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RESEARCH ARTICLE

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Investigating consumer preferences for known wild provenance of plants within the horticultural trade

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Societal Impact Statement

Although significant advances have been made in implementing international mechanisms to support the benefit sharing of natural resources in low and middle income countries, there are limited practical examples. Our research examines how the ornamental horticulture sector might be able to meet its benefit sharing requirements. Employing a consumer survey, we reveal the potential for monetary benefit sharing to emerge for plants with Known Wild Provenance. Our results indicate that although consumers value plants that have their Known Wild Provenance clearly labelled, the magnitude of this estimate is insufficient to generate meaningful monetary benefits.

Summary

- The global trade in ornamental plants is significant and growing. Historically, the relationship between the acquisition of novel plants from the wild for use in ornamental horticulture has been referred to as plant hunting. However, questions are now being raised about the ethical utilisation of biological resources and if those countries providing access to material from the wild are receiving adequate benefits. It is in this context that we examine if plants of Known Wild Provenance (KWP) are valued by UK consumers, and if a potential premium could be the basis of a benefit-sharing agreement.
- Employing a choice experiment, we assess consumers' preferences and willingness to pay (WTP) for KWP.
- Our analysis reveals that KWP did not prove to be a strong driver for plant buyers.
- Although a positive WTP is generated it is relatively small. Thus, the ability of commercial horticulture to provide monetary benefits to support benefit sharing is likely limited. This result raises questions as to how benefit sharing might then be implemented if buyers of plants are not prepared to pay a price premium.

KEYWORDS
benefit sharing, choice experiment, known wild provenance, plant hunting, willingness to pay

1 | INTRODUCTION

The global trade of ornamental plants and associated seeds has a long history. Much of this trade depended on the relationship between the acquisition of novel plants from the wild for use in ornamental horticulture, commonly referred to as "Plant Hunting" (Fry, 2009). Plant hunting, the process of collecting novel plant material for the purposes of scientific understanding and cultivation, has been at the heart of horticulture for as long as horticulture has existed (Seebens et al., 2022). During the 18th and 19th centuries plant hunting reached a peak, with the Victorians having a voracious appetite for new and interesting plants from around the world (Fry, 2009; Van Kleunen et al., 2018). This tradition continues with many benefits for conservation (Thomas et al., 2022) as well as concerns for biodiversity (Tonellotto et al., 2022). Importantly, the global trade in ornamental plants is significant in terms of value with it estimated to be worth US $ 47.5 billion in 2020 and forecast to grow to US$ 72.5 billion by 2027 (Absolute Reports, 2022). While in the United Kingdom, the trade in ornamentals is estimated to be worth £1.6 billion (Department of the Environment, Food and Rural Affairs [DEFRA], 2022a).[1]

Despite the scale of the international trade, little is known about gardeners' attitudes to the origin of ornamental plants. For example, they may prefer ornamental plants with known wild provenance (KWP), where KWP indicates that plants accessed as seed or living material are directly sourced from their country of origin (Hinsley et al., 2018). Within the United Kingdom, some nurseries sell ornamental plants with KWP that provide detailed notes, descriptions, or descriptive labels regarding the source of the plants and the expeditions made to collect them (see Notes S1 for details). Further, there is a widely cited example of how an endangered plant from the Seychelles (*Impatiens gordonii*) was used to help develop a popular hybrid "Ray of Hope." This plant has proven very popular with visitors to the Eden Project with the money raised from sales being channelled directly into conservation activities in the Seychelles (Smith, 2015). However, in general, it remains unclear to what extent KWP of ornamental plants matters and is valued by gardeners.

