Forest Research

Evaluation of i-Tree Eco surveys in Great Britain

Impacts and key lessons: The views of stakeholders

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The Research Agency of the Forestry Commission

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Forest Research is the Research Agency of the Forestry Commission and is the leading UK organisation engaged in forestry and tree related research. The Agency aims to support and enhance forestry and its role in sustainable development by providing innovative, high quality scientific research, technical support and consultancy services.

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Executive Summary

Introduction

Great Britain's urban forest resource is under increasing threat from the impacts of pollution, neglect, development and construction, health and safety concerns and risk management, other budgetary priorities, and a lack of evidence of its value to society. Tools such as the i-Tree Eco surveys provide public bodies and others with evidence of the urban forest resource in their area, the benefits it provides, and the other costs it can help to avoid. This should help to leverage resources and activity, and change attitudes. However, despite the fact that more than twenty i-Tree Eco surveys have been carried out across the UK, it is unclear as yet to what extent they have led to renewed enthusiasm for managing, protecting and enhancing the urban forest resource so as to maximise the ecosystem services they provide. This publication reports the results of an online questionnaire and interviews with a range of stakeholders with knowledge and experience of i-Tree Eco surveys. The purpose was to learn from their experiences, and investigate their views of how successful i-Tree Eco has been thus far. This evaluation study investigated a number of aspects of the experiences of stakeholders, including the impact they believed i-Tree Eco studies have had, barriers to impact and ways to overcome the barriers.

Participants

A majority of the 40 questionnaire respondents were from the public sector. Seventeen interviews were completed. These were with a variety of professionals in six case study locations, and some with broader national-level experience of i-Tree Eco.

Key audiences and important information

In the questionnaire responses, local authorities were identified by the highest number of respondents as a key audience for the results of i-Tree Eco surveys. In the interviews, local authorities, national government and other public bodies were all thought to be key audiences. Of the information provided by i-Tree Eco surveys, 'air pollution removal' was considered to be 'very important' by 55% of questionnaire respondents – higher than for any of the other information categories. In the interviews 'ecosystem service values' were mentioned most commonly as being important.

Impacts

Conceptual impact: Questionnaire results revealed that following involvement in an i-Tree Eco study, stakeholders have a better understanding of what the i-Tree Eco results can show and the importance of trees in the urban realm, and that they now know better where to look for more information about the results of i-Tree Eco. In the interviews, topics where understanding was reported to have increased include details such as the

local tree population and which species to plant, but also broader topics such as the importance of urban trees and ecosystem services.

Capacity: There were some comments made by the interviewees about skills development occuring as a result of involvement in i-Tree Eco, either personally or amongst others, although these were limited in number. Interviewees reported a few specific examples of how i-Tree Eco had resulted in additional funding opportunities, either from external or internal sources.

Connectivity: The interviews revealed a number of examples of new or increased collaboration within and between organisations as a result of involvement in i-Tree Eco work.

Instrumental impact: A quarter of the questionnaire respondents noted there had been a lot of change relating to promotion of the existing tree resource as a result of i-Tree Eco. However, only 3% of respondents stated that i-Tree Eco had led to a lot of change in the maintenance or more regular maintenance of trees. A further 10% said there had been 'a little change' in maintenance. Interviewees reported that the results from the i-Tree Eco surveys had been used, or were being used, in a range of policies, plans, strategies, landscape design packages, and evidence packs. According to interviewees, results from i-Tree Eco were also being used, or had been used, in other diverse ways to influence practice, processes and debates.

Barriers to impact and how to overcome them

A range of barriers to impact were identified but interviewees also had many recommendations and suggestions for overcoming the barriers. The barriers were related to: knowledge exchange and dissemination; organisations having other priorities; insufficient resources; trees being viewed as negative; organisational change and staff turnover; lack of a project champion and senior level buy-in; and departments not being joined up. To help overcome some of these barriers, future i-Tree Eco projects need to:

- Have a project champion throughout, and senior level buy-in,
- Have a clear aim for the i-Tree Eco study, this intimately links to knowing who the audience is and tailoring report outputs for the aim and audiences,
- Be realistic about the time and resources needed for data collection, analysis, reporting and dissemination, and
- Widen the scope of ecosystem services addressed by the studies in order to more effectively demonstrate the value of the urban tree resource, demonstrate value to other key social issues such as health, and help overcome negative attitudes towards trees.

1. Introduction

1.1. The urban forest

The urban forest comprises all the trees in an urban area – in public and private spaces, in parks, playgrounds, amenity areas, and gardens, along streets, roadsides and other linear routes, and beside waterways and water bodies. It forms part of the 'green infrastructure' of an area, and contributes to the wider urban ecosystem (Doick et al., 2016). Definitions of urban forest include reference to a number of different facets:

- 'Type' of location, to distinguish it from 'rural':
    - For example city, town, peri-urban, suburban.
- Aspects of natural resources:
    - For example, trees and shrubs.
- The presence of humans:
    - Such as communities, organisations, and settlements.
- Management and conservation activity.
- Benefits provided by the urban forest:
    - Including environmental, ecological, social, psychological and economic (Davies et al, 2017a).

Perhaps of most importance when distinguishing urban forest from rural forests and woodlands is the presence of concentrated populations of people, working, living, playing and travelling, and the associated urban infrastructure of buildings, networks, and other human-made structures. How and where aspects of the urban forest occupy space alongside these populations and infrastructure is crucial to urban forestry - the management, maintenance, development and conservation of the urban forest.

1.2. Ecosystem services

Like all ecosystems, urban forests provide a range of benefits and services, termed ecosystem services. Given their urban setting these ecosystem services may be particularly context-specific and of more direct benefit to society. The UK National Ecosystem Assessment[1] provided a framework to examine these goods and services using four categories. These are listed here with examples of the services that may be provided by urban forests:

[1] http://uknea.unep-wcmc.org/Default.aspx

- *Provisioning services* that can be provided by the urban forest include the production of food products (berries, nuts, and fruit), woodfuel, and items such as horse chestnut conkers for games, and holly leaves and berries for seasonal decoration.
- *Regulating services* provided by the urban forest include the cooling of local climates, air quality improvement through the trapping of particulate air pollution, noise abatement, carbon sequestration, interception of rainwater, and the regulation of storm water run-off.
- The urban forest provides *cultural ecosystem services* by providing opportunities for exercise and relaxation, through inspiration for art, by connecting people to nature in cities and towns, by providing space for socialising and 'de-stressing', through adding landscape structure and colour, via cultural, social and family links and histories, and through opportunities for education, learning and development.
- *Supporting services* are the overarching services needed for the production of the other categories of ecosystem services. In an urban setting, they include the cycling of nutrients and the provision of habitat for wildlife.

Urban forests also provide *disservices*, which have negative impacts on human health and well-being (Carinanos et al, 2017). For example, some tree pollen triggers allergies, and some trees provide habitat for wildlife that may be considered a pest or nuisance, such as grey squirrels and pigeons. Trees may also be the home to insects such as the larvae of the Oak Processionary Moth whose hairs are a hazard to human health. Trees in urban areas may also cause problems such as damage to infrastructure (e.g. pavements and underground pipes), and problems for roadside drainage systems through leaf litter. They can also cause anxiety by creating areas of darkness, shade and shadow leading to perceptions of danger. Other disservices are the sticky honeydew from aphids associated with some lime trees, and leaf fall leading to slip hazards on pavements.

1.3. i-Tree

In order to fully understand how best to manage the urban forest and maximise potential ecosystem services whilst minimising ecosystem disservices, there is a need to more fully understand the urban forest resource in any given area, and the potential benefits it provides. For this, appropriate survey tools and processes are required.

'i-Tree' is a suite of software programmes developed by the USDA Forest Service[2]. From the suite, i-Tree Eco, i-Tree Canopy and i-Tree Hydro have been used in the UK. This report focuses on i-Tree Eco[3]. i-Tree Eco is a package designed to provide data on urban forest structure and composition, and monetary valuation for selected ecosystem

[2] https://www.itreetools.org/
[3] However, some respondents to the online questionnaire may not have made this distinction and readers should bear that in mind when looking at the questionnaire results.

services. The data provided by i-Tree Eco surveys includes canopy cover, species composition and condition of trees, and the replacement costs of trees. In addition, i-Tree Eco values several regulating ecosystem services provided by urban forests. In i-Tree Eco surveys data is collected using plot sampling, which is then extrapolated up for the city (or other type of urban area under study), and combined with local weather and pollution data to calculate area-scale ecosystem service provision.

i-Tree Eco has been used widely in North America since its release in 2006. Since then it has been applied in over 100 countries.

i-Tree Eco has been mentioned in national policies in GB as being a useful approach to urban forest valuation (Independent Panel on Forestry, 2012; Scottish Government, 2016; Forestry Commission Scotland, 2015) and has been recognised as an appropriate valuation tool in the UK (Natural England, 2013). In GB, the first i-Tree Eco study conducted was in Torbay, England in 2011, and the survey has since been carried out in 22[4] urban areas in England, Wales and Scotland (figure one).

[4] This is the total number of projects known to the authors to have been completed in GB at the time of the study, as indicated by publically available project reports.

