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DOI:

[10.1016/j.ecoser.2018.07.006](https://doi.org/10.1016/j.ecoser.2018.07.006)

Document Version

Publisher's PDF, also known as Version of record

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Citation for published version (APA):

Davies, H. J., Doick, K. J., Hudson, M. D., Schaafsma, M., Schreckenber, K., & Valatin, G. (2018). Business attitudes towards funding ecosystem services provided by urban forests. *Ecosystem Services*, 32(B), 159-169. <https://doi.org/10.1016/j.ecoser.2018.07.006>

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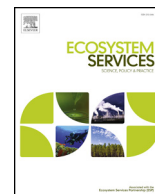
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Business attitudes towards funding ecosystem services provided by urban forests



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ARTICLE INFO

Keywords:

Payments for ecosystem services
Public-private partnerships
City trees
Climate change adaptation
Corporate social responsibility

ABSTRACT

Urban trees and woodlands provide a wide range of ecosystem services (ES) to society, for example, flood risk reduction, air purification, and moderation of urban heat islands. Despite this, local government budgets for tree planting and maintenance have declined in many cities throughout the world. Thus far, the academic literature has largely ignored whether businesses are willing to help fund urban forests and the ES they provide. Business financing via payments for ecosystem services (PES) within the urban realm is also under-researched and lacking in practice. This study aims to address these research gaps. Semi-structured interviews were carried out with 30 businesses of varying sizes and sectors, operating in Southampton, UK. Respondents thought a public-private partnership would be feasible, with a focus on voluntary payments towards enhancing air quality, reducing flood risk, and improving aesthetics. Respondents would prefer to choose from a list of location-specific, cost-effective, monitored projects to fund directly, for marketing and/or corporate social responsibility purposes. To facilitate business funding of urban forest-based ES, clear communication of the expected environmental benefits and a strong business case are required, drawing on the experience of similar initiatives. From our findings, we recommend the piloting and analysis of such PES schemes.

1. Introduction

The world is experiencing increasing urbanization and growth of cities: the proportion of the population residing in urban areas increased from 34% in 1960 to 54% in 2016, and is projected to reach 66% by 2050 (United Nations, 2015; The World Bank, 2017). The proportion of urban dwellers is particularly high in developed countries, with 83% in the UK, 82% in the US, and 75% in the EU (The World Bank, 2017). As cities become more densely developed, the increase in human-made surfaces and corresponding loss of urban greenspace increases the risk of flooding and urban heat island effects (Lemonsu et al., 2015; Miller and Hutchins, 2017). Air pollution is also a problem in many densely populated cities – particularly in more deprived areas – influenced by urban morphology and local meteor-

ological conditions (Netcen, 2006; Abhijith et al., 2017; Bodnaruk et al., 2017). Each of these negatively impacts human health and wellbeing and is likely to be exacerbated by climate change. Increased frequency and intensity of extreme weather events (i.e. heatwaves and extreme precipitation events) as well as increasing ozone concentration, will impact significantly on businesses and communities in city environments (European Environment Agency, 2016).

Supporting other engineering and policy solutions, urban forests¹ can help address these issues through the provision of regulating ecosystem services (ES) such as heat amelioration (Doick and Hutchings, 2013); stormwater attenuation (Armson et al., 2013); and air purification (Escobedo and Nowak, 2009). There are calls for additional tree cover in cities worldwide in order to improve resilience to climatic changes and enhance quality of life (e.g. Salbitano et al., 2016). How-

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¹ The ‘urban forest’ is defined as “all woods and trees in and around urban centres” (Konijnendijk et al., 2006).

ever, funding for urban trees and other green infrastructure² has declined in many cities, particularly in Europe, exacerbated by government austerity (van Zoest and Hopman, 2014; Kabisch, 2015). Business financing – perhaps through payments for ecosystem services (PES) – could pose a potential solution (Bade et al., 2015; Davies et al., 2017).

Drawing on definitions by Wunder (2005), Muradian et al. (2010) and Defra (Smith et al., 2013), and a study by Waylen and Martin-Ortega (2018), this paper defines PES as ‘a transfer of resources between ES buyers and sellers that aims to improve provision of ES for the benefit of society and the environment’. The following principles apply:

- Voluntariness – stakeholders ideally enter into a PES agreement on a voluntary basis, however governments may act on their behalf, or regulate involvement, if necessary.
- Payment source – payments are made by the beneficiaries of ES (citizens, businesses, or governments acting on their behalf). This includes those benefitting from reputational enhancement or actions that compensate for (unregulated) environmental harm.
- Conditionality – payment is conditional on the delivery of quantified ES, or on the implementation of robust land use practices proven to deliver ES benefits.
- Additionality – ES benefits (or proxy land use practices) are over-and-above the baseline (or business-as-usual) level, and do not lead to the loss or degradation of ES elsewhere.

The limited literature on the subject suggests that business attitudes towards (investing in) ES are generally positive, but with some business owners unaware of ES and others with perceptions that may prevent increased ES provision (Wolf, 2004a; Koellner et al., 2010). Furthermore, there are currently few documented examples of business-funded PES schemes located entirely in urban areas. During 2012–2015, Defra funded three pilot projects to investigate the potential for urban PES schemes in the UK. Those in Luton and Hull were considered to be a success – despite the fact that neither are actually up and running as a fully-fledged PES scheme – while that in Manchester failed to gain any business support (Defra, 2016). Eves et al. (2015) suggest that applying PES to urban contexts is more challenging than in rural environments because costs and benefits are less clear, and there are far more stakeholders involved.

Though not labelled as PES, there are other urban schemes with similar objectives. A social enterprise in Edinburgh offers corporate sponsorship packages to support tree planting in the city, however it is unclear how successful this has been (TreeTime Edinburgh, 2015). A non-profit organisation in the US (City Forest Credits, 2017) has recently started offering carbon and quantified co-benefit credits to urban forest projects in cities nationwide; while another has launched a private-to-private stormwater trading market in Washington D.C. to facilitate developers in funding green infrastructure projects to reduce stormwater runoff in the city (NatureVest, 2017). In Australia, the City of Melbourne (2018) has launched an ‘Urban Forest Fund’ seeking to match-fund contributions from organisations and individuals in order to pay for 40,000 new trees in the city.

This study aimed to explore business attitudes towards establishing business-funded PES schemes in a developed city context. Three research questions were posed:

1. What are business attitudes towards trees and the ES they provide?
2. What are business attitudes towards private sector investment in urban forests?
3. What are business preferences regarding the operation of an urban forest PES scheme?

