

1 **Assessing consumer preferences for forest bathing: A new challenge to promote**
2 **forest recreation services in a rural region in Spain.**

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12
13 **Abstract**

14 This study evaluates consumer preferences for forest bathing and seeks to promote
15 alternative forest-based recreation services in rural areas (Orihuela del Tremedal, Pinares
16 de Rodeno), both located in Aragón (northeastern Spain). Respondents were presented
17 with a range of hypothetical forest bathing scenarios that varied by price, the presence or
18 absence of a guide, and the option to participate individually or in a group of 5-10 people.
19 An opt-out alternative was also included to capture preferences for none of the presented
20 options. Using a random parameter logit model, specified in willingness to pay (WTP)
21 space, the results indicate a significant higher WTP for forest bathing in Orihuela del
22 Tremedal over Pinares de Rodeno. Participants also expressed a greater WTP towards
23 guided sessions and engaging in the activity alone rather than in groups. These findings
24 provide an accurate economic valuation of forest bathing as an ecosystem service,
25 offering valuable insights for policymakers and local authorities. The results can support
26 informed decision-making regarding the sustainable management and promotion of
27 natural resources in rural areas, while simultaneously enhancing local economic
28 development.

29 **Keywords:** Choice experiment; consumer preferences; ecosystem services; rural
30 development; shinrin-yoku; willingness to pay space.

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Abbreviations: MITT, Ministry of Industry, Trade and Tourism; DCE, discrete choice experiment; WTP, willingness to pay; WTPS, willingness to pay space; RPL, random parameter logit; PS, Preference Space.

32 **1. Introduction**

33 Forests provide a wide array of ecosystem services that are fundamental to human
34 existence and well-being. These include provisioning, regulating and cultural services,
35 which range from direct tangible uses such as timber production, to indirect tangible
36 services like erosion control, and intangible benefits such as cultural and spiritual
37 enrichment (Taye et al., 2021). While many of these services are rivalrous and can be
38 traded in markets as private goods with observable prices, some others are non-excludable
39 and provided 'free of charge' as common public goods. Although offering forest
40 ecosystem services at no cost may appear reasonable from a societal perspective,
41 continued free provision can lead to suboptimal forest management outcomes (Froger et
42 al., 2015). Assigning economic value to environmental goods and services is a way of
43 demonstrating the relative importance of ecosystem services for human well-being and
44 environmental sustainability (Schild et al., 2018). An accurate economic evaluation of
45 ecosystem services not only supports informed policy decisions regarding the socially
46 optimal use and management of natural resources but also enables public authorities to
47 promote long-term, sustainable economic benefits.

48 As urban areas expand, rural forests are assuming an increasingly important role in
49 enhancing the quality of life for citizens. They offer a range of ecosystem services
50 including environmental regulation (Gómez-Baggethun and Barton, 2013; Nesbitt et al.,
51 2017); contributions to physical, mental, and social health (Mitchell and Popham, 2008)
52 and economic opportunities (Wolf, 2009). Economic opportunities in the context of forest
53 bathing and other nature-based recreation activities refers to the potential for these
54 practices to generate financial value and support livelihoods, businesses, and local
55 economies, while also contributing to broader sustainability goals. To fully harness these
56 benefits, it is essential that planners, managers, and policymakers accurately assess the
57 costs and benefits of forests during land-use planning and construction processes.
58 Particular attention should be given to enhancing circular economy principles, ensuring
59 sustainability, and avoiding the pitfalls of overtourism (Livesley et al., 2016).

60 According to the Spanish Institute of Statistics (INE), tourism is a key pillar of the
61 Spanish economy, which in 2023 contributed €184.002 million, equivalent to 12.3% of
62 GDP, and generated over 5.2 million jobs, representing 12% of the total employment
63 (INE, 2024). Despite these economic gains, tourism has also produced significant
64 environmental costs, particularly in the degradation of forest-based ecosystem services

65 that are often undervalued due to their intangible and non-market nature (Pueyo-Ros,
66 2018). In response, the new strategy of the Ministry of Industry, Trade and Tourism
67 (MIIT) has shifted towards a more sustainable tourism, with a focus on socio-economic
68 development, that preserves the natural and cultural values of rural areas, and adapts the
69 ongoing environmental changes (MITT - Ministry of Industry, Trade and Tourism, 2019).
70 These strategies are consistent with the national plans adopted by other governments,
71 which have introduced a range of policies and programmes aimed at mitigating the effects
72 of forest destruction, from afforestation initiatives, such as tree-planting projects, to
73 innovative forest management practices (Barry et al., 2014; Oldfield et al., 2013).

74 At the same time, these public policy shifts reflect a broader change in tourist
75 preferences. Increasingly, tourists are seeking environmentally responsible experiences,
76 favouring tranquil rural destinations over the congestion of urban life. Consequently,
77 ecotourism, which emphasises the sustainable use of the natural and cultural environment,
78 has gained traction (Akten and Tanribir, 2014; Ceylan and Tülbentçi, 2020; Duletić et al.,
79 2024). Nature-based ecotourism is currently one of the fastest-growing sectors in global
80 tourism, with sustained growth in the provision of ecosystem services projected in the
81 coming years (Duletić et al., 2024; Matilainen and Lähdesmäki, 2014). Within the context
82 of rural forests, the term ‘ecosystem services’ refers to the benefits provided to humans
83 through functional processes and interactions with the surrounding environment and local
84 ecology (Livesley et al., 2016). Rural forest ecosystem services are highly interrelated.
85 For example, access to rural green spaces can offer recreation opportunities, subsequently
86 reducing stress levels and providing physical health benefits (Meyer et al., 2019). Despite
87 this interrelation, ecosystem services are commonly categorised into four broad
88 categories: supporting, provisioning, regulating, and cultural, to facilitate discussion and
89 analysis (Alcamo et al., 2003).

90 Our work primarily focuses on cultural ecosystem services, a category closely linked
91 to the well-being of humans in green rural and urban environments (Jansson, 2013; Meyer
92 et al., 2019; Wolf et al., 2015). However, cultural ecosystem services remain poorly
93 defined, particularly in the field of rural and urban forestry (Satz et al., 2013). For this
94 study, we expand upon the definition of cultural ecosystem services as presented by the
95 Millennium Ecosystem Assessment. This includes ‘the nonmaterial benefits people
96 obtain from ecosystems through spiritual enrichment, cognitive development, reflection,

97 recreation, and aesthetic experiences' (Alcamo et al., 2003), as well as the economic
98 benefits derived from the non-consumptive use of ecosystems, such as forest bathing.

99 One of the key assets in developing rural nature-based ecotourism is the presence of
100 forests (Bjärstig and Sténs, 2018). Spain (19 million hectares) is the third-largest country
101 in the EU in terms of forest area, after Sweden (28 million hectares) and Finland (22
102 million hectares) (EUROSTAT, 2023). Forest ecosystems cover more than half of the
103 national territory, with 28 million hectares (55.3%) of which two-thirds (18.5 million
104 hectares) are wooded, while the remainder are non-wooded (Official Association of
105 Spanish Forest Engineers (COIM), 2023). In this context, new forest-related ecotourism
106 products, such as mycotourism (Büntgen et al., 2017; de Frutos et al., 2019), have been
107 successfully introduced. However, other products remain underdeveloped. One example
108 is the *Shinrin-yoku*, or forest bathing. Forest bathing involves walking at a gentle, non-
109 strenuous pace through a forest, interspersed with pauses for breathing exercises,
110 meditation, and mindful observation of the natural surroundings (Siah et al., 2023). More
111 specifically, it is an experience rooted in mindful awareness, during which all five senses
112 are engaged through interaction with various forest elements, such as leaves, branches,
113 deadwood, flowers, and natural scents, as well as purpose-built features designed to
114 enhance the activity, including barefoot paths and tree-hugging structures (Antonelli et
115 al., 2022). Forest bathing emerged in the 1980s as a component of preventive healthcare
116 in Japan (Tsunetsugu et al., 2010), gaining popularity due to its stress-reducing and
117 relaxation-inducing properties. Since the 2000s, medicine and nursing disciplines have
118 increasingly demanded scientific validation of such practices. Subsequent studies have
119 investigated the physiological and psychological health benefits of forest bathing
120 (Tsunetsugu et al., 2010; Wen et al., 2019), including its effect on blood pressure
121 regulation (Ideno et al., 2017), cardiovascular function (Kobayashi et al., 2018),
122 neuroendocrine activity, emotional well-being, and the alleviation of anxiety and
123 depression (Wen et al., 2019). Currently, a number of forest bathing and therapy
124 associations have been established and officially recognised across various countries,
125 including Canada, Germany, Italy, Lithuania, and the United States, with the objective of
126 promoting the practice among the wider population (Farkic et al., 2021). Although forest
127 bathing is well established in Japan and some other Asian countries (e.g., South Korea,
128 China and Taiwan), it remains relatively new in Spain and has yet to be assessed in terms
129 of consumer preferences and willingness to pay (WTP). Understanding these dimensions

130 is important if the practice is to be promoted as a viable ecotourism offering for both
131 domestic and international tourists, particularly those from Western cultures.

132 The main objective of this research is to examine consumer preferences and WTP for
133 forest bathing in two rural Spanish locations: the pine forest of Pinares de Rodeno and
134 the pine forest of Orihuela del Tremedal. Preferences are assessed using a discrete choice
135 experiment (DCE) alongside a questionnaire exploring participants' habits and health
136 status.

137 While the existing literature has largely focused on scientifically validating the health
138 benefits of forest bathing, primarily highlighting its positive physical and psychological
139 effects on human health (De Meo et al., 2023, 2022; Derks et al., 2020; Kil et al., 2021;
140 Kotte et al., 2019; Roviello et al., 2022; Ugolini et al., 2021; Wen et al., 2019; Yau and
141 Loke, 2020), a complementary body of research has sought to identify the specific
142 environmental characteristics of forest settings that maximise these health outcomes
143 (Doimo et al., 2020; Riviaccio et al., 2024; Saito et al., 2019; Takayama et al., 2017).
144 Despite this growing scientific interest, there remains a significant gap in the literature
145 regarding the economic valuation of forest bathing from a consumer behaviour
146 perspective. To our knowledge, only three studies have empirically examined consumer
147 preferences and WTP for forest bathing as an ecosystem service, and none have been
148 conducted in Spain. Specifically, Uyan (2020) applied a contingent valuation method to
149 assess consumers' WTP for a forest bathing entrance fee in the Philippines. Visintin et al.
150 (2024) used contingent valuation methods and estimated WTPs to evaluate the demand
151 for forest bathing in northern Italy regions. Finally, Paletto et al. (2024) used the zonal
152 travel cost method through interviews to explore preferences and economic values
153 associated with forest bathing in Northern Italy. Although these studies contribute
154 valuable insights, our approach differs methodologically. Contingent valuation methods
155 typically elicit WTP for a single, hypothetical scenario using direct questioning, which
156 can be prone to hypothetical bias and often lack realism (Murphy and Stevens, 2004), and
157 interviews that principally rely on self-reported data are vulnerable to social desirability
158 bias, potentially compromising data validity (King and Bruner, 2000). In contrast, DCEs
159 present respondents with a series of alternatives featuring varying attributes, enabling the
160 estimation of marginal values. This approach reflects more accurately real-world
161 decision-making processes and yields more robust, policy-relevant insights (Lusk and
162 Schroeder, 2004). This is also reflected in the growing popularity within the last ten years

163 of using DCEs to evaluate forest recreation activities (Elsasser et al., 2016; Giergiczny et
164 al., 2021, 2015; Pellegrini et al., 2024; Sagebiel et al., 2017; Tu and and Abildtrup, 2016;
165 Yao et al., 2014), among others. To mitigate hypothetical bias, which is common in stated
166 preference methods, this study uses a cheap-talk script (Cummings and Taylor, 1999).