The need to understand the value attached to KWP also has a more general motivation stemming from the increasing importance placed on enabling benefit sharing arrangements (Laird et al., 2020; Sara et al., 2022; United Nations Conference on Trade and Development [UNCTAD], 2017a; United Nations Environment Programme [UNEP], 2021). Benefit sharing is where the benefits (monetary and/or non-monetary) from the use of biodiversity should be shared fairly with the country of origin. The concept of benefit sharing was one of the three core objectives introduced by the 1992 United Nations (UN) Convention on Biological Diversity (CBD) (CBD, 2016a). The subsequent practical implementation of benefit sharing can occur informally via bio-based trade and the use of voluntary sustainability standards (UNEP, 2021), formally but on a voluntary basis via the UNCTAD BioTrade Initiative (UNCTAD, 2017a) and formally on a regulatory basis via the Nagoya Protocol (NP), a supplementary agreement to the CBD (CBD, 2016b).

A growing body of literature on benefit sharing has focussed on the NP. This is because the NP has a specific focus on access and benefit sharing (ABS) from the "utilisation" of genetic material. The NP was adopted in 2010 (UNEP, 2011) and implemented in 2014 (CBD, 2016b).[2] Any country which is party to the NP, 117 had ratified the NP in 2019 (Avilés-Polanco et al., 2019), puts in place national legislation to enable implementation. This means that only countries that have decided to sign up as Parties are bound by the NP itself. Many countries have subsequently updated and introduced relevant legislation such as that governing biodiversity management and use, as well as specific ABS legislation (Escobar-Pemberthy & Calle Saldarriaga, 2020; Sirakaya, 2022).[3] These legislative developments mean that in practice although a plant collector is not bound by the NP, they must comply with national legislation in the country where they access genetic resources, and where they utilise those resources (Coolsaet et al., 2015; Michiels et al., 2022). The complicated issue for individual plant collectors, is that in some cases national law will differ, or go further than, the guidelines set out in the NP.

Importantly, national legislation implementing the NP usually only applies to instances where "research and development" takes place and in many cases may not apply to the ornamental horticulture trade. For example, when seeds are collected and then just grown or propagated (i.e., there is no research), these practices may not be subject to a country's ABS requirements. In contrast, other as aspects and practices of the ornamental horticulture trade might count as research and development and be subject to national ABS legislation. For example, in the UK guidance, ABS regulations (DEFRA, 2022b) state that where genetic resources are used for the purposes of "crossing and selection" this likely constitutes utilisation. In this case, such practices would be subject to ABS legislation, which would trigger benefit sharing. However, the point at which trade in biodiversity moves from the informal to the formal regulation of the NP ABS can at times be difficult to determine (UNCTAD, 2017a). Regardless of whether or not the NP ABS requirements apply to the ornamental trade does not mean that benefit sharing arrangements should be ignored. Indeed, the trade in ornamental plants needs to actively embrace benefit sharing principles within the wider framework of legal plant collecting, as well as ethical trade organised as bio-based trade (e.g., BioTrade Initiative; UNCTAD, 2017a, 2017b), or by linking voluntary standards to the Sustainable Development Goals (SDGs) (Schleifer et al., 2022), or via commercial arrangements about how to decide to allocate profits (UNEP, 2021). One practical way in which financial benefits could in principle be generated is if ornamental plants with KWP are positively valued by buyers compared with non-KWP plants. In other words, if it the case that KWP is valued and that this can be translated into a

[1]In 2017, the horticulture and landscaping trade contributed £24.2 billion to UK GDP (Oxford Economics, 2018). This is expected to be £42 billion by 2030 (Ornamental Horticulture and Roundtable Group, 2019).

[2]Details of NP ABS implementation are available via the ABS Clearing-House, a virtual platform providing information on ABS agreements established by Article 14 of the NP (https://absch.cbd.int/en/).

[3]For UK regulation governing the NP, see https://www.gov.uk/guidance/abs.

price premium then this additional monetary amount could form the basis of a benefit sharing agreement.