2. Materials and methods

2.1. The study area

Given the exploratory nature of the study, it was deemed appropriate to take a case study approach. Southampton was chosen as the study area for three reasons: representativeness, worsening environmental quality, and proactive city planning. With a population of just over 250,000, Southampton is classified by the OECD (2017) as a medium-sized city, thus representative of cities in Europe (Dijkstra and Poelman, 2012). However, Southampton has a higher population density (4917 persons per km) and population growth rate (9% during 2004–14) than the majority of Europe’s cities (Eurostat, 2016), and is an international transport hub (boasting a port and airport, as well as three motorways). The city is thus particularly exposed to environmental hazards, including air pollution, urban heat islands, and surface water flooding (Southampton CC, 2014). Indeed, Southampton become one of five UK cities requiring designation of a ‘Clean Air Zone’ due to its continued failure to comply with EU law on limits for nitrogen dioxide (NO₂) (Defra, 2015a). Finally, the city benefits from a proactive local authority that uses the Green Space Factor³ in planning decisions (Kruuse, 2011; Farrugia et al., 2013), as well as a tree canopy cover of 18.5% (Mutch et al., 2017) – higher than the average for English towns and cities of 16.4% (Doick et al., 2017).

2.2. Data collection

Interviews were conducted by the lead author with senior business representatives such as sustainability managers, directors and business owners. These were carried out by telephone (n = 28) or face-to-face (n = 2). The methods used to recruit businesses included:

- Contacting existing business contacts of staff at the University of Southampton – 11 out of 31 participated.
- Approaching attendees of two business functions held in Southampton – ten out of 19 participated.
- Contacting Southampton businesses directly via email – four out of 34 participated.
- Advertising the study in the newsletters of five business membership organisations – five out of an unknown number participated.

Due to difficulties encountered in recruiting participants, just 16 of the 30 businesses included in the study were physically located within the area administered by Southampton City Council. Six were located in the adjacent local authority areas of Eastleigh, Test Valley and the New Forest (largely with Southampton postcodes), whilst nine were based elsewhere in the county of Hampshire (e.g. Winchester or Fareham). In these cases, staff and/or customers were known to reside within Southampton, and all business representatives were asked to respond as if financial contributions would be going to their local council.

The interviews were semi-structured, with business representatives initially answering 26 closed questions provided in advance (see Appendix A). Questions were grouped into six themes:

² Green infrastructure is defined by the European Commission (2013) as “a strategically planned network of natural and semi-natural areas [incorporating green and blue spaces] with other environmental features designed and managed to deliver a wide range of ecosystem services”. This concept has been extended by Laforteza et al. (2013) to comprise five interrelated blocks (ecosystem services, biodiversity, social and territorial cohesion, sustainable development, and human wellbeing), which importantly interact over both time and space.

³ The Green Space Factor is a planning policy tool that has been adopted by a number of city authorities across Europe to incorporate green infrastructure in development projects. The tool allocates a score to different types of surfaces based on infiltration potential, which is used as a proxy for ES delivery.

- Costs and benefits of urban trees;
- Relationship between business and the natural environment;
- Public-private funding for urban trees;
- Arranging the financial transaction;
- Conditions of involvement in a public-private funding scheme; and
- About your business.

Qualitative data is particularly appropriate for studies ascertaining people's attitudes. During the interview, follow-up questions were therefore employed to enable respondents to elaborate on their answers – particularly if a point of particular relevance to the study was raised (Foddy, 1993). Interviews were recorded and lasted for 27 min on average, ranging between 13 and 53 min.

2.3. Data analysis

Qualitative and quantitative analyses were performed on the interview data. The closed questions were primarily 'yes' or 'no' (resulting in binary variables), though some involved making a choice from multiple answers (resulting in categorical or ordinal variables). Non-parametric chi-squared (χ^2) tests for associations between the variables were performed. Due to the small sample size, categorical and ordinal variables were converted to binary variables before undertaking these tests to increase the expected frequency of each cell (Knol and Berger, 1991; Rupp, 2008). With all variables being binary, it was therefore necessary to apply continuity correction to the results (Haber, 1980). It was not deemed appropriate to also apply a Bonferroni correction for multiple tests, as such corrections are overly strict – particularly for a small and exploratory study such as this (Nakagawa, 2004). As such, the results, summarised in Appendix B, should be interpreted with caution. A three-point Likert scale was used to identify respondents' attitudes towards tree benefits and tree nuisances – the mean scores for these were compared using a Student's t-test. Statistical results are reported as χ^2 or t statistics, along with their respective probabilities (P) and degrees of freedom (ν). Descriptive statistics, i.e. the percentage of respondents answering yes or no to closed questions, are also provided.

The follow-up questions allowed respondents to answer more extensively. These parts of the interviews were transcribed verbatim (edited to remove repetitions, stop words and habitual irrelevant phrases). The transcripts were then analysed in the software package 'Nvivo v.11' (QSR International, 2015) using a thematic approach, following the process outlined by Braun and Clarke (2006). Full data on themes and codes for the qualitative analysis can be found in Appendix B. Qualitative findings are presented in the results section as numbers of respondents commenting on a theme and the numbers of comments they made. Direct quotations were also selected to illustrate the key points, as suggested by Braun and Clarke (2006). Business representatives are identified as BR01 to BR30.

3. Results

Of the 30 interviewed businesses; 33% were classified by Companies House (2016) as micro, 20% as small, 10% medium, and 37% as large⁴. Given that 89% of all Southampton's enterprises are micro, this size was under-represented in the sample, and all other sizes over-represented (Nomis, 2016). Businesses operating in the professional, ICT and transport sectors were over-represented in the sample compared with the average for Southampton (Nomis, 2015), whilst education, health and the wholesale/retail/motor trades were under-represented. Business sector relates to the UK Standard Industrial Classification of

Economic Activities (Office for National Statistics, 2009).

The locations of responding businesses were mapped using the software package 'ArcMap 10.5' (Esri, 2016). This revealed that all but one business was located in an area defined by Rowland et al. (2017) as urban or suburban. Six businesses were located in areas that exceeded the EU annual mean limit for NO₂ of 40 $\mu\text{g}/\text{m}^3$ (Defra, 2015b). Nine were in locations with at least a moderate probability of surface water flooding (above 1 m depth in a 1 in 100 year rainfall event, or above 0.1 m in a 1 in 30 year event) (Environment Agency, 2016). Nine businesses were located in those parts of the city shown to experience the highest surface temperatures (Osborne, 2016). In total, 18 businesses were in locations affected by at least one of these three environmental issues.

3.1. What are business attitudes towards trees and the ES they provide?

3.1.1. Perceived benefits and environmental risk to businesses

The attitude of businesses towards urban trees was overwhelmingly positive, with 26 respondents making 79 positive statements. These related principally to cultural and regulating services that trees provide to businesses and their staff (54 references from 21 respondents). Six respondents also stated that urban trees have financial benefits for their businesses, though these are unquantified. Positive statements included:

"I think there's a general consensus [amongst the local businesses] that they'd rather be in a green area with trees." (BR22)

"Indirectly the wellbeing [benefit provided by urban trees] is related to the prosperity of the business... if I feel better I'm going to be better at my job and I'll go out and get more business." (BR24)

"[Trees] reducing flooding and staff sickness... is a benefit [to our organisation]." (BR27)

"If you've got something that looks nice and it's kept nice, then you've got a higher chance of that area making more money and getting more customers." (BR29)

In terms of the specific ES that respondents considered most important to their businesses, improved aesthetics of the local area was important to 93% of respondents, followed by improved air quality and employee health (Fig. 1).