167 Findings are expected to offer valuable insights to public authorities, particularly
168 local governments in the study areas. These insights can inform the valuation of rural
169 forest services, prioritise forest-related investments, and support the design of sustainable
170 ecotourism strategies centred on forest bathing and related ecosystem services.

171 The remainder of the paper is structured as follows: Section 2 outlines the materials
172 and methods employed in the study. Section 3 presents the empirical results, while
173 Section 4 discusses the key findings in the context of existing literature, explores their
174 policy and management implications, and proposes directions for future research. Finally,
175 Section 5 provides the concluding remarks.

176 **2. Materials and Methods**

177 *2.1. Survey structure*

178 A 10-minute survey was conducted alongside a DCE to achieve the objective of this
179 research. Upon providing informed consent, respondents were asked to complete a series
180 of attitudinal questions regarding connection with nature such as regular visits to natural
181 spaces (walking, hiking, forest bathing, birdwatching, wild swimming), personal habits
182 such as everyday pro-environmental practices (sustainable mobility of cycling or waling
183 instead of driving etc.), and their health status such as sport activities, and whether they
184 suffer from any medically subscribed condition. The next section of the questionnaire
185 presented respondents with the DCE. Before beginning with the DCE, participants were
186 presented with some basic information on the two forest cites. Since they were not
187 experts, details on the tree species were not provided. Consumers where first provided
188 with easy-to-understand information highlighting the reasons of having to face a
189 monetary entrance to visit the forest for a forest bathing activity¹. Participants received a
190 brief overview of the key features of the two forest sites. Because both sites are in Aragón,
191 it was assumed that they would already possess some awareness of the principal

¹ “To get the most benefit from forest bathing, the forest needs to be well maintained. This includes caring for the trees and undergrowth, keeping the paths clear and safe, and providing any necessary facilities. If you are asked to pay a small entry fee to visit a forest prepared for forest bathing, the money will help cover the cost of hiring a guide and the work needed to maintain the forest, trails, and facilities.”

192 differences between them. The information provided to respondents for each forest
193 included: name, location, altitude, and the general climate of the main tree species (see
194 this information below in each forest's description). As forest bathing activities were
195 unavailable, respondents were asked to imagine a hypothetical recreational destination
196 choice scenario. They were instructed to assume they would spend a few days in the Sierra
197 de Albarracín region to experience forest bathing. They were asked to choose between
198 two different forest sites or to opt for none of the available options. The final section of
199 the questionnaire collected information on participants' sociodemographic
200 characteristics. The questionnaire results are not reported in this paper, as they fall outside
201 the scope of the present study.

202 *2.2. Choice experiment design*

203 The DCE was selected for its ability to evaluate multiple product/service attributes
204 simultaneously, based on random utility theory (McFadden, 1973), and to approximate
205 real-world consumer purchasing behaviour (Adamowicz et al., 1998). Within the choice
206 modelling framework, respondents are asked to make repeated selections among
207 alternative products, each defined by a set of attributes with varying levels. This approach
208 closely mirrors the consumer decision-making process, and its familiarity with
209 participants is a key advantage over other commonly used valuation methods such as
210 experimental auctions (Lusk and Schroeder, 2004).

211 The first step in implementing a DCE is selecting the reference product. In this study,
212 the reference product is the ecosystem service of forest bathing. The second step involves
213 identifying the reference product's relevant attributes and corresponding levels (Table 1).
214 Price is a key attribute, as it enables the estimation of marginal WTP. Four price levels
215 (€5, €10, €15, and €20) with an average of €12.5, a minimum of €5, and a maximum of
216 €20 were selected based on insights gathered from two focus group sessions conducted
217 with consumers and subject-matter experts. Each session lasted approximately two hours
218 and was held within the study's designated rural forest sites, both situated in the Sierra de
219 Albarracín region. The second attribute is the forest bathing area. We selected these two
220 pine forests due to their existing use as natural recreational areas. Both locations feature
221 established walking trails, designated recreational facilities, and are situated in close
222 proximity to small villages, making them easily accessible for local residents and visitors.

223 Table 1. Forest bathing attributes and levels.

No.	Attributes	Levels
1	Price (€/package)	5€/package, 10€/package, 15€/package and 20€/package
2	Forest bathing area	Rural forest of Pinares de Rodeno Rural forest of Orihuela del Tremedal
3	Guide	Service experienced with a guide (Guide) Service experienced without a guide
4	Group	Service experienced as a group of 5 to 10 people (Group) Service experienced alone

224 Source: Own elaboration.

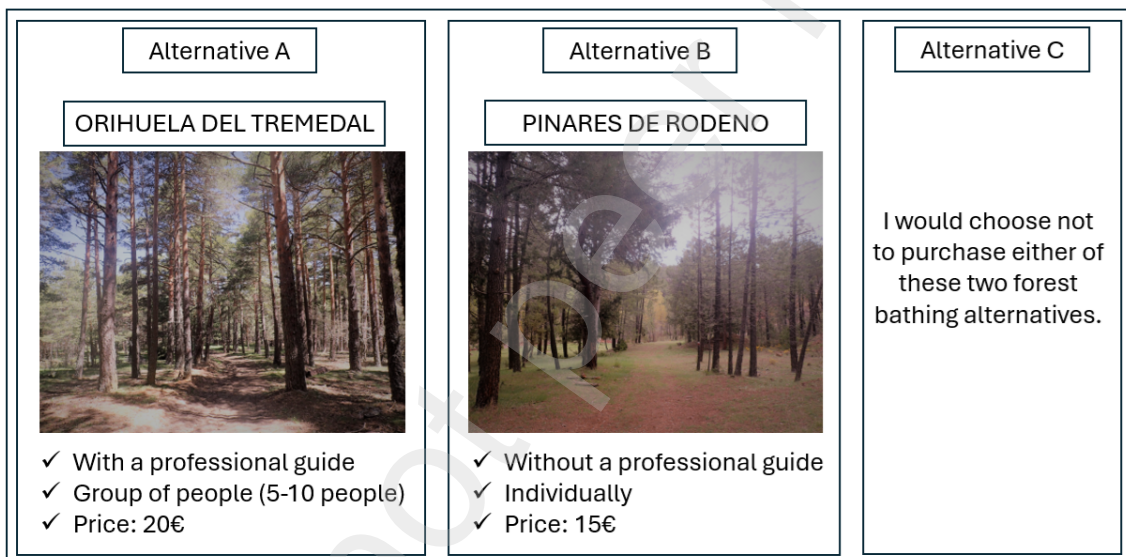
225 The first forest, Pinares de Rodeno, is a healthy stand dominated by the
 226 Mediterranean species Maritime pine (*Pinus pinaster* Ait.) located within a designated
 227 protected landscape in eastern Spain (40°19'59.00" N, 1°21'09.49" W, 1206 m a.s.l.,
 228 Sierra de Albarracín, Teruel). It comprises naturally regenerating pine woodland with a
 229 range of age classes from about 20 to 60 years. The site also contains scattered individuals
 230 of oak (*Quercus pyrenaica* Willd) and Sun rose (*Cistus laurifolius* L.) The pines in this
 231 forest have a mean height and an average diameter at breast height (DBH, measured at
 232 1.30 m) of 30 cm. This forest is primarily used for recreational activities and features a
 233 tourist information center, market walking trails, and outdoor fitness equipment (Sancho-
 234 Knapik et al., 2022).

235 The second forest, Orihuela del Tremedal, is a vigorous stand dominated by the
 236 Temperate European species Scots pine (*Pinus sylvestris* L.), notable for its reddish bark.
 237 It is located approximately 33 km northwest of the first forest (40°31'59.46" N,
 238 1°39'09.85" W, 1600 m a.s.l., Sierra de Albarracín, Teruel), within a special protection
 239 area for birds. This forest also comprises naturally regenerating pine woodlands but is
 240 characterised by older, taller, and thicker trees than those in Pinares de Rodeno.
 241 Recreational infrastructure includes a residential leisure complex, picnic areas, and the
 242 Virgin of Tremedal sanctuary. In adjacent areas, there is also selective timber harvesting
 243 for lumber production.

244 The third attribute (GUIDE) denotes the presence or absence of a guide who would
 245 lead participants through the forest bathing experience. The final attribute (GROUP)
 246 specifies whether the session will be conducted individually or in a group of 5 to 10
 247 participants.

248 Respondents were presented with two alternatives in each choice task, each
 249 representing a different forest bathing package comprising different attribute
 250 combinations and associated price levels. Additionally, a third alternative (NOBUY) was
 251 included, allowing participants to opt out if they preferred neither option (see Figure 1 for
 252 an example of a choice task)². The structure of the choice task followed the methodology
 253 outlined by Street and Burgess (2007). To manage the number of choice tasks effectively
 254 while ensuring an optimal experimental design, the study employed an orthogonal main
 255 effects plan to develop the profiles (Street and Burgess, 2007). The orthogonal main effect
 256 plan was calculated using SPSS, which generated 12 distinct profiles. The resulting
 257 design achieved a D-efficiency of 91.2% relative to the theoretical optimal design.

258 Figure 1. Example of a choice task of forest bathing.



259

260 Source: Own elaboration. Note: Translated from the original Spanish version.
 261

262 *2.3. Econometric specification: The willingness to pay space model.*

263 In the DCE literature, the standard approach for estimating WTP is to do so in preference
 264 space (PS). In this framework, marginal utility coefficients are first estimated, and WTP
 265 values are subsequently derived by calculating the ratio of these coefficients. An
 266 alternative approach is to estimate directly in WTP space, which addresses several
 267 limitations associated with the PS method³. WTP space reformulates the model such that

² About 17% of the participants chose the no-buy alternative.

³ While in PS the distribution of WTPs is a ratio of two random variables, in WTP space the distribution is specified directly (e.g., normal, log-normal), rather than assuming the ratio, giving more control over the behaviour and interpretability of the WTP distribution. In PS, the correlation between price attribute

268 the estimated coefficients represent WTP valued directly. This requires that appropriate
269 distributions for the WTP estimates are specified from the outset.

270 The econometric foundation of DCEs is the Random Utility Model (RUM). RUM
271 assumes that individuals choose the alternative that provides the highest level of utility
272 among a set of alternatives. Under this framework, the utility, U_{njt} that individual n derives
273 from alternative j in choice situation t is composed of two components: a systematic
274 component, $V(X_{njt}, \beta_n)$, which is a function of the attributes of alternative j ; and a random
275 component reflecting unobserved preference heterogeneity. This heterogeneity is
276 modelled as $\beta_n = \beta + \Delta_{zn} + \Gamma_{vn}$, where z_n is a vector of M observable characteristics of
277 individual n influencing the mean of the taste parameters, and v_n is a vector of K
278 unobserved random variables with zero mean, known variances (typically unit), and zero
279 covariances. The error term ε_{njt} , captures unmeasured variation in preferences. That is,

$$280 \quad U_{njt} = V_{njt}(X_{njt}, \beta_n) + \varepsilon_{njt} \quad (1)$$

281 The multinomial choice model outlined thus far incorporates both observed and
282 unobserved heterogeneity in individual-level preference parameter n . Observed
283 heterogeneity is captured by the term Δ_{zn} while unobserved heterogeneity is represented
284 by Γ_{vn} . To estimate equation (1), it is necessary to specify a distribution for the error term.
285 Assuming that the error components are independently and identically distributed across
286 individuals, alternatives and time. Therefore, the utility function can be expressed as:

$$287 \quad U_{njt} = \text{NO-BUY} + \text{PRICE}_{njt} + \text{GUIDE}_{njt} + \text{GROUP}_{njt} + \text{TREMEDAL}_{njt} + \varepsilon_{njt} \quad (2)$$

288 The alternative-specific constant (NO-BUY) represents a dummy variable equal to 1
289 when the NO-BUY alternative is chosen and 0 otherwise. PRICE_{njt} is a continuous
290 variable corresponding to the four price levels specified in Table 1. The remaining
291 attributes (GUIDE, GROUP, and TREMEDAL) enter the model as dummy variables (1
292 = present, 0 = absent). The ε_{njt} error term follows a Type I Extreme Value distribution.

