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RESEARCH ARTICLE

Public preference for the rewilding framework: A choice experiment in the Oder Delta

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Abstract

1. Rewilding is an emerging paradigm in restoration science and is increasingly gaining popularity as a cost-effective ecosystem restoration option. A rewilding framework was recently proposed that contains three integral components: restoring trophic complexity, allowing for stochastic disturbances and enhancing species' potential to disperse. However, as of yet, there has been limited quantitative analysis looking at public preference for rewilding and each of its elements.
2. We used a discrete choice experiment approach to determine public preference for rewilding in the Oder Delta. The unique geographical context of the Oder Delta, spreading evenly across two countries, allowed us to analyse differences between the German ($n = 1005$) and Polish ($n = 1066$) samples.
3. In both countries, we found that respondents were willing to pay for rewilding interventions when compared against a status quo option. Notably, preferences were strongest for restoring trophic complexity through promoting the comeback of large mammals.
4. In addition, we found respondents living locally to the study region had significantly different preferences than the nationwide samples, exhibiting negative willingness to pay for the restoration of natural flooding regimes and the presence of large predator species.

KEYWORDS
choice experiment, land use policy, rewilding, social-ecological systems

1 | INTRODUCTION

Effective restoration interventions in socio-ecological systems require a comprehensive understanding of the relationship between people and ecosystems. Given past failures to meet restoration goals (IPBES, 2019; Navarro et al., 2017), it is crucial to not only enhance our knowledge of alternative nature restoration approaches but also gain a deeper understanding of how people perceive and engage with nature restoration. The reasons for this are twofold. First, no single restoration strategy can be universally applicable; understanding how individuals value alternative nature restoration approaches can help inform the selection and implementation of suitable approaches. Second, the success of a conservation project is contingent on understanding the social context within which it operates (Knight et al., 2008).

Rewilding is an emerging paradigm in restoration science and offers an alternative strategy to other restoration approaches. It has been highlighted as a key mechanism to overcome the global biodiversity crisis and increase the resilience of the biosphere to man-made climate change (Svenning, 2020). Many restoration techniques require managing ecosystems on a trajectory towards a desired end goal state, followed by continued maintenance over time to conserve a single target species or habitat (Bullock et al., 2022; Corlett, 2016). By contrast, in rewilding, there is no pre-defined target for how the landscape and biodiversity should look (Pereira & Navarro, 2015). Rewilding pursues self-sustaining ecosystems, and the results of a rewilding project are often uncertain and dynamic, with wide ranging impacts across a landscape and has been highlighted as a potentially cost-effective restoration approaches due to reduced management costs over time (Schou et al., 2021).

Perino et al. (2019) outline a framework for rewilding that contains three key elements: restoring trophic complexity, allowing for natural stochastic disturbances to occur and restoring species dispersal processes. Trophic complexity focusses on active or passive species reintroductions to restore lost trophic processes, while stochastic disturbance allows natural disturbance regimes to occur without direct management by humans. Dispersal relates to the ability of species to move naturally across a site. This framework has been further developed to include indicators and actions aimed at supporting implementation (Quintero-Uribe et al., 2022; Torres et al., 2018) and can provide a basis for assessing public preferences for rewilding and guiding rewilding management interventions.

Engaging key stakeholders in the planning stage is key to restoration success (Fischer et al., 2021; Pereira et al., 2020) and can otherwise lead to conflicts that could alter the status quo between human–nature relationships (Killion et al., 2021). Given the potential for rewilding to disrupt established social-ecological systems (Butler et al., 2021), it is essential to study the extent of wider public support for rewilding to design and implement policies with maximum social acceptance. While rewilding has the potential to yield positive biodiversity impacts and attractive landscapes (Van Berkel & Verburg, 2014), it can also lead to undesired outcomes, such as natural disturbances or human–wildlife conflicts (Salvatori et al., 2021). In order to better understand the social dimensions of rewilding, there is a critical need to assesses public preferences for rewilding outcomes, particularly in socio-ecological systems in which human activities have historically formed an integral part of the landscape.

Stated preference studies have been widely used to understand attitudes towards conservation and restoration. The discrete choice experiment (DCE), in which respondents choose between alternatives to reveal the weights they put on different factors (Hanley et al., 1998), is one frequently used method. Discrete choice experiments have been used extensively to investigate public preferences for specific outcomes that can be achieved through active management of ecosystems, demonstrating that the public often exhibit willingness to pay (WTP) for the restoration of natural landscape elements (e.g. Hanley et al., 1998; Senzaki et al., 2017; Tan et al., 2018). Previous studies show polarized views towards wild nature in Europe (Giergiczny et al., 2022). Bauer et al. (2009) found that half of respondents in a Swiss study were in favour of the restoration of wilderness, while the other half were unsupportive, while in the Netherlands, De Groot and Van Den Born (2003) showed that over 80% of respondents favoured wild landscapes designed to exhibit the 'greatness and forces of nature'. Hanley et al. (2009) demonstrate that people are more likely to favour landscape change, if they know it has changed over time. While incorporating some of the concepts from the rewilding framework, these definitions do not adequately cover the breadth of the rewilding approach as defined in this study. To the best of our knowledge, this study presents the first empirical assessment of preferences for the constituent elements of the rewilding approach.

