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Understanding public administrators' and citizens' preferences for a successful transition to pesticide-free urban green spaces

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Bans on the cosmetic use of pesticides in urban green spaces (UGS) is part of the toolbox to reduce pesticide use. While most technical barriers have been lifted, the acceptability of the global changes induced by pesticide-free UGS management is questioned. Public administrators in charge of UGSs have their own preferences and poorly informed opinions on citizens' ones. A Discrete Choice Experiment approach was adopted to investigate the discrepancy between the preferences of French citizens and public administrators in charge of technical and budget decisions, in 2017, when the pesticide ban was enforced. Results indicate that the most important differences are in the willingness to improve the working conditions of the maintenance teams, the interest in more natural UGSs and the relevance of communication on the pesticide ban. By challenging some of the opinions of UGS administrators with regard to citizens' preferences, our results remove some of the barriers to a successful transition toward pesticide-free UGSs.

Keywords: choice experiment; France; pesticide; stakeholders; urban land

1. Introduction

Reducing pesticide use has become a goal shared by many countries and a major issue in public policies due to the negative impacts of pesticides on the environment and on human health. In particular, the European Union has placed pesticides at the center of the Green Deal and Farm to Fork strategy, targeting a reduction in pesticide use by 50% by 2030 (European Commission 2020). Since 2009, Integrated Pest Management was specified in the Sustainable Use of pesticide Directive (SUD) as the cornerstone of European Union (EU) policy to reduce pesticides (European Parliament and Council 2009). The failure of this strategy (pesticide use has not decreased in the EU) calls for a new paradigm: the pesticide-free strategy (Jacquet *et al.* 2022).

The prohibition of pesticides was already foreseen as a potential solution in sensitive areas and where pesticides are used for cosmetic purposes, including public parks and gardens (European Parliament and Council 2009). Indeed, while pesticide use on amenity areas accounts for less than 3% of total pesticide use per year, it has disproportionate environmental effects, in particular through the contamination of sewage systems, ditches, drains or groundwater (Kristoffersen *et al.* 2008), and higher health

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risks, since the population is more directly exposed to pesticides than in agricultural areas. The European Commission work program for 2022 includes a revision of the SUD, to help meet the EU objectives. Among the options on the table, prohibiting the use of pesticides in sensitive urban green spaces in all Member States is envisaged. Since 2003, many Canadian municipalities have also banned the cosmetic use of pesticides in public areas (Pralle 2006).

To comply with such a pesticide ban, public managers of urban green spaces (UGSs) have to modify their practices. But the transition to pesticide-free management in UGSs is not a question of pure technical substitution of chemicals with alternative weeding and plant protection techniques. Rather, the transition always entails more global changes in the management of urban landscapes, such as extensive use of mulching, less frequent mowing, planting of new plant species and more generally the reorganisation of the maintenance work and differentiating between maintenance tasks according to the type of areas (Gutleben 2020). Keeping the level of weed control unchanged would lead to a major increase in management costs (Cheval, Gutleben, and Laille 2017). While technical references are available on alternatives to pesticides for green space management, this transition also creates other challenges for local public authorities, who generally have limited information on citizens' preferences upon which to base their decisions. Since the seventies, cultural norms have favored neat-looking urban landscapes (Nassauer 1995). After so many years with "zero weeds" as standard, public administrators may fear the limited social acceptance of weeds, and more generally the major changes resulting from the transition to zero pesticide use in urban landscapes.

The missing evidence on the preferences of the different stakeholders could be one of the main challenges for a successful transition to pesticide-free UGSs. Diverging preferences with regard to the consequences of the pesticide ban between citizens and those in charge of technical and budget decisions could lead to poorly informed and welfare-decreasing decisions. Given the ecological and societal value of UGSs, more research on how urban green spaces are managed and maintained is needed (Lindholst 2008; Rosol 2010).

Knowledge of the differences between the preferences of citizens and public administrators in charge of applying environmental policy is still too limited (Spegel 2017). This is particularly problematic since, in Cost Benefit Analysis, policy makers often rely on expert judgements rather than on stakeholder surveys to estimate the benefits associated with alternative environmental management plans, to be balanced against the costs of such projects (Colombo *et al.* 2009). Administrators' decisions are sometimes considered to be poorly aligned with the interests of the general public, either due to paternalistic attitudes (they choose the option perceived as the best for the citizens, the environment or for future generations, even if citizens dislike it) (Carlsson, Kataria, and Lampi 2011), or because they serve their own interests, such as maximising the size of their service or budget (Niskanen 1971; Buchanan, Tollison, and Tullock 1980).

Diverging preferences between managers (responsible for technical aspects) and politicians (responsible for budg*et al*location and municipal staff, including the UGS maintenance teams) are also likely to slow down the transition. They work for the same organisation (the city) and their common objective is the supply of UGS for the citizens. The relationship between managers and local politicians can be described as a principal-agent relationship in which the purchaser (the politicians) seeks to formulate

(implicitly or explicitly) contracts with the agent (the managers and the maintenance teams). In the transition to the new system without pesticides, managers are more likely to be more knowledgeable on the technical aspects than the elected official responsible for budgetary decisions; therefore leading to a situation of information asymmetry. In this context of information asymmetry, drawing up a contract in order to introduce incentives for the managers to follow the city council's objectives is complex (Marrelli and Pignataro 2001). Overall, the convergence of local politicians and technical managers' preferences will depend on the degree of integration of elected officials and managers in the same organisation and the level of information asymmetry on technical aspects. This is even more of a challenge when the provision green-space maintenance is outsourced (Lindholst 2008).

This study investigates the potential discrepancy between the preferences regarding the transition toward pesticide-free UGSs of local politicians (responsible for providing the financing and other resources necessary for UGS maintenance), managers (responsible for the design and maintenance of UGSs) and urban citizens frequenting UGSs but with no public role in UGS management. It is aimed at shedding light on the obstacles faced by municipalities, due to the fact that diverging preferences between the administrators of UGSs (including politicians and managers) and their citizens are likely to jeopardise the efficient transition toward pesticide-free UGSs.

To compare their preferences, we administered a Discrete Choice Experiment (DCE) with identical choice sets to the three groups, along with questions specific to each group. DCE have been used in the last decade to understand citizens' preferences for UGSs and the multiple services they offer (recreation, health …), including non-use value (Tu, Abildtrup, and Garcia 2016; Giergiczny and Kronenberg 2014). DCEs also provide a suitable framework for comparing preferences between different stakeholders. Using DCEs, some authors have investigated the potential discrepancy between the preferences of the general public and those of scientists or experts (not directly involved in administering policy) (Rogers 2013; Colombo *et al.* 2009; Ek, Elofsson, and Lagerkvist 2018) or those of public administrators (Carlsson, Daruvala, and Jaldell 2012, Carlsson, Kataria, and Lampi 2011; Alberini, Longo, and Riganti 2006; Eggert, Kataria, and Lampi 2018; Spegel 2017; Nordén *et al.* 2017). Others have focused on comparing the preferences of producers of environmental services and their beneficiaries (Tienhaara *et al.* 2020; Bateman 1996; Latacz-Lohmann and Schreiner 2019). The comparison of politicians' and managers' preferences is less common (see Bech (2003) and Baji *et al.* (2016) for such investigations in the health sector). The results of these studies on the similarity or divergences in the preferences of different stakeholders are clearly contextual and call for new evidence in the context of urban land management. To the best of the authors' knowledge, there are no similar studies focusing on preferences regarding pesticide-free UGSs.

The research was conducted in France, one of the main users of pesticides in the world (the 9th ranked country), where non-agricultural areas account for 5% of total pesticide use (in 2009) (Amblard *et al.* 2009). In 2014, following other Member States such as Germany, Denmark, the Netherlands and Luxemburg, France decided to officially extend its efforts in pesticide-use reduction for non-agricultural areas (gardens, parks and infrastructures) (Kristoffersen *et al.* 2008). The Labbé law has banned pesticide use in parks, on roads and footpaths and in forests accessible to the public since the 1st of January 2017 (Legifrance 2014). As of July 2022, the ban will extend to all public or private green spaces frequented by the public, including cemeteries,

green areas of hospitals, schools, hotels, camping grounds, commercial zones etc. (Legifrance 2021). Our research generates new knowledge on the differences between the preferences of citizens and public administrators in charge of applying environmental policy. It also contributes to the scarce literature on the management of UGSs without pesticides. It sheds light on the importance of challenging some of the opinions of UGS administrators with regard to what changes are accepted by citizens in parks and gardens. Doing so, our results can contribute to removing the socio-psychological barriers to a successful transition toward pesticide-free UGSs in a more general context.

The article is structured as follows. Section 2 presents the method. The results are provided in Section 3, and discussed in Section 4. The final section concludes.

2. Method

Based on Lancaster's demand theory (Lancaster 1966) and McFadden's Random Utility Maximisation framework (McFadden 1973), Discrete choice experiments are now used extensively for environmental valuation, for example to estimate the non-market values of environmental services, including recreation (Louvière and Timmermans 1990; Birol and Koundouri 2008). The method relies on hypothetical choices, and it is particularly useful in a situation where citizens are not able to choose between different options in their real life.[1] DCE outperforms other stated preference methods since they provide additional insights into preferences for specific characteristics of the management action, on top of the measure for the welfare impact of the environmental change (Mariel 2021). Moreover, one can simultaneously estimate preferences for multiple attributes, which is highly relevant when multiple dimensions are impacted by the environmental change (UGS management without pesticides in our study).