293 To distinguish specific non-random parameters, rows of zeros are specified in Γ . A
294 pure random parameters MNL model arises when $\Delta = 0$ and Γ is diagonal (in the Cholesky

coefficients may be correlated, resulting in biased or imprecise WTP estimates. These correlations are inherently handled in WTP space since WTP is estimated directly, and the estimation is typically more efficient and stable. If the price coefficient is small in magnitude or close to zero, the WTP values are unrealistically high (Train and Weeks, 2005).

295 decomposition). The basic MNL model results when $\Delta = 0$ and $\Gamma = 0$. The model can also
 296 accommodate scale heterogeneity in both observed and unobserved components. The
 297 specification is thus extended as:

$$298 \quad \beta_n = \sigma_n[\beta + \Delta_{zn}] + [\gamma + \sigma_n(1 - \gamma)] \Gamma_{vn}, \quad (3)$$

299 where $\sigma_n = \exp[\bar{\sigma} + \delta' \mathbf{h}_n + \tau w_n]$ is the individual-specific scale parameter. Here, \mathbf{h}_n is a
 300 vector of L observed characteristics of individual n , which may overlap with \mathbf{z}_n ; δ captures
 301 the impact of observed heterogeneity on scale; w_n is a standard normally distributed
 302 unobserved term; $\bar{\sigma}$ is the mean of the scale distribution; τ is the coefficient capturing
 303 unobserved scale heterogeneity; and γ is a weighting parameter that indicates how
 304 variance in residual preference heterogeneity varies with scale, with $0 \leq \gamma \leq 1$. If $\gamma = 0$,
 305 then a scale mixed logit model emerges, given in the specific form:

$$306 \quad \beta_n = \sigma_n[\beta + \Delta_{zn} + \Gamma_{vn}] \quad (4)$$

307 Further simplification, where $\Gamma = 0$ and $\Delta = 0$, yields a scaled multinomial logit
 308 model, $\beta_n = \sigma_n \beta$. This generalised mixed model structure also enables straightforward
 309 reparameterisation for estimation in WTP space (Fosgerau and Bierlaire, 2009; Hensher
 310 and Greene, 2011; Scarpa et al., 2010, 2008; Train and Weeks, 2005).

311 The choice of parameter distributions is critical when estimating WTP. Certain
 312 specifications may produce heavily skewed WTP distributions with unrealistically large
 313 values. A common strategy to mitigate this involves fixing the price coefficient. However,
 314 assuming homogeneity in price sensitivity across individuals may be unrealistic (Meijer
 315 and Rouwendal, 2006). Train and Weeks (2005) offer an alternative by estimating the
 316 RPL directly in WTP space.

317 Assuming utility is separable in price p_{njt} and non-price attributes \mathbf{x}_{njt} (GUIDE, GROUP,
 318 TREMEDAL), the utility function can be expressed as:

$$319 \quad U_{njt} = a_j + \lambda_n p_{njt} + \beta_n' \mathbf{x}_{njt} + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} \quad (5)$$

320 This form represents a generalized mixed logit model in PS, assuming appropriate
 321 distributions for λ_n and β_n (Hensher et al., 2015; Thiene and Scarpa, 2009; Train and
 322 Weeks, 2005). To reformulate this model in WTP space the utility function becomes:

$$323 \quad U_{njt} = a_j + \lambda_n [p_{njt} + (1/\lambda_n) \beta_n' \mathbf{x}_{njt}] + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} = a_j + \lambda_n [p_{njt} + \theta_n' \mathbf{x}_{njt}] + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} \quad (6)$$

324 In this formula, λ_n serves as the normalizing constant. The parameters in PS are
 325 defined as $\lambda_n = (\lambda_p + \sigma_p + w_n)$ and β_n as $\beta_{nk} = (\beta_k + \sigma_k v_{nk})$, allowing for full correlation
 326 among the $K+1$ random parameters. To ensure consistent signs for WTP estimates, we
 327 constrain $\lambda_n = \lambda_p \exp(\lambda_o + \tau w_n)$ (Thiene and Scarpa, 2009). Although the sign of the
 328 expression is not imposed a priori, estimates typically yield a negative λ , as expected.
 329 Following Hensher et al. (2015), Eq. (6) corresponds to a GMXL model in WTP space,
 330 obtained by setting $\gamma = 0$, the row in Γ corresponding to λ_p to zero, and normalizing β such
 331 that the price coefficient equals 1. The final WTP space specification is:

$$332 \quad U_{njt} = \text{NOBUY} + \theta_1 \text{Price}_{njt} + \theta_2 \text{GUIDE}_{njt} + \theta_3 \text{GROUP}_{njt} + \theta_4 \text{TREMEDAL}_{njt} + \varepsilon_{njt} \quad (7)$$

333 Based on Eq. 7, we estimated several models and selected the best fit based on several
 334 criteria, including Log-Likelihood (LL) values, Akaike Information Criterion (AIC), χ^2
 335 and McFadden's R^2 values. The baseline model was the multinomial logit (MNL) model.
 336 However, to account for heterogeneous preferences we estimated a Random Parameter
 337 Logit (RPL) model in PS. Finally, we estimated an equivalent RPL model but in WTP
 338 space with correlated attributes. The model fit criteria results indicate that the WTP space
 339 model had a superior fit compared to the rest. More precisely, the MNL performed worst
 340 with the RPL performing slightly better. Both models had higher LL, and lower χ^2 and
 341 McFadden's R^2 values than the WTP space model. In addition, the parameter τ in the
 342 WTP space model is statistically significant, suggesting that explicitly modelling scale
 343 heterogeneity leads to a better specification (Train and Weeks, 2005). Finally, the
 344 Cholesky matrix in the WTP space model indicated strong evidence of correlated random
 345 parameters, reinforcing the inappropriateness of assuming independence (see the
 346 Cholesky matrices in Appendix, Tables A.1).

347 Based on these criteria we select the WTP space⁴ model with correlated attributes to
 348 report the results. The sign of the WTP space model is not an issue anymore and the
 349 attributes are directly interpreted as monetary values (Hensher et al., 2015). However, it
 350 remains essential to differentiate between positive and negative WTP values within the
 351 WTP space framework to provide more effective price and policy implementations. To
 352 this end, marginal WTP estimates are calculated using the cost parameter, as follows:

⁴ Following Hensher et al. (2015), the parameter on cost in the WTP space is implicitly $-0.35 \cdot \exp(-1.52^2 + 1.52 \cdot w(i))$.

$$353 \quad WTP_{\text{Attribute}} = - \frac{\frac{\partial U_{njt}}{\partial \text{Attribute}}}{\frac{\partial U_{njt}}{\partial \text{Price}}} = - \frac{\beta_{\text{Attribute}}}{\beta_{\text{Price}}} \quad (8)$$

354 Following Hensher et al. (2015), the model follows an unconstrained triangular
 355 distribution with full correlation structure. All estimates were conducted using the Nlogit
 356 6.0 Econometric Software, Inc. (<http://limdep.com/products/nlogit/>).

357 3. Results

358 3.1. Sample characteristics

359 The research was conducted in Aragón (Spain), which is the region that locates both forest
 360 bathing areas, and which consumers are likely aware with the differences between the
 361 two selected forest bathing sites. To elicit the preferences of citizens regarding forest
 362 bathing alternatives, we conducted an online survey in collaboration with a professional
 363 market research agency. Before launching the online survey, we carried out a pilot
 364 questionnaire with 20 individuals to ensure that the interviewees correctly understood all
 365 questions. We selected a sample of 397 individuals⁵, randomly stratified by gender and
 366 age. Summary statistics for the characteristics of the sample and the regions' population
 367 are presented in Table 2.

368 Table 2. Sample sociodemographic characteristics (%).

	Aragón	Sample
Gender^a		
Male	49.5	45.8
Female	50.5	54.2
Age (mean)^a		
From 18 to 34 years	21.0	26.5
From 35 to 55years	29.2	44.6
More than 55 years	36.9	29.0
Education level^b		
Primary studies	14.2	18.1
Secondary studies	53.3	43.3
University studies	32.5	38.5
Household income		
Below 1500€	N/A	20.5
Between 1500€ and 2500€	N/A	56.3
More than 2500€	N/A	23.2

369 Source: Own elaboration. Note: ^a Spanish Census of Population, 2024 www.ine.es (INE, 2024). ^b
 370 Organisation for Economic Cooperation (OECD, 2020).

⁵ This sample size for a confidence level of 95.5% ($k = 2$) when estimating proportions for the more conservative scenario ($p = q = 0.5$) results in a sampling error of $\pm 5\%$.

371 The sample closely resembles the regions' population regarding gender, age, and
 372 education level. The average age of the participants was 45 years, with approximately
 373 44% falling within the 35 to 55 age range. Females slightly outnumbered males,
 374 accounting for 54% of the participants. Approximately 38% of the participants have
 375 completed university studies, and 23% report a net monthly income exceeding €2500.

376 *3.2. Estimation results*

377 The WTP space model is summarised in Table 3. As expected, the alternative-specific
 378 constant associated with the no-buy option was negative and statistically significant,
 379 indicating that respondents derived lower utility from the opt-out alternative compared to
 380 any of the designed forest bathing packages.

381 Table 3. Summary of model results.

	WTP space model
<i>Mean Values</i>	<i>Coefficients</i>
<i>GUIDE</i>	-8.57 (0.56) ***
<i>GROUP</i>	4.24 (0.63) ***
<i>TREMEDAL</i>	-1.25 (0.46) ***
<i>PRICE</i>	Fixed parameter
<i>NO-BUY</i>	-2.61 (0.07) ***
<i>Standard deviations of parameter distribution</i>	
<i>GUIDE</i>	15.74 (0.91) ***
<i>GROUP</i>	20.15 (1.04) ***
<i>TREMEDAL</i>	3.88 (0.56) ***
<i>PRICE</i>	Fixed parameter
Beta_WTP	-0.35 (0.05) ***
S_WTP	Fixed parameter
τ	1.52 (0.09) ***
γ	Fixed parameter
N	4764
LL	-3626.11
χ^2	3215.36
AIC	7279.20
McFadden R ²	0.31

382 Source: Own elaboration. Notes: Robust standard errors per choice (individual and choice set) in
 383 parentheses. ***, ** and * are significant at 1, 5 and 10%, respectively.

384 The price coefficient (PRICE) is fixed, hence, to ascertain the appropriate sign for
385 each WTP estimate derived we use the parameter on cost and the procedure in (Eq. 8).
386 The WTP space estimates indicate that consumers are willing to pay a premium of €8.57
387 for a forest bathing experience that includes a guide. In contrast, they are only willing to
388 undertake forest bathing in a group of approximately 5 to 10 people, rather than
389 individually, if offered at a discount rate of €4.24 per session. The forest of Orihuela del
390 Tremedal is positively valued, commanding a price premium of €1.25 relative to the
391 Pinares de Rodeno area. Additionally, the statistically significant standard deviations for
392 all variables suggest substantial preference heterogeneity.