In this paper, we empirically examine if plants of KWP attract additional value (i.e., price premium) compared to those without KWP. If a price premium is revealed, then this could be a means through which monetary benefit sharing is facilitated for ornamental plants. However, if a meaningful price premium cannot be identified, then other policy options will be required if benefit sharing is to be achieved. To undertake this task, we develop a choice experiment (CE) as part of a survey instrument that allows us to examine if plants of KWP are more highly valued by individuals than those of non-KWP horticultural origin. A CE allows us to determine the relative value placed on product attributes (Bristol et al., 2014; Train, 2009; Veríssimo et al., 2009). In our case, the attribute of specific interest is KWP for ornamental plants. Given the choices made by respondents to our CE tasks, we are able to statistically assess the values placed on all attributes used. With our CE, we are testing the hypothesis that if a potential price premium exists for plants with KWP that it could form the basis of a benefit-sharing agreement.

2 | MATERIALS AND METHODS

2.1 | Ethics

This research received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

2.2 | Choice experiment design

To undertake our analysis, we first needed to design our CE. Preliminary work involved in designing the survey instrument began by examining sales labels from four nurseries known to sell KWP plant material in the United Kingdom. The nurseries sell a wide range of plant species across all sectors of the industry including alpine plants, succulents, rhododendrons, woody shrubs and trees, grasses, and herbaceous perennials. Two of the nurseries actively "plant hunt" and two do not. Examples of the information provided on sales labels are given in Notes S2. Given these labels, we identified several typical attributes attached to plants. For example, terms such as hardiness, vigour, and ability to grow in certain conditions were frequently used. These terms are experience attributes in that the buyer can verify the claim once a plant has been purchased. Other common information provided on labels included the cultivar name, flower colour, and leaf shape. These are search attributes in that these features and characteristics can be easily evaluated before purchase. Finally, we see information for plants marketed with KWP. This is a classic example of a credence attribute, in that the information provided cannot be verified by the buyer before or after the purchase has been made.

Based on the labels examined, an initial set of 15 attributes were identified. Then via focus group work involving 19 participants drawn from the Scottish Rock Garden Club forum, this set was reduced to those attributes considered most important. To establish which attributes mattered most to potential buyers, we asked the focus to consider the following question that presented the 15 identified attributes:

> What do you look for when you are buying plant from a nursery?
> From the list of features below, please rank the FIVE most important features or information when selecting a plant. (Please select your FIVE most important features ranking them in order of importance to you)

The final version of the CE was composed of six attributes, four that are commonly used on nursery plant labels, a KWP attribute, and a price attribute. The price levels employed in the CE were based on those observed in the market and the industry specific knowledge of the authors. The attributes employed in the CE were fully explained to respondents before they could complete the choice tasks. A description of each of the attributes and the levels employed in the CE are shown in Table 1.

Given the set of attributes and levels shown in Table 1, we next designed the choice tasks employing the experimental design software Ngene version 1.1.2 (Choice Metrics, 2012). We implemented an efficient design assuming a multinomial logit utility specification assuming D-error (Scarpa & Rose, 2008) and uninformative priors. We created 32 unique choice cards that we split into four blocks of eight choice tasks. Thus, each survey respondent needed to consider eight choice tasks with each requiring a selection to be made between three plant options and a no choice option. Before each choice task, we asked respondents: "Which of the plant choices shown would you buy based solely on the information provided?" An example of a choice task is shown in Figure 1.

As can be seen from Figure 1, the combination of attributes that are present or absent and the price level all vary across the three plant options offered. All we ask of respondents was to select the preferred plant option or if preferred they could select a no choice option that implies no purchase.

The survey instrument was composed of the CE tasks plus various other questions covering a range of topics relating to a respondent's plant purchases, their gardens, and the socio-economic status of respondents including age, employment status, whether they were linked to horticulture professionally, their level of education, their gender identity, and where they currently live (see Notes S2 for a copy of the survey instrument).

2.3 | Data collection

The survey was implemented online using SurveyMonkey. The survey was initially targeted at respondents that shop for plants in specialist

TABLE 1 Choice experiment attribute names, descriptions, and levels employed.