In this study, our aim is to bridge this knowledge gap regarding public preferences for rewilding interventions. Using the Oder Delta region, we focus on residents of Germany and Poland, and evaluate their preferences for various rewilding interventions encompassing the entire rewilding framework. Specifically, we employ a DCE to assess respondents' WTP for changes in land management. By designing attribute levels across a rewilding gradient, the results of this study can provide insights into the unique elements of the rewilding approach that respondents value. The findings from this study can lead to a more nuanced understanding of people's preferences for rewilding and the possibility to tailor management interventions towards specific, socially desirable restoration outcomes.

2 | METHODS

2.1 | Study area

The Oder Delta is situated on the Baltic coast of the Germany–Poland border (Figure 1). It spreads across both countries, covering an approximate 450,000 ha, of which approximately 200,000 ha makes up the German portion, and 250,000 ha the Polish. The site borders the Baltic Sea and contains the Szczecin Lagoon (70,000 ha). The natural qualities of the site make it an important tourist destination. Approximately 40% of the total terrestrial Oder Delta area is part of the European Natura2000 network and comprises diverse natural habitats such as riparian and swamp forests, deciduous and coniferous forests on mineral sites, peatlands, standing- and flowing waters, open and semi-open inland dunes and heathlands. The region is surrounded by heterogeneous landscapes of forests, rivers and wetlands, making it suitable for the natural comeback of wildlife.

Like many European landscapes (Kaplan et al., 2009), the Oder Delta has been shaped significantly by human activity over the past centuries. In particular, the creation of dams and dikes increased the amount of land available for agriculture and forestry, which are now major land uses in the region. Nowadays, the Oder Delta is popular with tourists, offering activities such as birdwatching, hiking, wildlife observation and swimming in the lakes and the Baltic Sea. The study area offers a unique opportunity to study WTP between two different countries. Respondents in Germany and Poland are valuing an identical area (the Oder Delta), but from alternative cultural