2.1. Survey design

Respondents had to choose their preferred option between two hypothetical pesticide-free UGS management scenarios described by six attributes characterising UGSs after the pesticide ban. This choice task was repeated ten times (nine effective ones and a tenth to check the consistency of respondents' answers) with different levels for the two alternative schemes.[2] The choices made are used to estimate the willingness to pay (WTP) for each of these characteristics, and the welfare gains or losses for alternative transition scenarios.

This article is based on the same experimental design as Lefebvre, Maslianskaia-Pautrel, and Laille (2021) but with different respondents. Lefebvre, Maslianskaia-Pautrel, and Laille (2021) focus on citizens' preferences and how they are affected by their visit frequency to UGSs. Here, we surveyed three categories of stakeholders: local politicians, managers and citizens. Following Carlsson, Kataria, and Lampi (2011), we presented the same choices to all three categories of stakeholders. By comparing the WTP and welfare impacts for the three groups of stakeholders, we can assess the congruence among the choices of the politicians, managers and citizens.

In order to establish an identical experimental design for the three stakeholders, we had to focus on the UGS characteristics that were impacted by the pesticide ban, and that were discernible by, and of potential interest for, the citizens. The literature on landscape planning and environmental economics relating to preferences for UGSs, complemented by technical references provided by the resource center for UGS

management in France, were analyzed to make a first selection of attributes. Discussions with local politicians and managers in charge of the transition toward pesticide-free UGSs confirmed that these characteristics were relevant for the purpose of the study. A pilot study conducted with 75 respondents from the three types of stakeholders allowed us to check the understanding of the attributes and estimate priors. The attributes selected are: recreational opportunities, visual appearance, fauna abundance, provision of information, working conditions for maintenance teams and the monetary attribute. All the attributes' levels can be achieved with pesticide-free management and this study allows us to determine which ones are preferred by the different stakeholders. Table 1 summarises the attributes and levels selected and Figure 1 provides an example of the choice card.

The monetary attribute is presented as a percentage increase in the budget allocated to UGS maintenance due to the pesticide ban. This format of the monetary attribute is meaningful for all three types of stakeholders. While respondents may have a different understanding of the consequences of such an increase in the UGS budget (some may fear an increase in local taxes, while others may be concerned by the fact that fewer local public services will be offered in other areas if the budget is reallocated to UGSs), we believe they are all impacted by an increase in the UGS budget. Considering the attribute as an increase in local taxes (as commonly done in local environmental service valuation) could have created an incentive compatibility issue (Carson and Groves 2007), since the three groups would not have been subject to the same budget constraint, thus precluding a direct comparison of preferences of the groups. Indeed, managers and politicians were asked to answer as if they were decision-makers, not citizens/taxpayers. Moreover, annual local taxes differ notably from one city to another and determining the right level for a study encompassing all French metropolitan territory would have been difficult.

The originality of our approach is that the levels of the attributes have been defined to describe the changes in the USGs (consequences of the pesticide ban), therefore allowing the estimation of the welfare impacts of the transition. The reference level corresponds to an unchanged situation with respect to what could be obtained with chemical pesticides. We assume that the UGS characteristics can be left unchanged even if technical constraints have changed with the pesticide ban. Recreational opportunities and working conditions are attributes which may improve or deteriorate with the pesticide ban compared to the unchanged situation, resulting in three levels in the DCE. Since it is unrealistic to consider a case where the pesticide ban generated a loss of wildlife or a reduction in the public budget allocated to UGSs (Cheval, Gutleben, and Laille 2017), the second level for those attributes corresponds to a small increase and the third one to a major increase with respect to the "unchanged situation". The two remaining attributes have two levels. For the visual appearance, the reference level is "controlled", since it corresponds to the visual appearance obtained with pesticides; that is, the situation in most UGSs before the pesticide ban. The second level is a more "natural" appearance, since UGS managers may decide to limit control of the vegetation and accept a wilder-looking space. For the information attribute, the reference level is a lack of information, while an alternative with the transition could be the implementation of information campaigns targeted at citizens and maintenance teams.

We estimated priors based on the pilot survey and generated a fractional factorial design using the D-efficiency criteria to obtain 36 pair-wise choices grouped in 4

Table 1. Attributes.

Attributes	Description	Level and Variable name
Recreational opportunities	They depend on the green area characteristics such as functionality, accessibility, security, and aesthetics. Pesticide-free management may require changes that could alter these characteristics for elements such as atmosphere, plantations, paths or furniture.	Improved USE(+) Unchanged* Reduced USE(-)
Visual appearance	The change to pesticide-free management implies the presence of more weeds in green areas such as urban parks, but also along footpaths, by walls or at the base of trees. Depending on what is desirable and the methods of management, this vegetation can have a natural or managed look.	Controlled* Natural NATU
Fauna abundance	Pesticide-free management may boost the populations of all types of local animal species (e.g. birds, insects, small animals). Some of this fauna is useful for the maintenance of the green areas (e.g. controlling undesirable insects).	Major increase FAUNA(++) Minor increase FAUNA(+) Unchanged*
Information and Training	Pesticide-free management creates many changes concerning the level of service of the green areas, the key skills required of workers, the organisation of work, and the associated costs. To facilitate these changes, the local communities can decide to offer training and/or information for maintenance teams and residents.	Absent* Existing INFO
Working conditions	With pesticide-free management, there is no longer any risk associated with manipulating pesticides, but there are other factors that affect working conditions. They include physical working conditions and being exposed to an increased risk of accidents or professional illnesses (e.g. due to noise, dust, exhaust gases, awkward positions). Being subjected to comments from members of the general public, who are sometimes aggressive, is also a psychological risk. With the change to pesticide-free management these risk factors evolve as the work changes, creating potentially better or worse working conditions.	Improved WORK(+) Unchanged* Risk of deterioration WORK(-)
Budget	This concerns the local community budget allocated to green areas (maintenance and investment). Generally, 2 to 5% of the community's maintenance budget is dedicated to green areas. A change to pesticide-free management is expected to increase this budget for several reasons: the change in labour requirements, the purchasing of specific equipment, the reorganisation of the space (e.g. new plants), sub-contracting, training workers, and informing the population.	0%,+5%,+15% BUDG

* Reference level.

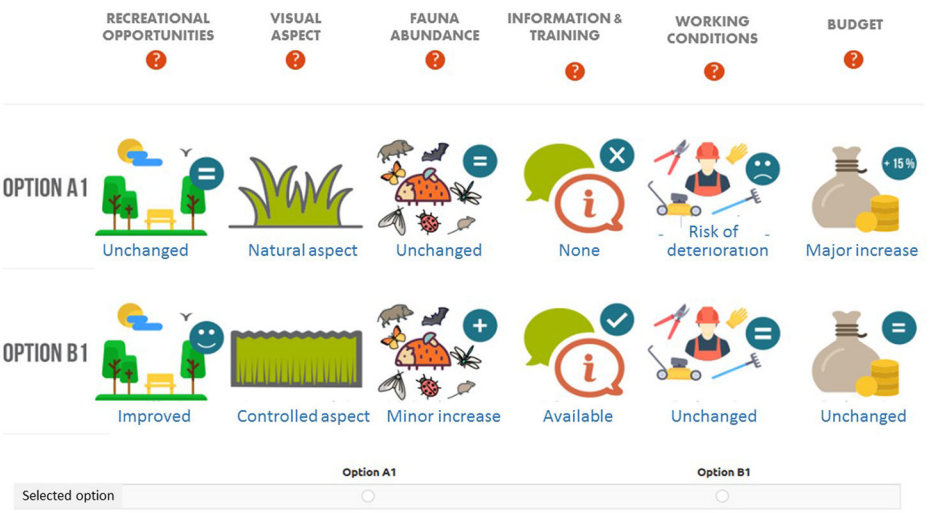

Figure 1. Example of choice card.
Note: We did not follow the most common practice of presenting attributes in rows and choices in columns.

blocks, with each respondent thus answering 9 choice tasks. According to the S estimate, a sample size of 52 respondents (S estimate $= 13 \times 4$ blocks $= 52$) would be sufficient to obtain significant parameter estimates for all of the attributes (Rose and Bliemer 2013). The full description of the experimental design is available in Lefebvre, Maslianskaia-Pautrel, and Laille (2021).

Prior to the choice experiment, respondents were informed about the context of the survey: the pesticide ban in French UGSs since the 1st of January 2017. The type of green space under study was also specified (i.e. parks and gardens). Respondents were told to give their answers in reference to the parks and gardens in their city. Importantly, we designed the introduction of the survey such that local politicians and managers were encouraged to choose the options in the choice scenarios that they would implement in their professional position (see the survey instructions in the Electronic Supplementary Material (ESM)). To do so, the introduction emphasised that the survey was about the opinions of different types of stakeholders. The second part was specific to each type and respondents, therefore, had to think about the survey topic from the perspective of their assigned role. For example, local politicians had to provide information on their mandate and seniority in local politics, managers on their employer and seniority in their occupation, and citizens on their habits related to the use of UGSs. This part of the survey helped respondents fix the idea in their minds that we were interested in their answers relating to their role as a specific type of stakeholder. In particular, this ensured that politicians and managers did not select options in the experiment according to their personal preferences as citizens visiting UGSs. We therefore have three well-defined groups of stakeholders.