Attribute	Description	Levels
Price (£)	The price is based on a plant in a 2 ltr pot or, when thinking about alpine plants, in a 9 cm diameter pot	£2, £4, £7, £10, £14, £20
Hardy	Will it be ok outside in the winter in the UK? Ok outside in the winter means that it would be undamaged by frost and does not need special care during the winter such as wrapping or moving to frost free conditions. For example, the label may read "Hardy to −10°C or lower" "Needs frost protection over winter" "Not suitable for outdoor cultivation year-round" "Only hardy in the mildest areas of the UK"	Yes(✓) /No(**X**)
Named cultivar	Is it a named cultivar or variety? A cultivar is a plant variety that has been produced in cultivation by selective breeding, a variety (var.) can often be found growing and reproducing naturally in the wild. Plants grown from its seeds will often come out true to type. The label may give more than just its botanical name, e.g., *Rosa rugosa* "Scabrosa," *Dahlia* "Bishop of Llandaff," *Forsythia x intermedia* "Lynwood," *Phyllostachys nigra var. henonis*	Yes(✓) /No(**X**)
Rare in cultivation	Is it rare in cultivation? Rare in cultivation means that it is rarely offered for sale or only available from a very small number of specialist growers and only ever available in limited numbers. The label may read "rarely offered for sale," "limited availability," "the first time we are able to introduce this species, limited numbers available"	Yes(✓) /No(**X**)
Rare in wild	Is it rare in the wild? Rare in the wild means it may have an IUCN (International Union for the Conservation of nature) red list threat status of vulnerable, endangered or critically endangered. The label may state "threatened in its natural habitat," "a rare species where it is found in the wild" "Endangered in the wild by …."	Yes(✓) /No(**X**)
Know wild provenance	Does it have known wild provenance (KWP)? KWP may come in the form of a collection locality, collectors code and accession number or other documented evidence that it had been, or is a 1st generation direct descendant of, a plant collected in the wild. The label may say something like "RBM1901," "Tibetan form," "originally found on a small hillside in Yunnan," "collected just south of Antofagasta, Chile."	Yes(✓) /No(**X**)

Card 1	Plant 1	Plant 2	Plant 3
Price (£)	£ 4.00	£ 2.00	£ 20.00
Will it be ok outside in the winter in the UK?	✓	✗	✓
Is it a named cultivar or variety?	✓	✗	✓
Is it rare in cultivation?	✗	✗	✓
Is it rare in the wild?	✗	✓	✓
Does it have known wild provenance?	✗	✓	✗

FIGURE 1 Example choice task from the choice experiment. The figure shows the three plant options faced by respondents. A tick symbol indicates the presence of an attribute and a cross the absence an attribute. Respondents indicate below the columns which plant they would buy or if they decided they could indicate a no choice.

nurseries. It was initially distributed to a range of plant societies via their social media feeds, newsletters, and journals. It was also distributed via a range of specialist plant groups on Facebook and via Twitter between August 2018 and February 2019. In total 14 national plant societies and clubs were contacted, with the majority willing to disseminate the link to their members. To increase the response rate, the survey was subsequently opened to members of specialist plant groups and gardening enthusiasts on social media. On agreeing to participate in the survey, each respondent was directed to select one of four links to the survey based on the day of their birthday. This was done to ensure an effective coverage of survey responses for each of the four CE blocks.

In total, 646 respondents took part in the online survey yielding 5168 choice task responses (8 × 646). Summary sample socio-economic descriptive statistics provided in Table S1 show that the average age of respondents is 49 years, the largest group of respondents by gender are females (59%), 71% are university educated, with just over a quarter of respondents employed in horticulture, and 67% having been a member of a gardening or plant society. A limitation of our sample of respondents is that we did not know what our population of respondents looks like in terms of characteristics or composition prior to implementing the survey. As such, we cannot be sure if the sample is truly representative or not and as such should be treated as a convenience sample drawn from the population of interest.