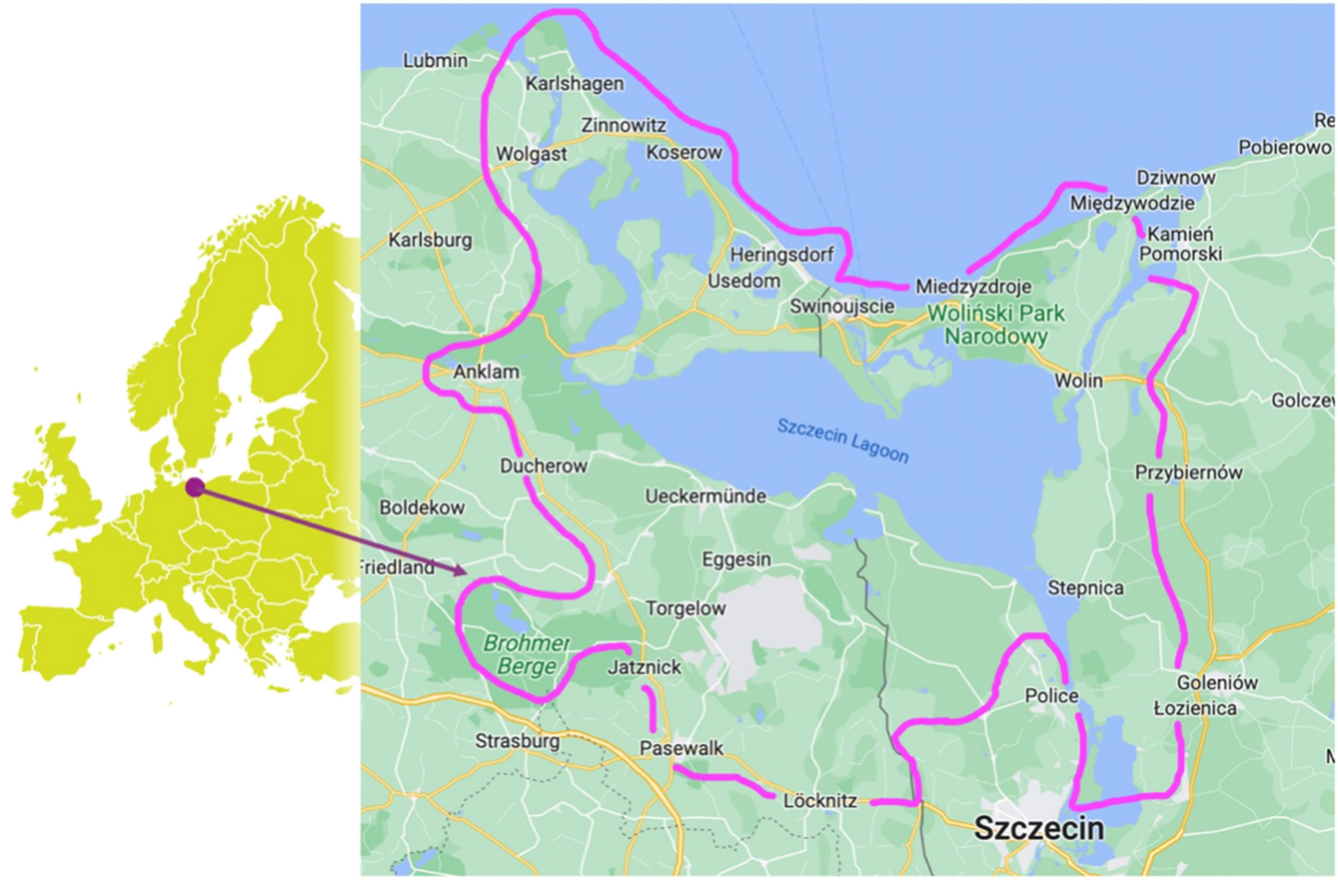


FIGURE 1 Geographical extent of the Oder Delta region defined in this study.

and political contexts. Designing an optimal rewilding management plan for the Oder Delta requires insights from both sides of the border.

2.2 | Identification of rewilding interventions

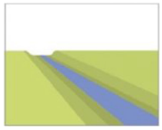
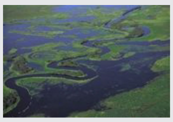
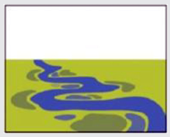
To evaluate public preference for rewilding outcomes, we selected rewilding interventions based on the elements of the rewilding framework, namely trophic complexity, stochastic disturbances and dispersal. We defined interventions as outcomes of changes in the management in the Oder Delta that would be observable in 2050, ranging from intensive production (the status quo in this study) to naturalness (fullest extent of rewilding). These hypothetical but plausible scenarios were based on the rewilding management plan for the Oder Delta and the expert opinions of researchers and site managers (Table 1) and were designed to be easily achievable through either changes in management practices at the site, either through assisted or artificial restoration measures. To improve respondent comprehension, we used language understandable to the general public to describe and explain rewilding levels without using the exact terminology from the rewilding framework. The icons depicting the attribute levels were designed to be understood by respondents with limited prior knowledge of the ecological concepts underpinning the framework.

Trophic complexity, the first element of the rewilding framework, is linked to Svenning et al.'s (2016) concept of trophic rewilding and aims to address the so-called 'Anthropocene defaunation' (Dirzo et al., 2014). It addresses the loss of predators and herbivores, which can make ecosystems more susceptible to collapse, as important ecological interactions and services are lost (Pringle et al., 2023; Ripple et al., 2015). Rewilding approaches can enhance trophic complexity through active species reintroduction or more passive means such as the creation of networks that encourage natural species return (Perino et al., 2019). To assess preference for trophic complexity, we defined two attributes: the presence of large herbivores and large carnivores. The attribute levels varied depending on the presence of two key species, which are either currently present in the Oder Delta or could feasibly return through managed reintroductions or natural recolonizations. In the status quo level, none of the key species were present in the Oder Delta by 2050, while both target species were present in the upper rewilding levels.

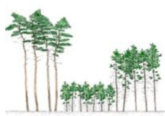
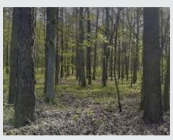
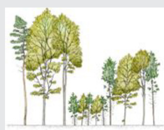
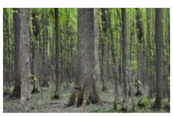
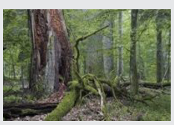
The second element of the rewilding framework, stochastic disturbances, focusses on the trajectory towards self-sustainability within rewilding management, allowing natural processes such as

TABLE 1 Attributes, levels and their description in the discrete choice experiment.