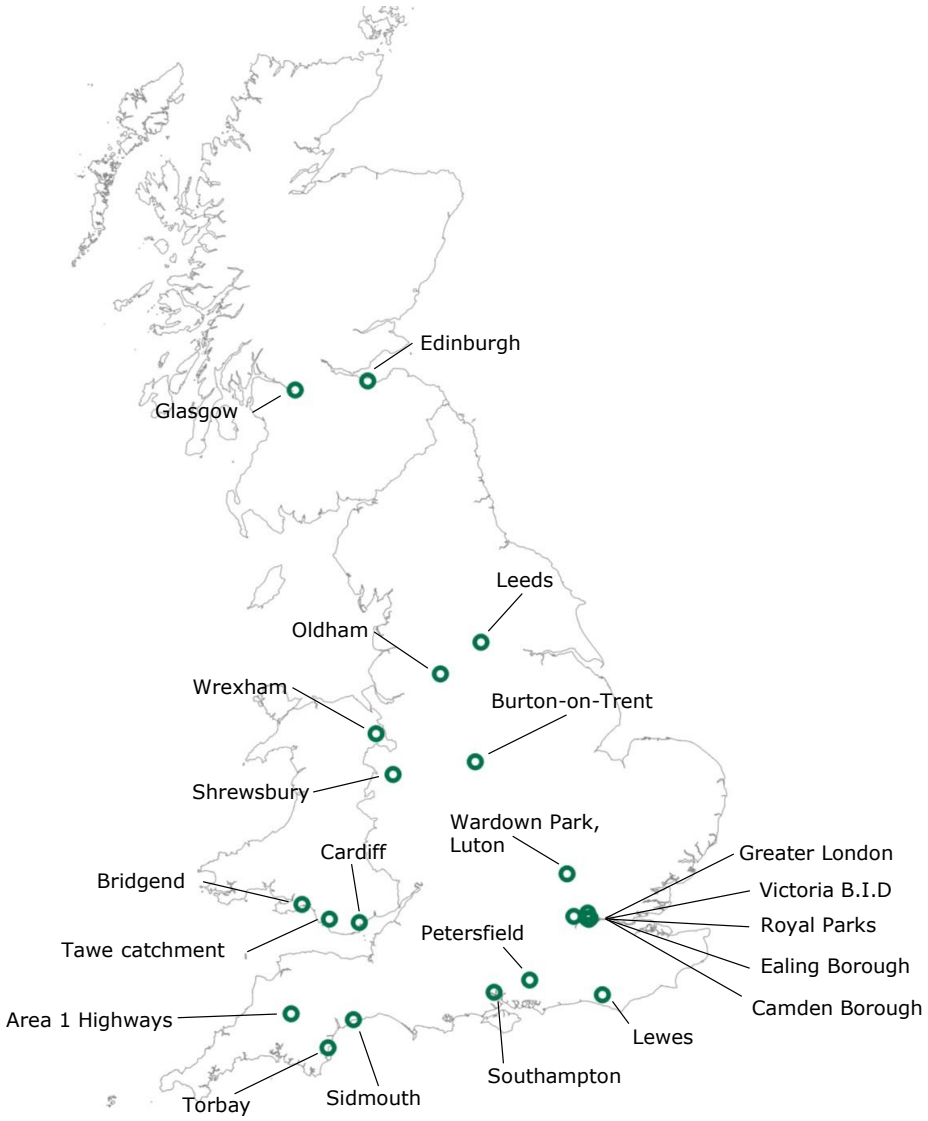

Figure one: Map of the 22 i-Tree Eco projects known to be completed or in progress in GB as of January 2018.

1.4. Urban forest policy in Great Britain

The concept of the 'urban forest' first appeared on the GB policy agenda in the 1990s, when it was mentioned beside the main forestry focus of rural forests and woodlands (e.g. Forestry Commission, 1998; Forestry Commission (Wales), 2001; Scottish Government, 2000). In the 2000s policies on urban fringe woodlands were developed as community forests rose up the agenda with their own specific targets (Scottish Government, 2006; Defra, 2007; WIAT, 2005). During the same period, recognition grew of the ecosystem services provided by urban trees, and underlined the need for

more research into their state (Scottish Government, 2014; Defra, 2008; Forestry Commission, 2009). In Wales, the urban forest agenda was promoted by urban forest assessments (Natural Resources Wales, 2014, Natural Resources Wales, 2016), as well as the Well-being of Future Generations Act (2015), and the Environment Act (2016), which contain a mandate to utilise an ecosystem service approach for forest management. Scotland has also taken an ecosystem service based approach to planning policies, and indicated in 2016 the intention to review its forestry strategy (Scottish Government, 2016). In England there are also policies that highlight use of ecosystem valuation tools and reiterate the benefits of urban forests (Defra, 2013).

While national interest in urban forests and their benefits has grown, it is at the local authority level where most decisions about urban forest management are made. Within individual councils, urban tree responsibility may be set within different departments or spread across different groups (Britt & Johnson, 2008). Councils can utilise national policy to drive programmes, but the ability of councils to carry through proactive strategies is often limited due to lack of resources and time (Britt & Johnson, 2008). This became particularly significant following the cutbacks in public sector finances following the financial crash of 2008. Reviews of urban forestry practice in Great Britain have revealed a risk-focused approach to tree management (Britt & Johnson, 2008; Van der Jagt & Lawrence, 2015, Davies et al, 2017), where potential for tree damage to buildings and risk to public safety lead local authorities to manage urban trees so as to minimise those risks. Many local authorities identify a lack of information about the urban forest resource, and a need for improved datasets to support coordinated and long-term urban forest management planning (e.g. Ipswich Borough Council, 2010; Wyre Forest District Council, 2009).

1.5. Evaluation of i-Tree Eco surveys in Great Britain

In Great Britain, the only evaluation of an i-Tree Eco study available at the time of this report was a review of the impacts of the Wrexham i-Tree Eco study (Jaluzot & Evison, 2016). Key positive impacts reported by interviewees in that evaluation included information from the i-Tree Eco project helping to inform and drive the delivery of a new urban tree and woodland strategy, and to identify specific targets within that strategy. The i-Tree Eco report was done to inform the new strategy, and was therefore designed to provide results to be utilised in local policy and practice. The project helped to retain a tree officer post and associated budget, and raised the profile of urban forests at local and national levels. It also led to greater cooperation between different departments within the council, such as planning and housing. The Wrexham i-Tree Eco project led the way for further projects in Wales, including in 'Swansea and the Tawe Catchment' and in Bridgend County Borough.

As interest in conducting i-Tree Eco surveys in urban settings within Great Britain grows, it is important to understand more about what impacts these projects might be having. Therefore evaluation of i-Tree Eco surveys in Great Britain is an important next step in

development to learn lessons and highlight challenges and successes. Given that only one i-Tree Eco evaluation study could be found, Forest Research was commissioned by Forestry Commission-GB, Forestry Commission England, Forestry Commission Scotland and the Welsh Government to carry out an evaluation of six i-Tree Eco surveys across Great Britain.

1.6. Study outline, aims and objectives

A study was conducted to evaluate the impact of i-Tree Eco surveys in GB. This study is split into four parts: Part 1 of the study is a literature review report to examine the policy drivers for these surveys and international examples of attainable impact. Part 2, this Impact Evaluation report, comprised stakeholder interviews and an online questionnaire to gather and review experiences from GB i-Tree Eco projects and investigate their impact. Part 3 is composed of one-page impact summaries for eight individual i-Tree Eco projects. Part 4 is an Executive Summary drawing together the impacts, barriers to achieving impact, and recommendations for future projects from Parts 1 and 2.

The reports for Parts 1 to 4 are available from: www.forestry.gov.uk/fr/itree-evaluation

The aim of Part 2, the impact evaluation, was:

- To investigate the experiences and opinions of stakeholders involved or otherwise interested in i-Tree Eco studies in order to learn lessons.

In order to achieve this aim, a number of objectives were identified:

- To develop understanding of the routes to involvement and roles performed;
- To investigate the observations of stakeholders about the interested audiences and dissemination vehicles used;
- To examine the experiences of stakeholders of impacts on knowledge, attitudes, funding, skills, policy, practice, collaboration and knowledge exchange;
- To identify the barriers to impact that stakeholder have perceived or observed;
- To investigate options for overcoming barriers to impact;
- To present suggestions for change and improvements for future projects.

2. Methods

2.1. Approach to evaluation

The approach to evaluation of i-Tree Eco was to directly question stakeholders participating in i-Tree Eco surveys, or those with some other interest in the use and development of the software package.

2.1.1. Impact evaluation framework

This evaluation utilised an impact evaluation framework devised by Meagher et al (2008). They outlined five potential impact categories:

- Instrumental: changes to plans, decisions, behaviours, practices, actions, policies,
- Conceptual: changes to knowledge, awareness, attitudes, opinions, motivations,
- Capacity-building: changes to skills, expertise, funding, resources,
- Connectivity: changes to the number and quality of links, relationships, and levels of trust,
- Culture change: changes in attitudes towards knowledge exchange and impact.

2.1.2. Evaluation questions

The proposal for the i-Tree Eco evaluation project specified the following evaluation questions, based on the impact evaluation framework devised by Meagher et al (2008).

Q1) Have the i-Tree Eco projects (completed, on-going and in-preparation) had any of the following impacts and if so in what way?

- Direct influence on a specific policy or practice
- Changes in understanding, attitudes and ways of thinking about an issue or problem or solution
- Increases in capacity, skills, expertise and funding
- Improved links between researchers and stakeholders

Q2) Are there any values and benefits of urban forests that are not being adequately captured in the i-Tree Eco approach and what solutions might there be to address this?

Lessons learnt were expected to be applicable across the UK, and of specific interest and relevance to other i-Tree Eco surveys proposed for the near future.

2.2. Questionnaire and interviews

Two main evaluation activities have been undertaken to investigate stakeholder views and experiences of i-Tree Eco. An online questionnaire was designed and distributed to stakeholders using Survey Monkey[5]. This included a number of closed and open-ended questions. The questions are included in appendix one.

The questionnaire was live from May 2017 to October 2017. Organisations to be sent the questionnaire invitation and link were identified through a brainstorming session in Forest Research. Those selected for invitation included the Arboricultural Association, Local Government Association, Forest Research, Forestry Commission, Greenspace Scotland, Green Infrastructure Partnership, Institute of Chartered Foresters, and the London Tree Officer Association. All agreed to message their members or include the questionnaire link in their newsletter. Additional individuals were identified via a variety of means including existing professional contacts, online searching and snowballing. The questionnaire link was also advertised through Forest Research's Facebook and Twitter accounts, and webpages, and promoted at the conference of the Institute of Chartered Foresters in 2017.

To add more in-depth exploration of the experience and opinions of stakeholders, semi-structured interviews were conducted alongside the online questionnaire. The in-depth qualitative interviews were designed to investigate in more detail some of the same questions asked through the questionnaire. The interview questions are also included as an appendix to this report (appendix two).Similar to the approach used to identify questionnaire contacts, interviewees were identified using a combination of existing professional contacts known to the project team, snowballing, and online searches. Interviews were conducted by telephone during February-August 2017. The interviews lasted for approximately 40-50 minutes.

This report combines the findings from the interviews and online questionnaire. Thus all findings and conclusions are based on the comments, opinions, experiences and perceptions of the interviewees and questionnaire respondents.

2.3. Data analysis

2.3.1. Questionnaire

Data were exported directly from SurveyMonkey to IBM SPSS v19. Analysis was limited to deriving descriptive statistics and using charts to illustrate the findings.

2.3.2. Interviews

With the interviewees' consent, the interviews were recorded using a digital voice recorder, and subsequently transcribed in full. All transcriptions were imported into

[5] https://www.surveymonkey.co.uk/

NVivo[6] (V8) and coded. Coding is an interpretive technique used to organise qualitative data and to identify key themes. A coding framework is normally used and can be based on a combination of pre-specified high level themes, and inductively-derived themes. These themes are labelled with a code that provides an indication of what is included within that theme. Inductive coding requires the researcher to carefully read the data and identify themes within it (Braun & Clarke, 2006). For this project, an initial coding framework was pre-designed, based on the interview questions. These provided tier one and two themes. Subsequently, a third tier of themes was added, based on inductive analysis of the data, thereby relying on the themes that emerged from the responses of the interviewees.

Following coding, a process of affinity mapping was used for some sections of the report to facilitate clustering and presentation of the results. Affinity mapping is a process that presents a way to express common ideas without quantifying them. Affinity mapping can be useful when there is a need to organise and summarise a large amount of qualitative information, and present a coherent story from the thoughts and opinions of a diverse group.

In some cases, direct quotes are provided to illustrate the points being made. No quotes are attributed by name to any individual or specific i-Tree Eco survey location.