2.4 | Model specification

The data collected are used to model a utility function that represent a respondent's preference ordering over a set of choices (McFadden, 1974). The utility function will depend on the attributes (including price) of each choice. Let x_{ijt} denote a $k \times 1$ vector of attributes presented to respondent i ($i = 1, ..., N$) selecting alternative j ($j = 1, ..., J$) in choice situation t ($t = 1, ..., T$). Next, we assume that U_{ijt} is the utility that a respondent attains from x_{ijs} such that individual i is assumed to receive utility from the jth alternative from the tth choice set:

$$U_{ijs} = x'_{ijt}\beta_i + e_{ijt} \quad (1)$$

where the first term on the right-hand side of Equation (1) is typically referred to as the systematic utility component. The other term in Equation (1) is the error term e_{ijt} and it is assumed to be extreme value (Gumbel) distributed, independent of x'_{ijt} and uncorrelated across individuals or choices. β_i is a ($k \times 1$) vector describing the preferences of individual i assumed be an independently and identically normal distributed vector which is expressed as follows:

$$\beta_i = \beta + \Gamma\nu_i \quad (2)$$

where β_i has a mean β and Γ is a diagonal matrix containing σ, which are the standard deviation of the random parameter distributions of respondent taste parameters (β_i) around β and ν is the individual and choice specific unobserved random disturbances with mean zero and standard deviation one. By employing random parameters in Equation (2), we are implementing a mixed logit (MXL) model specification (McFadden & Train, 2000; Train, 2009). For our preferred model specification, all attributes except the alternative specific constant (ASC) that captures "no choice" are assumed to follow a normal distribution. In addition, as is becoming common in the CE literature, we estimate our models in what has been termed WTP space. The reason for adopting this approach is that it can significantly reduce the instability associated with WTP estimates recovered from preference space (Balcombe et al., 2010). It also means that model parameters are directly interpretable as WTPs. Given this model specification, our utility function can be expressed as follows:

$$\begin{aligned} U_{ijt} = \beta_1 \Big[& Price_{ijt} + \beta_{2,i} Hardy_{ij} + \beta_{3,i} Named\ Cultivar_{ijt} \\ & + \beta_{4,i} Rare\ in\ Cultivation_{ijt} + \beta_{5,i} Rare\ in\ Wild_{ijt} \\ & + \beta_{6,i} KWP_{ijt} + \beta_7 No\ Choice_{ijt} \Big] + e_{ijt} \end{aligned} \quad (3)$$

where $\beta_{2,i}$ to $\beta_{6,i}$ represent WTP parameters for the ith individual for the associated attributes. As our econometric specification has a log-likelihood function that does not have a closed-form, it therefore needs to be estimated using simulated maximum likelihood. With our data, we employed 1000 Halton draws. To undertake model estimation, we employed the software NLOGIT Version 6 (Greene, 2016). All variables except Price are dummy coded following the definitions given in Table 1.

We then follow Yao et al. (2014) and Xuan et al. (2021) and employ a two-stage approach to explain our WTP estimates in terms of respondent socio-economic characteristics. This entailed estimation of several ordinary least squares (OLS) models with individual attribute WTP estimates being the dependent variable. We also pooled the data and estimated a random effects (RE) panel model specification assuming that each set of attribute specific individual WTP estimates are the dependent variable in the panel and that the explanatory variables are the socio-economic variables used in the OLS specifications.

The socio-economic data we employed is as follows. We converted respondent age into a dummy variable that is equal to one if a respondent is older than 45 and zero otherwise (Age Old). For education, we converted the data into a dummy variable equal to one if the respondent has a university undergraduate degree or higher (Edu Uni) and zero otherwise. For gender, we employ a dummy equal to one if the respondent is female (Female) and zero otherwise. For the employed in horticulture, we have a dummy equal to one if working in the industry (Prof), and for employment status, we have a dummy equal to one if the respondent is employed or self-employed (Work) and zero otherwise.

3 | RESULTS

We present the result for our preferred model specification the MXL in WTP space (MXL WTP) in Table 2. We also examined the MXL in preference space and various latent class models (LCMs). A comparison of model performance indicated that the MXL WTP was the preferred specification (see Table s2).