393 4. Discussion

394 This study provides valuable insights into consumer preferences and WTP for forest-
395 bathing experiences, offering a nuanced understanding of how specific attributes shape
396 perceived value. Although the literature on recreational forest use is extensive, few
397 investigations have focused specifically on forest bathing (Visintin et al., 2024), making
398 this work one of the earliest dedicated inquiries.

399 Overall, the results show that forest bathing holds an economic value, contributing
400 significantly to the recreation of forest sites, beyond the well-documented health benefits
401 established in the literature (De Meo et al., 2023, 2022; Derks et al., 2020; Kil et al., 2021;
402 Kotera et al., 2022; Kotte et al., 2019; Lim et al., 2020; McEwan et al., 2021; Roviello et
403 al., 2022; Ugolini et al., 2021; Wen et al., 2019; Yau and Loke, 2020). This economic
404 value represents a key parameter for policy development, highlighting the need to account
405 for the broader societal value of non-market ecosystem services, such as landscape
406 appreciation and recreational experiences (Pellegrini et al., 2024).

407 Specifically, consumers were willing to pay €8.57 for a guided forest-bathing
408 experience, indicating a strong preference for professionally facilitated sessions that may
409 enhance both the therapeutic and educational dimensions of the activity. This WTP aligns
410 with previous economic valuations of guided forest-bathing activities. For example,
411 Visintin et al. (2024) reported a WTP of €5.83 per guided hike in northern Italy, while
412 Uyan (2020) found a mean WTP of USD 15 (€13.87) and a median of USD 10 (€9.24) in
413 the Philippine, where guided forest bathing has been offered for several years. In the
414 Italian Alps, Paletto et al. (2024) estimated a consumer surplus of €35.80 per person per
415 visit. This higher WTP value reported by Paletto et al. likely reflects intrinsic differences

416 between sites, local spending power, regional GDP, and methodological approaches
417 (Chaudhry and Tewari, 2006). Overall, WTP estimates are typically lower than
418 consumer-surplus figures derived from the travel cost method, a discrepancy attributable
419 to both socio-economic factors and methodological distinctions among contingent
420 valuation, travel cost methods and DCEs (Mayor et al., 2007).

421 A stronger WTP for guided rather than unguided sessions also correspond with
422 behavioural research on forest bathing, which has largely emphasised its health benefits.
423 McEwan et al. (2021), reported that participants often found it difficult to engage in forest
424 bathing independently without a guide, whereas Lim et al. (2020) observed no significant
425 difference between guided and unguided experiences. Notably, most existing studies have
426 examined unguided forest bathing (McEwan et al., 2021), and only a limited body of
427 work has explored structured, guided sessions incorporating a variety of activities (Kotera
428 et al., 2022). Given the scarcity of WTP studies in forest bathing and predominance of
429 research focusing on health-related outcomes, future investigations should undertake
430 comparative evaluations of guided and unguided forest-bathing sessions, assessing both
431 health impacts and WTP.

432 The results further indicate that a group forest bathing experience involving 5 to 10
433 participants would require a discount of €4.24 to be considered acceptable, representing
434 a 34% reduction from the average session price of €12.5. This suggests a clear disutility
435 associated with less personalised formats, potentially driven by concerns over reduced
436 tranquillity, privacy, or the quality of the immersive experience. While individual
437 sessions are understandably more highly valued, they may pose economic challenges for
438 providers due to higher delivery costs. As such, this finding could inform a differentiation
439 strategy whereby stakeholders offer individual sessions at a premium and group
440 experiences at a more accessible price point. Currently, there is a lack of empirical
441 literature directly comparing individual and group-based forest bathing in terms of
442 consumer preferences and/or WTP. Future research should aim to fill this gap, evaluating
443 trade-offs between experience quality and economic feasibility. Lastly, the findings
444 reveal that the Orihuela del Tremedal forest was associated with a price premium of €1.25
445 compared to the Pinares de Rodeno site. This suggests the importance of environmental
446 and locational attributes in shaping consumers' WTP. Such preferences likely reflect
447 perceived differences in landscape quality, natural features, and/or accessibility. To better
448 inform regional planning and forest management strategies, future research should

449 explore consumer preferences and WTP across a broader range of Spanish forest settings
450 with varying ecological and geographical characteristics.

451 *4.1 Policy and Management Recommendations*

452 Based on these findings, several practical recommendations can be made for
453 policymakers and forest managers aiming to enhance both the economic and social value
454 of forest bathing services. The evidence confirms that forest bathing holds measurable
455 economic value while also contributing significantly to human health and well-being
456 through the recreational use of forest environments. As such, **policymakers** should adopt
457 a multi-actor, sustainable approach that integrates forest conservation with health-focused
458 recreational activities. While current EU, national, and regional policies centre on forest
459 protection and climate objectives, they have yet to incorporate the health-related benefits
460 of forest interaction fully.

461 At the EU level, the *EU Forest Strategy for 2030*, introduced under the European
462 Green Deal and the EU Biodiversity Strategy, focuses on the restoration, resilience, and
463 sustainable management of Europe's forests (European Commission (EC), 2021). It
464 promotes synergies between the tourism sector, forest owners, and conservation bodies,
465 advocating for developing ecotourism standards that enhance human health without
466 compromising ecological integrity, particularly in protected areas. The strategy also
467 underlines the importance of cross-sectoral collaboration and is scheduled for review
468 before 2025 to assess implementation progress and determine the need for further
469 measures.

470 At the national level, Spain's *Forest Strategy Horizon 2050* presents a long-term,
471 holistic vision for sustainable forest management, drawing on over a century of
472 silvicultural expertise (Ministerio para la Transición Ecológica y el Reto Demográfico
473 (MTERD), 2022). It positions forests as key actors in climate mitigation, biodiversity
474 conservation, and the circular bioeconomy, while prioritising innovation, digitalisation,
475 and socio-economic revitalisation of rural areas. Importantly, it promotes inclusive
476 governance by engaging local stakeholders in forest stewardship, especially concerning
477 public and communally owned forests (MTERD, 2022).

478 Regionally, the *Aragón Forest Plan (2022)* aligns closely with national and EU
479 objectives, emphasising ecosystem service provision, biodiversity, and climate resilience
480 (Government of Aragón Portal (GAP), 2022). It seeks to bolster rural economies,

481 encourage population retention, and foster public awareness of the role of sustainable
482 forest management in environmental and societal resilience. However, like the national
483 and EU-level strategies, it does not explicitly incorporate policies linking forest use to
484 public health outcomes.

485 Despite growing recognition of the health benefits of forest-based interventions,
486 there is currently no dedicated policy at the EU, Spanish national, or Aragonese regional
487 level addressing the direct contribution of forests to human health and well-being. The
488 World Health Organization (WHO) advocates forest bathing as a health-promoting
489 intervention and calls for access to high-quality, well-maintained woodlands to facilitate
490 safe and beneficial engagement with nature (WHO, 2017). Policymakers are therefore
491 encouraged to integrate forest bathing into broader public health and environmental
492 agendas, positioning it as a viable component of social prescribing. This approach is
493 already being implemented in Surrey, UK, where Guildford Borough Council, in
494 partnership with Voluntary Action Surrey, is piloting forest bathing as a social
495 prescription for 200 NHS patients under the UK Government's Green Social Prescribing
496 programme (GOV.UK, 2021). Similarly, in Spain, the Regional Government of Castilla
497 y León has launched the *Forests for Health* programme, offering guided activities in
498 protected natural areas to promote health and well-being (Junta de Castilla y León, 2023).
499 These initiatives illustrate the growing potential of nature-based interventions to be
500 embedded within mainstream health and forest policy frameworks.

501 **Management recommendations** should first prioritise investment in guided forest
502 bathing programmes, as consumers demonstrate a clear WTP for structured experiences
503 led by trained facilitators. This suggests the potential for job creation and capacity
504 building through certification and training schemes for forest therapy guides. Second,
505 offerings should accommodate individual participation options, or at least maintain low
506 group sizes, to preserve the tranquillity and personalised experience that users value most.
507 Third, site selection should carefully consider ecological, aesthetic, and accessibility
508 attributes, as locations such as Orihuela del Tremedal command a price premium,
509 reflecting higher perceived value. It is particularly important to ensure the presence of a
510 walkable and diverse network of forest trails, complemented by seating areas within
511 stands or benches along the paths. Given the high expectations regarding visitor safety, a
512 comprehensive emergency response plan should be developed in collaboration between
513 forest bathing operators and local emergency services. Lastly, incorporating non-market

514 valuation into forest planning processes can help justify the allocation of resources toward
515 recreation-based services and strengthen the case for multifunctional forest management
516 strategies that balance timber production with cultural ecosystem services such as nature-
517 based health and wellbeing interventions.

518 This study has several limitations. First, given the lack of real service on the market
519 in the region of Aragón, we used hypothetical purchases, which may be subject to
520 hypothetical bias (Murphy et al., 2005) and social desirability bias (Fisher, 1993). We
521 may have also overlooked other essential factors in consumer preferences, such as tree
522 species composition, travel distance, forest management, and other recreation activities,
523 which can affect perceptions of consumers (Paletto et al., 2024, 2023). Hence, future
524 research can explore how preferences and WTP are affected during a forest bathing
525 experience and include additional forest characteristics that are important to consumer.

526 **5. Conclusions**

527 This study assessed consumer preferences for forest bathing to support alternative forest-
528 based recreational services in rural areas of Spain, specifically Orihuela del Tremedal and
529 Pinares de Rodeno. The results demonstrate that consumers differentiate between forest
530 bathing packages based on both the mode of delivery and the location, and that these
531 differences hold significant economic value. These insights are crucial for developing and
532 pricing forest bathing offerings, underscoring the importance of integrating non-market
533 values into ecosystem service assessments and sustainable forest policy frameworks.
534 Although the findings do not exhaustively capture the broader socio-economic relevance
535 of forest bathing at the territorial level, they offer a valuable point of reference for
536 stakeholders and forest managers seeking to implement such initiatives in the region.
537 Encouraging forest bathing may also foster a deeper emotional connection with nature
538 and enhance appreciation for biodiverse forest environments, ultimately contributing to
539 their conservation through a mutually beneficial relationship between humans and the
540 natural world. The next step is to examine the supply side and the associated economic
541 impacts, including the creation of local employment opportunities. For example,
542 professional forest-bathing guides and accommodation providers for multi-day stays, and
543 to define an organisational model that is both economically and socially sustainable.

544

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848 **Appendices**

849 **Appendix 1**

850 Table A.1- Correlation and Cholesky Matrix for WTP space model

851

Correlation Matrix	<i>Guia</i>	<i>Grupo</i>	<i>Tremedal</i>	<i>Price</i>
<i>Guia</i>	1.00	0.05	-0.45	0.00
<i>Grupo</i>	0.05	1.00	0.39	0.00
<i>Tremedal</i>	-0.45	0.39	1.00	0.00
<i>Price</i>	0.00	0.00	0.00	0.00

Cholesky Matrix				
<i>Guia</i>	15.74***			
<i>Grupo</i>	1.05	20.13***		
<i>Tremedal</i>	-1.75**	1.61**	3.07***	
<i>Price</i>	-	-	-	-

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1 **Assessing consumer preferences for forest bathing: A new challenge to promote**
2 **forest recreation services in a rural region in Spain.**

3

4 **Abstract**

5 This study evaluates consumer preferences for forest bathing and seeks to promote
6 alternative forest-based recreation services in rural areas (Orihuela del Tremedal, Pinares
7 de Rodeno), both located in Aragón (northeastern Spain). Respondents were presented
8 with a range of hypothetical forest bathing scenarios that varied by price, the presence or
9 absence of a guide, and the option to participate individually or in a group of 5-10 people.
10 An opt-out alternative was also included to capture preferences for none of the presented
11 options. Using a random parameter logit model, specified in willingness to pay (WTP)
12 space, the results indicate a significant higher WTP for forest bathing in Orihuela del
13 Tremedal over Pinares de Rodeno. Participants also expressed a greater WTP towards
14 guided sessions and engaging in the activity alone rather than in groups. These findings
15 provide an accurate economic valuation of forest bathing as an ecosystem service,
16 offering valuable insights for policymakers and local authorities. The results can support
17 informed decision-making regarding the sustainable management and promotion of
18 natural resources in rural areas, while simultaneously enhancing local economic
19 development.