2.2. Sample

The survey was administered online with Limesurvey between October 2017 and March 2018. Given the unavailability of a database or panel with local politicians and

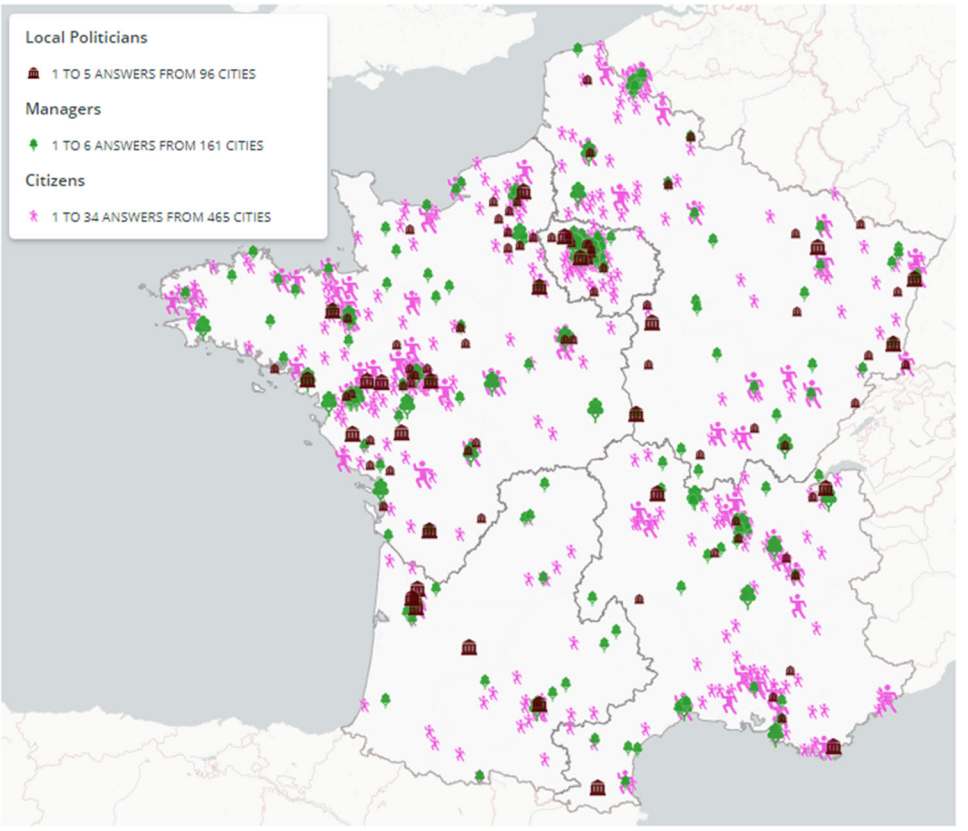

Figure 2. Geographical distribution of respondents.

UGS managers, we have used a mix between convenience and snowball sampling: the questionnaire was distributed through networks of mayors and UGS managers, who have then shared the survey with citizens. The survey has also been distributed in our networks to reach more citizens. This process has allowed us to obtain a convenience sample of 1,423 individuals. The final sample is made up of 1,124 respondents: 766 citizens, 137 local politicians and 221 managers. We have deleted from the final sample: i) those who did not pass the consistency check comprising the comparison of the choice made in the first and seventh choices, since they were the same (only the names of options A and B were swapped); ii) those giving unreliable answers to the questions related to attribute non-attendance [3]; iii) those who accidentally answered the survey despite not living in metropolitan France.

As shown in Figure 2, respondents are distributed throughout the French metropolitan territory, however the North-West of France is overrepresented in the sample relative to the population (38% in the sample compared to 23% in the population), due to the location of the research team. Moreover, retired people over 65 years old are under-represented in our citizen sample and females and people who have received higher education are over-represented, compared to the French population.

Regarding the education level, 86% of the respondents have completed higher education (which is more than the corresponding figure for the French population: 63%). More citizens than politicians and managers have completed higher education (92%

compared to 74% for managers and 75% for politicians). This characteristic of our sample is interesting, because it differs from Carlsson, Kataria, and Lampi (2011). In their research, they indicated that differences in priorities (with regard to improvements in environmental quality) between administrators and the general public could be explained by the fact that administrators are, on average, better educated than the general public. Beyond the citizens' education level, our user sample also frequently visits UGSs: 34% of the citizens have visited a UGS several times a week during the last 12 months, 27% have visited a UGS once a week and 39% have visited one less than once a week.

The sample covers a wide range of experiences and seniority with regard to zero pesticide use. Half of the respondents (54%) – for all the three types – declared the transition to zero pesticide use started in their city before the pesticide ban (between 3 and 10 years ago), while 30% of them answered that it started more recently (less than 3 years ago). But citizens are largely unaware of when their city started the transition (47%). Although managers and politicians overall perceive that the transition has been well-received by citizens, 24% of managers and 36% of politicians perceive that the transition to zero pesticides has not been well-received by the citizens. While 29% of managers perceive that the transition has not been well handled by the local politicians, 16% of politicians bemoan a lack of support by UGS maintenance teams and managers. Given this heterogeneity in experiences of the transition, our results are likely to be of interest for most of the French territory.

2.3. *Econometric approach*

2.3.1. *The specification of the RPL model*

The Random Parameter Logit (RPL) model formulation has become one of the most widely used econometric structures for the analysis of DCE, since it allows parameters to vary across respondents, flexible substitution patterns and correlation with unobserved factors (Train 2003).

The utility V_{ijt} for respondent i from choosing alternative j in choice set t is defined as:

$$V_{ijt} = X'_{ijt}\beta_i + \epsilon_{ijt}$$

where $\epsilon_{ijt}\_\{ijt\}$ is assumed to be independent and identically distributed following a Gumbel distribution. The vector X'_{ijt} is the vector of attribute levels presented in Section 2.1 and β_i is the vector of unknown parameters of the mean coefficients. In the RPL model, the heterogeneity across respondents i is introduced by allowing β to deviate from the population means following a random distribution with density $f(\beta|\Omega)$. The vector of random parameters can be decomposed into (Mariel and Meyerhoff 2018):

$$\beta_i = \beta + \wedge\ z_i + \Gamma\ \mathrm{v}_i$$

where β is the parameter representing the mean coefficients of the random parameter distributions, z_i is the vector of observed individual characteristics with the associated parameter matrix $\wedge$. The interaction effects with the stakeholders represents the mean-shifters included in the matrix $\wedge$, which will be used to answer the research question related to whether different stakeholders have similar preferences for pesticide-free UGS management attributes. The random unobserved taste variation is represented by

v_i, composed of uncorrelated random variables with mean zero with the associated parameter matrix Γ. Both uncorrelated and correlated RPL can be estimated. In the correlated RPL, the full variance-covariance of the random parameters (the Cholesky matrix Γ) is estimated, while only the diagonal elements of Γ are estimated in the uncorrelated RPL (the variance elements are fixed by identification restrictions). The most common specification is the uncorrelated RPL, however the dataset may have unobserved effects that are correlated among alternatives in a given choice situation. The correlated specification enables the correlation of the error term for each respondent in different situations (Hensher 2015). In order to disentangle all potential sources of correlation (scale heterogeneity from other sources), Hess and Train (2017) suggest allowing for all forms of correlation among utility coefficients estimating the full covariance. Since we use dummy-coded variables, the choice of the base category can lead to Type I errors and therefore to biased results if we do not consider potential correlation across the different levels of the same attribute (Burton 2019). Therefore, we follow the suggestion by Mariel and Meyerhoff (2018) encouraging researchers not to constrain the correlations in the RPL.

The random parameters for the UGS attributes are assumed to follow a triangular distribution and a log-normal distribution for the monetary attribute. Different model distribution combinations were tested and the one that represented the best goodness of fit according to the AIC/n criteria was selected. It is common practice in the DCE literature to limit the distribution of the monetary attribute to be non-random or to constrain it to have only the expected sign as the marginal utility of the monetary attribute is expected to be negative.

Given the random coefficients for the attributes in the RPL model, we can compute the portion of the population for which the model assigns a non-expected sign, using the cumulative mass function of the frequency distribution of the parameter over the population.

2.3.2. *Measuring preferences for specific characteristics and their relative importance*

Attribute coefficients cannot be directly interpreted as the relative weight of the attributes since they are confounded with the underlying subjective scale of the utilities (Lancsar, Louviere, and Flynn 2007). To measure the effect of each attribute on a common scale, we rely on the WTP ratio. Since attributes are modeled as dummy-coded variables, the WTP associated with attribute k and level l is equivalent to the willingness to accept an increase in the city UGS budget (expressed as a percentage point increase) for changes from the unchanged level of attribute k to level l.

$$\mathrm{WTP}_k^l = \frac{-\beta_k^l}{\exp(\beta_{BUDG})}$$

where β_k^l is the coefficient associated with attribute k and β_{BUDG} is the coefficient associated with the monetary attribute.

To take into consideration heterogeneity across respondents, we estimated the median WTP and the corresponding confidence interval following the Krinsky and Robb (1986) procedure with 1,000 draws. The median value of the log-normal distribution is calculated as $\exp(\beta_{BUDG})$. We present median WTP as we believe that for studies aiming to assess public policies the median is a better value than the mean, as it represents the central tendency and it avoids the problem of deriving a WTP estimate that is sensitive to outliers. The lower and upper limits of a 95% confidence

interval are given by the 26th and 975th sorted estimates of WTP, respectively (Hole 2007). In order to estimate WTP, we use the sampling uncertainty of means (Rodríguez-Entrena *et al.* 2012). The WTP values are computed for each stakeholder considering the significant interaction term between the attribute and the stakeholder identity, as shown in Table 2. For example, the WTP for the INFO attribute for the managers is as follows:

$$\mathrm{WTP}_k^l = \frac{-(\hat{\beta}_{INFO} + \hat{\beta}_{INFO\times Managers})}{\exp\left(\hat{\beta}_{BUDG}\right)}\%$$

where $\hat{\beta}_{INFO}$ and $\hat{\beta}_{BUDGET}$ are the estimated means, $\hat{\beta}_{INFO\times Managers}$ represents the heterogeneity in means of the attribute INFO for the managers (the interaction with BUDG is not included as it is not significant.