With this model specification, the Price attribute is assumed fixed, and the attributes estimates are WTP values. In terms of the attributes, all are positively valued and statistically significant. In contrast to the other attributes, Rare in Wild is marginally statistically significant at the 10% level and negative as such has not been as important in driving choice. We can also note that the 95% confidence interval crosses zero. Turning to KWP, we can see that this attribute is positive and statistically significant, which indicates that the use of this attribute on a plant label yields positive utility. In terms of model performance, there is significant preference heterogeneity highlighted by the statistically significant estimates for the standard deviations for all the random parameters. As such, employing an econometric specification that allows for respondent heterogeneity is appropriate.

Turning to the No Choice option, 32% of responses yielded this result. The positive coefficient estimate reported in Table 2 for the No Choice option indicates that it was positively valued by respondents. In attempting to explain this result, we found that a two-class LCM yielded probability of class membership estimates almost identical at 0.68 (Class 1) and 0.32 (Class 2). In addition, Class 1 yielded a statistically significant negative coefficient for the No Choice option (i.e., preferred to select options A, B, or C), whereas for Class 2 the No

TABLE 2 Mixed logit in willingness to pay space model results. Coefficients are automatically willingness to pay estimates. A positive coefficient indicates amount willing to pay for a plant with a specific attribute present. The random parameter results indicate statistical support for modelling respondent preferences being heterogeneous.

Attributes	Coefficient	SE	95% CI
Hardy	35.848**	4.235	27.546 to 44.149
Named cultivar	9.575***	1.038	7.541 to 11.611
Rare in cultivation	4.971***	1.258	2.503 to 7.437
Rare in wild	−4.339*	2.342	−8.931 to 0.252
Known wild provenance	4.623***	1.274	2.124 to 7.121
Price	1.000		
No choice (ASC)	0.550***	0.182	0.192 to 0.907
Random parameter	**SD**	**SE**	
Hardy	25.315***	3.940	
Named cultivar	18.162***	2.940	
Rare in cultivation	17.854***	2.781	
Rare in wild	21.037***	3.277	
Known wild provenance	20.902***	3.206	
Chi squared (14)	3913.8***		
Log likelihood (LL)	−5207.5		
McFadden R^2	0.273		
AIC	2.021		
BIC	2.038		
N (sample size)	5,168		

Note: 95% CI = 95% confidence interval; ASC = Alternative Specific Constant; AIC = Akakie Information Criteria; BIC = Bayesian Information Criteria; SE = Standard Error; SD = Standard Deviation.
***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Choice coefficient is positive and statistically significant. When we examine the class membership explanatory socio-economic variables, we note that being male and working as a professional in the industry are positive for Class 1 and negative for Class 2. This suggests that respondents positively valued the No Choice option are more likely to not male and not working in this industry. Full results for the two-class LCM are provided in Table S3. Unfortunately, due to a limitation imposed on survey length, we could further explore this issue with debriefing questions.

Given the WTP estimates in Table 2, we can see that respondents placed the highest value on plants being Hardy. Importantly, although the WTP for KWP is positive, it is the lowest valued attribute. Thus, although the results indicate that respondents value KWP positively, it is of much lower value compared with whether a plant can be described as Hardy. As such, we think it is appropriate to treat this WTP estimate with a degree of caution.

Next, we report results for our second stage estimation that explain variation in individual WTP results as a function of various socio-economic variables. The results reported in Table S4 are for each attribute estimated using OLS, and our RE panel model specification results are in Table S5. The results in Table S4 show there is a significant degree of variation between the socio-economic variables and the individual WTP estimates for each of the attributes. Care needs to be taken in interpreting these results given the relatively low level of model fit, although each specification is statistically significant. Focusing on KWP, being university educated (Edu Uni) is negatively related to WTP for KWP, whereas being in work (Work) is positively related. We also note that being a Prof (i.e., working in the industry) was positively and highly significantly associated with named cultivars and rarity in cultivation. Interestingly, hardiness was negatively associated with Prof, which may indicate an interest in species that are challenging to grow in the local climate. Turning to the RE results in Table S5, working in the industry (Prof) and being in work (Work) lead to an individual positively valuing the attributes. The attribute dummies are interpreted relative to the intercept which in this case captures the excluded attribute KWP. The difference between the intercept and the dummies gives a mean estimate of the WTP, which are similar in magnitude to those reported in Table 2.