[6] A software package designed for analysing qualitative data

3. The Participants

3.1. The questionnaires: Locations, sectors and roles

Fifty one questionnaire responses were received but after excluding those that were only partially completed, the final number of cases available for analysis was 40.

In the questionnaire, respondents were provided with a list of 16 i-Tree Eco project locations and asked which of these they had heard of or been involved in. All 16 of the i-Tree Eco locations had been heard of by at least one respondent (this included the six covered in the interviews - see below). For example, more than half had heard of the Torbay study. Of the 16 named i-Tree Eco survey locations, respondents had been involved in 10 of them (figure two). An additional five[7] i-Tree study locations were named by individuals who completed the online questionnaires, giving coverage of 21 different GB i-Tree study locations[8]. This shows the wide range of locations covered by the questionnaire responses.

[7] The additional i-Tree Eco survey locations were Forest of Avon, Ipswich, Luton Park, North Somerset council area, and Seaford.
[8] It is possible that some of these additional locations were not i-Tree Eco surveys but i-Tree Canopy studies; or i-Tree Eco projects not yet completed/reported.

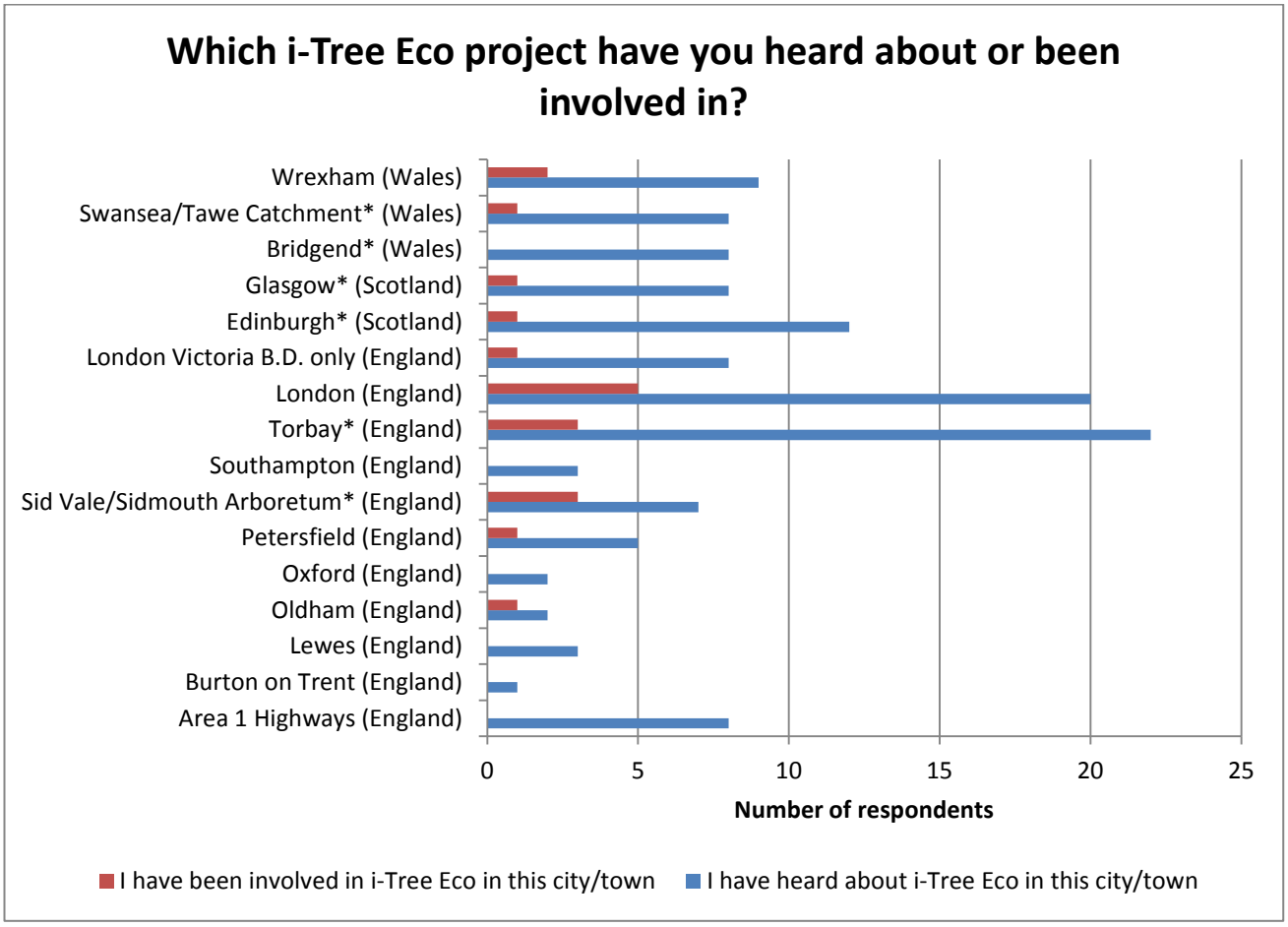

Figure two: i-Tree Eco survey locations known to questionnaire respondents

*Indicates interviewee location.

Questionnaire respondents were from a wide variety of sectors, encompassing public, private and third sector organisations. A majority were from the public sector (14). Types of organisations that respondents worked for have been grouped as follows:

- Local Authorities (8) & National Park Authority (1)
- Other public bodies including devolved administration (5)
- Private companies (7) (Mainly forestry companies, professional tree service companies, landscape companies. Also a constructor).
- Third sector (5)
- Research (2)[9]

[9] Note that not all respondents provided this information hence the total does not add up to 40.

There was a question included in the online questionnaire that asked respondents about their roles within i-Tree Eco, and provided pre-specified categories. Based on these categories, 'Publicising the report', was the most popular (except 'other role'). Note that respondents could specify more than one role. Responses are:

- Involved in publicising the report (11)
- Surveyor (7)
- Administration of the i-Tree survey (5)
- Volunteer (4)
- Provided technical support (3)
- Other role (20)

3.2. The interviews: Locations and roles

Seventeen interviews were completed with professionals involved in a variety of roles connected to i-Tree Eco surveys in Great Britain (GB). Specifically, interviewees were involved in six i-Tree Eco surveys from across England, Wales and Scotland, namely: Torbay, Sidmouth, Edinburgh, Glasgow, Bridgend, and Swansea and the Tawe catchment. A further four interviewees provided an overarching national (GB) perspective.

The interview data reveals the wide range of roles that the stakeholders played within i-Tree Eco projects (table one). While the table includes some details of specific roles (right hand column), these have been classified into generic roles that include funding, project initiation, project management, and a range of technical input. Some interviewees performed multiple roles. Most common roles are project initiation and technical input, which itself incorporates multiple types of roles and tasks such as data collection, delivering training, involvement in sampling plots, and printing services.

Table one: Roles of interviewees in i-Tree Eco

Generic role	Number of comments	Examples of specific roles
Project initiation	*9*	• Initiated the project. • Set up the project. • Fed into process of setting up the project. • Set up a steering group. • Contracted organisations to sit on a steering group.
Technical input	9	• Involved in data collection • Took part in sampling. • Surveyed. • Produced location maps for the surveyors. • Provided technical support for sampling survey points. • Delivered training. • Ran CPD sessions. • Provided printing services.
Involved at the end	8	• Reviewed information at the end of the project. • Provided feedback on the draft report. • Worked to apply the results.
Funding	7	• Provided financial assistance to set the project up. • Provided project funding. • Part funded the production of the final document.
Meetings / steering group	5	• Represented the organisation in project meetings • Sat on a stakeholder group.
Project management	4	• Project managed. • Steered the project.
Policy level	4	• Kept aware of what was going on so as to use it the results in future evidence and policy work. • Kept aware of its implications for urban forestry policy across the UK, and the relevance of the evidence. • Had a policy role at national level. • Liaison with government.

3.3. Involvement in i-Tree Eco

3.3.1. Questionnaires: When and how did they hear about i-Tree Eco?

In the questionnaire stakeholders were asked how and when they heard about i-Tree. The majority first heard about i-Tree Eco more than a year ago, with half indicating they first heard about it more than three years ago (figure three). This suggests it is not a new concept for most of the respondents.

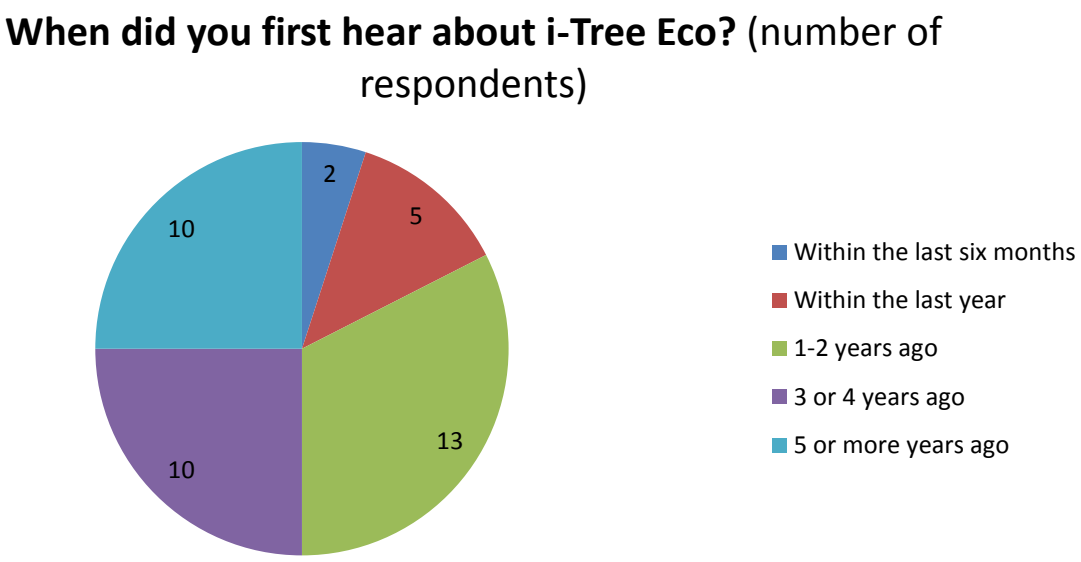

Figure three: When did questionnaire respondents hear about i-Tree Eco?

When asked how they first heard about i-Tree the most popular responses were through a peer or through a colleague who was involved in an i-Tree study (figure four). This suggests the sector has a strong professional network with good communication.