20 **Keywords:** Choice experiment; consumer preferences; ecosystem services; rural
21 development; shinrin-yoku; willingness to pay space.

22

23 **1. Introduction**

24 Forests provide a wide array of ecosystem services that are fundamental to human
25 existence and well-being. These include provisioning, regulating and cultural services,
26 which range from direct tangible uses such as timber production, to indirect tangible
27 services like erosion control, and intangible benefits such as cultural and spiritual
28 enrichment (Taye et al., 2021). While many of these services are rivalrous and can be
29 traded in markets as private goods with observable prices, some others are non-excludable
30 and provided ‘free of charge’ as common public goods. Although offering forest
31 ecosystem services at no cost may appear reasonable from a societal perspective,
32 continued free provision can lead to suboptimal forest management outcomes (Froger et
33 al., 2015). Assigning economic value to environmental goods and services is a way of
34 demonstrating the relative importance of ecosystem services for human well-being and
35 environmental sustainability (Schild et al., 2018). An accurate economic evaluation of
36 ecosystem services not only supports informed policy decisions regarding the socially
37 optimal use and management of natural resources but also enables public authorities to
38 promote long-term, sustainable economic benefits.

39 As urban areas expand, rural forests are assuming an increasingly important role in
40 enhancing the quality of life for citizens. They offer a range of ecosystem services
41 including environmental regulation (Gómez-Baggethun and Barton, 2013; Nesbitt et al.,
42 2017); contributions to physical, mental, and social health (Mitchell and Popham, 2008)
43 and economic opportunities (Wolf, 2009). Economic opportunities in the context of forest
44 bathing and other nature-based recreation activities refers to the potential for these
45 practices to generate financial value and support livelihoods, businesses, and local
46 economies, while also contributing to broader sustainability goals. To fully harness these
47 benefits, it is essential that planners, managers, and policymakers accurately assess the
48 costs and benefits of forests during land-use planning and construction processes.
49 Particular attention should be given to enhancing circular economy principles, ensuring
50 sustainability, and avoiding the pitfalls of overtourism (Livesley et al., 2016).

51 According to the Spanish Institute of Statistics (INE), tourism is a key pillar of the
52 Spanish economy, which in 2023 contributed €184.002 million, equivalent to 12.3% of
53 GDP, and generated over 5.2 million jobs, representing 12% of the total employment
54 (INE, 2024). Despite these economic gains, tourism has also produced significant
55 environmental costs, particularly in the degradation of forest-based ecosystem services

56 that are often undervalued due to their intangible and non-market nature (Pueyo-Ros,
57 2018). In response, the new strategy of the Ministry of Industry, Trade and Tourism
58 (MIIT) has shifted towards a more sustainable tourism, with a focus on socio-economic
59 development, that preserves the natural and cultural values of rural areas, and adapts the
60 ongoing environmental changes (MITT - Ministry of Industry, Trade and Tourism, 2019).
61 These strategies are consistent with the national plans adopted by other governments,
62 which have introduced a range of policies and programmes aimed at mitigating the effects
63 of forest destruction, from afforestation initiatives, such as tree-planting projects, to
64 innovative forest management practices (Barry et al., 2014; Oldfield et al., 2013).

65 At the same time, these public policy shifts reflect a broader change in tourist
66 preferences. Increasingly, tourists are seeking environmentally responsible experiences,
67 favouring tranquil rural destinations over the congestion of urban life. Consequently,
68 ecotourism, which emphasises the sustainable use of the natural and cultural environment,
69 has gained traction (Akten and Tanribir, 2014; Ceylan and Tülbentçi, 2020; Duletić et al.,
70 2024). Nature-based ecotourism is currently one of the fastest-growing sectors in global
71 tourism, with sustained growth in the provision of ecosystem services projected in the
72 coming years (Duletić et al., 2024; Matilainen and Lähdesmäki, 2014). Within the context
73 of rural forests, the term ‘ecosystem services’ refers to the benefits provided to humans
74 through functional processes and interactions with the surrounding environment and local
75 ecology (Livesley et al., 2016). Rural forest ecosystem services are highly interrelated.
76 For example, access to rural green spaces can offer recreation opportunities, subsequently
77 reducing stress levels and providing physical health benefits (Meyer et al., 2019). Despite
78 this interrelation, ecosystem services are commonly categorised into four broad
79 categories: supporting, provisioning, regulating, and cultural, to facilitate discussion and
80 analysis (Alcamo et al., 2003).

81 Our work primarily focuses on cultural ecosystem services, a category closely linked
82 to the well-being of humans in green rural and urban environments (Jansson, 2013; Meyer
83 et al., 2019; Wolf et al., 2015). However, cultural ecosystem services remain poorly
84 defined, particularly in the field of rural and urban forestry (Satz et al., 2013). For this
85 study, we expand upon the definition of cultural ecosystem services as presented by the
86 Millennium Ecosystem Assessment. This includes ‘the nonmaterial benefits people
87 obtain from ecosystems through spiritual enrichment, cognitive development, reflection,

88 recreation, and aesthetic experiences' (Alcamo et al., 2003), as well as the economic
89 benefits derived from the non-consumptive use of ecosystems, such as forest bathing.

90 One of the key assets in developing rural nature-based ecotourism is the presence of
91 forests (Bjärstig and Sténs, 2018). Spain (19 million hectares) is the third-largest country
92 in the EU in terms of forest area, after Sweden (28 million hectares) and Finland (22
93 million hectares) (EUROSTAT, 2023). Forest ecosystems cover more than half of the
94 national territory, with 28 million hectares (55.3%) of which two-thirds (18.5 million
95 hectares) are wooded, while the remainder are non-wooded (Official Association of
96 Spanish Forest Engineers (COIM), 2023). In this context, new forest-related ecotourism
97 products, such as mycotourism (Büntgen et al., 2017; de Frutos et al., 2019), have been
98 successfully introduced. However, other products remain underdeveloped. One example
99 is the *Shinrin-yoku*, or forest bathing. Forest bathing involves walking at a gentle, non-
100 strenuous pace through a forest, interspersed with pauses for breathing exercises,
101 meditation, and mindful observation of the natural surroundings (Siah et al., 2023). More
102 specifically, it is an experience rooted in mindful awareness, during which all five senses
103 are engaged through interaction with various forest elements, such as leaves, branches,
104 deadwood, flowers, and natural scents, as well as purpose-built features designed to
105 enhance the activity, including barefoot paths and tree-hugging structures (Antonelli et
106 al., 2022). Forest bathing emerged in the 1980s as a component of preventive healthcare
107 in Japan (Tsunetsugu et al., 2010), gaining popularity due to its stress-reducing and
108 relaxation-inducing properties. Since the 2000s, medicine and nursing disciplines have
109 increasingly demanded scientific validation of such practices. Subsequent studies have
110 investigated the physiological and psychological health benefits of forest bathing
111 (Tsunetsugu et al., 2010; Wen et al., 2019), including its effect on blood pressure
112 regulation (Ideno et al., 2017), cardiovascular function (Kobayashi et al., 2018),
113 neuroendocrine activity, emotional well-being, and the alleviation of anxiety and
114 depression (Wen et al., 2019). Currently, a number of forest bathing and therapy
115 associations have been established and officially recognised across various countries,
116 including Canada, Germany, Italy, Lithuania, and the United States, with the objective of
117 promoting the practice among the wider population (Farkic et al., 2021). Although forest
118 bathing is well established in Japan and some other Asian countries (e.g., South Korea,
119 China and Taiwan), it remains relatively new in Spain and has yet to be assessed in terms
120 of consumer preferences and willingness to pay (WTP). Understanding these dimensions

121 is important if the practice is to be promoted as a viable ecotourism offering for both
122 domestic and international tourists, particularly those from Western cultures.

123 The main objective of this research is to examine consumer preferences and WTP for
124 forest bathing in two rural Spanish locations: the pine forest of Pinares de Rodeno and
125 the pine forest of Orihuela del Tremedal. Preferences are assessed using a discrete choice
126 experiment (DCE) alongside a questionnaire exploring participants' habits and health
127 status.

128 While the existing literature has largely focused on scientifically validating the health
129 benefits of forest bathing, primarily highlighting its positive physical and psychological
130 effects on human health (De Meo et al., 2023, 2022; Derks et al., 2020; Kil et al., 2021;
131 Kotte et al., 2019; Roviello et al., 2022; Ugolini et al., 2021; Wen et al., 2019; Yau and
132 Loke, 2020), a complementary body of research has sought to identify the specific
133 environmental characteristics of forest settings that maximise these health outcomes
134 (Doimo et al., 2020; Riviaccio et al., 2024; Saito et al., 2019; Takayama et al., 2017).
135 Despite this growing scientific interest, there remains a significant gap in the literature
136 regarding the economic valuation of forest bathing from a consumer behaviour
137 perspective. To our knowledge, only three studies have empirically examined consumer
138 preferences and WTP for forest bathing as an ecosystem service, and none have been
139 conducted in Spain. Specifically, Uyan (2020) applied a contingent valuation method to
140 assess consumers' WTP for a forest bathing entrance fee in the Philippines. Visintin et al.
141 (2024) used contingent valuation methods and estimated WTPs to evaluate the demand
142 for forest bathing in northern Italy regions. Finally, Paletto et al. (2024) used the zonal
143 travel cost method through interviews to explore preferences and economic values
144 associated with forest bathing in Northern Italy. Although these studies contribute
145 valuable insights, our approach differs methodologically. Contingent valuation methods
146 typically elicit WTP for a single, hypothetical scenario using direct questioning, which
147 can be prone to hypothetical bias and often lack realism (Murphy and Stevens, 2004), and
148 interviews that principally rely on self-reported data are vulnerable to social desirability
149 bias, potentially compromising data validity (King and Bruner, 2000). In contrast, DCEs
150 present respondents with a series of alternatives featuring varying attributes, enabling the
151 estimation of marginal values. This approach reflects more accurately real-world
152 decision-making processes and yields more robust, policy-relevant insights (Lusk and
153 Schroeder, 2004). This is also reflected in the growing popularity within the last ten years

154 of using DCEs to evaluate forest recreation activities (Elsasser et al., 2016; Giergiczny et
155 al., 2021, 2015; Pellegrini et al., 2024; Sagebiel et al., 2017; Tu and and Abildtrup, 2016;
156 Yao et al., 2014), among others. To mitigate hypothetical bias, which is common in stated
157 preference methods, this study uses a cheap-talk script (Cummings and Taylor, 1999).

158 Findings are expected to offer valuable insights to public authorities, particularly
159 local governments in the study areas. These insights can inform the valuation of rural
160 forest services, prioritise forest-related investments, and support the design of sustainable
161 ecotourism strategies centred on forest bathing and related ecosystem services.

162 The remainder of the paper is structured as follows: Section 2 outlines the materials
163 and methods employed in the study. Section 3 presents the empirical results, while
164 Section 4 discusses the key findings in the context of existing literature, explores their
165 policy and management implications, and proposes directions for future research. Finally,
166 Section 5 provides the concluding remarks.