4 | DISCUSSION

Currently, there has not been much research about how benefit sharing, via NP ABS or other benefit sharing mechanisms, may impact the ornamental horticulture sector. Here, we examined hypothetically whether a price premium exists for plants with a label indicating if plants had KWP compared to plants without. The hypothesis we have tested is that if a potential price premium does exist for plants with

KWP that it could form the basis of a monetary benefit-sharing agreement. To test this hypothesis, we examined consumer preferences for buying plants that have KWP by developing and analysing data from a stated preference CE. The need to employ a CE stems from the lack of market data on actual supply and demand of plants that have indicators of KWP. Our analysis and results add to a small literature that have used CEs to examine aspects of consumer choice about plants: orchids (Hinsley et al., 2015), roses (Chavez et al., 2020), cut flowers (Rihn et al., 2014, 2015, 2016, 2019; Rombach et al., 2018), and sustainable plant attributes (Khachatryan et al., 2021; Yue et al., 2016). Importantly, none of the antecedent literature examined if consumers value KWP or related plant product attributes.

The results of the CE have revealed interesting findings regarding the types of attributes that appear to determine purchase preferences on the part of UK plant buyers. First, there is a strong preference amongst buyers for plants that are hardy, as would be expected given the UK's temperate climate. Second, KWP is not acting as an attribute that is driving the purchase choice. Although there is evidence that there is a positive value attached to KWP, it is a relatively small value, and it is valued the least compared to the other attributes employed other than Rare in the Wild. Third, we found that rare in the wild was negatively valued by survey respondents. This result can be interpreted as implying that respondents prefer plants likely to be sourced in a sustainable manner. Yue et al. (2016) have previously reported consumers are WTP more for sustainably labelled plants.

While KWP was found to only result in a small price premium, it does not mean wild provenance material has an equal or lower value to horticultural material since wild provenance material could be the source of novel attributes or attributes that are linked to value, such as hardiness. As such, wild provenance material at a fundamental level acts as supply of material for the horticultural trade, with no additional value. Only once other specific attributes have been identified, such as increased hardiness, which we know from the CE attract a high WTP, is KWP likely to translate into increased value. Thus, in terms of benefit sharing, our result indicates that there is little evidence to argue that a meaningful stream of monetary benefits can be generated using a KWP label.

Our result regarding consumer WTP for KWP, however, need to be treated with a degree of caution. The result for KWP as reported may, in part, reflect the fact that KWP is not an attribute that buyers consider (or know). Clearly, KWP is a credence attribute and therefore cannot be evaluated by the buyer even after a plant has been purchased, unlike hardiness which could be considered an experience attribute that can be determined once purchased, while search attributes such as flower colour are easily evaluated prior to purchase. Given this possibility, one issue that warrants further research is how a buyer perceives a credence attribute. In this CE, we implemented the KWP attribute without attempting to align the information with a known or trusted source. As reported by Khachatryan et al. (2021), how a label such as KWP is framed within a CE can have an impact on the resulting WTP estimates derived. Also, they note that informing survey respondents about how the survey results are going to be used (i.e., making the choice task consequential) also had a positive impact on the magnitude of the WTP. Furthermore, we employed text to describe KWP within the CE and not a logo. It has been observed by Rihn et al. (2019) that a label format can also have an impact on WTP estimates generated by a CE. Another limitation of the current study is that we did not explicitly consider the possibility of attribute nonattendance (ANA), which is an issue that has been the subject of much research within the CE literature (e.g., Hensher et al., 2005). Given the nature of the sample of respondents and the design of the CE, we contend that ANA is unlikely to be a serious issue. However, any future work on KWP should consider ANA, although as noted in the literature (e.g., Balcombe et al., 2015) the existence of ANA has been exaggerated somewhat within some of the existing literature.