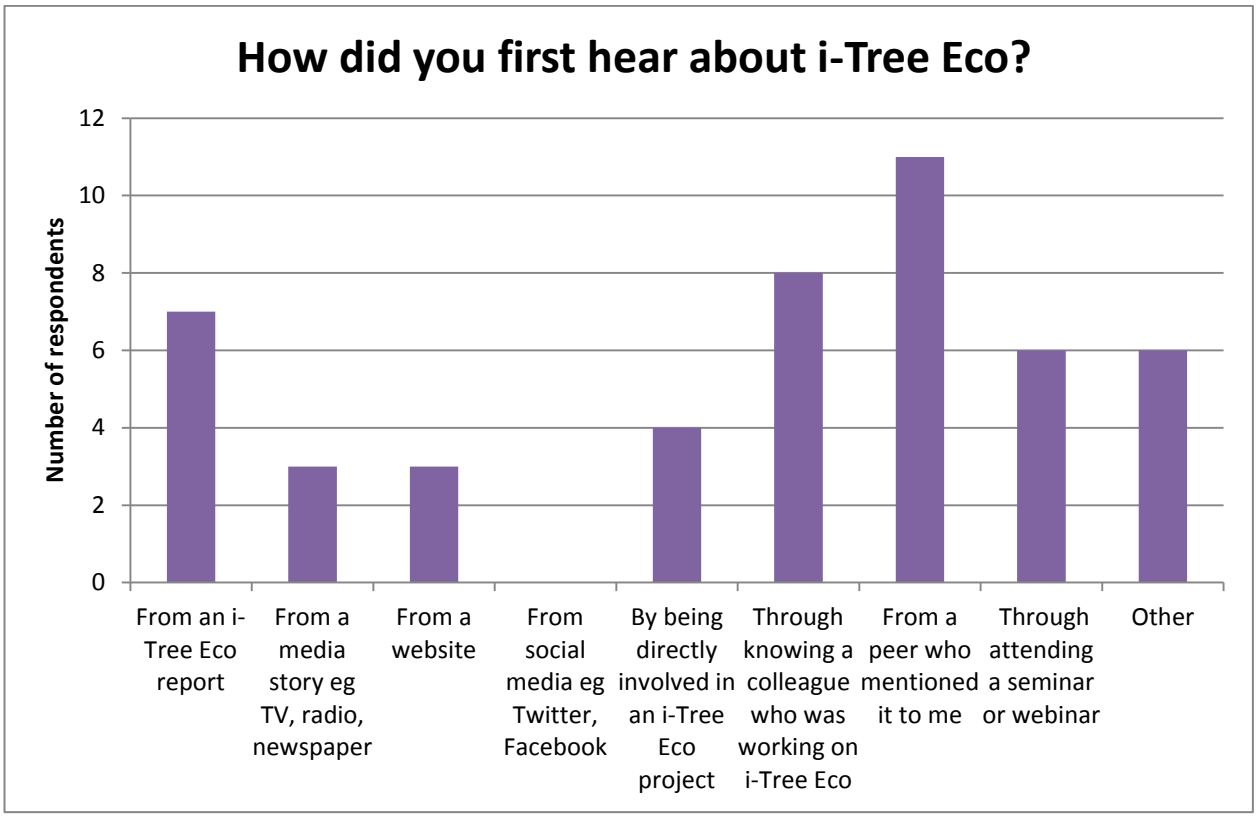

Figure four: How did questionnaire respondents hear about i-Tree Eco?

3.3.2. How did they get involved?

In both the questionnaires and interviews stakeholders were asked how they got involved in i-Tree Eco.

3.3.2.1 Questionnaires

In the questionnaires, there were two response categories of relevance to this question – one was "I was involved in some discussions about i-Tree" (11 people indicated this was how they got involved), and the second one was "I was asked to sit on a steering group" (four people indicated this was how they got involved).

3.3.2.2 Interviews

This part of the interview data reveals a number of other routes to involvement. Some stakeholders got involved through involvement with other projects and initiatives, or because it built on earlier work within their organisation. In other cases involvement arose because their role involved responsibility for urban trees, or trees and woodlands. In one case the interviewee picked up the work from a predecessor who had moved on. Some of the stakeholders were in a position of authority within an organisation and decided that i-Tree was a good fit for their organisation and that it was something they should utilise. As with the questionnaire results the role of colleagues and peers was significant and in some cases it was this profesionnal network that led to them becoming involved in i-Tree Eco.

4. Knowledge exchange and information

4.1. Audiences for the i-Tree Eco results

4.1.1. Questionnaires

In the questionnaire respondents were asked who they thought were the key audiences for the i-Tree Eco results and reports (figure five). The response categories were pre-specified. Local Authorities were identified by the highest number of respondents as a key audience, followed by government and then the public (respondents could specify more than one).

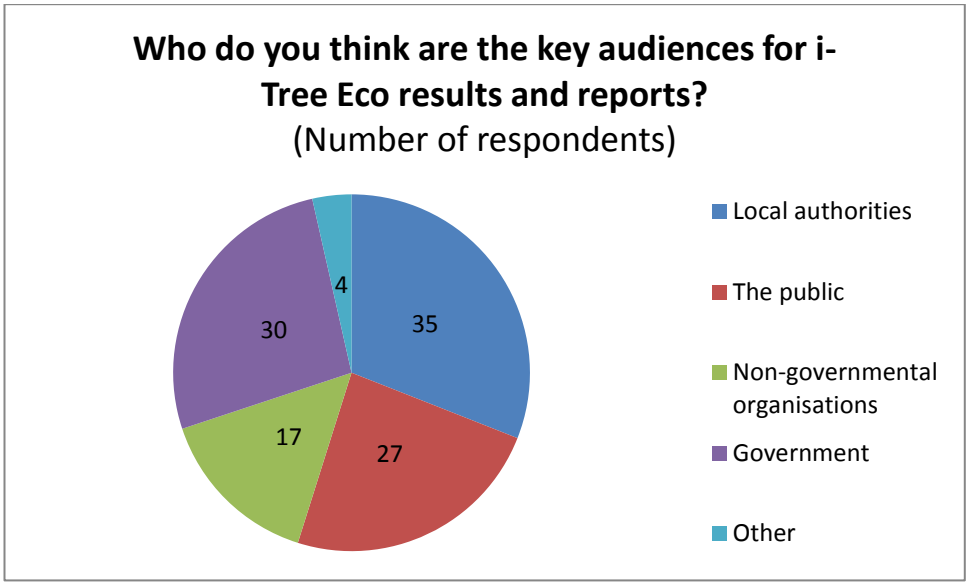

Figure five: Who are the key audiences for i-Tree Eco results?

4.1.2. Interviews

The interviews enabled a deeper exploration of the same question. Local authorities, national government and other public bodies were all thought to be key audiences. Alongside these, politicians, councillors, decision makers and those working at a strategic level, were also considered key. The private sector – including developers, housing associations, architects, and researchers – were also mentioned as being key audiences. The public, especially those with gardens with trees, were considered particularly important. People working in a range of specific sectors were mentioned as being key audiences, including planning, health, highways, housing, ecology, trees, green space, forestry, urban maintenance, and social services, demonstrating the recognition that i-Tree Eco results are not considered to be just for those with a direct involvement in trees.

4.2. Which data are important?

Both the questionnaire and interviews asked a question about which aspects of the i-Tree Eco survey data are important. The questions were slightly different, however, so results are presented separately.

4.2.1. Questionnaires

In the questionnaire, respondents were presented with a pre-specified list of information categories and an importance scale. These are shown in figure six. The information considered to be very important by more respondents than any other category of information was 'air pollution removal'. However, taking responses stating 'important' or 'very important' together, the information categories with the highest total are 'canopy cover', 'species diversity', and 'pest and disease susceptibility'.

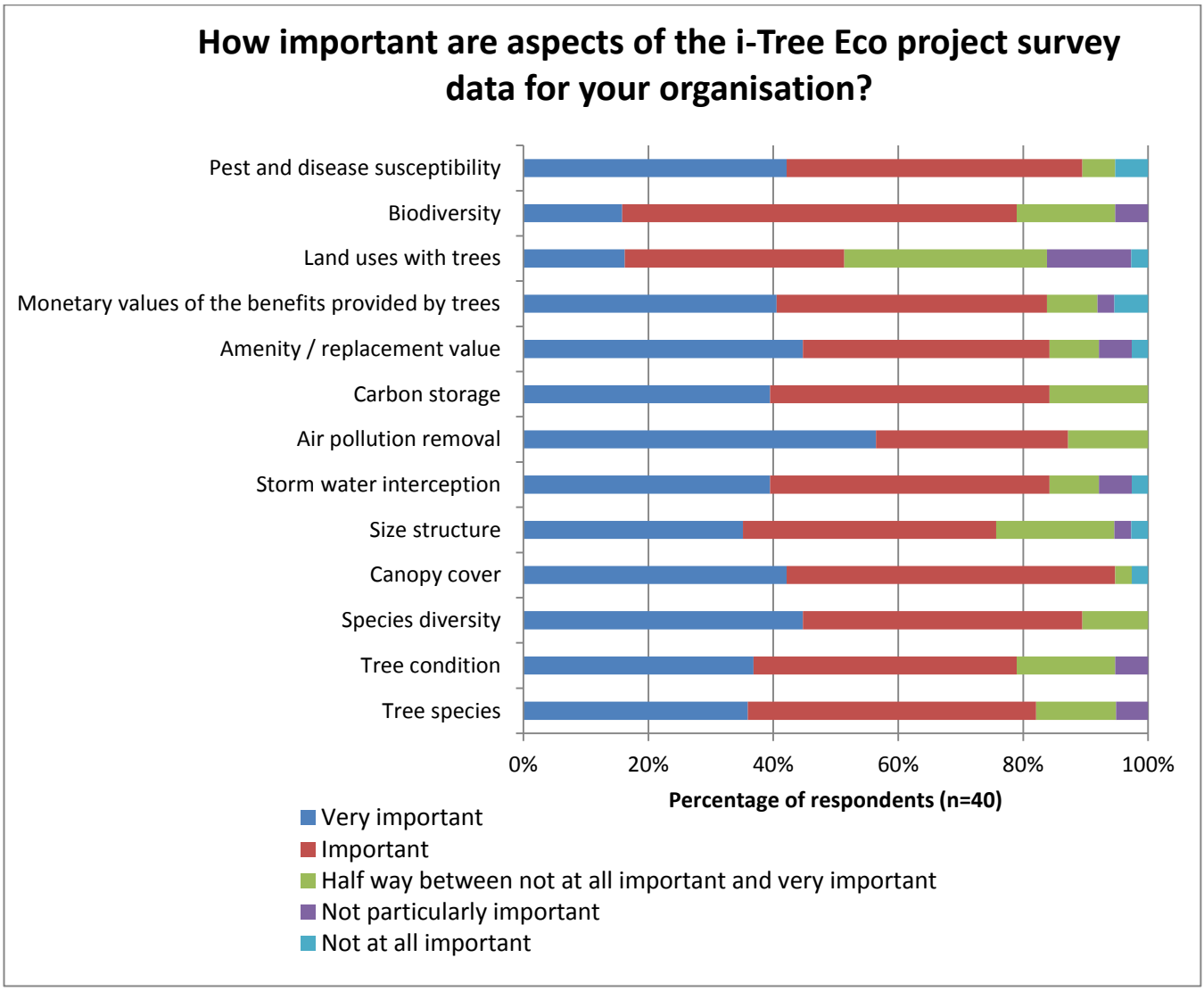

Figure six: How important are aspects of i-Tree Eco survey data?