The top three benefits rank the same regardless of whether 'very important' is considered alone or in conjunction with 'quite important'. However, reduced summer heat was ranked last of the nine specified benefits for 'very important' and 6th for 'very' and 'quite' important combined, and vice versa for reduced local flood risk. This is perhaps because only a minority of the businesses have been affected by extreme weather events: eight have experienced flooding of their buildings, car parks, or access road; whilst five have experienced overheating buildings during heatwaves.

Two-thirds of respondents were concerned about the potential impact of climate change on their business and/or the city overall (64 references from 27 respondents related to this point). This was particularly so for those located in areas with at least moderate risk of surface water flooding, significant at the 5% level ($\nu = 1$, $\chi^2 = 4.464$, $P = 0.035$). Medium-large firms also tended to be more concerned about climate change than micro-small ones ($\nu = 1$, $\chi^2 = 2.829$, $P = 0.093$). Overall, respondents were most concerned about flooding (13 respondents), air pollution ($n = 10$), heatwaves ($n = 9$), sea level rise ($n = 3$) and energy prices ($n = 3$), but only a minority (23%)

⁴ Companies House classifies micro businesses as those with ≤ 10 employees and/or turnover \leq £632,000; small as having 11–50 employees and/or turnover \leq £6.5 million; medium with 51–250 employees and/or turnover \leq £25.9 million; and large as > 250 employees and/or turnover $>$ £25.9 million.

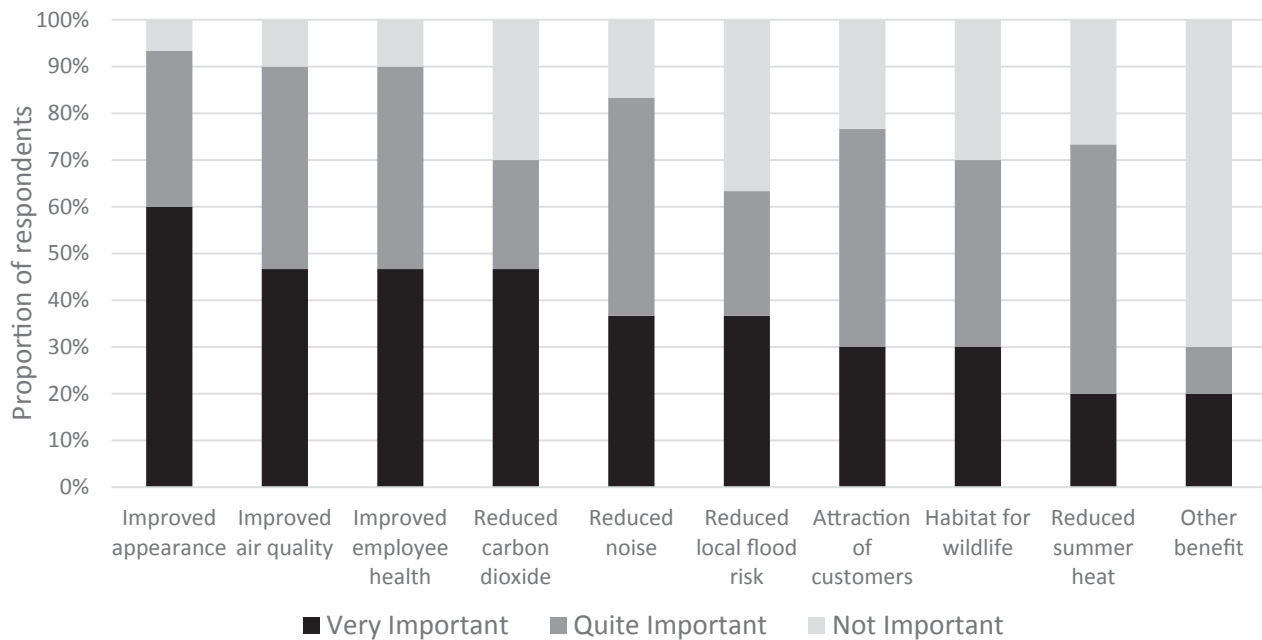


Fig. 1. Importance of tree benefits to businesses.

specifically mentioned trees as a nature-based solution⁵ to many of these issues. Comments included:

“Flood risk is a big one for us... The multi-storey car park is usually the worst for it... [If there were] green areas, soakaways, [or] SUDS in that area, I'm sure it would help reduce that risk.” (BR11)

“Southampton has got some of the worst air quality in the UK.” (BR23)

“I reckon a few days of 40 degree heat here would cripple this building.” (BR21)

3.1.2. Perceived nuisances and governance of the urban forest

Despite this overall positivity for trees, and concern about the environment, 16 respondents made 26 negative or ambivalent comments about trees and the services they provide, including:

“Structural damage from tree roots is probably one of our biggest costs.” (BR12)

“I don't think [my customers] would really care if there are trees or not or whether I contribute to them being around in the local environment.” (BR03)

“I think the climate change issue is not going to be changed by urban tree planting.” (BR12)

Specific tree nuisances affected only a minority of businesses, and were generally considered unimportant: the mean rating given to the nuisances was significantly lower (at the 1% level) than that given to the benefits ($\nu = 550$, $t = -12.193$, $P = 0.001$). Bird and aphid excrement falling on cars, trees obstructing business signs, pollen allergies,

⁵ The European Commission (2015) defined nature-based solutions as “living solutions inspired by, continuously supported by and using nature, which are designed to address various societal challenges in resource-efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits”. In the specific context of climate change adaptation in urban areas, nature-based solutions “include provision of urban green such as parks and street trees that may ameliorate high temperature in cities or regulate air and water flow” (Kabisch et al., 2017).

and structural damage were of greatest concern, affecting 37–43% of respondents. Nine respondents (30%) said they incur expenditure associated with tree nuisances, in particular for clearing up fallen leaves and repairing structural damage. The relationship between incurring expenditure and finding leaf fall to be a major nuisance was significant at the 5% level ($\nu = 1$, $\chi^2 = 4.836$, $P = 0.028$).

In terms of the governance of Southampton's urban forest, 33% of business respondents showed interest in collaborative decision-making via a steering group, whilst 10% would respond to consultations on tree planting and maintenance. However, due to resource constraints, the majority of respondents (40%) would simply like to be informed of the council's decisions, whilst 17% want no involvement at all. The size of the interviewed businesses seemed to influence their desired level of involvement: medium-large firms tended to prefer active involvement, whilst micro-small firms preferred passive/no involvement ($\nu = 1$, $\chi^2 = 3.229$, $P = 0.072$).