167 **2. Materials and Methods**

168 *2.1. Survey structure*

169 A 10-minute survey was conducted alongside a DCE to achieve the objective of this
170 research. Upon providing informed consent, respondents were asked to complete a series
171 of attitudinal questions regarding connection with nature such as regular visits to natural
172 spaces (walking, hiking, forest bathing, birdwatching, wild swimming), personal habits
173 such as everyday pro-environmental practices (sustainable mobility of cycling or waling
174 instead of driving etc.), and their health status such as sport activities, and whether they
175 suffer from any medically subscribed condition. The next section of the questionnaire
176 presented respondents with the DCE. Before beginning with the DCE, participants were
177 presented with some basic information on the two forest cites. Since they were not
178 experts, details on the tree species were not provided. Consumers where first provided
179 with easy-to-understand information highlighting the reasons of having to face a
180 monetary entrance to visit the forest for a forest bathing activity¹. Participants received a
181 brief overview of the key features of the two forest sites. Because both sites are in Aragón,
182 it was assumed that they would already possess some awareness of the principal

¹ “To get the most benefit from forest bathing, the forest needs to be well maintained. This includes caring for the trees and undergrowth, keeping the paths clear and safe, and providing any necessary facilities. If you are asked to pay a small entry fee to visit a forest prepared for forest bathing, the money will help cover the cost of hiring a guide and the work needed to maintain the forest, trails, and facilities.”

183 differences between them. The information provided to respondents for each forest
184 included: name, location, altitude, and the general climate of the main tree species (see
185 this information below in each forest's description). As forest bathing activities were
186 unavailable, respondents were asked to imagine a hypothetical recreational destination
187 choice scenario. They were instructed to assume they would spend a few days in the Sierra
188 de Albarracín region to experience forest bathing. They were asked to choose between
189 two different forest sites or to opt for none of the available options. The final section of
190 the questionnaire collected information on participants' sociodemographic
191 characteristics. The questionnaire results are not reported in this paper, as they fall outside
192 the scope of the present study.

193 *2.2. Choice experiment design*

194 The DCE was selected for its ability to evaluate multiple product/service attributes
195 simultaneously, based on random utility theory (McFadden, 1973), and to approximate
196 real-world consumer purchasing behaviour (Adamowicz et al., 1998). Within the choice
197 modelling framework, respondents are asked to make repeated selections among
198 alternative products, each defined by a set of attributes with varying levels. This approach
199 closely mirrors the consumer decision-making process, and its familiarity with
200 participants is a key advantage over other commonly used valuation methods such as
201 experimental auctions (Lusk and Schroeder, 2004).

202 The first step in implementing a DCE is selecting the reference product. In this study,
203 the reference product is the ecosystem service of forest bathing. The second step involves
204 identifying the reference product's relevant attributes and corresponding levels (Table 1).
205 Price is a key attribute, as it enables the estimation of marginal WTP. Four price levels
206 (€5, €10, €15, and €20) with an average of €12.5, a minimum of €5, and a maximum of
207 €20 were selected based on insights gathered from two focus group sessions conducted
208 with consumers and subject-matter experts. Each session lasted approximately two hours
209 and was held within the study's designated rural forest sites, both situated in the Sierra de
210 Albarracín region. The second attribute is the forest bathing area. We selected these two
211 pine forests due to their existing use as natural recreational areas. Both locations feature
212 established walking trails, designated recreational facilities, and are situated in close
213 proximity to small villages, making them easily accessible for local residents and visitors.

214 Table 1. Forest bathing attributes and levels.

No.	Attributes	Levels
1	Price (€/package)	5€/package, 10€/package, 15€/package and 20€/package
2	Forest bathing area	Rural forest of Pinares de Rodeno Rural forest of Orihuela del Tremedal
3	Guide	Service experienced with a guide (Guide) Service experienced without a guide
4	Group	Service experienced as a group of 5 to 10 people (Group) Service experienced alone

215 Source: Own elaboration.

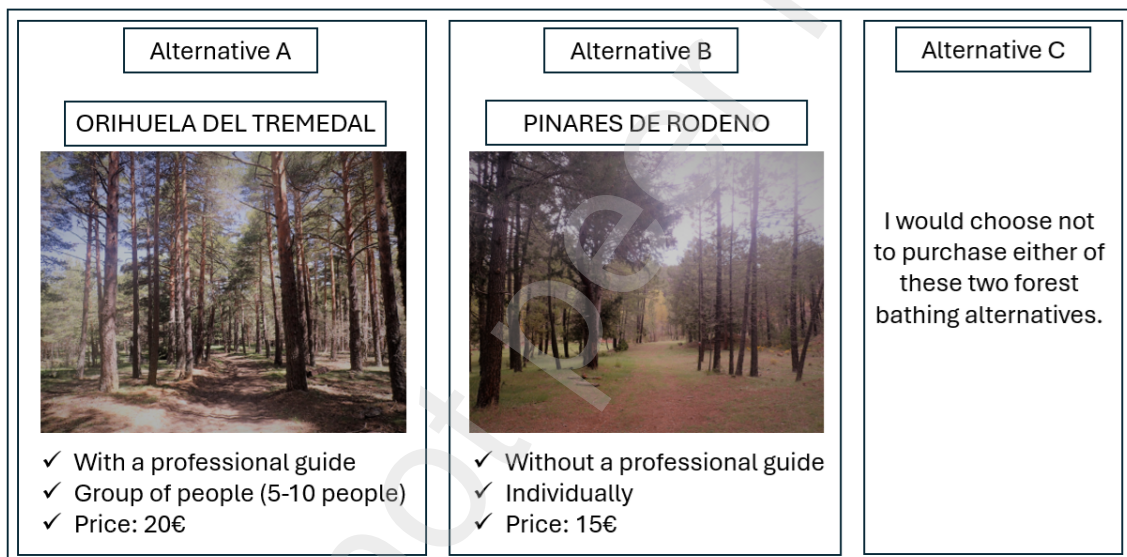
216 The first forest, Pinares de Rodeno, is a healthy stand dominated by the
 217 Mediterranean species Maritime pine (*Pinus pinaster* Ait.) located within a designated
 218 protected landscape in eastern Spain (40°19'59.00" N, 1°21'09.49" W, 1206 m a.s.l.,
 219 Sierra de Albarracín, Teruel). It comprises naturally regenerating pine woodland with a
 220 range of age classes from about 20 to 60 years. The site also contains scattered individuals
 221 of oak (*Quercus pyrenaica* Willd) and Sun rose (*Cistus laurifolius* L.) The pines in this
 222 forest have a mean height and an average diameter at breast height (DBH, measured at
 223 1.30 m) of 30 cm. This forest is primarily used for recreational activities and features a
 224 tourist information center, market walking trails, and outdoor fitness equipment (Sancho-
 225 Knapik et al., 2022).

226 The second forest, Orihuela del Tremedal, is a vigorous stand dominated by the
 227 Temperate European species Scots pine (*Pinus sylvestris* L.), notable for its reddish bark.
 228 It is located approximately 33 km northwest of the first forest (40°31'59.46" N,
 229 1°39'09.85" W, 1600 m a.s.l., Sierra de Albarracín, Teruel), within a special protection
 230 area for birds. This forest also comprises naturally regenerating pine woodlands but is
 231 characterised by older, taller, and thicker trees than those in Pinares de Rodeno.
 232 Recreational infrastructure includes a residential leisure complex, picnic areas, and the
 233 Virgin of Tremedal sanctuary. In adjacent areas, there is also selective timber harvesting
 234 for lumber production.

235 The third attribute (GUIDE) denotes the presence or absence of a guide who would
 236 lead participants through the forest bathing experience. The final attribute (GROUP)
 237 specifies whether the session will be conducted individually or in a group of 5 to 10
 238 participants.

239 Respondents were presented with two alternatives in each choice task, each
 240 representing a different forest bathing package comprising different attribute
 241 combinations and associated price levels. Additionally, a third alternative (NOBUY) was
 242 included, allowing participants to opt out if they preferred neither option (see Figure 1 for
 243 an example of a choice task)². The structure of the choice task followed the methodology
 244 outlined by Street and Burgess (2007). To manage the number of choice tasks effectively
 245 while ensuring an optimal experimental design, the study employed an orthogonal main
 246 effects plan to develop the profiles (Street and Burgess, 2007). The orthogonal main effect
 247 plan was calculated using SPSS, which generated 12 distinct profiles. The resulting
 248 design achieved a D-efficiency of 91.2% relative to the theoretical optimal design.

249 Figure 1. Example of a choice task of forest bathing.



250

251 Source: Own elaboration. Note: Translated from the original Spanish version.

252

253 2.3. Econometric specification: The willingness to pay space model.

254 In the DCE literature, the standard approach for estimating WTP is to do so in preference
 255 space (PS). In this framework, marginal utility coefficients are first estimated, and WTP
 256 values are subsequently derived by calculating the ratio of these coefficients. An
 257 alternative approach is to estimate directly in WTP space, which addresses several
 258 limitations associated with the PS method³. WTP space reformulates the model such that

² About 17% of the participants chose the no-buy alternative.

³ While in PS the distribution of WTPs is a ratio of two random variables, in WTP space the distribution is specified directly (e.g., normal, log-normal), rather than assuming the ratio, giving more control over the behaviour and interpretability of the WTP distribution. In PS, the correlation between price attribute

259 the estimated coefficients represent WTP valued directly. This requires that appropriate
260 distributions for the WTP estimates are specified from the outset.

261 The econometric foundation of DCEs is the Random Utility Model (RUM). RUM
262 assumes that individuals choose the alternative that provides the highest level of utility
263 among a set of alternatives. Under this framework, the utility, U_{njt} that individual n derives
264 from alternative j in choice situation t is composed of two components: a systematic
265 component, $V(X_{njt}, \beta_n)$, which is a function of the attributes of alternative j ; and a random
266 component reflecting unobserved preference heterogeneity. This heterogeneity is
267 modelled as $\beta_n = \beta + \Delta_{zn} + \Gamma_{vn}$, where z_n is a vector of M observable characteristics of
268 individual n influencing the mean of the taste parameters, and v_n is a vector of K
269 unobserved random variables with zero mean, known variances (typically unit), and zero
270 covariances. The error term ε_{njt} , captures unmeasured variation in preferences. That is,

$$271 \quad U_{njt} = V_{njt}(X_{njt}, \beta_n) + \varepsilon_{njt} \quad (1)$$

272 The multinomial choice model outlined thus far incorporates both observed and
273 unobserved heterogeneity in individual-level preference parameter n . Observed
274 heterogeneity is captured by the term Δ_{zn} while unobserved heterogeneity is represented
275 by Γ_{vn} . To estimate equation (1), it is necessary to specify a distribution for the error term.
276 Assuming that the error components are independently and identically distributed across
277 individuals, alternatives and time. Therefore, the utility function can be expressed as:

$$278 \quad U_{njt} = \text{NO-BUY} + \text{PRICE}_{njt} + \text{GUIDE}_{njt} + \text{GROUP}_{njt} + \text{TREMEDAL}_{njt} + \varepsilon_{njt} \quad (2)$$

279 The alternative-specific constant (NO-BUY) represents a dummy variable equal to 1
280 when the NO-BUY alternative is chosen and 0 otherwise. PRICE_{njt} is a continuous
281 variable corresponding to the four price levels specified in Table 1. The remaining
282 attributes (GUIDE, GROUP, and TREMEDAL) enter the model as dummy variables (1
283 = present, 0 = absent). The ε_{njt} error term follows a Type I Extreme Value distribution.