4.2.2. Interviews

The interviews contained the question: 'Which findings of the i-Tree Eco work do you think are most important?'. The responses from the interview text allowed the identification of phrases containing the different aspects of information. This revealed the following (the numbers relate to the number of times the specific 'type' of findings was mentioned in the responses). Some example quotes are also included.

- Ecosystem service values (18)

  "What is useful is to have a mechanism to be able to quantify some of the benefits provided by urban trees"

  "It was important that the i-Tree project helped us describe why the ecosystem services of urban trees are important, and it added valuations and financial valuation on the trees".

- Species (10)

  "I think another useful thing was that it provided some more detailed information about specific species that we have within the area, and related specific species to specific benefits, so which species actually provided the greatest benefit in terms of shade or dealing with air pollution or climate change mitigation or whatever".

- Air pollution (8)

  "there's key issues like … pollution at the moment is a major talking point, and so being able to quite clearly point to what trees can have particular impact on that, the contribution that trees make to it I think would be quite useful".

- Carbon sequestration, capture, storage (6)

  "I'd say the key results or the bit that we'd be interested obviously would be removal of 9,000 tonnes of carbon from the atmosphere, the carbon sequestration figures in terms of the 183 kilotonnes of carbon sequestrated".

- Pests and diseases / tree health (5)

  "In terms of species mix…this could become particularly important in terms of tree health in being able to identify where we have trees of a particular species that might be impacted by a particular biological agent".

- Canopy cover (extent and location) (3)

  "I think the headline figures, the total estimate of the total tree numbers, the canopy cover"

- Flood / water management (3)

> "For all of the organisations that I've spoken to, it is the key headlines, those kind of punchy things of, x amount of million litres of water, what is it? 252 million litres of water a year".

From the findings from the different parts of this evaluation (the questionnaire and the interviews) it is possible to conclude that there is a diversity of opinion about what data is important but also some commonalities such as air pollution and tree species diversity. It is important to note that asking the same question but in a different way impacts on the findings.

4.3. Who was interested in the results?

4.3.1. Interviews

The interviews included a question about who was interested in the i-Tree Eco survey results. Primarily the interviewees referred to local authorities; this included colleagues within their own teams, and those in other council departments including engineers, operations team, planners, tree officers, and conservation and biodiversity teams. More generally they noted that interest came from district councils, town councils, city councils, and across all levels from officers to middle and higher managers, officials, members and working parties. Interviewees also noted that there had been interest from other public bodies including Health Boards and devolved administrations.

The private sector had also shown interest in some i-Tree Eco survey results, including private land owners, academics, and professional industry bodies, associations and societies.

In terms of the third sector, Friends of the Earth was mentioned specifically as being particularly interested in the air pollution data.

However, some interviewees responded to this question about who was interested by saying that nobody was interested or that interest had been very low. So the story was not consistently positive in terms of there being a lot of interest from diverse sources. Specifically, some councils had failed to show any interest in the results. In other cases, interviewees stated that the general public "are not interested in the report" and "politically, I think the interest was low". Some also observed that tree specialists, planners, and professional audiences had not really shown any interest. As one interviewee put it: "There hasn't been a great deal of interest, to be perfectly honest with you".

Overall, these responses demonstrate there are always likely to be different responses to different i-Tree Eco surveys, depending on context, and it may not be possible to obtain widespread and active interest in the results.

4.4. Dissemination

It is likely that at least one factor influencing the levels of interest in any given i-Tree Eco survey is the approach taken to disseminate the results.

4.4.1. Interviews

Interviewees were asked how results were disseminated. Responses have been categorised as shown in table two. As can be seen, approaches were varied. The most popular approaches were the use of a variety of publication routes and a range of types of event. Specifically this included the use of infographics, a short summary, the printed press, workshops, conferences and event days. The use of online dissemination routes was also relatively significant but less so than the previous two categories of publications and events. There may be scope in future to investigate the effectiveness of these different channels to boost interest where it might otherwise be limited.

Table two: Dissemination routes for i-Tree Eco survey results

Dissemination route	Number of mentions in interview transcripts
PUBLICATIONS	**26**
Infographic	3
Two page summary / research summary	4
Report / technical report	3
Other reports / evidence pack	2
Press releases	5
Press, newspapers, industry press	9
EVENTS	**29**
Workshop/seminar	6
Meetings	2
Event day, event, local fair	8
Conferences	6
Presentations / talks at non-specified events	7
ELECTRONIC / ONLINE	**13**
Email	1
Web	6
Social media	2
Webinar	3
Intranet	1
OTHER	**9**
TV	1
Radio	1
Word of mouth; colleague to colleague	4
Use of a marketing consultant, other expert	2
Simultaneous publicity with other projects	1

5. Impacts from i-Tree Eco

At the heart of both the questionnaires and the interviews was a series of questions asking for the stakeholder's views of the impacts of the i-Tree Eco surveys. As described above there was interest in finding out whether they believed there had been impact across a number of categories. Broadly, these categories addressed conceptual impact (change in knowledge and understanding), capacity (change in skills and funding), connectivity (changes to collaboration), and instrumental impact (changes to policy and practice). The fifth impact category of 'cultural change' was not addressed in this study. Results relevant to these categories are presented in the sections that follow.

5.1. Conceptual impact

5.1.1. Questionnaires: Change in understanding

The questionnaire results revealed that more than 50% of the respondents believed there was now better understanding of what i-Tree Eco results can show, better understanding of the importance of trees in urban areas, and more knowledge about the urban tree resource. Results are:

- I/we have a better understanding of what the i-Tree Eco results can tell us – 24 respondents.
- I/we have more knowledge about the urban tree resource – 23 respondents.
- I/we have a better understanding of the importance of trees in the urban realm – 21 respondents.
- I/we know where to look for more information on the results of i-Tree Eco – 16 respondents.

Responses to the questionnaire revealed a number of areas where respondents reported they personally had gained increased knowledge. The three specific topics where understanding was reported to have increased by the greatest number of respondents are: The importance of the urban tree resource in general, the species composition mix of the urban tree resource, and the importance of trees in the removal of urban air pollution (figure five).

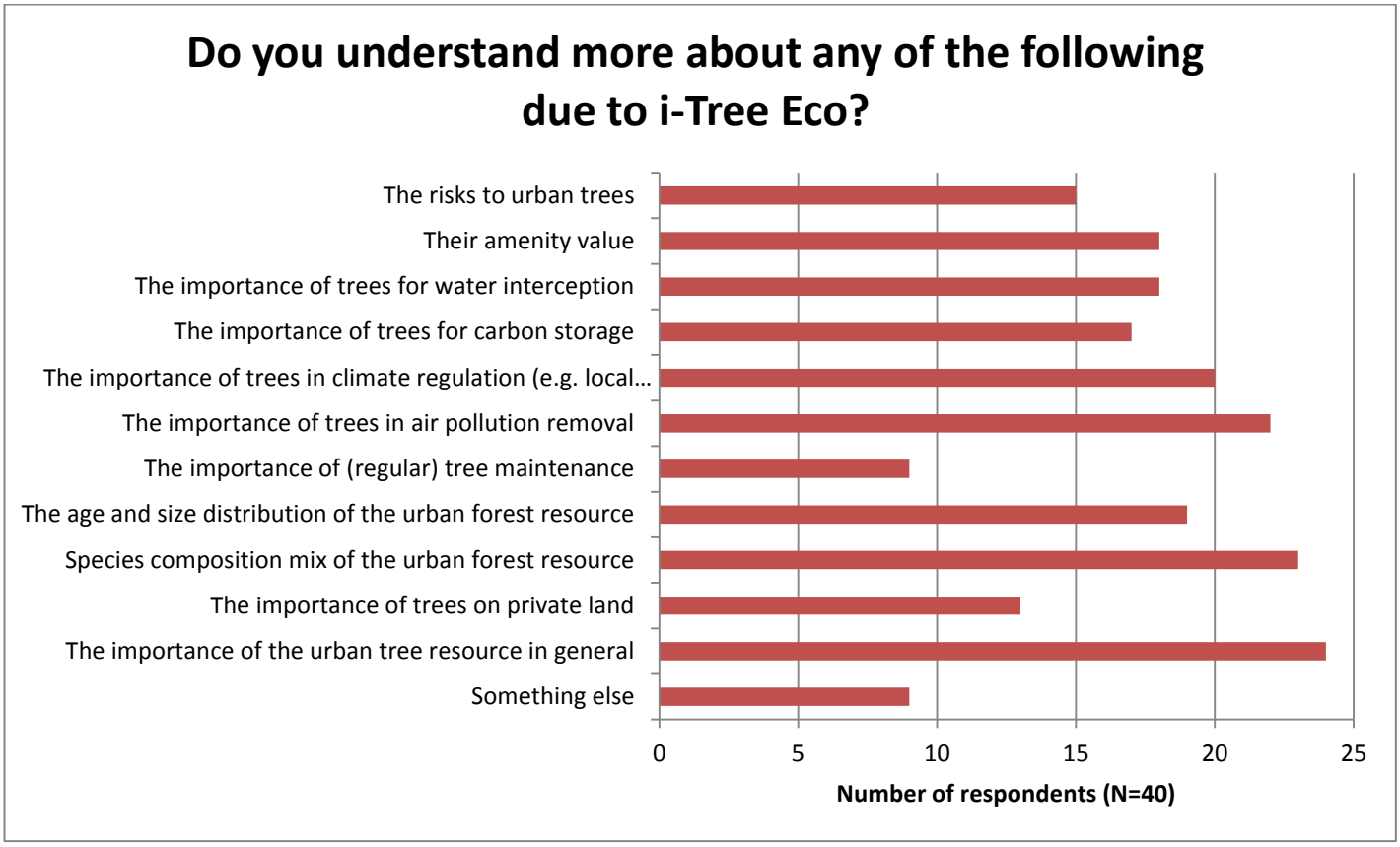

Figure five: Reported increase in understanding

5.1.2. Interviews: Change in individual understanding

Results from the interviews show that interviewees feel they personally developed understanding on a number of specific topics. These have been summarised in table three, with some example quotes drawn from the transcripts. Topics where understanding was reported to have increased include details such as the local tree population and which species to plant, but also broader topics such as the importance of urban trees and ecosystem services. Interviewees reported that knowledge had also been developed relating specifically to the process of carrying out an i-Tree Eco survey and learning what it can do, but also the limitations and difficulties relating to data collection and presentation of results so that they are of value to policy making.