3.2. What are business attitudes towards private sector investment in urban forests?

3.2.1. Mandatory, voluntary or not at all

Ninety-percent of business respondents agreed with the principle of private sector contributions to urban trees given the decline in public sector funds for this resource. Indeed, 14 respondents made 24 comments about investing in the local environment being a moral duty; for example:

“Every business has a responsibility to its local area, as a local employer and part of the local community... I think we've all got a moral duty, a part to play.” (BR10)

Whilst 28 respondents made 123 positive comments about the possible introduction of an urban forest PES scheme in Southampton, a similar number also expressed reservations (104 comments from 27 respondents). For example, 6 respondents made 6 comments about the urban forest being the council's responsibility:

“The local council have limited funds so it slips off their list of priorities... I'm not sure that I agree with the principle that the private sector should then step in and cover the problem.” (BR17)

When asked which stakeholders should contribute to financing

Southampton's urban trees, all respondents selected the local council, but only 63% thought that citizens should contribute. Whilst 67% thought that *all* businesses should contribute, 30% of respondents believed only those businesses causing pollution or loss of trees should contribute. Furthermore, ten respondents made 13 comments that polluters should pay *more* than other businesses, for example:

“Everybody [should contribute], but especially those causing pollution... if you're causing damage, you should be contributing more. It's just a matter of fairness.” (BR15)

None of these respondents identified themselves as a ‘polluter’ or a ‘destroyer’ of trees; they were shifting the responsibility to others. However, one other respondent said they would be motivated to contribute to right past wrongs:

“About 6 years ago we took out 3 or 4 trees to build a car park. Those trees were never replaced... so I think another reason [for contributing] is environmental damage caused by the business.” (BR26)

Just 27% of respondents would prefer mandatory (as opposed to voluntary) business contributions to Southampton's trees, with some stating it would be fairer (and cheaper) if everyone played a small part. Fourteen respondents made 19 comments in support of mandatory contributions (including five of those who voted for voluntary contributions). However, the majority of respondents (73%) thought that business contributions should be voluntary. Several of these reasoned that an environmental tax or similar mandatory payment would be unfair for small businesses, and might dissuade some from operating in the city (the payment amount was not discussed in the interviews). Overall, 24 respondents made 33 comments in support of voluntary contributions (including four of those who voted for mandatory contributions). Some respondents could see the benefits of both, for example:

“I think it should start on a voluntary basis, and then move to mandatory... after a period of consultation.” (BR30)

In contrast, two respondents commented ($n = 2$) that their business would be more inclined to volunteer their time, staff or equipment than money, for example:

“I don't think we would make a financial contribution. I can imagine us providing support perhaps through... some volunteer work.” (BR14)

3.2.2. What and where to fund

When asked what the council should focus the additional funds from businesses on, respondents were overwhelmingly in favour of the money being spent on enhancing benefits rather than reducing nuisances. Regulating ES were particularly popular, with 93% of respondents wishing additional funds to be channelled into improving air quality, and 83% into reducing local flood risk. The least popular of all the tree benefits was reducing summer heat (43%); more commonly selected by business respondents concerned by future climate change, significant at the 5% level ($\nu = 1$, $\chi^2 = 4.904$, $P = 0.027$). Two respondents selected all benefits *except* reducing summer heat – one said:

“I'm not sure [planting trees] is a particularly efficient way of doing that. There's better ways, like air conditioning... I'm not sure I'd want [the council] to... plant trees just because of the heat... The other [benefits] are better, more tangible.” (BR18)

Of the cultural benefits, improving the city's appearance was the most popular, selected by 77% of respondents. In contrast, only 57% wanted the council to address tree root-induced damage to infrastructure (the highest ranking tree nuisance). The benefits and nuisances that businesses would prefer to fund are shown in Fig. 2.

Comparing Figs. 1 and 2 suggests that the ES that respondents would prefer to fund in Southampton are not necessarily those that are of most importance to their own business. This is likely due to pollution

and flooding affecting the places where employees and customers of respondent businesses live. Three respondents (BR02, BR21 and BR29) specifically suggested that the PES scheme should be focused on enhancing the city's air quality given its recent ‘Clean Air Zone’ designation. In general, however, all respondents would be willing to fund the tree planting and maintenance activities knowing that a range (or bundle) of benefits would be provided.

Whilst all but one business (97%) would be willing to contribute to planting in areas currently devoid of trees, only 77% would be willing to contribute to enhanced maintenance of existing trees, as they perceived this to have less visual (and thus reputational) impact. Similarly, only 40% of respondents would be interested in contributing to the city's trees as a whole, whilst 60% would prefer to invest only in trees in the immediate vicinity of their business premises. This is because many respondents would require a tangible (and in some cases a financial) business benefit if an urban forest PES scheme were to receive their support (35 references from 19 respondents). For example:

“Financially it would be only in the immediate vicinity of your business premises... If you were doing it city-wide, you wouldn't necessarily – selfishly – see the benefits of it.” (BR04)

Sixteen respondents suggested that societal benefit would be a greater driver for them to invest than business benefit (24 references), whilst nine respondents commented that they would be looking for a win-win situation, for example:

“It can mean that you create initiatives where everyone wins – it's good for the local community because it brings more people to the Common⁶ for example, and it also brings revenue to the business.” (BR13)

3.2.3. Reasons to invest

The majority of respondents (85%) would wish to publicise their contribution in order to promote their business both internally and externally. Sixteen respondents made 34 comments to this effect:

“You can have some crowing: ‘I funded this!’ If you do it and its voluntary there's a CSR benefit which is [useful for] marketing.” (BR01)

“Engaging staff in a team effort to do something good. It makes people feel nice and value the company.” (BR16)

Wanting publicity is also reflected in business motivations for investing in Southampton's trees, with 83% of respondents saying it would enhance the reputation of their organisation (see Fig. 3). The second strongest motivating factor for contributing to an urban forest PES scheme would be to help meet corporate social responsibility⁷ (CSR) objectives – particularly for medium-large firms ($\nu = 1$, $\chi^2 = 3.416$, $P = 0.065$) and those affected by extreme weather events ($\nu = 1$, $\chi^2 = 3.601$, $P = 0.058$). Twenty respondents made 32 references to their proactive sustainability and/or CSR activities. Eleven respondents specified taking action to enhance the natural environment, though for some, CSR still has a more social focus. For example:

“We do CSR work, whether it's pulling Himalayan balsam or... doing some river restoration work.” (BR19)

⁶ The Common is the largest contiguous greenspace (1.48 km²) in Southampton, located to the north of the city centre. It contains a range of habitats, including woodland, parkland, rough grassland, ponds and wetlands, as well as formal recreation areas (Thomson, 1989).