The fact that we only find a small price premium attached to a label indicating for KWP does not imply that the ornamental plant sector can ignore the need to undertake benefit sharing. Even if there is minimal opportunity to generate monetary benefits at the point of sale, the industry could consider providing non-monetary benefits. Examples might include horticultural training or linking benefit sharing to the ex-situ conservation requirement of agreements that were set up through the CBD such as the Global Strategy for Plant Conservation (CBD, 2012). Furthermore, our analysis does not mean that at some point in the future that the opportunity for monetary benefit sharing will not emerge. In this situation, the mechanism put in place to facilitate the benefit sharing will in large part be determined by the legal constraints that bind. For example, if it happened to be that this needed to be done via the NP ABS, there exists a recent example for Rooibos tea that could be employed as a guide. The process through which this specific ABS came into being is described in detail by Schroeder et al. (2020). The particular benefit-sharing agreement is path breaking in that it is the largest between indigenous peoples and industry. This recognised the input of traditional knowledge in the conservation of the resource as well as its use, and the benefit-sharing agreement explicitly acknowledges this. As such, the agreement is also considered to be an example of the "art of the possible." This phrase neatly captures the fact that an agreement could be reached despite the myriad of difficulties faced. This is summarised by Schroeder et al. (2020) as follows:

> Although the rooibos case is unique in a number of aspects, the experience offers many transferable insights, including: patience; incrementalism; honesty; trust; genuine dialogue; strong legal support; a shared recognition that a fair, win-win deal is possible; government leadership; and unity amongst indigenous peoples. (p. 285)

However, the NP ABS is subject to various criticisms when it comes to implementation. For example, there have been recent calls for accelerated responsible research into the properties of plants and fungi for sustainable development, but concerns have been raised as to how the NP may negatively impact this (Antonelli et al., 2019). There is also a view expressed that the NP ABS may hinder and even have unintended consequences for the research and development of genetic resources (Guerra et al., 2020; Mekonnen & Spielman, 2021; Neumann et al., 2018). Furthermore, NP ABS is implemented via bilateral country level arrangements that make benefit sharing complicated to achieve (Deplazes-Zemp et al., 2018; Laird et al., 2020).

Questions also remain as to whether the NP ABS as an example of a benefit sharing mechanism is the appropriate or even necessary framework to consider when it comes to international trade in ornamental plants. In this case, trade in ornamental plants could consider other benefit sharing mechanisms. For example, it has been proposed that ornamental plants could be included within the BioTrade Initiative (UNCTAD, 2017a). There already exists a Peruvian case study for the trade in orchids (UNCTAD, 2017b). This case study indicates how the trade in orchids from Peru could be undertaken in manner that is consistent with CITES as well as generating benefits for the host country. However, the study also highlights that these benefits can only be achieved if a functioning traceability system can be implemented. Much of the same point has been made by Hinsley and Roberts (2018) in terms of the orchid trade in southeast Asia. And traceability is only one element of the legal requirements facing the trade that also include national plant collecting legislation, protected area rules and regulations, restrictions on collecting national protected species, and export regulations, plant health, and so forth. The need for traceability is also paramount if voluntary sustainability standards are to be employed and are to gain a meaningful reputation (Schleifer et al., 2022). If traceability can be insured, then use could be made of a Geographical Indication (GI) label, or a fair-trade label. Given the fact that labels with institutional and/or producer support and verification potentiality attract a higher WTP, then either of these options might generate higher benefits than we have estimated here.

AUTHOR CONTRIBUTIONS

Robert J. Blackhall-Miles, Iain M. Fraser, and David L. Roberts contributed equally to this work. The names are listed in alphabetical order.

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CONFLICT OF INTEREST

The authors declare no known conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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