Table three: Change in individual understanding

Topic	Example quote
The importance of urban trees	"I certainly understand more about how important urban trees are."
Value, benefit, ecosystem services	"Five years ago I hadn't any grasp of the value of trees, in terms of ecosystem service provision… so it's been a real eye opener and really powerful."
Which species to plant	"I have a much better idea of which trees should be planted".
Local tree population	"I understand a lot more about the tree population in my city which was really important."
i-Tree process	"Well, just by understanding the process and realising what it does. Just having more of an understanding of it, really."
Limitations of i-Tree	"I suppose the study itself, it brought, it improved my understanding of the process, and the limitations, I suppose the difficulties of gathering meaningful data, and then how to present that data in a way that will influence policy making and resource allocation."
Valuation techniques	"…improving my understanding of the economic valuation techniques, as well, because that was certainly something I wasn't particularly familiar with."
Data presentation	"…and then how to present that data in a way that will influence policy making and resource allocation."

In addition, other comments emphasise that their own understanding has increased without specifying how or in terms of what knowledge. Hence there were some other comments, such as, "I'd learnt an awful lot" and "I learnt a lot from doing it".

However, others stressed that they did not learn anything new. Generally, the reasons they gave were that they already worked in the sector, in some cases had been doing so for years, and so already knew the intrinsic value of trees in the urban environment. A relevant quote to illustrate this point is:

> "I've always known the intrinsic value of trees in the urban environment, health, education, carbon sequestration, all the things that are brought out in reports".

5.1.3. Interviews: Change in other's understanding

Results from the interviews suggest that stakeholders are aware or believe that i-Tree Eco has also increased the understanding of other people about a variety of topics, and about i-Tree Eco itself.

They believe that i-Tree Eco reinforced the understanding of the general public about trees and tree diseases, links to climate change and the environment in a wider sense, and the social benefits of trees.

One interviewee stated "I think anybody who has been exposed to the i-Tree Eco study has a better understanding of value and also how urban trees would be valued, and the range of benefits", demonstrating the perceived importance of i-Tree Eco for raising awareness and improving understanding. Another commented that part of the value of i-Tree Eco, and one way it can help increase understanding of others, is by providing the

evidence to demonstrate the multiple benefits of trees. It was also thought that having locally specific information and data was important for helping to change other's understanding.

Interviewees believe that another area of increased awareness is in i-Tree Eco itself and what it can do. It was noted that eight years ago there was little awareness in Great Britain of i-Tree Eco but now most working in the arboriculture sector understand i-Tree Eco and what it can deliver. It was also pointed out that the training in delivering i-Tree Eco provides background explaining why it is of value and hence provides a broad understanding not only in how to use the tool. All of these positive points demonstrate examples of how interviewees believe knowledge and awareness has changed.

5.2. Impact on capacity

5.2.1. Changes to skills

There were a limited number of comments made by the interviewees about skills development occuring as a result of involvement in i-Tree Eco, either personally or amongst others. In some cases the response was that involvement in i-Tree had definitely not produced any skills development, and one interviewee stated "I don't really know what skills you get from i-Tree Eco".

However, there were some positive examples. One interviewee reported that there were approximately 15 people who carried out tree surveys for the i-Tree Eco survey in their area. As none of them had done a tree survey before they all learnt something new. Another interviewee believed that studies that had involved volunteers would likely have increased the skills of those involved[10]. In other cases, having to pull together an i-Tree Eco study with colleagues involved understanding the methodology, being able to train people such as volunteers, and carry out fundraising to make that happen. So, the engagement in the activity helped skills development on all those fronts. Due to staff turnover within one organisation an interviewee reported having to continually educate new staff in the use of i-Tree Eco and train them to deliver projects. Also, due to the development and adaptation of i-Tree Eco software package individual capacity was reported to have grown through more awareness of the tool and its capabilities. In terms of formal education there were some reports of specific development. Following an i-Tree Eco study in Lewes, in which a group of students from a local college were involved with data collection, it was integrated into their curriculum. It was also reported that another college in Lancashire now includes i-Tree (as the full suite of software packages) as part of their BSc course, although it was unclear whether this was a direct result of involvement in an i-Tree Eco study.

[10] Although not one of the case studies in this evaluation, the i-Tree Eco London study involved volunteer surveyors, and a report of their experiences is available (O'Brien, 2015).

5.2.2. Changes to funding

5.2.2.1 Questionnaires

From the questionnaire results eight respondents said that the i-Tree Eco project had led to themself or others being able to secure funding to expand the urban tree resource.

5.2.2.2 Interviews

Interviewees reported a few specific examples of how i-Tree Eco had resulted in additional funding opportunities, either from external or internal sources. In Torbay a Heritage Lottery Fund proposal had been agreed for an i-Tree trail, a tree-based initiative to get people walking for improved health. At one council in England they were able to secure funding and support from Elected Members for additional arboricultural officer posts. In another area it was noted that prior to the i-Tree Eco study the tree officer was faced with budget cuts and a tree planting budget that had almost disappeared. After the study the tree planting budget was reinstated, and the tree officer was promoted to a position where they were involved in more strategic thinking. In other cases, it was felt that the i-Tree Eco work had led to the preservation of budgets during a period when many department budgets were being cut.

However, as one interviewee noted, things might have been different (that is, there might have been greater positive impact on funding and budgets for urban tree management) if the i-Tree Eco surveys had been carried out before the recession in 2009. It was noted that the 'big issues' are education and social care, and as budgets have contracted overall it is those areas that have taken most of the resource, making it particularly difficult to secure additional funding for tree planting and management. It is not possible to say from the data collected for this evaluation how the recession may have limited the impacts arising from i-Tree Eco projects, but it is likely to have played a part.

There were also a number of comments stating specifically that funding had not increased as a result of the i-Tree Eco study in the area. For example, some commented that they had "envisaged it would have more of a political impact and therefore an effect on budgets, but it hasn't" and "budgets are what budgets are and then people get a share of that so it doesn't actually matter what the intrinsic value is". Numerous other comments were given, such as, they were not aware of any increase in funding, had not seen any evidence of that, and that i-Tree had not brought about a direct resource allocation.

5.3. Impact on connectivity

5.3.1. Questionnaires: Changes to collaboration

The questionnaire investigated whether i-Tree Eco had led to any new collaborations. Half of those who responded to this question said that the i-Tree Eco work had led to

new engagement between different parts of their organisation. Also, more than half who responded indicated that new collaboration, specifically links to researchers, had helped understanding of the i-Tree Eco results.

5.3.2. Interviews: Changes to collaboration

The interviews revealed a number of examples of new or increased collaboration within and between organisations as a result of involvement in i-Tree Eco work.

This included new collaboration between additional teams and departments within local authorities, such as the climate change adaptation team, transport department and sustainability unit.

It was also noted that i-Tree Eco projects had led to new or improved collaboration between a wide range of bodies including: Private businesses, the Highways Agency, local schools, local interest groups such as a Hedge Group, the local Area of Outstanding Natural Beauty (AONB), councils, the health sector and local surgeries, the Woodland Trust, the Landscape Institute, universities, and Forest Research.

In addition, other networks and forums were mentioned as being very active in bringing diverse organisations together for i-Tree Eco studies. These included:

- the Urban Forest and Woodland Advisory Committee's Network (the 'Urban FWAC Network'), and
- the Trees and Design Action Group[11].

Overall, the i-Tree Eco surveys appear to have had much positive 'connectivity impact'. As one interviewee put it "I would say it's [involvement in i-Tree] reinforced our [positive] attitude [to collaboration]".

5.4. Instrumental impact

Both the questionnaire and the interviews gave stakeholders the opportunity to provide their views on how i-Tree Eco studies in GB had lead to change in policy or practice.

5.4.1. Questionnaires: Change in policy and practice

In the questionnaire, this was through a question that provided a fixed list of possible changes, and a scale to demonstrate the extent it had led to change. From 10 potential areas of policy or practice change there are very few where 'a lot' of change is noted (figure six). The most significant is 'been used to promote the existing tree resource'. In this case a quarter of the respondents noted there had been 'a lot' of change relating to promotion of the existing tree resource as a result of i-Tree Eco. However, other results were less positive. For example, more than a quarter of respondents stated that i-Tree

[11] tdag.org

Eco had not led to change 'at all' in the maintenance or more regular maintenance of trees.

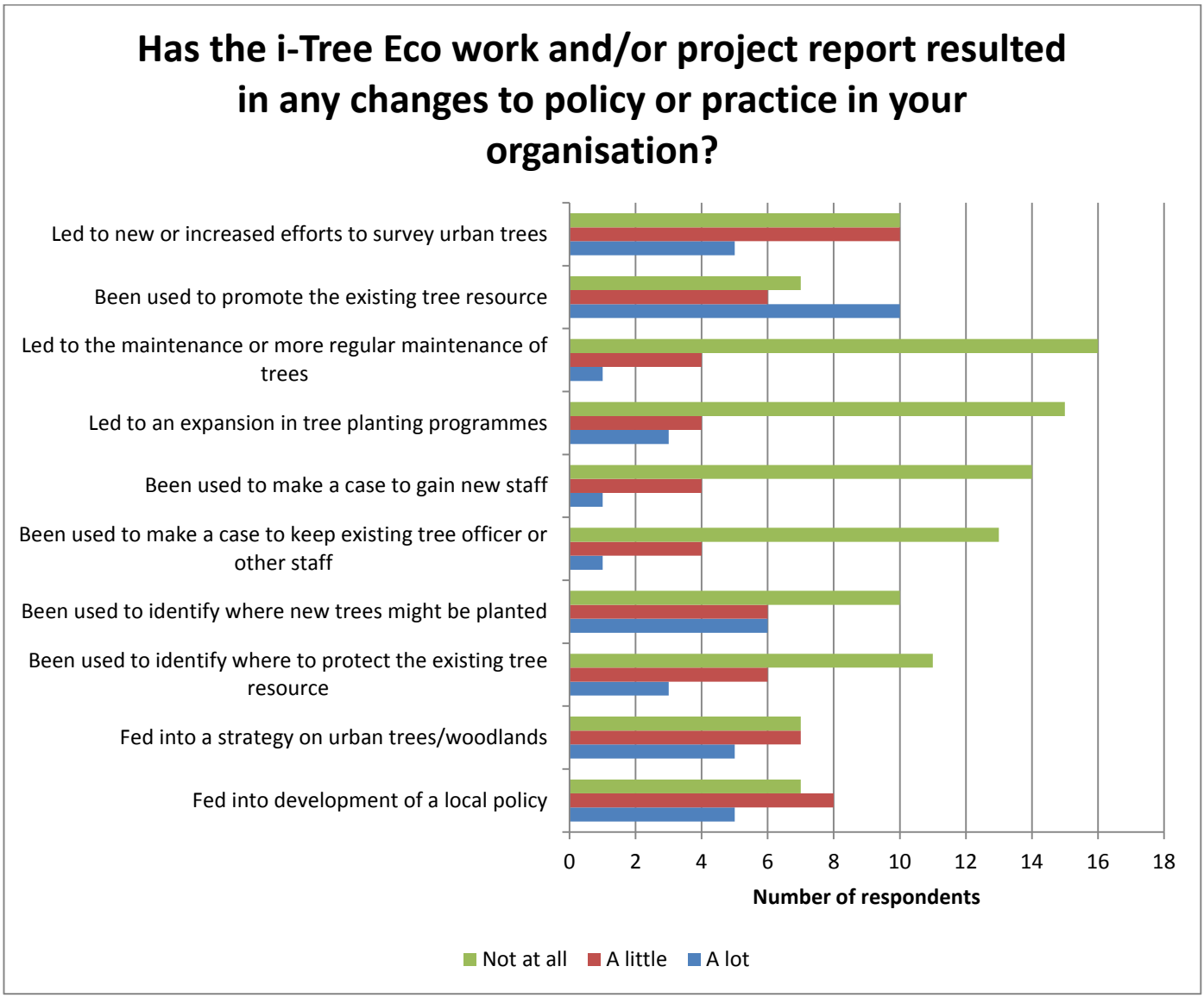

Figure six: Reported instrumental impact

5.4.2. Interviews: Change in policy

There were also results from the interviews that address whether there had been any change in policy or practice (instrumental impact) as a result of i-Tree Eco. Data from these interviews provide evidence of instrumental impact within local authorities, city councils and national bodies. Interviewees reported that the results from the i-Tree Eco surveys had been used, or were being used, in policies, plans, strategies, landscape design packages, and evidence packs, as detailed below. i-Tree Eco results were used in the following specific examples:

- To feed into a 'Trees in the City' policy;

  "It was one of the key documents that was referenced, that is part of the Trees in the City Policy, which we wrote in 2015, so it fed into that. And that policy document has a had a wide impact across the local authority".