⁷ CSR is defined by the European Commission (2001) as “a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis”. Some other definitions of CSR exclude the environmental dimension, for example Carroll (1991) who defined CSR as comprising four kinds of social responsibilities: economic, legal, ethical, and philanthropic.

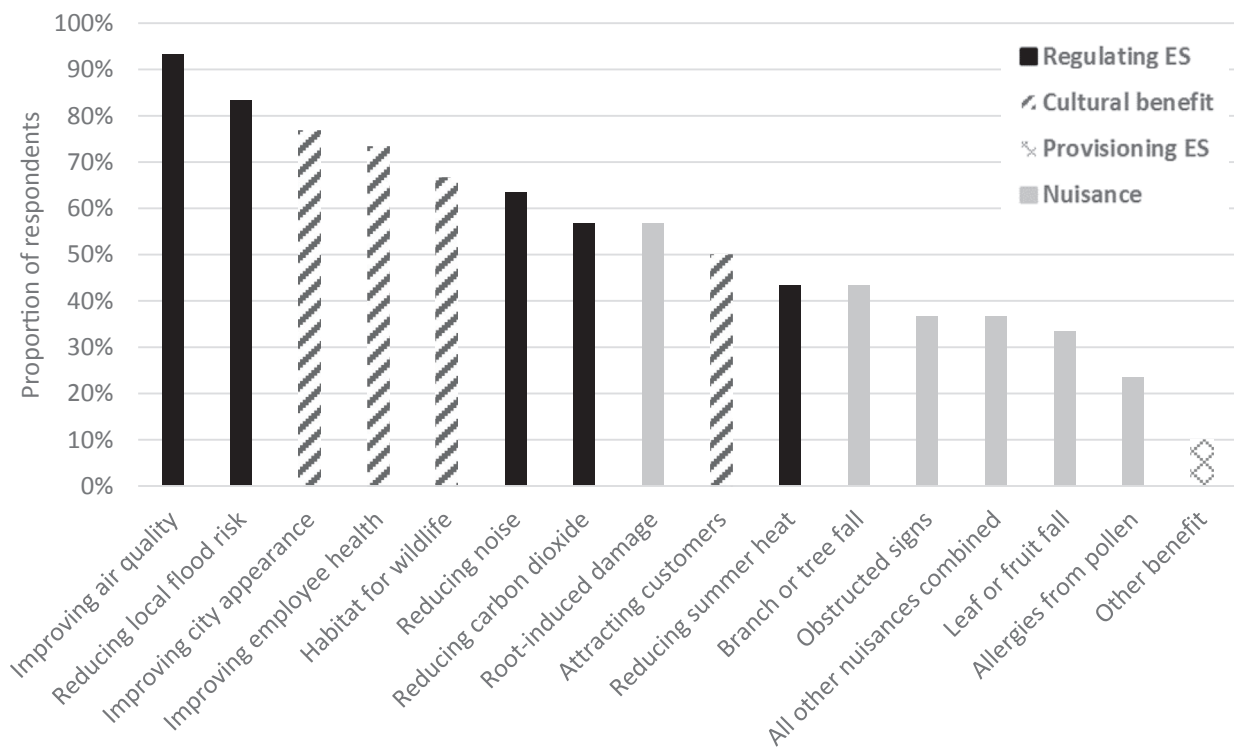


Fig. 2. Benefits and nuisances that councils should spend business funds on.

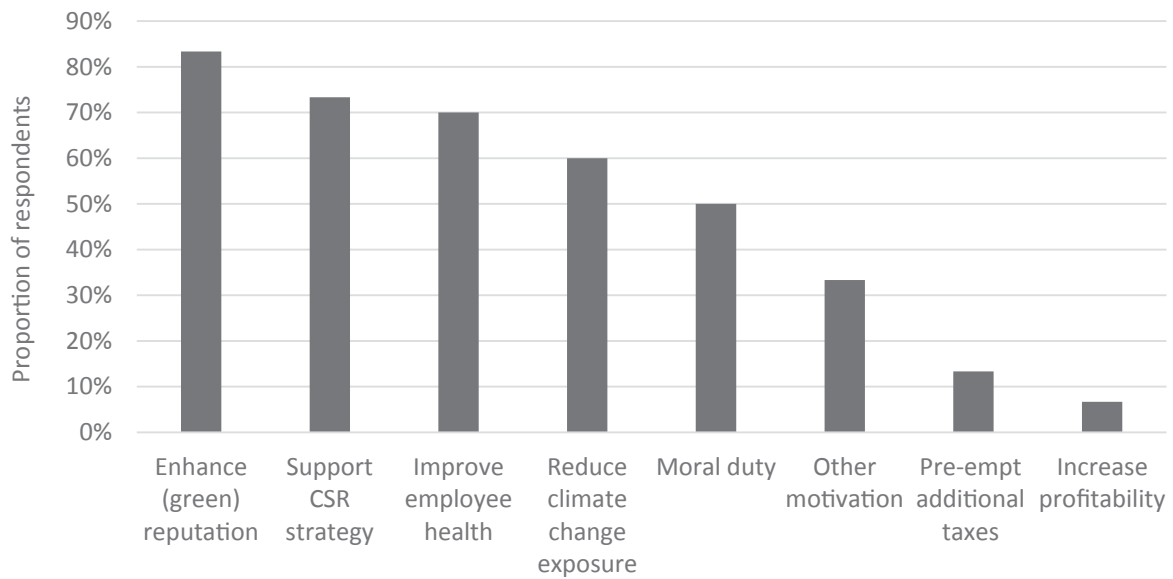


Fig. 3. Business motivations for investing in Southampton's trees.

“[Our CSR is] probably more community-focused rather than environmental.” (BR28)

The third strongest motivator for respondents was improving employees' health and wellbeing. Respondents with such motivations were more likely to want to enhance the maintenance of existing trees rather than just planting new ones, significant at the 5% level ($\nu = 1$, $\chi^2 = 5.111$, $P = 0.024$). They were also more likely to be located in a flood risk area ($\nu = 1$, $\chi^2 = 2.917$, $P = 0.088$). Ten respondents mentioned 'other' motivations – these included a more aesthetically pleasing environment in which to work ($n = 4$), improving local air quality ($n = 3$), setting an example to other businesses ($n = 1$), motivating staff ($n = 1$), and mitigating previous environmental damage ($n = 1$).