284 To distinguish specific non-random parameters, rows of zeros are specified in Γ . A
285 pure random parameters MNL model arises when $\Delta = 0$ and Γ is diagonal (in the Cholesky

coefficients may be correlated, resulting in biased or imprecise WTP estimates. These correlations are inherently handled in WTP space since WTP is estimated directly, and the estimation is typically more efficient and stable. If the price coefficient is small in magnitude or close to zero, the WTP values are unrealistically high (Train and Weeks, 2005).

286 decomposition). The basic MNL model results when $\Delta = 0$ and $\Gamma = 0$. The model can also
 287 accommodate scale heterogeneity in both observed and unobserved components. The
 288 specification is thus extended as:

$$289 \quad \beta_n = \sigma_n[\beta + \Delta_{zn}] + [\gamma + \sigma_n(1 - \gamma)] \Gamma_{vn}, \quad (3)$$

290 where $\sigma_n = \exp[\bar{\sigma} + \delta' \mathbf{h}_n + \tau w_n]$ is the individual-specific scale parameter. Here, \mathbf{h}_n is a
 291 vector of L observed characteristics of individual n , which may overlap with \mathbf{z}_n ; δ captures
 292 the impact of observed heterogeneity on scale; w_n is a standard normally distributed
 293 unobserved term; $\bar{\sigma}$ is the mean of the scale distribution; τ is the coefficient capturing
 294 unobserved scale heterogeneity; and γ is a weighting parameter that indicates how
 295 variance in residual preference heterogeneity varies with scale, with $0 \leq \gamma \leq 1$. If $\gamma = 0$,
 296 then a scale mixed logit model emerges, given in the specific form:

$$297 \quad \beta_n = \sigma_n[\beta + \Delta_{zn} + \Gamma_{vn}] \quad (4)$$

298 Further simplification, where $\Gamma = 0$ and $\Delta = 0$, yields a scaled multinomial logit
 299 model, $\beta_n = \sigma_n \beta$. This generalised mixed model structure also enables straightforward
 300 reparameterisation for estimation in WTP space (Fosgerau and Bierlaire, 2009; Hensher
 301 and Greene, 2011; Scarpa et al., 2010, 2008; Train and Weeks, 2005).

302 The choice of parameter distributions is critical when estimating WTP. Certain
 303 specifications may produce heavily skewed WTP distributions with unrealistically large
 304 values. A common strategy to mitigate this involves fixing the price coefficient. However,
 305 assuming homogeneity in price sensitivity across individuals may be unrealistic (Meijer
 306 and Rouwendal, 2006). Train and Weeks (2005) offer an alternative by estimating the
 307 RPL directly in WTP space.

308 Assuming utility is separable in price p_{njt} and non-price attributes \mathbf{x}_{njt} (GUIDE, GROUP,
 309 TREMEDAL), the utility function can be expressed as:

$$310 \quad U_{njt} = a_j + \lambda_n p_{njt} + \beta_n' \mathbf{x}_{njt} + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} \quad (5)$$

311 This form represents a generalized mixed logit model in PS, assuming appropriate
 312 distributions for λ_n and β_n (Hensher et al., 2015; Thiene and Scarpa, 2009; Train and
 313 Weeks, 2005). To reformulate this model in WTP space the utility function becomes:

$$314 \quad U_{njt} = a_j + \lambda_n [p_{njt} + (1/\lambda_n) \beta_n' \mathbf{x}_{njt}] + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} = a_j + \lambda_n [p_{njt} + \theta_n' \mathbf{x}_{njt}] + \delta' \mathbf{z}_{njt} + \varepsilon_{njt} \quad (6)$$

315 In this formula, λ_n serves as the normalizing constant. The parameters in PS are
 316 defined as $\lambda_n = (\lambda_p + \sigma_p + w_n)$ and β_n as $\beta_{nk} = (\beta_k + \sigma_k v_{nk})$, allowing for full correlation
 317 among the $K+1$ random parameters. To ensure consistent signs for WTP estimates, we
 318 constrain $\lambda_n = \lambda_p \exp(\lambda_o + \tau w_n)$ (Thiene and Scarpa, 2009). Although the sign of the
 319 expression is not imposed a priori, estimates typically yield a negative λ , as expected.
 320 Following Hensher et al. (2015), Eq. (6) corresponds to a GMXL model in WTP space,
 321 obtained by setting $\gamma = 0$, the row in Γ corresponding to λ_p to zero, and normalizing β such
 322 that the price coefficient equals 1. The final WTP space specification is:

$$323 \quad U_{njt} = \text{NOBUY} + \theta_1 \text{Price}_{njt} + \theta_2 \text{GUIDE}_{njt} + \theta_3 \text{GROUP}_{njt} + \theta_4 \text{TREMEDAL}_{njt} + \varepsilon_{njt} \quad (7)$$

324 Based on Eq. 7, we estimated several models and selected the best fit based on several
 325 criteria, including Log-Likelihood (LL) values, Akaike Information Criterion (AIC), χ^2
 326 and McFadden's R^2 values. The baseline model was the multinomial logit (MNL) model.
 327 However, to account for heterogeneous preferences we estimated a Random Parameter
 328 Logit (RPL) model in PS. Finally, we estimated an equivalent RPL model but in WTP
 329 space with correlated attributes. The model fit criteria results indicate that the WTP space
 330 model had a superior fit compared to the rest. More precisely, the MNL performed worst
 331 with the RPL performing slightly better. Both models had higher LL, and lower χ^2 and
 332 McFadden's R^2 values than the WTP space model. In addition, the parameter τ in the
 333 WTP space model is statistically significant, suggesting that explicitly modelling scale
 334 heterogeneity leads to a better specification (Train and Weeks, 2005). Finally, the
 335 Cholesky matrix in the WTP space model indicated strong evidence of correlated random
 336 parameters, reinforcing the inappropriateness of assuming independence (see the
 337 Cholesky matrices in Appendix, Tables A.1).

338 Based on these criteria we select the WTP space⁴ model with correlated attributes to
 339 report the results. The sign of the WTP space model is not an issue anymore and the
 340 attributes are directly interpreted as monetary values (Hensher et al., 2015). However, it
 341 remains essential to differentiate between positive and negative WTP values within the
 342 WTP space framework to provide more effective price and policy implementations. To
 343 this end, marginal WTP estimates are calculated using the cost parameter, as follows:

⁴ Following Hensher et al. (2015), the parameter on cost in the WTP space is implicitly $-0.35 \cdot \exp(-1.52^2 + 1.52 \cdot w(i))$.

$$344 \quad WTP_{\text{Attribute}} = - \frac{\frac{\partial U_{njt}}{\partial \text{Attribute}}}{\frac{\partial U_{njt}}{\partial \text{Price}}} = - \frac{\beta_{\text{Attribute}}}{\beta_{\text{Price}}} \quad (8)$$

345 Following Hensher et al. (2015), the model follows an unconstrained triangular
 346 distribution with full correlation structure. All estimates were conducted using the Nlogit
 347 6.0 Econometric Software, Inc. (<http://limdep.com/products/nlogit/>).

348 3. Results

349 3.1. Sample characteristics

350 The research was conducted in Aragón (Spain), which is the region that locates both forest
 351 bathing areas, and which consumers are likely aware with the differences between the
 352 two selected forest bathing sites. To elicit the preferences of citizens regarding forest
 353 bathing alternatives, we conducted an online survey in collaboration with a professional
 354 market research agency. Before launching the online survey, we carried out a pilot
 355 questionnaire with 20 individuals to ensure that the interviewees correctly understood all
 356 questions. We selected a sample of 397 individuals⁵, randomly stratified by gender and
 357 age. Summary statistics for the characteristics of the sample and the regions' population
 358 are presented in Table 2.

359 Table 2. Sample sociodemographic characteristics (%).

	Aragón	Sample
Gender^a		
Male	49.5	45.8
Female	50.5	54.2
Age (mean)^a		
From 18 to 34 years	21.0	26.5
From 35 to 55years	29.2	44.6
More than 55 years	36.9	29.0
Education level^b		
Primary studies	14.2	18.1
Secondary studies	53.3	43.3
University studies	32.5	38.5
Household income		
Below 1500€	N/A	20.5
Between 1500€ and 2500€	N/A	56.3
More than 2500€	N/A	23.2

360 Source: Own elaboration. Note: ^a Spanish Census of Population, 2024 www.ine.es (INE, 2024). ^b
 361 Organisation for Economic Cooperation (OECD, 2020).

⁵ This sample size for a confidence level of 95.5% ($k = 2$) when estimating proportions for the more conservative scenario ($p = q = 0.5$) results in a sampling error of $\pm 5\%$.

362 The sample closely resembles the regions' population regarding gender, age, and
 363 education level. The average age of the participants was 45 years, with approximately
 364 44% falling within the 35 to 55 age range. Females slightly outnumbered males,
 365 accounting for 54% of the participants. Approximately 38% of the participants have
 366 completed university studies, and 23% report a net monthly income exceeding €2500.

367 *3.2. Estimation results*

368 The WTP space model is summarised in Table 3. As expected, the alternative-specific
 369 constant associated with the no-buy option was negative and statistically significant,
 370 indicating that respondents derived lower utility from the opt-out alternative compared to
 371 any of the designed forest bathing packages.

372 Table 3. Summary of model results.

	WTP space model
<i>Mean Values</i>	<i>Coefficients</i>
<i>GUIDE</i>	-8.57 (0.56) ***
<i>GROUP</i>	4.24 (0.63) ***
<i>TREMEDAL</i>	-1.25 (0.46) ***
<i>PRICE</i>	Fixed parameter
<i>NO-BUY</i>	-2.61 (0.07) ***
<i>Standard deviations of parameter distribution</i>	
<i>GUIDE</i>	15.74 (0.91) ***
<i>GROUP</i>	20.15 (1.04) ***
<i>TREMEDAL</i>	3.88 (0.56) ***
<i>PRICE</i>	Fixed parameter
Beta_WTP	-0.35 (0.05) ***
S_WTP	Fixed parameter
τ	1.52 (0.09) ***
γ	Fixed parameter
N	4764
LL	-3626.11
χ^2	3215.36
AIC	7279.20
McFadden R ²	0.31

373 Source: Own elaboration. Notes: Robust standard errors per choice (individual and choice set) in
 374 parentheses. ***, ** and * are significant at 1, 5 and 10%, respectively.

375 The price coefficient (PRICE) is fixed, hence, to ascertain the appropriate sign for
376 each WTP estimate derived we use the parameter on cost and the procedure in (Eq. 8).
377 The WTP space estimates indicate that consumers are willing to pay a premium of €8.57
378 for a forest bathing experience that includes a guide. In contrast, they are only willing to
379 undertake forest bathing in a group of approximately 5 to 10 people, rather than
380 individually, if offered at a discount rate of €4.24 per session. The forest of Orihuela del
381 Tremedal is positively valued, commanding a price premium of €1.25 relative to the
382 Pinares de Rodeno area. Additionally, the statistically significant standard deviations for
383 all variables suggest substantial preference heterogeneity.

384 4. Discussion

385 This study provides valuable insights into consumer preferences and WTP for forest-
386 bathing experiences, offering a nuanced understanding of how specific attributes shape
387 perceived value. Although the literature on recreational forest use is extensive, few
388 investigations have focused specifically on forest bathing (Visintin et al., 2024), making
389 this work one of the earliest dedicated inquiries.

390 Overall, the results show that forest bathing holds an economic value, contributing
391 significantly to the recreation of forest sites, beyond the well-documented health benefits
392 established in the literature (De Meo et al., 2023, 2022; Derks et al., 2020; Kil et al., 2021;
393 Kotera et al., 2022; Kotte et al., 2019; Lim et al., 2020; McEwan et al., 2021; Roviello et
394 al., 2022; Ugolini et al., 2021; Wen et al., 2019; Yau and Loke, 2020). This economic
395 value represents a key parameter for policy development, highlighting the need to account
396 for the broader societal value of non-market ecosystem services, such as landscape
397 appreciation and recreational experiences (Pellegrini et al., 2024).

