a reasonable match for the future climate (2071-2079) in Stockton-on-Tees.

There are close matches in Hadleigh (South Suffolk), Windsor (Berkshire), Ilford (East London), Kelkheim near Frankfurt (Germany), and the north coast of Brittany (France). There are weaker matches in France, Germany and Poland.

The tool also provides monthly data for mean temperature, total precipitation, and diurnal temperature range, for both recent (2011-2020) and projected (2071-2079) timescales.

This information can be useful in understanding predicted changes in seasonal patterns and could be incorporated into future resource planning and species selection when preparing a tree strategy.

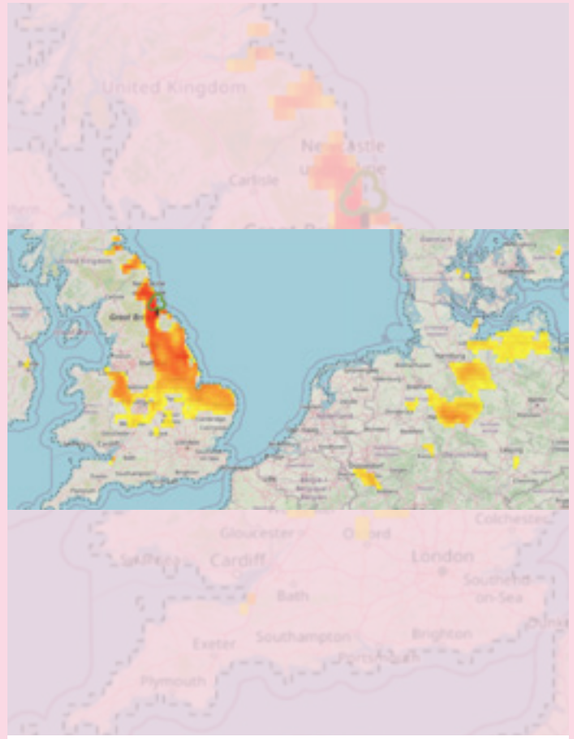

Figure 9. Map showing locations that currently (2011-2020) have a similar climate to Stockton's current climate (2011-2020). The best matches are shown in orange and red; weaker matches are shown in yellow. 1,000 matches were calculated.

Figure 10. Map showing locations that currently (2011-2020) have a similar climate to that predicted for Stockton in 2071-2079. The strongest matches are shown in orange; weaker matches are show in yellow. 1,000 matches were calculated.

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“AMAZING DAY! THANKS TO THE TEAM FOR THE OPPORTUNITY – HOPEFULLY WE CAN DO IT AGAIN IN FUTURE.”

Stockton-On-Tees resident at a Trees for Cities community tree planting day

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