3.3. What are business preferences regarding the operation of an urban forest PES scheme?

3.3.1. Partnerships and payments

Almost all business respondents (94%) agreed a partnership between the public and private sectors could be made to work for funding Southampton's urban trees. Fifteen respondents made a total of 20 comments on the importance of businesses and the council working together if a PES scheme is to be successful, with nine respondents mentioning the need for a steering group to make the decisions. For example:

“Rather than saying ‘here’s a load of money, go and plant trees’, it would be interesting to know, ‘could we get involved [in planting and

maintenance]?’ ...[That] would make the whole donation piece so much easier; otherwise it just looks like a tree tax.” (BR25)

Eight respondents commented that citizens should also be involved in the scheme – be that through financial contributions, volunteering their time, or even planting trees on their own land. For instance:

“Potentially citizens, because they’re going to benefit too – particularly on the flooding front and air quality.” (BR28)

Many of the respondents made recommendations on how to ensure that an urban forest PES scheme is fair and smooth running, though opinions differed somewhat. For example, most respondents thought that, if mandatory, contributions should reflect either the size of the business (43%) or the impact the business has on the environment (also 43%), rather than a set rate for all businesses (7%). Large and small firms had differing opinions on the fairness of all firms paying the same versus larger firms paying more (though statistically there was no relationship between these variables). Comments included:

“You can’t have a blanket rate payable by all businesses, otherwise [a multinational company] in Southampton would pay the same as me, and that’s just stupid – it would put me out of business; I’d have to move.” (BR23)

“I know from the apprentice levy the feeling about different rates for micro, small, medium and large is quite painful. So given the [large] size of our organisation, they’d prefer the cheap option which is a blanket rate.” (BR26)

However, ten respondents suggested (on 15 occasions) that the scheme should be as simple as possible to avoid wasting time and money on complex calculations and controversial decisions – such as working out what a firm’s environmental impact might be.

3.3.2. Information and monitoring

A total of 85 comments (from all respondents) were made about the level and type of information they would require before and during the implementation of a PES scheme. Firstly, assuming it were a voluntary scheme, a case for urban trees would need to be made to persuade businesses to invest (only two of our respondents were willing to invest without any further information). The majority (70%) of respondents would like to receive a business case (i.e. information on how their business is likely to benefit) before deciding whether or not to invest. A similar proportion (63%) would like an environmental case – particularly those motivated by improving employee health and wellbeing ($\nu = 1$, $\chi^2 = 3.308$, $P = 0.069$). Additional information – such as on similar schemes elsewhere, or a ‘social case’ for urban trees – would be required by 23% of respondents. For example:

“What you’d want is examples of three or four businesses that have had their businesses improved – and it’s not necessarily financially, it could be the softer effects like wellbeing.” (BR24)

If contributing voluntarily, the majority of respondents (73%) would prefer to select from a list of costed projects to fund directly. Eleven respondents explained that this was because they would be able to see where their money is going. Those preferring to make a set annual payment instead were largely those who wanted contributions to be mandatory, significant at the 1% level ($\nu = 2$, $\chi^2 = 11.045$, $P = 0.004$).

For the implementation stage, 13 respondents said they would trust the council to manage the scheme appropriately, and so would not require monitoring. This would allow more money to be spent on the trees. For instance:

“I trust the city council to do what they’re doing... I would save their

resource.” (BR13)

However, two-thirds of respondents would require the scheme to be monitored to make sure the council not only plants the trees (perhaps highlighted on a map), but ensures that they thrive. Twelve respondents made 16 comments on this, for example:

“If we’ve invested in them and then they’re left on their own, we don’t know whether they die or have been maintained. It would just be nice if someone came along and monitored them.” (BR05)

Eight respondents went further and suggested (or implied) that the tree programme should be monitored to make sure that it is achieving the promised benefits. Two-thirds of respondents said the cost-effectiveness of the tree programme would influence their (continued) involvement. A total of 23 comments were made by 20 respondents on this subject, including:

“I’m looking to get the best bang for my buck.” (BR08)

“I think if it became clear that the programme was deeply inefficient, then we’d certainly be less willing to contribute to it.” (BR17)

In contrast, eight respondents commented that with an environmental scheme such as this, cost is less important than the wide array of benefits. Three respondents (BR02, BR15 and BR19) mentioned that trying to prove the delivery of benefits, or even to value the ES, is complex and subjective, making the cost-effectiveness hard to determine, and potentially making the scheme financially prohibitive. For example:

“It’s hard to measure the money directly. I know there are some ecosystem services to put the value against, but it is rather subjective.” (BR19)

4. Discussion

4.1. What are business attitudes towards trees and the ES they provide?

Business preferences for urban forest-based ES have largely been ignored in the literature, except for Wolf (2004a). Wolf’s research focuses on establishing the preferences of retail businesses and their customers across the USA for trees and the ES they provide. For the 165 business owners/managers responding to Wolf (2004a)’s first multi-city survey, visual amenity was considered to be the most beneficial urban forest based-ES, supporting the findings of our study (e.g. BR14). This was followed by heat regulation, nature connections, air purification and noise reduction (all rated as moderately beneficial or above) (Wolf, 2004a).

In our study, these ES were also important to business respondents, though addressing heat and nature connections were comparatively more important in the USA, and air quality and noise in the UK. This difference is perhaps influenced by Southampton’s particularly poor air quality record and increasing pollution concerns recently, coupled with the higher average summer temperatures experienced in each of the US cities. Indeed, seven of our respondents commented either that summer heat is not an issue for them, or that the ES of heat amelioration is less tangible or of lower priority than other ES (e.g. BR18). Davies et al. (2017) also found a number of local authority tree officers suggesting the ES of heat amelioration to be of low importance in the cool British climate.

Overall, we found that business respondents rated tree benefits in Southampton as significantly more important than tree nuisances ($P < 0.01$), in agreement with Wolf (2004a). This is in contrast to the perception of local authority tree officers in Britain that businesses have

a negative attitude towards trees (Davies et al., 2017). Nevertheless, Wolf (2004a) found attitudes of business owners/managers towards trees to be significantly less positive than those of their customers. The author found the greatest tree nuisances to businesses in US cities to be obstructing business signs and damage to infrastructure, followed by leaf fall and bird droppings. Along with allergies from pollen, up to 43% of our business respondents also considered these as important.

A study carried out with shoppers in a business district in Georgia in 2002 found the presence of trees to be more important to those who also worked in the district than those who did not, leading Wolf (2004b) to suggest “green streets may contribute to employee satisfaction”. This is supported by our study (e.g. BR24 and BR27), as well as others that suggest green space close to business premises can reduce stress and increase productivity (e.g. Lottrup et al., 2015). These authors found that employees of knowledge-based companies in Denmark whose view was dominated by trees reported higher job satisfaction and self-ratings of work performance. Gilchrist et al. (2015) similarly found both use and views of greenspace at UK science parks promoted employee wellbeing, with trees/woodland being preferred to grass and flowering plants.

In terms of business customers, Wolf (2009) found that US consumers were willing to travel further and more often to retail areas with trees, spend more time there once they arrived, and “pay 9% more in small cities and 12% more in large cities for equivalent goods and services”. This contrasts with the perceptions of our business respondents (e.g. BR03), as just 20% thought trees were financially beneficial to their business (mainly through increasing staff productivity), and only one (BR29) mentioned that trees could increase sales revenue. This may reflect the types of business included in the studies however, as only one of our respondents represented the retail sector.