398 Specifically, consumers were willing to pay €8.57 for a guided forest-bathing
399 experience, indicating a strong preference for professionally facilitated sessions that may
400 enhance both the therapeutic and educational dimensions of the activity. This WTP aligns
401 with previous economic valuations of guided forest-bathing activities. For example,
402 Visintin et al. (2024) reported a WTP of €5.83 per guided hike in northern Italy, while
403 Uyan (2020) found a mean WTP of USD 15 (€13.87) and a median of USD 10 (€9.24) in
404 the Philippine, where guided forest bathing has been offered for several years. In the
405 Italian Alps, Paletto et al. (2024) estimated a consumer surplus of €35.80 per person per
406 visit. This higher WTP value reported by Paletto et al. likely reflects intrinsic differences

407 between sites, local spending power, regional GDP, and methodological approaches
408 (Chaudhry and Tewari, 2006). Overall, WTP estimates are typically lower than
409 consumer-surplus figures derived from the travel cost method, a discrepancy attributable
410 to both socio-economic factors and methodological distinctions among contingent
411 valuation, travel cost methods and DCEs (Mayor et al., 2007).

412 A stronger WTP for guided rather than unguided sessions also correspond with
413 behavioural research on forest bathing, which has largely emphasised its health benefits.
414 McEwan et al. (2021), reported that participants often found it difficult to engage in forest
415 bathing independently without a guide, whereas Lim et al. (2020) observed no significant
416 difference between guided and unguided experiences. Notably, most existing studies have
417 examined unguided forest bathing (McEwan et al., 2021), and only a limited body of
418 work has explored structured, guided sessions incorporating a variety of activities (Kotera
419 et al., 2022). Given the scarcity of WTP studies in forest bathing and predominance of
420 research focusing on health-related outcomes, future investigations should undertake
421 comparative evaluations of guided and unguided forest-bathing sessions, assessing both
422 health impacts and WTP.

423 The results further indicate that a group forest bathing experience involving 5 to 10
424 participants would require a discount of €4.24 to be considered acceptable, representing
425 a 34% reduction from the average session price of €12.5. This suggests a clear disutility
426 associated with less personalised formats, potentially driven by concerns over reduced
427 tranquillity, privacy, or the quality of the immersive experience. While individual
428 sessions are understandably more highly valued, they may pose economic challenges for
429 providers due to higher delivery costs. As such, this finding could inform a differentiation
430 strategy whereby stakeholders offer individual sessions at a premium and group
431 experiences at a more accessible price point. Currently, there is a lack of empirical
432 literature directly comparing individual and group-based forest bathing in terms of
433 consumer preferences and/or WTP. Future research should aim to fill this gap, evaluating
434 trade-offs between experience quality and economic feasibility. Lastly, the findings
435 reveal that the Orihuela del Tremedal forest was associated with a price premium of €1.25
436 compared to the Pinares de Rodeno site. This suggests the importance of environmental
437 and locational attributes in shaping consumers' WTP. Such preferences likely reflect
438 perceived differences in landscape quality, natural features, and/or accessibility. To better
439 inform regional planning and forest management strategies, future research should

440 explore consumer preferences and WTP across a broader range of Spanish forest settings
441 with varying ecological and geographical characteristics.

442 *4.1 Policy and Management Recommendations*

443 Based on these findings, several practical recommendations can be made for
444 policymakers and forest managers aiming to enhance both the economic and social value
445 of forest bathing services. The evidence confirms that forest bathing holds measurable
446 economic value while also contributing significantly to human health and well-being
447 through the recreational use of forest environments. As such, **policymakers** should adopt
448 a multi-actor, sustainable approach that integrates forest conservation with health-focused
449 recreational activities. While current EU, national, and regional policies centre on forest
450 protection and climate objectives, they have yet to incorporate the health-related benefits
451 of forest interaction fully.

452 At the EU level, the *EU Forest Strategy for 2030*, introduced under the European
453 Green Deal and the EU Biodiversity Strategy, focuses on the restoration, resilience, and
454 sustainable management of Europe's forests (European Commission (EC), 2021). It
455 promotes synergies between the tourism sector, forest owners, and conservation bodies,
456 advocating for developing ecotourism standards that enhance human health without
457 compromising ecological integrity, particularly in protected areas. The strategy also
458 underlines the importance of cross-sectoral collaboration and is scheduled for review
459 before 2025 to assess implementation progress and determine the need for further
460 measures.

461 At the national level, Spain's *Forest Strategy Horizon 2050* presents a long-term,
462 holistic vision for sustainable forest management, drawing on over a century of
463 silvicultural expertise (Ministerio para la Transición Ecológica y el Reto Demográfico
464 (MTERD), 2022). It positions forests as key actors in climate mitigation, biodiversity
465 conservation, and the circular bioeconomy, while prioritising innovation, digitalisation,
466 and socio-economic revitalisation of rural areas. Importantly, it promotes inclusive
467 governance by engaging local stakeholders in forest stewardship, especially concerning
468 public and communally owned forests (MTERD, 2022).

469 Regionally, the *Aragón Forest Plan (2022)* aligns closely with national and EU
470 objectives, emphasising ecosystem service provision, biodiversity, and climate resilience
471 (Government of Aragón Portal (GAP), 2022). It seeks to bolster rural economies,

472 encourage population retention, and foster public awareness of the role of sustainable
473 forest management in environmental and societal resilience. However, like the national
474 and EU-level strategies, it does not explicitly incorporate policies linking forest use to
475 public health outcomes.

476 Despite growing recognition of the health benefits of forest-based interventions,
477 there is currently no dedicated policy at the EU, Spanish national, or Aragonese regional
478 level addressing the direct contribution of forests to human health and well-being. The
479 World Health Organization (WHO) advocates forest bathing as a health-promoting
480 intervention and calls for access to high-quality, well-maintained woodlands to facilitate
481 safe and beneficial engagement with nature (WHO, 2017). Policymakers are therefore
482 encouraged to integrate forest bathing into broader public health and environmental
483 agendas, positioning it as a viable component of social prescribing. This approach is
484 already being implemented in Surrey, UK, where Guildford Borough Council, in
485 partnership with Voluntary Action Surrey, is piloting forest bathing as a social
486 prescription for 200 NHS patients under the UK Government's Green Social Prescribing
487 programme (GOV.UK, 2021). Similarly, in Spain, the Regional Government of Castilla
488 y León has launched the *Forests for Health* programme, offering guided activities in
489 protected natural areas to promote health and well-being (Junta de Castilla y León, 2023).
490 These initiatives illustrate the growing potential of nature-based interventions to be
491 embedded within mainstream health and forest policy frameworks.

492 **Management recommendations** should first prioritise investment in guided forest
493 bathing programmes, as consumers demonstrate a clear WTP for structured experiences
494 led by trained facilitators. This suggests the potential for job creation and capacity
495 building through certification and training schemes for forest therapy guides. Second,
496 offerings should accommodate individual participation options, or at least maintain low
497 group sizes, to preserve the tranquillity and personalised experience that users value most.
498 Third, site selection should carefully consider ecological, aesthetic, and accessibility
499 attributes, as locations such as Orihuela del Tremedal command a price premium,
500 reflecting higher perceived value. It is particularly important to ensure the presence of a
501 walkable and diverse network of forest trails, complemented by seating areas within
502 stands or benches along the paths. Given the high expectations regarding visitor safety, a
503 comprehensive emergency response plan should be developed in collaboration between
504 forest bathing operators and local emergency services. Lastly, incorporating non-market

505 valuation into forest planning processes can help justify the allocation of resources toward
506 recreation-based services and strengthen the case for multifunctional forest management
507 strategies that balance timber production with cultural ecosystem services such as nature-
508 based health and wellbeing interventions.

509 This study has several limitations. First, given the lack of real service on the market
510 in the region of Aragón, we used hypothetical purchases, which may be subject to
511 hypothetical bias (Murphy et al., 2005) and social desirability bias (Fisher, 1993). We
512 may have also overlooked other essential factors in consumer preferences, such as tree
513 species composition, travel distance, forest management, and other recreation activities,
514 which can affect perceptions of consumers (Paletto et al., 2024, 2023). Hence, future
515 research can explore how preferences and WTP are affected during a forest bathing
516 experience and include additional forest characteristics that are important to consumer.

517 **5. Conclusions**

518 This study assessed consumer preferences for forest bathing to support alternative forest-
519 based recreational services in rural areas of Spain, specifically Orihuela del Tremedal and
520 Pinares de Rodeno. The results demonstrate that consumers differentiate between forest
521 bathing packages based on both the mode of delivery and the location, and that these
522 differences hold significant economic value. These insights are crucial for developing and
523 pricing forest bathing offerings, underscoring the importance of integrating non-market
524 values into ecosystem service assessments and sustainable forest policy frameworks.
525 Although the findings do not exhaustively capture the broader socio-economic relevance
526 of forest bathing at the territorial level, they offer a valuable point of reference for
527 stakeholders and forest managers seeking to implement such initiatives in the region.
528 Encouraging forest bathing may also foster a deeper emotional connection with nature
529 and enhance appreciation for biodiverse forest environments, ultimately contributing to
530 their conservation through a mutually beneficial relationship between humans and the
531 natural world. The next step is to examine the supply side and the associated economic
532 impacts, including the creation of local employment opportunities. For example,
533 professional forest-bathing guides and accommodation providers for multi-day stays, and
534 to define an organisational model that is both economically and socially sustainable.

535

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839 **Appendices**

840 **Appendix 1**

841 Table A.1- Correlation and Cholesky Matrix for WTP space model
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Correlation Matrix	<i>Guia</i>	<i>Grupo</i>	<i>Tremedal</i>	<i>Price</i>
<i>Guia</i>	1.00	0.05	-0.45	0.00
<i>Grupo</i>	0.05	1.00	0.39	0.00
<i>Tremedal</i>	-0.45	0.39	1.00	0.00
<i>Price</i>	0.00	0.00	0.00	0.00
Cholesky Matrix				
<i>Guia</i>	15.74***			
<i>Grupo</i>	1.05	20.13***		
<i>Tremedal</i>	-1.75**	1.61**	3.07***	
<i>Price</i>	-	-	-	-

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Assessing consumer preferences for forest bathing: A new challenge to promote forest recreation services in a rural region in Spain.

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Abstract

This study evaluates consumer preferences for forest bathing and seeks to promote alternative forest-based recreation services in rural areas (Orihuela del Tremedal, Pinares de Rodeno), both located in rural Spain. Respondents were presented with a range of hypothetical forest bathing scenarios that varied by price, the presence or absence of a guide, and the option to participate individually or in a group of 5-10 people. An opt-out alternative was also included to capture preferences for none of the presented options. Using a random parameter logit model, specified in willingness to pay (WTP) space, the results indicate a significant higher WTP for forest bathing in Orihuela del Tremedal over Pinares de Rodeno. Participants also expressed a greater WTP towards guided sessions and engaging in the activity alone rather than in groups. These findings provide an accurate economic valuation of forest bathing as an ecosystem service, offering valuable insights for policymakers and local authorities. The results can support informed decision-making regarding the sustainable management and promotion of natural resources in rural areas, while simultaneously enhancing local economic development.

Keywords: Choice experiment; consumer preferences; ecosystem services; rural development; shinrin-yoku; willingness to pay space.

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Abbreviations: MITT, Ministry of Industry, Trade and Tourism; DCE, discrete choice experiment; WTP, willingness to pay; WTPS, willingness to pay space; RPL, random parameter logit; PS, Preference Space.

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