- To inform a Local Development Plan;
- To be fed into Supplementary Planning Guidance on trees and development as it comes up for review;
- Facts and figures from i-Tree Eco were included within a Neighbourhood Plan;
- The study results were referenced within a Green Infrastructure Strategy;
- To help shape an Open Space Strategy in a city;
- Results were being fed into a Landscape Design Package, a piece of work (still in the pipeline) looking at tree planting, hedge laying, hedge planting and the species composition of that; and,
- Fed into and influenced an Evidence Pack for the local Public Services Board.

5.4.3. Interviews: Change in practice

Results from i-Tree Eco were also being used, or had been used, in other diverse ways to influence practice, processes and debates, including:

- Figures were used by an Ash Resilience Forum, looking at the impacts of Ash dieback in a region;
- The data on urban forest composition were used for master-planning and the management of the urban forest;
- To get support for a tree planting programme in the city;
- To encourage more planting in a large urban park in a town council area;
- Helped to "build a case for a broader approach to tree management";
- Within a 'Task and Finishing Forum' within the Council looking at the tree service;
- Being sent to the Climate Change team within the local council for meeting climate change adaptation and targets;
- To bridge the gap, in policy terms, between a more traditional rural forestry focus and urban forestry; and
- Helped to get people talking more about trees in urban environments and peri-urban environments rather than in traditional woodland settings.

6. Barriers to impact

The previous section outlines a wide range of impacts reported by interviewees and questionnaire respondents. Interviewees were also given the opportunity to identify barriers to impact, and these are discussed below. [Note that all of the content in this section is drawn from the interviews].

6.1. Problems with knowledge exchange and dissemination

The evaluation interviews conducted with stakeholders demonstrated recognition that knowledge exchange, and communication and dissemination of findings, was an area of the i-Tree Eco studies that had not always been successfully planned and delivered. This presented a barrier to impact in many cases, and incorporated issues relating to:

- A lack of clarity about who was the audience,
- Insufficient resources available for dissemination,
- A lack, within project teams, of the skills needed for effective knowledge exchange, and
- A failure to produce outputs appropriate for different audiences and levels of technical understanding (in the first instance).

However, there was also evidence of a learning process taking place, suggesting that some lessons had already been learnt about early challenges in dissemination and knowledge exchange.

6.2. The public sector has other priorities

Interviewees pointed out that one of the major barriers to achieving change as a result of conducting an i-Tree Eco survey is that the public sector has other priorities. This is particularly the case because of cutbacks in the sector which has caused councils and other public bodies to focus efforts and resources on areas such as education, social care, and health. This point is best illustrated by quotes from the interviewees:

> "What I have realised…is how little it impinges on most… you know, I've been in this little bubble of environmental-ness and just focusing on that. Now… my work covers many more things and it's marginal, to be honest with you".
>
> "Last year it wasn't even on the radar, because we were too busy sorting out whether we had jobs".
>
> "It's not seen as a corporate priority basically".

> "If we had had i-tree before the crash … in 2009, I think it might have been received differently, I think we're in a period of contraction in local authorities in the UK. Contracting funding and increasing demand for the big issues - and frankly the big issues are education and social care and these are the ones that soak up most of the resource".

> "It's very difficult to see how you could argue for, or very difficult to make the argument for, increased resources for urban forestry when the health service is actually underfunded".

Linked to this, there was some recognition that a lack of crossover between funding streams represented another barrier to impact. This point is best represented by the quote:

> "Parks and recreation, conservation and biodiversity teams, planning teams, they don't have the funding at their fingertips to be able to do things that are needed for this, whereas other organisations, such as health boards, and even other areas within the local authorities, highways and drainage do".

6.3. People see trees as negative

Some of the interview responses stressed that delivering change following the results of i-Tree Eco surveys can be difficult because some people, including both professionals and the general public, have negative opinions about trees in urban areas. This problem is not directly related to i-Tree Eco but is a general attitudinal barrier.

Some of the specific issues highlighted by interviewees were concerns about trees blocking out light, and people being nervous that trees might make their street feel a bit less safe because they shade out certain areas. Other concerns relate to leaves, maintenance, and interference with cabelling. Specifically it was commented that highway engineers, for example "still all see trees as really a problem they could do without". However, it was stressed by one interviewee that "we can address those issues if we have those conversations" but they recognised that currently "we're not having conversations about why these are good and important things".

6.4. Insufficient resources

Connected to the issue of public bodies having other priorities is the availability of resources (funding and time) for i-Tree and urban forestry. There are two main aspects to this: the first relates specifically to carrying out an i-Tree Eco survey and fully exploiting the data from it; and the second relates more broadly to improving the focus on, and management of, the urban forest resource.

A range of specific issues were mentioned by the interviewees regarding the i-Tree Eco survey and availability of resources. These included:

- Not having enough resources for analysing the data collected through the survey,
- Not having enough funds to fully distribute findings to the relevant people,
- The need to be realistic about how much resource is needed to deliver an i-Tree Eco study,
- Not having sufficient in-house resources, including time, for publicity and dissemination, and
- Problems with where funding sits within local authorities, that is, in which departments.

Quotes from the interview data help to illustrate these points:

> "We haven't managed to analyse the results…because we haven't got the money to do it".
>
> "That's where we fell down really … not … having enough money to … have the results fully analysed … and to distribute it to the relevant people".
>
> "We don't have the time to promote it as widely as maybe we would have hoped we could do".
>
> "I guess the only barriers to implementing any recommendations would obviously be financial, those would be the key barriers".

6.5. Organisational restructuring / Staff turnover

For many of the i-Tree Eco surveys, timing coincided with cutbacks in public spending, following the global recession, resulting in organisational restructuring and staff changes. Both of these processes have (in the opinion of the interviewees) proved to be barriers to realising impact from the i-Tree Eco studies. That said, staff changes are a part of any organisation and ought to be an issue that is readily mitigated against. Likewise, organisational change is common and it need not be a barrier to impact for i-Tree Eco studies. It should be emphasised, however, that the changes following the global recession have been more significant and had a bigger impact than 'normal' organisational change. Nevertheless the following quotes demonstrate that - for a number of the interviewees - the issues of personnel and organisational change have added to the other challenges to achieving impact.

> "There's been a reduction in staff as a whole across the local authority. People, the key working links that were there before, don't exist anymore. Whole structures have changed, so we're having to re-educate. We work very hard talking to other departments, so we're just going to have start the process all over again, and just have conversations with them".

> "There's been a complete reorganisation of the structure of the Council from top to bottom. So this is, unfortunately, it's been really poor timing for this".

> "It's quite a changing council, as much as any councils are, people move around rather rapidly, so yes, the lead person, as far as I'm aware, had already moved off the project by the time I was given the project, so the connections for it continually changed, and I think that served as a kind of nail in the coffin for getting any drive and momentum of getting it approved within the council and for it to have been any use".

6.6. Lack of a 'champion' and senior staff buy in

The lack of senior buy in or lack of a high level champion for the i-Tree Eco studies was mentioned by some of the interviewees as a barrier to impact. This connects to the previous section on personnel change since, in some cases, the 'champion' for the project was not a senior member of staff but was working at the level where staff turnover is generally higher. This meant there was greater likelihood that the project champion was lost part way through the project. Some quotes of relevance to this section are presented here:

> "The report and the findings and the buy-in hadn't occurred at a senior enough level within the council".

> "There have been a number of internal organisational changes which would make it difficult to ensure that there were champions".

6.7. Departments are not joined up

There was an awareness that the information within an i-Tree Eco report needs to be passed on and used by service areas within councils, including highways, health and sustainable urban drainage. However, it was noted by interviewees that this would require them (other departments) to have "a different mind-set to want to deliver their objectives through green infrastructure". Not having this organisational structure created a barrier to impact.

7. Overcoming barriers and increasing impact

To counter some of the barriers described above, and increase the potential for positive impacts, the following are presented as processes or activities that should be built in to any future i-Tree Eco projects, where possible.

7.1. Overcoming the barriers

7.1.1. Knowledge exchange and dissemination

To specifically address the barrier to impact of problems relating to knowledge exchange and dissemination, interviewees had various suggestions, arising from their own learning process, having been involved in an i-Tree Eco project and encountered problems with dissemination. These are presented here.

Some interviewees talked about the need for translation of technical findings, and dumbing down of language; others about using different types of output, or adding further explanation, and others still about the need to "tease out the relevant bits of information for the audiences".

As i-Tree survey data revealed the proportion of canopy cover found on private land it became more clear to project teams how important it might be to have results accessible to the general public so that they could have a greater understanding of the benefits provided by the trees on their own property. This reflects the questionnaire results which showed that 27 of 40 respondents thought the public were a key audience for i-Tree projects.

It was felt that i-Tree Eco project teams could engage more with friends groups, community groups, and neighbourhood groups (e.g. City of Trees in Manchester, the Red Rose Forest, Trees for Cities in London, the Tree Council etc.) to increase impact of i-Tree Eco surveys.

There were reports from some interviewees that they had attempted to do revisions of their document to make it more accessible for other departments to enable them to take and utilise information of relevance for them. In some cases this resulted in a summary document being written at a later date, a significant time after the initial report. Future projects would ideally need to build in the production of a suitable summary document to their project planning timeline.

One interviewee suggested talking to, for example, health and highways departments (or whoever should be the audience) in advance of report writing, to understand from them what kind of information might be of interest and use, and how they would need it presented and reported.

Other interviewees recognised the importance of articulating the findings to organisations who do not plant or maintain trees. For example, it was pointed out that other land managers such as social housing associations might be able to utilise i-Tree findings if they were made relevant and accessible to such a body.