Finally, the impact of future climate change on their business was of concern to two-thirds of our respondents. This is higher than other studies, for example PricewaterhouseCoopers (2017) revealed that 50% of the 1379 surveyed CEOs from around the world were either ‘extremely’ or ‘somewhat’ concerned about the impact of ‘climate change and environmental damage’ on their business growth prospects. Despite having concerns about climatic and environmental change, less than one-quarter of our sample thought of trees as a nature-based solution to these issues. In part, this may be due to a lack of knowledge – one respondent commented that they knew nothing of tree benefits prior to the interview, whilst several others were unsure how such benefits could be realised. Davies et al. (2017) similarly reported limited understanding of ES amongst private and public sector stakeholders.

4.2. What are business attitudes towards private sector investment in urban forests?

Overall, business respondents were supportive of the private sector, as beneficiaries of ES, contributing to Southampton’s urban trees. However, the majority thought it would be unfair and/or unpopular to make this a mandatory requirement due to the myriad of existing taxes and charges businesses face. In part this was simply a dislike for taxes, but some smaller businesses were concerned that a new eco-tax would put them out of business. In reality, any mandatory charge would be extremely low, and ideally ring-fenced for spending exclusively on tree planting that would have direct business benefits. It is therefore important that such messages are communicated to businesses to increase support for a mandatory scheme.

Just over half of our sample thought that a polluter pays system could also be appropriate – with 7 suggesting that *only* polluters or developers should pay. In this context, PES could be designed as a policy mix, rather than a single instrument (Barton et al., 2017). One

solution could require mandatory contributions from polluters and developers, topped up by voluntary (or even in-kind) contributions from other businesses for CSR purposes. Alternatively, an entirely voluntary scheme could encourage contributions from those wishing to compensate for damage caused (as suggested by BR26) as a public relations exercise, in addition to a typical beneficiary pays approach. Either way, to increase voluntary contributions, it should be stressed that *all* businesses have a role to play in sustainability and environmental enhancement, as even simply driving to work can contribute to poor air quality and climate change.

We do not know of any other studies investigating the willingness of businesses to invest in urban forest-based ES. Outside of the urban realm, Koellner et al. (2010) used contingent valuation to help understand the factors influencing firms’ willingness to invest in four tropical forest-based ES in Costa Rica – watershed protection, carbon sequestration, biodiversity conservation and scenic beauty. The study found no statistical difference in preferences based on business size or sector (industry, consumer and financial), but a statistically significant difference in opinion between the 31 international and 29 Costa Rican firms. The latter group were willing to invest in all four ES (especially watershed protection which benefitted many of them directly), but international firms were only willing to pay for the international benefit of carbon sequestration (Koellner et al., 2010). Only five of our sample were international firms; these were not statistically different to the British firms in terms of ES funding preferences. In contrast to our findings, Koellner et al. (2010) found that most businesses considered biodiversity conservation and scenic beauty of forests to be of public rather than business concern. However, in an urban environment, these two services are arguably of greater importance (and more tangible) than watershed protection or carbon sequestration (e.g. see Dobbs et al., 2011; Gómez-Baggethun and Barton, 2013).

A UK study into business preferences for investing in river-based ES in Manchester city centre found that visual amenity was of most interest to businesses – particularly those operating in the leisure, tourism and catering/hospitality industries (CLES and TWT, 2015). This supports the findings of our study (three of our business respondents represented such industries) and those of Wolf (2004b, 2004a). However not one business was willing to pay to enhance the river because they thought there would be no commercial benefit and they felt no moral duty to their local environment (CLES and TWT, 2015). This finding is in sharp contrast to our own, whilst Koellner et al. (2010) similarly found 75% of business respondents willing to invest in forest ES. The authors were surprised to find that intrinsic motivations had the largest influence on firms’ willingness to invest in ES, closely followed by improving company image (the most important motivator in our study). Unfortunately, with a response rate of just 6%, it is likely that Koellner et al. (2010)’s findings may be down to the fact that only firms interested in ES responded to the survey. Though 30% of those contacted participated in our study, self-selection bias (towards possibly more ‘green’ or philanthropic businesses) may also explain some of our own positive findings.

Drivers of environmental CSR reported in the literature relate overwhelmingly to benefitting the company, rather than to benefitting the environment or society (Weber, 2008; Meißner and Grote, 2015). Our study supports this to some extent – for example, 60% of businesses would prefer any trees they fund to be planted near their premises to ensure that *they* will benefit. However this ignores the indirect business benefits of trees spread across the city: better air quality and aesthetics improve *living* and *commuting* environments, and thus health and productivity of staff; whilst enhancing the attractiveness of the city for *future* employees, investors and customers (Gore et al., 2013). In contrast to this self-centred view, eight respondents commented that trees should be planted in areas of need and/or where they are best suited, to avoid benefitting only the richer areas. For example:

“If you look at the impoverished areas, they have no businesses but they could do with some trees.” (BR15)

Nevertheless, Koellner et al. (2010) and Meißner and Grote (2015) both felt that intrinsic motivations are rarely sufficient to invest in PES schemes, and so a business case (focusing on commercial benefit) would most likely be needed to persuade most firms to invest.

4.3. What are business preferences regarding the operation of an urban forest PES scheme?

Due to the complexities of an urban environment and the large number of buyers (and potentially sellers) involved, Brewer et al. (2014) and CLES and TWT (2015) state that a very lengthy period of inter-organisational working will be required to establish a successful public-private PES partnership. Our respondents were optimistic that such a partnership could work for funding urban forests, though some wanted more involvement in decision-making than others, and only a minority showed interest in forming a steering group to help develop and monitor the tree planting and maintenance projects. Though there was no desire amongst respondents for an intermediary (such as a charity) to be involved, intermediaries are common in PES schemes and have been found to improve coordination and trust between ES buyers and sellers (Sattler et al., 2013). Furthermore, with upfront canvassing, administration and transaction costs of PES schemes often (prohibitively) high, intermediaries can play a crucial role by reducing or meeting these costs (Vatn, 2010; Matzdorf et al., 2013). TreeTime Edinburgh (2015), City Forest Credits (2017) and NatureVest (2017) are useful examples of intermediaries in an urban context.

From their experience with the Defra-funded PES pilot scheme in the urban area of Hull, MacGillivray and Wragg (2013) found it hard to find primary buyers willing to purchase ES, and suggested that secondary buyers (such as the local council or an NGO) will often be needed to act on their behalf (making contributions mandatory). This is perhaps due to concerns about free-riding, as found by Eves et al. (2015) during interviews with manufacturing companies in the UK, and suggested by BR06 from our own study: *“if you make [the scheme] voluntary, only those that are like me will stick their hands in their pockets”*.