To test whether the difference in WTP across stakeholders is significant, we apply the Complete Combinatorial test suggested by Poe, Giraud, and Loomis (2005). This is a non-parametric test that involves comparing differences in WTP for all possible combinations of the estimates obtained by the Krinsky–Robb method.

2.3.3. *Measuring welfare impacts*

In order to analyze the barriers to a successful transition to zero-pesticide UGSs, we measure whether different transition scenarios have different impacts on stakeholders' welfare. We calculate the welfare impacts with the compensating surplus indicator (CS) (Meyerhoff, Liebe, and Hartje 2009; Espinosa-Goded, Barreiro-Hurlé, and Ruto 2010; Rodríguez-Entrena *et al.* 2012). CS is the maximum amount of money a respondent would be willing to pay (or willing to accept) to have the same utility in the pesticide-free scenario as in a benchmark scenario. CS can be measured for different scenarios defined by different combinations of attributes. The CS for the change from the benchmark (B) to a pesticide-free management option (MO) is estimated by calculating the difference between the total utility of each scenario (V_B and V_{MO}), and multiplying this by the negative inverse of the coefficient for the budget attribute β_{BUDG} (Hanemann 1984).

$$\mathrm{CS}_{MO_k} = \frac{\mathrm{V}_B - \mathrm{V}_{MO_k}}{-\exp(\beta_{BUDG})}$$

In order to estimate the CS for the population, we have used the same method as for WTP.

3. Results

We first analyze the correlation across parameters to select the best model. Then we present the WTP by attributes and type of stakeholders. Finally, we measure whether different stakeholders are impacted differently by two different transition scenarios.

3.1. *Model selection: correlated vs uncorrelated RPL*

Table 2 presents the results of the uncorrelated and correlated RPL. The estimates are similar in magnitude. We tested the null hypothesis that all out-of-diagonal elements of the correlation matrix of the random parameters are zero. The likelihood ratio statistic is

Table 2. RPL model estimations (Uncorrelated and Correlated).

	Uncorrelated		Correlated	
	Coef.	Std.error	Coef.	Std.error
Attributes (means)				
USE(-)	−1.592	0.106***	−1.993	0.140***
USE(+)	0.562	0.078***	0.719	0.097***
NATU	1.093	0.077***	1.298	0.106***
FAUNA(+)	1.007	0.072***	1.300	0.115***
FAUNA(++)	1.895	0.109***	2.541	0.187***
INFO	0.577	0.060***	0.666	0.082***
WORK(-)	−1.766	0.107***	−2.189	0.152***
WORK(+)	0.719	0.085***	0.926	0.118***
BUDG	−2.825	0.100***	−2.721	0.114***
Heterogeneity in means				
USE(-) x Politicians	0.082	0.241	−0.045	0.289
USE(-)x Managers	0.109	0.176	0.088	0.204
USE(+) x Politicians	−0.164	0.175	−0.198	0.199
USE(+) x Managers	−0.061	0.155	−0.004	0.175
NATU x Politicians	−0.441	0.174**	−0.515	0.210**
NATU x Managers	−0.261	0.148*	−0.332	0.173*
FAUNA(+) x Politicians	−0.322	0.165*	−0.329	0.235
FAUNA(+) x Managers	−0.179	0.131	−0.174	0.179
FAUNA(++) x Politicians	−0.510	0.243**	−0.527	0.357
FAUNA(++) x Managers	−0.482	0.201**	−0.495	0.284*
INFO x Politicians	0.229	0.136*	0.266	0.169
INFO x Managers	0.265	0.124**	0.270	0.151*
WORK (-) x Politicians	0.154	0.218	0.002	0.271
WORK (-) x Managers	0.169	0.173	0.138	0.211
WORK (+) x Politicians	−0.572	0.186***	−0.583	0.208***
WORK (+) x Managers	−0.286	0.178	−0.314	0.198
BUDG x Politicians	0.149	0.171	−0.074	0.193
BUDG x Managers	0.017	0.134	0.202	0.142
Attributes (Standard Deviations)				
USE(-)	1.308	0.098***	3.767	0.296***
USE(+)	0.655	0.127***	1.003	0.246***
NATU	1.254	0.074***	3.762	0.519***
FAUNA(+)	0.367	0.160**	2.659	0.281***
FAUNA(++)	1.459	0.104***	5.326	0.464***
INFO	0.643	0.083***	2.240	0.247***
WORK(-)	1.401	0.105***	4.185	0.537***
WORK(+)	0.642	0.102***	1.718	0.537***
BUDG	1.020	0.073***	2.672	0.385***
Log-Likelihood	−4,890.093		−4,764.015	
Observations	10,116		10,116	
AIC/n	0.974		0.956	
Parameters	36		72	

Note: The standard deviations reported are estimated considering the correlation between parameter estimates (Hensher 2015) using 1000 Halton draws. Estimated with NLOGIT 6.0. x corresponds to the interaction between the stakeholder type and the attribute.

$LR = -2 \times ((-4890.1) - (-4764.0)) = 252.2 > 51 = \chi^2(36)\ 0.05$, leading to rejection of the null hypothesis. Moreover, the AIC is better for the correlated model (even after penalising for adding more parameters). As a result, we focus on the correlated model.

The parameter estimates are significant (at the 1% significance level) and have the expected sign according to theoretical predictions.[4] They are positive for attributes corresponding to an improvement and negative for a deterioration, as well as for an increase in the budget. All the attribute standard deviations are significant, confirming the high levels of unobserved heterogeneity and the value-added of the RPL model (compared to specifications not allowing heterogeneity in preferences through the parameter distribution).

According to the correlation matrix (See Table 1 in Electronic Supplementary Material), as expected, the highest negative correlations are observed among the attributes that can experience an improvement and a deterioration (for example −0.929 between USE(+) and USE(-)).

3.2. *Do citizens and administrators of UGSs have similar preferences for pesticide-free UGS attributes?*

First, we comment on the significance of the interaction between the respondent type and each attribute in the correlated RPL model (Table 2). We observe heterogeneity of preferences among stakeholders in the mean parameters of the attributes related to natural appearance and fauna abundance (less valued by politicians and managers). The availability of information is more valued by managers while the improvement of working conditions is less valued by politicians. There are no significant interactions between the stakeholder type and the budget attribute.

The heterogeneity across stakeholders also translates into differences in the percentage of the population with a non-expected sign across managers, politicians and citizens (see Table 2 in the Electronic Supplementary Material). Fewer managers put a negative value on information (16%) than citizens or politicians (25.3%). More politicians assign a negative value to a more natural appearance (32% against 21.1% for citizens and 28.2% for managers) and the improvement of working conditions (33% against 9.9% for citizens and managers). However, there are no differences across stakeholders in the preferences toward recreational opportunities.

Furthermore, we rely on WTP to analyze the relative importance of each attribute and the differences across stakeholders. We compare the median WTP and the rank of each attribute for the citizens, managers and politicians. The heterogeneity observed through the interaction terms (NATU, FAUNA, INFO, WORK(+)) in Table 2 is also reflected in significant differences in the WTP estimates (Table 3). The results of the Complete Combinatorial test (Poe, Giraud, and Loomis 2005) show that there are significant differences across types of stakeholders at the 10% level for all the attributes where there is heterogeneity among stakeholders, except for the NATU attribute between managers and politicians (see subscripts in Table 3).

The attribute with the highest absolute median WTP for citizens and politicians (and ranked second for managers) is the major increase in fauna: citizens and politicians are willing to accept an increase in the UGS budget of 38.7%, while managers have a lower WTP (31.1%). All stakeholders are also willing to accept an increase in the budget for a more natural appearance rather than a more controlled look (The median is 11.7% for politicians, 14.5% for managers and 19.7% for citizens), but politicians and managers place less value on a natural look than citizens do (this attribute ranks 4th for citizens, 5th for politicians and managers).

Table 3. Willingness To Pay per attribute and per stakeholder type: tradeoff between increase in budget allocated to UGSs and other UGS characteristics.