It is important to recognise that a multitude of outputs may be needed – infographics for key facts easily understood by all; summary document with a bit more detail; and a technical report for tree specialists. A research summary document was considered to be particularly important: "I think the research summary is really, really critical in addressing getting important messages out".

Project teams may need to buy in professional communications guidance (on how to get key messages out).

In many of these responses it was clear that understanding about how knowledge exchange needed to be varied and tailored to different groups had developed through the process of the i-Tree Eco project. Interviewees reported the realisation that they needed to learn the lessons about failings in knowledge exchange and "do a better job at promoting and presenting the findings of the report".

7.1.2. Urban trees are not a priority; resources are allocated elsewhere; trees are viewed as negative

A number of the barriers in section six are interlinked and if it can be more strongly demonstrated why urban trees are of value, multiple barriers may be overcome. Interviewees had suggestions to address this point and these are described here.

i-Tree Eco needs to be able to demonstrate how urban trees are important to the health agenda. i-Tree Eco needs to be able to provide results about social and health benefits because that is what people are interested in, and that is where the resources are allocated. This would help to emhasise why urban trees should be considered a priority, and should thereby leverage more resources. To re-iterate these points, interviewees thought that i-Tree Eco results could be used more forcefully to make the case for why urban trees are important. To achieve this, the i-Tree Eco reports may need to move beyond presenting evidence to interpreting that evidence to make it more meaningful.

More i-Tree Eco project teams should consider involving volunteers and citizens ("ordinary people") in i-Tree Eco surveys, perhaps by linking with Treezilla, in order to help more people understand the importance of their own trees and those around them. This could help change perceptions that trees are negative.

7.1.3. Insufficient resources

Some i-Tree Eco survey teams learnt that there was more to i-Tree Eco than the data gathering process and made this point with regard to resources. At the project planning phase, teams (or potential teams) need to be realistic about the time and resources

needed, not just for on the ground project delivery, but also data analysis, reporting, and ongoing dissemination and communication. As one interviewee commented:

> "I think it's also just being realistic about the resources it takes to run these, whether you're running it with professional surveyors and surveying teams, or with volunteers, it is quite an exercise. So, having enough resources to be able to go as far as you'd like".

7.1.4. Organisational change and staff turnover

Many of the comments about overcoming the barriers to impact are in fact about project management. This is the case here. Interviewees were clear that there needs to be continuity in terms of project team members to ensure direction and commitment is maintained. If this is not possible then effective processes for hand over of projects part way through is recommended.

7.1.5. Lack of buy-in

Depending on the nature of the organisation leading the i-Tree Eco work, projects will benefit if there is high-level buy-in from senior staff who understand the value of the work and who are commited to utilising the findings from the i-Tree Eco survey.

7.2. Other suggestions to increase impact

Interviewees had numerous additional suggestions for future i-Tree projects that could help to increase impact.

It was suggested that more i-Tree Eco surveys are needed across the country to fully understand the national picture.

One interviewee thought that repeat surveys were needed in specific locations so as to understand trends and changes in quality of the urban tree resources.

It was felt by some that there could be greater use of i-Tree Eco survey results to inform target setting, for example with regard to extent of canopy cover in the area, and tree species diversity.

Some interviewees suggested that there was a need for a greater awareness within project teams that i-Tree Eco is a data collection tool and should be viewed as the start of the process, not the final product. As one interviewee put it, and as with any project, i-Tree Eco project teams need to "have a clear idea of where you're going; what are your objectives. And then use information from i-Tree to inform that".

7.3. Other ecosystem service values of interest

By broadening the scope of data that i-Tree Eco surveys could provide, it is possible that impact would be increased as more areas of interest are addressed. As i-Tree Eco

surveys capture data primarily concerning the value of regulating ecosystem services, interviewees were asked whether information capturing other values would be useful. The interviews revealed a number of opinions about extra information that would be valuable in future i-Tree Eco projects and reports. Interviewees noted that it would be useful if future i-Tree Eco surveys could provide information, or more information, on the following topics:

- Biodiversity values;
- Health and social values;
- Distribution of ownership (public/private) so as to inform pest and disease management strategies;
- The aesthetic value of the trees[12];
- A social damage cost for $PM_{2.5}$[13]; and
- A value for noise abatement provided by urban trees.

On the subject of providing more information about the link between urban trees and human health, one interviewee mentioned some of the specific health indicators that could be of relevance, as illustrated in the following quote:

> "…the whole health agenda. How trees and the environment can impact on things like asthma sufferance, obesity, hospital recovery … So the whole spectrum of health and also the impact of trees on our mental wellness, in terms of providing places where people are able to relax and de-stress".

It was also noted that information is needed about the capital requirement for managing the urban tree resource. As one interviewee put it, the i-Tree Eco survey results need to clearly say 'the urban tree resource is worth this much, it provides benefits to this value, and it needs this much investment to manage annually'.

Overall, this section demonstrates some lessons learnt from i-Tree, and the key issues that future projects should address so as to ensure that the maximum possible impact is realised.

[12] Incorporated into some, but not all studies via a CAVAT valuation
[13] Social damage cost for $PM_{2.5}$ has not yet been developed for official use by UK government. However, some studies have taken the UK's social damage cost for PM to apply to $PM_{2.5}$ as well as PM_{10} and have applied this value.

8. Conclusion

This report has enabled a broad and deep reflection on the experiences of stakeholders who have been involved in the i-Tree Eco surveys.

The research shows that there has been a range of impacts from the i-Tree Eco studies carried out. Connectivity (collaboration) impacts seemed to be strong. Little change was reported in attitudes but interviewees noted conceptual impact occurred through reported increases in knowledge, understanding and awareness. There was an increase in capacity for some, with some examples of skills development and increased funding. A range of instrumental impacts were evident in terms of policy and practice at a local level.

A range of barriers to impact were identified but interviewees also had many recommendations and suggestions for overcoming the barriers. These were related to:

- knowledge exchange and dissemination;
- organisations having other priorities;
- insufficient resources;
- trees being viewed as negative;
- organisational change and staff turnover;
- lack of a project champion and senior level buy-in; and
- departments not being joined up.

In future, to overcome barriers to impact and increase impact, i-Tree project teams need to have a clear aim as to why a survey is being undertaken and who is the audience. Knowledge exchange is thus very important, so as well as technical reports, there needs to be a plain English summary accessible to a wide range of audiences. This has implications for the level of resources dedicated to the processes of dissemination and communication. There is scope for gathering additional information about the costs incurred by different i-Tree Eco project teams, and how this relates to the approach taken, the dissemination that was applied, and the impact achieved[14]. There also needs to be organisational buy-in for any i-Tree Eco survey and, if possible, a project champion involved right through the process. By demonstrating more strongly the value of the urban tree resource, perhaps through increasing the range of ecosystem services valued by i-Tree Eco studies, a number of barriers to impact could be overcome.

[14] O'Brien's report (2015) relating to the London i-Tree Eco project contains a short section outlining the costs incurred and is an example of how such information could be presented.

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Appendix 1. Questions in the online questionnaire

- Which organisation do you work for?
- What is your role within the organisation?
- When did you first hear about i-Tree Eco?
- How did you first hear about i-Tree Eco?
- Which i-Tree Eco project have you been involved with or heard about?
- If you got involved in i-Tree Eco - how did that happen?
- Which findings of the i-Tree Eco project do you think are or would be most useful to you and your organisation?.
- Do you feel there has been any change in your understanding and attitudes about urban trees and the values they provide to society due to i-Tree Eco?
- Are you aware of any changes in understanding, attitudes, actions in your organisation about the urban tree resource and its value due to i-Tree Eco?
- Are you aware of any changes in understanding, attitudes, actions among others outside of your organisation about the urban tree resource and its value due to i-Tree Eco?
- Has undertaking the i-Tree Eco work and/or the production of the i-Tree Eco project report resulted in any changes to policy or practice that your are aware of in your organisation?
- Has involvement in i-Tree Eco increased your or others [colleagues/stakeholders] capacity, skills or expertise?
- Has the i-Tree Eco project led to you/others to being able to secure funding to expand the urban tree resource?
- Has the i-Tree Eco work led to any new collaboration within your or with other organisations?
- As a result of i-Tree Eco have you or anyone within your organisation changed your attitudes to engaging/working with researchers?
- Who do you think are the key audiences for i-Tree Eco results and reports?
- If you know or found out about an i-Tree Eco report how did that happen?
- Have you seen a full i-Tree Eco report?
- Have you seen a short summary i-Tree Eco report?
- Do you think the i-Tree Eco outputs (e.g. full report, summary) produced need any translation to make them easier for you to understand?
- Are you aware of any barriers/challenges that have reduced the impact of the i-Tree Eco?
- What could be done in the future to avoid some of the problems or issues outlined above?
- The values for urban trees not currently captured by i-Tree Eco include the following list. Can you let us know whether these values of urban trees are also important in your opinion?

Appendix 2. Interview questions

Interview questions

About interviewee
I. What is your role in the organisation?
II. When did you get involved in, or become aware of, the i-Tree Eco survey work?
III. How did you get involved, and why?
IV. What do you know about how the i-Tree survey and reporting was run?
1.1. What level of interest has there been in the i-Tree work/reports?
1.2. Has this interest been in the key headline results or in the detail of the survey, or anything else?
1.3. Has the i-Tree Eco work changed your understanding of, or attitude towards, urban trees and their value, and the benefits they provide to society?
1.4. And do you think the i-Tree eco survey work has changed understanding of, or attitude towards, urban trees within your organisation?
1.5. And do you think the i-Tree eco survey work has changed understanding of, and attitude towards, urban trees among others outside of your organisation?
2.1. Has undertaking the i-Tree Eco work and the production of the i-Tree Eco reports resulted in any changes to policy or practice that you are aware of?
3.1. Has involvement in the i-Tree Eco work increased your or others' skills or expertise?
3.2. If yes, what has this led to?
3.3. Has the i-Tree Eco work led to you, your colleagues or others being able to secure funding for urban tree management or expansion?
4.1. Has the project led to any new collaboration within your organisation?
4.2. What was the connection between your organisation and the i-Tree Eco survey team? (those carrying out the work) – (only relevant if this was not you and your organisation). Have there been any benefits or challenges for your organisation related to this?
4.3. As a result of the work, have you or any of your colleagues changed your attitudes to engaging/working with others? (external organisations)
5.1. Who was the audience for the i-Tree Eco survey report? Who should know about the results?
5.2. How were the i-Tree Eco survey results / report made known?
6.1. Are you aware of any barriers or issues that may have reduced the impact of the work?
6.2. What could have been done differently to avoid the issues just described? (if any)
7.1 Which findings of the i-Tree Eco work do you think are most important, and why?
7.2. Are there any values not captured by the i-Tree work that are relevant for valuing the urban tree resource?
7.3. Is there any other information not captured that you think would have been useful?
7.5. Are there any future plans to do more with this work and its data/ results? Any follow on?
Thank you.

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