To persuade businesses to contribute voluntarily, the council or intermediary would need to make a strong case for investment, perhaps explaining how businesses could improve their reputation, meet CSR objectives, and improve employee wellbeing (thus allaying fears over free-riders who would miss out on such benefits). Bennett et al. (2014) in the USA found that utility companies' interest in water-based PES schemes would be enhanced by demonstration of financial benefits, whilst Eves et al. (2015) recommended communicating the key successes from other PES schemes with target audiences. Making a business case (incorporating environmental and social aspects) to company owners and managers is key – not just for raising funds, but for spreading the message of social and environmental sustainability more widely amongst this influential community. Knowledge exchange between the business sector and universities/governments/NGOs regarding environmental issues and opportunities has increased in recent decades due to institutional pressures and access to environmental knowledge transfer networks, but remains voluntary and ad hoc (Wassmer et al., 2014; Stadler and Lin, 2017). The involvement of an intermediary to help with knowledge exchange may be useful in this context (Schomers et al., 2015).

There was no requirement amongst our respondents for business-funded projects to be distinguished from the council's regular activities (i.e. ensuring additionality) – likely due to few UK local authorities still having budgets for tree planting (Davies et al., 2017). Nevertheless, respondents preferred the idea of planting new trees over maintaining existing trees, whilst BR01 and BR17 were concerned that businesses should not be picking up the slack left by public sector budget cuts. In terms of conditionality, Koellner et al. (2010) found that the existence

of an independent verifier ensuring that the service paid for is in fact delivered, was important for all firms (i.e. ensuring output conditionality). This finding was not supported by our study – the majority of respondents would be content with a record of tree planting (input conditionality), though a minority would like to 'see the benefits' being delivered in order to justify their continued involvement. Tools such as i-Tree Eco⁸ or Treezilla⁹ might be useful in this regard.

Cost-effectiveness (i.e. delivering benefits at the lowest cost) has been identified as one of three main characteristics of PES success, along with environmental effectiveness and achieving equity (Jack et al., 2008). The majority of our respondents deemed cost-effectiveness of the PES scheme to be important, with one (BR23) expressing a concern that councils do not always spend money wisely. However, Kroeger (2013) argues that cost-effectiveness (and therefore environmental effectiveness) of PES schemes cannot be determined because, at best, they account only for the 'flow' of ES provided (or at worst, land-use changes assumed to provide such ES); not the 'value' of the realised benefits. In a review of 25 PES schemes from across the world, Hejnowicz et al. (2014) found that 84% of these measured inputs (i.e. land-use changes) rather than outputs (i.e. actual ES provision), with only tenuous links generally made between the two. However, as noted by Lima et al. (2017) and our own respondents, there is uncertainty around the delivery of benefits from PES schemes, and trying to prove and/or value delivery can increase transaction costs. In terms of distributive equity, BR01 and BR15 suggested the council might need to prioritise disadvantaged areas to avoid businesses only paying for tree planting in their own wealthy neighbourhoods; whilst also avoiding gentrification of impoverished areas.

4.4. Study limitations

There are a number of limitations to our study: problems in recruiting respondents resulted in a small sample size, contributing to a lack of significant statistical results. Almost half of the businesses were located outside the target city, generally in less urbanised areas, whilst the business size segmentation of the sample also differed from the known enterprise demographics, with micro businesses particularly lacking. Future studies should aim for a much larger and more representative sample, with more emphasis placed on engaging with smaller businesses. Identifying the saliency of the significant and non-significant relationships reported here (via further studies) will be important for the marketing of urban forest-PES schemes. An additional issue is potential non-response bias: 70% of those contacted directly did not take part, whilst very few businesses responded to the advertising of the study in local business newsletters; perhaps the subject-matter was not perceived as sufficiently salient to respond. However, it is also possible that non-respondents may have had less positive – even negative – attitudes towards (paying for) trees. Such views could undermine the feasibility of an urban forest-PES scheme. Future studies should seek to identify these, for example by randomised visits or phone calls to non-respondents.

5. Conclusions

This exploratory study makes an important contribution to the sparse literature on business attitudes towards trees and ecosystem services, and funding these. It also facilitates the piloting of business-funded, urban PES schemes as a means of improving city image, quality

⁸ i-Tree Eco is a software application developed in the USA that uses data collected in the field to quantify the structure and environmental effects of urban trees, and calculate their value to society (USDA Forest Service, no date).

⁹ Treezilla is an online platform whereby trees in the UK are mapped (by anybody), and the value of the ecosystem services they provide is displayed (The Open University, no date).

of life, and adaptation to climate change in cities across Britain and elsewhere; though additional research on the subject would be advantageous to any such pilot.

In our self-selecting sample, business attitudes towards trees were positive, with benefits mostly prioritised over nuisances. Moreover, climate change was a concern to many respondents. Business respondents were also positive towards the possibility of private sector investment in urban forests – but would prefer contributions to be voluntary. Some businesses are intrinsically motivated to help the environment; however, this is rarely enough on its own. As such, businesses would prefer to choose from a list of location-specific projects to fund directly, as this would enable them to benefit both directly (e.g. from improved employee health), and indirectly (e.g. improving their reputation via marketing and CSR).

Regarding the operation of an urban forest PES scheme, this would ideally be through a partnership between the public and private sectors (potentially incorporating citizens). Respondents were most interested in making payments towards enhancing air quality, reducing flood risk, and improving the appearance of the city, though there was little interest in paying for heat amelioration despite heat-event experiences and climate change projections. However, they would first require the council (or an intermediary) to set out how their business and local area would be likely to benefit from the scheme, drawing on the key successes and lessons learnt from similar schemes elsewhere. Most respondents also considered transparency, input-based conditionality, and cost-effectiveness of the scheme to be necessary.

Based on our results, we believe that business-funded PES schemes have potential as a means of funding improved ES delivery from urban forests. However, if sufficient businesses are to contribute to make a voluntary scheme viable, then a strong, concise case for investment is needed. This should incorporate social, environmental and business aspects, supported by quantified and, where possible, valued ES data, and with real examples of business benefits.

Should future studies support our findings, we recommend that pilot urban forest-PES schemes should be designed and evaluated – perhaps focusing initially on city centres or business districts – following steps outlined by authors such as Sattler and Matzdorf (2013). It would also be useful to determine if citizens and/or community groups might have a role to play in funding urban forests.

Funding sources

Funding for the research was provided by EPSRC, the University of Southampton, the Scottish Forestry Trust, and Forest Research.

Ethical approval

Ethical approval for this research was granted by Ethics and Research Governance Online (ERGO 24254) at the University of Southampton.

Acknowledgements

We thank the business representatives for their participation in this study. We are grateful to Simon Kemp, Paul Bennett and Ian Harwood (University of Southampton) for access to contacts; and to the Federation of Small Businesses, Future South, Business South, the Rotary Club of Southampton, and the Southern Policy Centre for advertising our study to their members.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ecoser.2018.07.006>.

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