Attribute	Median	90% Conf. Interval	Rank
USE(-)			
Citizens	−30.4	[-39.3;−22.9]	3
Politicians	−30.4	[-39.3;−22.9]	3
Managers	−30.4	[-39.3;−22.9]	3
USE(+)			
Citizens	10.9	[7.8;15.0]	7
Politicians	10.9	[7.8;15.0]	6
Managers	10.9	[7.8;15.0]	8
NATU			
Citizens	19.7^p,m	[15.3;25.5]	4
Politicians	11.7^u	[8.5;16.4]	5
Managers	14.5^u	[11.0;19.7]	5
FAUNA(+)			
Citizens	19.6	[14.6;26.4]	5
Politicians	19.6	[14.6;26.4]	4
Managers	19.6	[14.6;26.4]	4
FAUNA(++)			
Citizens	38.7^m	[31.4;47.3]	1
Politicians	38.7^m	[31.4;47.3]	1
Managers	31.1^u,p	[25.1;38.5]	2
INFO			
Citizens	10.0^m	[7.5;7.5]	8
Politicians	10.0^m	[7.5;7.5]	7
Managers	14.2^u,p	[11.2;18.3]	6
WORK(-)			
Citizens	−33.5	[-40.9;−27.4]	2
Politicians	−33.5	[-40.9;−27.4]	2
Managers	−33.5	[-40.9;−27.4]	1
WORK(+)			
Citizens	14.1^p	[10.3;18.6]	6
Politicians	5.2^u,m	[2.0;8.8]	8
Managers	14.1^p	[10.3;18.6]	7

Note: WTP estimated with the Krinsky and Robb (1986) procedure (1000 draws). ^{u,p,m} means that the WTP is significantly different at the 10% level for the stakeholder type in row and the types in subscript (u for user, p for politicians and m for managers) according to the Complete Combinatorial test suggested by Poe, Giraud, and Loomis (2005) (see Table 3 in the Electronic Supplementary Material for complementary results on this test). Attributes are ranked according to the absolute values of the median MRS.

The attributes reflecting a deterioration have (as expected) a negative sign in the WTP estimates, but they also have high ranks (attributes are ranked according to the absolute values of the median MRS). All stakeholders are negatively impacted by a deterioration in the recreational facilities. Half of the respondents (whatever their type) are willing to accept a 30.4% increase in the budget to avoid a reduction in recreational opportunities (rank 3). This value is higher than the willingness to accept a budget increase for improved opportunities (10.9%), suggesting that losses and gains are valued differently (Kahneman and Tversky 2012).

An increase of 33.5% in the budget is acceptable for all stakeholders to avoid a deterioration in working conditions. This is particularly important for managers (rank 1, while this attribute is ranked 2 for citizens and politicians). But the willingness to accept an increase in the budget for the improvement of working conditions is lower

than the compensation requested for a deterioration, in particular for the politicians: half of them are willing to accept only a 5.2% increase in the budget for an improvement in the working conditions and the majority of citizens and managers accept an increase of 14.1% (while they are all willing to accept a budget increase of 33.5% to avoid a deterioration). For the politicians, the improvement in working conditions is less of a priority (rank 8 versus rank 6 for the citizens and rank for the managers).

The WTP for information campaigns and training is rather low, in particular for citizens, who are only willing to accept a 10% budget increase to have access to such information. Training and information is valued more positively by managers (rank 6) compared to citizens (rank 8) and politicians (rank 7).

3.3. Welfare impacts on citizens and public administrators of different transition scenarios

Beyond the preferences for different attributes, we are interested, here, in the welfare impacts of the transition, and the potential discrepancies among different types of stakeholders. Table 5 presents the median compensating surplus (and confidence interval) for two extreme transition options presented in Table 4: all the attributes are set at their most deteriorated level in MO1 and their most improved level in MO2. These scenarios are compared to a hypothetical benchmark (B) corresponding to a situation where all attributes would remain unchanged following the transition, compared to the situation with pesticides. It is hypothetical, since it is impossible to maintain exactly the same UGS characteristics without the help of chemical pesticides and without a deterioration in working conditions.

Table 4. Attribute levels associated with different management options (MO).

	Benchmark	MO1	MO2
Recreational opportunities	Unchanged	Deteriorated	Improved
Visual appearance	Controlled	Controlled	Natural
Fauna abundance	Unchanged	Unchanged	Major increase
Training and Information	Absent	Absent	Existing
Working conditions	Unchanged	Risk of deterioration	Improved

Table 5. Compensating surplus in the two management options (MO).

Attribute	Median	90% Conf. Interval
MO1		
Citizens	63.7	[51.9; 78.5]
Politicians	63.7	[51.9; 78.5]
Managers	63.7	[51.9; 78.5]
MO2		
Citizens	−93.8	[-115.2; −76.3]
Politicians	−76.9	[-95.3; −62.4]
Managers	−85.4	[-105.1; −69.2]

Note: Estimation with the Krinsky and Robb (1986) procedure (1000 draws). CS $>$ 0 means stakeholders are worse off and require compensation for the welfare loss. CS $<$ 0 means that stakeholders are better off and would be willing to increase the budget allocated to UGSs for this scenario.

The first scenario, MO1, is akin to the status quo in terms of visual appearance, fauna abundance and information, but with a deterioration in working conditions and recreational opportunities. The median compensation requirement for the MO1 scenario is positive (a change in the UGS budget of +63.7 percentage points), confirming that most respondents will suffer from a loss in utility if this management option is chosen. More interestingly, results reveal that the compensation requirement is not significantly different for the three types of respondents, suggesting that preferences converge in the losses domain.

However, small differences appear in the MO2 scenario. These improvements compared to the status quo are valued more by the citizens, since the compensation they require is more strongly negative (−93.8 percentage points) than that registered by the managers (−85.4 percentage points) and politicians (−76.9 percentage points). The politicians have the lowest welfare gain in this scenario. This result is driven by the higher value attached by citizens to a natural appearance and increased abundance of fauna, as well as to the improvement in working conditions. As mentioned before, managers and politicians are more aware of the cost involved in achieving these improvements, and these costs may be reflected in their preferences. Yet, according to the Poe test, there are no significant differences at the 5% level in the welfare effects of both scenarios across stakeholders (see Table 3 in ESM).

4. Discussion

Understanding whether public administrators' opinions on other stakeholders' preferences are confirmed by evidence is important to reduce frictions hindering the transition. Local politicians taking decisions not compatible with managers' or citizens' preferences on pesticide-free UGSs could prevent a rapid and welfare-increasing transition. The information collected on stakeholders' priorities with regard to different attributes can help local politicians and managers in designing their pesticide-free UGS management strategies to maximise all stakeholders' benefits given the budget constraints. While our results shed light on diverging preferences for some of the attributes, we also find agreement on several dimensions.

In line with the theory of bureaucracy (Niskanen 1971; Buchanan, Tollison, and Tullock 1980), one might have thought that managers would be interested in increasing the size of their service (the budget and the number of employees allocated to UGS maintenance), whereas elected officials would be interested in controlling it, because they have to finance other local public policies. This assumption is not borne out in this research. All stakeholders have similar preferences with regard to the impact of the transition on the budget allocated to UGSs. However, our results shed light on diverging preferences between citizens, managers and local politicians with regard to how this budget should be spent (reflected in the WTP for the different attributes).

The working conditions of the maintenance teams appear to be an important aspect to consider for a successful transition. These conditions could deteriorate despite the elimination of the health risk due to chemical pesticide use since there are other important risk factors: mechanical or thermal weeding involve carrying more heavy equipment and for a longer time period; exposure to the public, with some frequent complaints by citizens perceiving areas as neglected, cause psycho-social risks. All types of respondents converge on the importance of dedicating budget in order to

safeguard the working conditions. This suggests that citizens have understood that keeping parks and gardens up to date with respect to the change in the law, and capable of meeting the public demands, requires not only design, planning and investment, but also daily provision of green-space maintenance by the city agents (Lindholst 2008). Nevertheless, spending budget to improve the working conditions is less of a priority. In particular, the local politicians who are in charge of the human resources for UGS maintenance are the most reluctant to improve working conditions. They may have interpreted this attribute in terms of wage increases and been deterred by the impact on the city budget. For citizens, on the other hand, being in favor of this improvement does not require any involvement on their part and they may overstate their willingness to improve working conditions in order to boost their self-image. The divergence of managers' and politicians' preferences is an indication of limited integration within the local administration and potential information asymmetry. This may be due to the fact that the workers in charge of UGS maintenance may not often be present in the city council buildings, since they are mostly working outside and the buildings for their materials are often not situated in the city center. More integration in order to align preferences and objectives would benefit the transition.

The increase in the abundance of fauna (insects and birds, including auxiliaries that can help to control pests) is likely to be observed with the reduction of pesticides (Aubertot *et al.* 2005; Muratet and Fontaine 2015). But our results show that respondents do not seem to be concerned (or have not considered) the potential damage caused by animals (the noise and dirt generated by birds, the disgust factor for insects and spiders), since all stakeholders are willing to accept a high increase in the budget for UGS design and management favoring fauna.

Our results complement recent evidence on the more positive emotions and increased well-being in urban landscapes rich in wildlife (Cameron *et al.* 2020). Managers have, on average, a lower WTP than the two other groups. This may be due to their reluctance to deal with the rare, but irritating, complaints from some visitors. The burden of such complaints was frequently pointed out during the interviews conducted with managers before the survey. However, assuming their behaviors reflect the preferences declared in this survey, we show that the majority of citizens are not likely to complain. The presence of fauna is perceived as greater naturalness. Other studies have shown that naturalness is perceived as more aesthetically pleasing and increases self-reported well-being (Ode Sang *et al.* 2016). But no studies to date have explored the differences between the preferences of the visitors and those of the administrators. During focus group interviews, several managers claimed that many citizens dislike the natural look. Our results suggest that this is an inaccurate perception of citizens' preferences, since we find that only 21.1% of the citizens prefer a more controlled visual aspect. Most of them are willing to pay for a more natural aspect, which is is line with previous studies that have highlighted the preference for dense vegetation and fallow-like settings (de Groot and van den Born 2003; Harris *et al.* 2018). This claim may reflect, instead, some managers' own concerns: 28.2% of them prefer a more controlled visual aspect, and 32% of the local politicians (Table 2 ESM). Those may perceive a natural appearance as a sign of a poorly managed area, therefore conveying a negative image of their work. Pesticides have been used in UGSs since the seventies and the priorities of elected officials, urban citizens and managers have evolved since then, reflecting the pressure for hygiene in urban areas, but could just as well change again (Gutleben 2020). To lift barriers, our results suggest that training managers and

providing information to local politicians on urban greening is more important than communication to the general public, the majority of whom are already convinced that strong control of the vegetation is not desirable.

This leads us to another important divergence concerning the importance of information and training. In the French cities that voluntarily engaged in pesticide-free management before the ban, citizens were largely informed about pesticide-free management through message boards in public areas and announcements in the local press. Our results show that citizens are only willing to accept a small increase in the UGS budget for that (this is the attribute less valued by citizens). This may be explained by the fact that many of the respondents may have already benefited from such information campaigns before the survey was launched and therefore do not value the benefit of more information. Unfortunately, we cannot distinguish those who live in cities where the transition happened before the pesticide ban from the others. Most importantly, we find that managers are willing to accept a larger budget increase for information. Managers may be willing to share their knowledge and believe that a better informed general public will translate into higher acceptance of the changes resulting from the zero-pesticide transition. Those who have invested, in the past, in developing such communication tools may also want confirmation that these were worthy efforts. The information attribute also includes training of maintenance teams, and can therefore explain the higher preference of managers for this attribute. Our results question the need for costly information and training measures, since they are less valued by citizens than by managers.

Despite this divergence, we observe congruence of preferences with regards to the importance of taking advantage of the transition to improve recreational opportunities offered by UGSs. Lawns in parks and gardens are used for a broad range of activities: quiet recreation (reading, talking and walking), sports, plays and social occasions including meals. Previous research has shown that short cut landscapes are associated with improved quality of life and personal safety (Ignatieva *et al.* 2020). While less frequent mowing can contribute to a more natural visual aspect, our results show that if it is likely to reduce recreational opportunities, it should be avoided. Since the willingness to accept an increase in the budget allocated to natural-looking UGSs is higher for citizens than for managers and politicians, maintenance teams can limit their intervention to controlling vegetation and the budget can be reallocated toward an improvement in recreational opportunities.

The results on the welfare impacts contribute to the scarce literature regarding how much citizens are willing to pay for an important transition likely to be environmentally beneficial and how much money administrators think should be spent on it (Carlsson, Kataria, and Lampi 2011). We find, here, no differences in the compensating surplus for two extreme scenarios. While divergence is more likely to be visible with such extreme scenarios, further studies could include similar calculations for other city-specific scenarios. Indeed, the external validity of our results is limited by the cultural differences likely to impact preferences and UGS management modes (Wilkerson *et al.* 2018).

Overall, the study provides further evidence on the usefulness of discrete choice modeling when it comes to estimating citizens' preferences for environmental services with multiple dimensions and non-use values, and comparing these preferences with those of the administrators of such services. While DCEs offer many opportunities, methodological challenges also emerge.

One challenge is the fact that the same respondent may have different answers according to the role he plays when answering the survey. Here, administrators were

asked to respond as they would when making a public policy decision, and not to convey their private preferences. Previous literature indicates that studies where administrators were asked to answer as public decision-makers (Carlsson, Kataria, and Lampi 2011; Nordén *et al.* 2017; Alberini, Longo, and Riganti 2006; Terwel and ter Mors 2015; Agren, Dahlberg, and Mörk 2007) found more noticeable differences from the general public's preferences than studies where they were asked to state their private preferences (Spegel 2017). We could have included in the questionnaire questions to control whether our strategy makes sure politicians and managers choose the options they would implement in their professional position, in order to have three well-defined groups of stakeholders

One of the challenges in online DCE is to reduce choice-task complexity, and the cognitive effort required from respondents (Hoyos 2010). In this particular research, it would be worth further investigating the heuristics used by respondents, whether they differ across types and how they may have affected the results.

Making sure respondents have the same understanding of the attributes and levels is an important challenge. Here, the perception of what is a natural visual aspect is likely to differ across individuals, ranging from letting weeds take over in the absence of human influence to careful landscaping with indigenous plants that form an ecosystem that helps to deter common weeds, and therefore depends upon human protection and management (Nassauer 1995). We have, indeed, observed important heterogeneity in preferences for the natural appearance, with more than a quarter of the politicians and managers (and citizens to a lesser extent) preferring a more controlled appearance. Describing attributes with photos of urban parks and gardens could have enhanced the evaluability of the choice tasks (Hsee 1996), but the use of visualisation techniques is controversial (see Patterson *et al.* (2017) for a literature review). Indeed, images can include unintentional idiosyncratic information that might confound the effect of factors that the researcher is trying to understand (Patterson *et al.* 2017) and the provision of images makes responses less consistent across choice questions (Shr *et al.* 2019).

More generally, a better understanding of the drivers of heterogeneity in preferences within each category of stakeholders would benefit this research. We could learn from an analysis of the role of characteristics such as region, gender, age, town size and seniority (in the job for managers, mandate for politicians or city residence for citizens). These characteristics may better explain diverging preferences than the stakeholder type. Unfortunately, the present survey did not allow for the collection of homogeneous data on these aspects for the three types. Moreover, previous evidence suggests that accounting for the characteristics of the usual park destination is important to understand preferences (Bullock 2008). Here, respondents were asked to state their preferences for an average park or garden in their city. But according to the principle of\textit{differentiated management}, each public green area can benefit from a specific treatment, according to its ecological, cultural and social function in the city (Allain 1997; Aggéri 2010). Estimating the willingness to pay for this diversity within a city, and the differences across stakeholders, is a promising research avenue.

5. Conclusion

The study relies on a discrete choice experiment to compare the preferences of three categories of stakeholders (citizens, managers in charge of the technical decisions and local politicians in charge of the budget) with regard to the transition toward pesticide-free

UGSs. It supplies information on citizens' preferences to UGS administrators who have to make tradeoffs in the implementation of the pesticide ban with a budget constraint.

We found no significant differences between the three groups of respondents with regard to the welfare impact of two extreme ways to organise the transition to pesticide-free management. However, the method enables additional insights into preferences for specific characteristics of the management action and differences in the priorities of the different groups. We found that strong preferences for the non-deterioration of recreational opportunities and working conditions of the maintenance teams are shared by all three types of respondents. But we also found noticeable differences between the preferences of elected representatives, managers and citizens. Managers tend to overestimate the importance of information on the pesticide ban for both citizens and workers, compared to the value associated with this attribute by citizens and politicians. Moreover, managers are less willing to accept an increase in budget to have wild-looking UGSs with abundant fauna, while these characteristics are valued by the majority of citizens. All agreed on the importance of ensuring that the working conditions do not deteriorate. However, local politicians were more reluctant than the other two categories to improve them.

Our results challenge some of the received opinions held by French managers and elected representatives on urban citizens' acceptance of the changes resulting from the transition toward pesticide-free UGSs. Local governments have an important role in coordinating and mediating the plural interests of the various stakeholders concerned by UGSs (Azadi *et al.* 2011). Beyond generating evidence on stakeholders' preferences through survey, public administrators could collect information through other channels. For example, the maintenance team could receive training on how to communicate with passersby and report to their managers, in order to be more responsive to citizens' demands. Public participation in UGS governance is also a way to collect citizens' needs, so that planners can provide an appropriate provision of urban green space (Rosol 2010; Azadi *et al.* 2011).

Technical solutions for a successful transition exist. Shedding light on the specific UGS characteristics where preferences are diverging can help to lift the remaining socio-psychological barriers to a successful implementation of cosmetic pesticide bans, likely to multiply, in particular in the framework of the revision of the European Sustainable Use of pesticide Directive.

Notes

1. Citizens do not typically have the opportunity to choose the exact characteristics of the UGSs they visit and can rarely express their preferences on management options and how their city budget is allocated to UGS maintenance. However, in the same city, different areas can be managed differently following the principles of "differentiated management" (Allain 1997).
2. There is no opt-out in our design, since the transition to pesticide-free management is compulsory by law. The aim of the experiment is not to estimate the willingness to pay for (or accept) the pesticide ban (see Hirsch and Baxter (2009, 2011) for such a study in Canada). The status-quo is not an available option, since maintaining the UGS characteristics as they were before the pesticide ban but without access to pesticides would necessarily entail higher costs. The monetary attribute would therefore be modified.
3. For the question "Did you systematically ignore any characteristic(s) when choosing between options A and B?" we delete those who selected the answer "I didn't ignore any characteristics" but at the same time selected one of the attributes.

4. The interpretations based on standard errors (such as p-values and confidence intervals) should be taken cautiously, since our sample is non-probabilistic. No inference for the population can be made (Hirschauer et al. 2020).

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References

Aggéri, G. 2010. *Inventing the Natural Cities of Tomorrow: Differentiated Management, Sustainable Management of Green Spaces* [*Inventer les villes natures de demain: Gestion différenciée, gestion durable des espaces verts*]. (In French). Dijon, France: Educagri édition.

Agren, H., M. Dahlberg, and E. Mörk. 2007. "Do Politicians' Preferences Correspond to Those of the Voters? An Investigation of Political Representation." *Public Choice* 130 (1-2): 137–162. doi:10.1007/s11127-006-9077-1.

Alberini, A., A. Longo, and P. Riganti. 2006. "Using Surveys to Compare the Public's and Decisionmakers' Preferences for Urban Regeneration: The Venice Arsenale." https://papers.ssrn.com/abstract=945046

Allain, Y.-M. 1997. "The City: A New Territory for Nature? Differentiated Management in Europe [La ville: un territoire nouveau pour la nature? la gestion différenciée en Europe]." *Journal d'agriculture traditionnelle et de botanique appliquée* 39 (2): 199–217. doi:10.3406/jatba.1997.3624.

Amblard, G., H. Bonnavaud, C. Buche, D. Cercueil, and L. Charvet. 2009. "Pesticides in Everyday Life [Technical Report Alterre-Bourgogne]. [Pesticides au quotidien [Rapport technique alterre-bourgogne]." https://hal.archives-ouvertes.fr/hal-01190511/document

Aubertot, J.-N., J. M. Barbier, A. Carpentier, J. J. Gril, L. Guichard, P. Lucas, S. Savary, I. Savini, and M. Voltz. 2005. "Pesticides, Agriculture and the Environnement. Reducing Pesticide Use and its Environmental Impacts [Pesticides, agriculture et environnement. Réduire l'utilisation des pesticides et en limiter les impacts environnementaux]." Expertise scientifique collective 789 Inra-Cemagref. http://temis.documentation.developpement-durable.gouv.fr/docs/Temis/0080/Temis-0080961/23321.pdf

Azadi, H., P. Ho, E. Hafni, K. Zarafshani, and F. Witlox. 2011. "Multi-Stakeholder Involvement and Urban Green Space Performance." *Journal of Environmental Planning and Management* 54 (6): 785–811. doi:10.1080/09640568.2010.530513.

Baji, P., M. García-Goñi, L. Gulácsi, E. Mentzakis, and F. Paolucci. 2016. "Comparative Analysis of Decision Maker Preferences for Equity/Efficiency Attributes in Reimbursement Decisions in Three European Countries." *The European Journal of Health Economics* 17 (7): 791–799. doi:10.1007/s10198-015-0721-x.

Bateman, I. J. 1996. "Household Willingness to Pay and Farmers' Willingness to Accept Compensation for Establishing a Recreational Woodland." *Journal of Environmental Planning and Management* 39 (1): 21–44. doi:10.1080/09640569612651.

Bech, M. 2003. "Politicians' and Hospital Managers' Trade-Offs in the Choice of Reimbursement Scheme: A Discrete Choice Experiment." *Health Policy* 66 (3): 261–275. doi:10.1016/S0168-8510(03)00064-2.

Birol, E., and P. Koundouri. 2008. *Choice Experiments Informing Environmental Policy: A European Perspective*. Cheltenham, UK: Edward Elgar Publishing.

Buchanan, J. M., R. D. Tollison, and G. Tullock. 1980. *Toward a Theory of the Rent-Seeking Society*. College Station, TX: Texas A & M University.

Bullock, C. H. 2008. "Valuing Urban Green Space: Hypothetical Alternatives and the Status Quo." *Journal of Environmental Planning and Management* 51 (1): 15–35. doi:10.1080/09640560701712242.

Burton, M. 2019. "Model Invariance When Estimating Random Parameters with Categorical Variables." Conference Paper Australian Agricultural and Resource Economics Society (AARES), 2019, Melbourne, Australia. doi:10.22004/ag.econ.285040.

Cameron, R., P. Brindley, M. Mears, K. McEwan, F. Ferguson, D. Sheffield, A. Jorgensen, *et al.* 2020. "Where the Wild Things Are! Do Urban Green Spaces with Greater Avian Biodiversity Promote More Positive Emotions in Humans?" *Urban Ecosystems* 23 (2): 301–317. doi:10.1007/s11252-020-00929-z.

Carlsson, F., D. Daruvala, and H. Jaldell. 2012. "Do Administrators Have the Same Priorities for Risk Reductions as the General Public?" *Journal of Risk and Uncertainty* 45 (1): 79–95. doi:10.1007/s11166-012-9147-3.

Carlsson, F., M. Kataria, and E. Lampi. 2011. "Do EPA Administrators Recommend Environmental Policies That Citizens Want?" *Land Economics* 87 (1): 60–74. doi:10.3368/le.87.1.60.

Carson, R. T., and T. Groves. 2007. "Incentive and Informational Properties of Preference Questions." *Environmental and Resource Economics* 37 (1): 181–210. doi:10.1007/s10640-007-9124-5.

Cheval, H., C. Gutleben, and P. Laille. 2017. "Technical and Economic Solutions for Pesticide-Free Transition [Conditions technico-économiques du passage au « Zéro Phyto »]." https://www.plante-et-cite.fr/files/ressource/file:1079836

Colombo, S., A. Angus, J. Morris, D. J. Parsons, M. Brawn, K. Stacey, and N. Hanley. 2009. "A Comparison of Citizen and "Expert" Preferences Using an Attribute-Based Approach to Choice." *Ecological Economics* 68 (11): 2834–2841. doi:10.1016/j.ecolecon.2009.06.001.

de Groot, W. T, and R. J. G. van den Born. 2003. "Visions of Nature and Landscape Type Preferences: An Exploration in The Netherlands." *Landscape and Urban Planning* 63 (3): 127–138. doi:10.1016/S0169-2046(02)00184-6.

Eggert, H., M. Kataria, and E. Lampi. 2018. "Difference in Preferences or Multiple Preference Orderings? Comparing Choices of Environmental Bureaucrats, Recreational Anglers, and the Public." *Ecological Economics* 151: 131–141. doi:10.1016/j.ecolecon.2018.04.034.

Ek, C., K. Elofsson, and C.-J. Lagerkvist. 2018. "Which Type of Policy Instrument Do Citizens and Experts Prefer? A Choice Experiment on Swedish Marine and Water Policy." Working Paper in Economics University of Gothenburg (746). https://gupea.ub.gu.se/handle/2077/58220

Espinosa-Goded, M., J. Barreiro-Hurlé, and E. Ruto. 2010. "What Do Farmers Want from Agri-Environmental Scheme Design? A Choice Experiment Approach." *Journal of Agricultural Economics* 61 (2): 259–273. doi:10.1111/j.1477-9552.2010.00244.x.

European Commission. 2020. "Farm to Fork Strategy: For a Fair, Healthy and Environmentally-Friendly Food System." https://ec.europa.eu/food/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

European Parliament and Council. 2009. "Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 Establishing a Framework for Community Action to Achieve the Sustainable Use of Pesticide." https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0071:0086:EN:PDF

Giergiczny, M., and J. Kronenberg. 2014. "From Valuation to Governance: Using Choice Experiment to Value Street Trees." *Ambio* 43 (4): 492–501. doi:10.1007/s13280-014-0516-9.

Gutleben, C. 2020. "The Pesticide-Free City Trend in Public Spaces: Creative Ways to Healthier Landscapes. [Les politiques « Zéro pesticide » au sein des collectivités territoriales: l'innovation dans le paysage pour la santé des habitants]." *Environnement Risques Santé* 19 (2): 113–121. DOI doi:10.1684/ers.2020.1415.

Hanemann, W. M. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses." *American Journal of Agricultural Economics* 66 (3): 332–341. doi:10.2307/1240800.

Harris, V., D. Kendal, A. K. Hahs, and C. G. Threlfall. 2018. "Green Space Context and Vegetation Complexity Shape People's Preferences for Urban Public Parks and Residential Gardens." *Landscape Research* 43 (1): 150–162. doi:10.1080/01426397.2017.1302571.

Hensher, D., J. Rose, and W. Greene. 2015. *Applied Choice Analysis,* Second ed. Cambridge, MA: Cambridge University Press.

Hess, S., and K. Train. 2017. "Correlation and Scale in Mixed Logit Models." *Journal of Choice Modelling* 23: 1–8. doi:10.1016/j.jocm.2017.03.001.

Hirsch, R., and J. Baxter. 2009. "The Look of the Lawn: Pesticide Policy Preference and Health-Risk Perception in Context." *Environment and Planning C: Government and Policy* 27 (3): 468–490. doi:10.1068/c0809.

Hirsch, R. A., and J. Baxter. 2011. "Context, Cultural Bias, and Health Risk Perception: The "Everyday" Nature of Pesticide Policy Preferences." *Risk Analysis* 31 (5): 847–865. doi:10.1111/j.1539-6924.2010.01560.x.

Hirschauer, N., S. Grüner, O. Mußhoff, C. Becker, and A. Jantsch. 2020. "Can p-Values be Meaningfully Interpreted without Random Sampling?" *Environment and Planning C: Government and Policy* 14 (3): 71–91. doi:10.1214/20-SS129.

Hole, A. R. 2007. "A Comparison of Approaches to Estimating Confidence Intervals for Willingness to Pay Measures." *Health Economics* 16 (8): 827–840. doi:10.1002/hec.1197.

Hoyos, D. 2010. "The State of the Art of Environmental Valuation with Discrete Choice Experiments." *Ecological Economics* 69 (8): 1595–1603. doi:10.1016/j.ecolecon.2010.04.011.

Hsee, C. K. 1996. "The Evaluability Hypothesis: An Explanation for Preference Reversals between Joint and Separate Evaluations of Alternatives." *Organizational Behavior and Human Decision Processes* 67 (3): 247–257. doi:10.1006/obhd.1996.0077.

Ignatieva, M., D. Haase, D. Dushkova, and A. Haase. 2020. "Lawns in Cities: From a Globalised Urban Green Space Phenomenon to Sustainable Nature-Based Solutions." *Land* 9 (3): 73. doi:10.3390/land9030073.

Jacquet, F., M. Jeuffroy, J. Jouan, E. L. Cadre, I. Litrico, T. Malausa, X. Reboud, and C. Huyghe. 2022. "Pesticide-Free Agriculture as a New Paradigm for Research." *Agronomy for Sustainable Development* 42 (1): 8. doi:10.1007/s13593-021-00742-8.

Kahneman, D., and A. Tversky. 2012. "Prospect Theory: An Analysis of Decision under Risk." In *Handbook of the Fundamentals of Financial Decision Making*, Vol. 4 of World Scientific Handbook in Financial Economics Series, edited by L. C. MacLean, and W. T. Ziemba. 99–127. Singapore: World Scientific. doi:10.1142/9789814417358_0006.

Krinsky, I., and A. L. Robb. 1986. "On Approximating the Statistical Properties of Elasticities." *The Review of Economics and Statistics* 68 (4): 715–719. doi:10.2307/1924536.

Kristoffersen, P., A. Rask, A. Grundy, I. Franzen, C. Kempenaar, J. Raisio, H. Schroeder, J. Spijker, A. Vershwele, and L. Zarina. 2008. "A Review of Pesticide Policies and Regulations for Urban Amenity Areas in Seven European Countries." *Weed Research* 48: 201–214. doi:10.1111/j.1365-3180.2008.00619.x.

Lancaster, K. J. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74 (2): 132–157. doi:10.1086/259131.

Lancsar, E., J. Louviere, and T. Flynn. 2007. "Several Methods to Investigate Relative Attribute Impact in Stated Preference Experiments." *Social Science & Medicine* 64 (8): 1738–1753. doi:10.1016/j.socscimed.2006.12.007.

Latacz-Lohmann, U., and J. A. Schreiner. 2019. "Assessing Consumer and Producer Preferences for Animal Welfare Using a Common Elicitation Format." *Journal of Agricultural Economics* 70 (2): 293–315. doi:10.1111/1477-9552.12297.

Lefebvre, M., M. Maslianskaia-Pautrel, and P. Laille. 2021. "Users' Preferences for Pesticide-Free Management of Urban Green Spaces: The French Example [Préférences des usagers pour la gestion des espacaces verts urbains sans pesticides: l'exemple de la France]." *Revue Economique* 72 (4): 947–967. doi:10.3917/reco.726.0947.

Legifrance. 2014. "Law n°2014-110 of February 6, 2014 Aiming to Better Control the Use of Phytosanitary Products on the National Territory (Labbé Law)." https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000028571536

Legifrance. 2021. "Order of January 15, 2021 on Measures to Protect People When Using Plant Protection Products in Private Properties, Places Frequented by the Public and in Places for Collective Use." https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043023130

Lindholst, A. C. 2008. "Improving Contract Design and Management for Urban Green-Space Maintenance through Action Research." *Urban Forestry & Urban Greening* 7 (2): 77–91. doi:10.1016/j.ufug.2008.02.001.

Louvière, J., and H. Timmermans. 1990. "Stated Preference and Choice Models Applied to Recreation Research: A Review." *Leisure Sciences* 12 (1): 9–32. doi:10.1080/01490409009513087.

Mariel, P., and J. Meyerhoff. 2018. "A More Flexible Model or Simply More Effort? On the Use of Corrélâtes Random Parameters in Applied Choice Studies." *Ecological Economics* 154: 419–429. doi:10.1016/j.ecolecon.2018.08.020.

Marrelli, P., D. Hoyos, J. Meyerhoff, M. Czajkowski, T. Dekker, K. Glenk, J. B. Jacobsen, U. Liebe, S. B. Olsen, J. Sagebiel, and M. Thiene. 2021. *Environmental Valuation with Discrete Choice Experiments: Guidance on Design, Implementation and Data Analysis.* Cham, Switzerland: SpringerBriefs in Economics, Springer Nature. https://doi.org/10.1007/978-3-030-62669-3.

Marrelli, M., and G. Pignataro. 2001. *Public Decision-Making Processes and Asymmetry of Information*. New York, NY: Springer.

McFadden, D. 1973. "Condition Logit Analysis of Qualitative Choice Behavior." In *Frontiers in Econometrics*, edited by P. Zarembka, 105–142. Cambridge, MA: Academic Press.

Meyerhoff, J., U. Liebe, and V. Hartje. 2009. "Benefits of Biodiversity Enhancement of Nature-Oriented Silviculture: Evidence from Two Choice Experiments in Germany." *Journal of Forest Economics* 15 (1-2): 37–58. doi:10.1016/j.jfe.2008.03.003.

Muratet, A., and B. Fontaine. 2015. "Contrasting Impacts of Pesticides on Butterflies and Bumblebees in Private Gardens in France." *Biological Conservation* 182: 148–154. doi:10.1016/j.biocon.2014.11.045.

Nassauer, J. I. 1995. "Messy Ecosystems, Orderly Frames." *Landscape Journal* 14 (2): 161–170. doi:10.3368/lj.14.2.161.

Niskanen, W. A. 1971. *Bureaucracy and Representative Government*. Piscataway, NJ: Transaction Publishers.

Nordén, A., J. Coria, A. M. Jönsson, F. Lagergren, and V. Lehsten. 2017. "Divergence in Stakeholders' Preferences: Evidence from a Choice Experiment on Forest and Scapes

Preferences in Sweden." *Ecological Economics* 132: 179–195. doi:10.1016/j.ecolecon.2016.09.032.

Patterson, Z., J. M. Darbani, A. Rezaei, J. Zacharias, and A. Yazdizadeh. 2017. "Comparing Text-Only and Virtual Reality Discrete Choice Experiments of Neighbourhood Choice." *Landscape and Urban Planning* 157: 63–74. doi:10.1016/j.landurbplan.2016.05.024.

Poe, G. L., K. L. Giraud, and J. B. Loomis. 2005. "Computational Methods for Measuring the Difference of Empirical Distributions." *American Journal of Agricultural Economics* 87 (2): 353–365. doi:10.1111/j.1467-8276.2005.00727.x.

Pralle, S. 2006. "Timing and Sequence in Agenda-Setting and Policy Change: A Comparative Study of Lawn Care Pesticide Politics in Canada and the US." *Journal of European Public Policy* 13 (7): 987–1005. doi:10.1080/13501760600923904.

Rodríguez-Entrena, M., J. Barreiro-Hurlé, J. A. Gómez-Limón, M. Espinosa-Goded, and J. Castro-Rodríguez. 2012. "Evaluating the Demand for Carbon Sequestration in Olive Grove Soils as a Strategy toward Mitigating Climate Change." *Journal of Environmental Management* 112: 368–376. doi:10.1016/j.jenvman.2012.08.004.

Rogers, A. A. 2013. "Public and Expert Preference Divergence: Evidence from a Choice Experiment of Marine Reserves in Australia." *Land Economics* 89 (2): 346–370. doi:10.3368/le.89.2.346.

Rose, J. M., and M. C. J. Bliemer. 2013. "Sample Size Requirements for Stated Choice Experiments." *Transportation* 40 (5): 1021–1041. doi:10.1007/s11116-013-9451-z.

Rosol, M. 2010. "Public Participation in Post-Fordist Urban Green Space Governance: The Case of Community Gardens in Berlin." *International Journal of Urban and Regional Research* 34 (3): 548–563. doi:10.1111/j.1468-2427.2010.00968.x.

Sang, O., I. Knez, B. Gunnarsson, and M. Hedblom. 2016. "The Effects of Naturalness, Gender, and Age on How Urban Green Space Is Perceived and Used." *Urban Forestry & Urban Greening* 18: 268–276. doi:10.1016/j.ufug.2016.06.008.

Shr, Y.-H., R. Ready, B. Orland, and S. Echols. 2019. "How Do Visual Representations Influence Survey Responses? Evidence from a Choice Experiment on Landscape Attributes of Green Infrastructure." *Ecological Economics* 156 (3): 375–386. doi:10.1016/j.ecolecon.2018.10.015.

Spegel, E. 2017. "Valuing the Reduction of Floods: Public Officials' versus Citizens' Preferences." *Climate Risk Management* 18: 1–14. doi:10.1016/j.crm.2017.08.003.

Terwel, B. W., and E. ter Mors. 2015. "Host Community Compensation in a Carbon Dioxide Capture and Storage (CCS) Context: Comparing the Preferences of Dutch Citizens and Local Government Authorities." *Environmental Science & Policy* 50: 15–23. doi:10.1016/j.envsci.2015.01.015.

Tienhaara, A., E. Haltia, E. Pouta, K. Arovuori, I. Grammatikopoulou, A. Miettinen, K. Koikkalainen, H. Ahtiainen, and J. Artell. 2020. "Demand and Supply of Agricultural ES: Towards Benefit-Based Policy." *European Review of Agricultural Economics* 47 (3): 1223–1249. doi:10.1093/erae/jbz044.

Train, K. 2003. *Discrete Choice Methods with Simulation*. Cambridge, UK: Cambridge University Press.

Tu, G., J. Abildtrup, and S. Garcia. 2016. "Preferences for Urban Green Spaces and Peri-Urban Forests: An Analysis of Stated Residential Choices." *Landscape and Urban Planning* 148: 120–131. doi:10.1016/j.landurbplan.2015.12.013.

Wilkerson, M. L., M. G. Mitchell, D. Shanahan, K. A. Wilson, C. D. Ives, C. E. Lovelock, and J. R. Rhodes. 2018. "The Role of Socio-Economic Factors in Planning and Managing Urban Ecosystem Services." *Ecosystem Services* 31: 102–110. doi:10.1016/j.ecoser.2018.02.017.