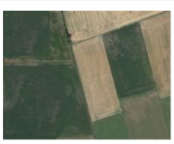
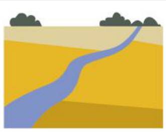
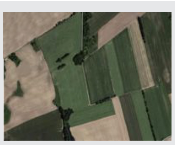
Attribute I—River status in 2050

Levels	River shape	Icon	Floodplain restoration	Oxbows	River water purification	Biodiversity
Regulated straightened			Prevented by dykes	No	Very low	Very low
Regulated meandering			Prevented by dykes	No	Low	Low
Semi-regulated meandering			Partially restored	Yes	Medium	Medium
Unregulated meandering			Restored	Yes	High	High

Attribute II—Forest status in 2050

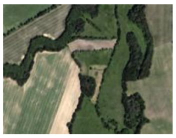
Levels	Forest structure	Icon	Tree species	Tree size	Deadwood and dying trees	Biodiversity
Intensive management			Same	Same	Removed	Very low
Mixed-species managed			Mixed	Same	Removed	Low
Semi-natural			Mixed	Mixed	Removed	Medium
Natural			Mixed	Mixed	Present	High

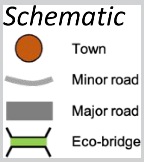
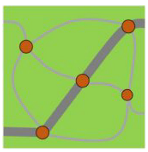
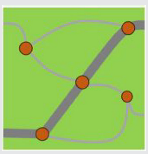
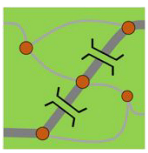
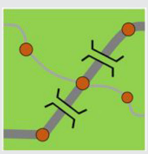
Attribute III—Agriculture status in 2050

Levels	Land use	Icon	Nature corridors	Chemical fertilizers used	Local agricultural productivity	Biodiversity
Intensive			No	Yes	Very high	Very low
Low-intensive			No	Yes	High	Low

(Continues)

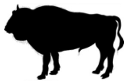
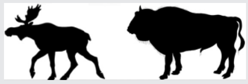
TABLE 1 (Continued)

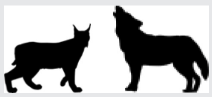
Attribute III—Agriculture status in 2050						
Levels	**Land use**	**Icon**	**Nature corridors**	**Chemical fertilizers used**	**Local agricultural productivity**	**Biodiversity**
Low-intensive with nature corridors			Yes	No	Medium	Medium
Land abandonment			Yes	No	No production	High

Attribute IV—Land area linkage in 2050						
Levels	**Schematic** 	**New roads built**	**Removal of roads**	**Total road length (per 100 km²)**	**Eco-bridges**	**Land area linkage**
Road development		Yes	No	25% increase *50 km per 100 km²*	No	Very low
No development		No	No	No change *40 km per 100 km²*	No	Low
Construction of eco-bridges		No	No	No change *40 km per 100 km²*	Yes	Medium
Deintensification and eco-bridges		No	Yes	25% decrease *30 km per 100 km²*	Yes	High

Attribute V—Large herbivore presence in 2050	
Levels	**Icon**
Neither Elk or Bison present	
Just Elk	

TABLE 1 (Continued)

Attribute V—Large herbivore presence in 2050	
Levels	**Icon**
Just Bison	
Elk and Bison present	

Attribute VI—Large carnivore presence in 2050	
Levels	**Icon**
Neither Wolf or Lynx present	
Just Lynx	
Just Wolf	
Wolf and Lynx present	

flooding or deadwood to occur freely within an ecosystem, without human intervention or control. This approach can have biodiversity benefits since it enhances ecosystem heterogeneity and complexity by fostering natural successional regimes (Bengtsson et al., 2003), although it may also entail negative perceived consequences for people's interests. Three landscape-level attributes were defined for stochastic disturbances: forests, rivers and agriculture. Levels varied on a scale from intensive management to maximize production, to completely hands-off management, in which natural ecosystem processes occur freely. The upper level of each of these attributes contained an element of stochastic disturbance. For example, with forests, deadwood was left on the forest floor. This was described to the respondents and also care was taken to ensure these disturbances were well-represented in the icons (Table 1).

The third element, dispersal, concerns individuals' ability to disperse naturally, therefore contributing to favourable demographic and genetic species status (Lacy, 1997). Within the rewilding approach, numerous management interventions such as hedgerows at the local scale to large-scale nature corridors and eco-bridges can support a multi-scale approach to increasing ecosystem connectivity (Keeley et al., 2021) and species resilience to a changing climate (Krosby et al., 2010). Urban expansion, agriculture and subsequent habitat degradation has led to significant obstacles to the free movement of animal species within the Oder Delta. The levels for the connectivity attribute ranged from increased intensification of roads, reducing dispersal possibility, to de-intensification through road removal and creation of eco-bridges to maximize connectivity.

2.3 | Choice experiment set-up

To determine respondent WTP for rewilding interventions in the Oder Delta, we conducted a DCE. The survey was conducted online in both Germany and Poland, with respondents selected by professional online survey companies to provide a representative sample of the respective national populations (Supporting Information, S1). The survey consisted of three sections. The first section contained standard socio-demographic questions and also studied respondents' prior use of the Oder Delta. The second section contained the choice experiment along with follow-up questions assessing respondent comprehension and motivation, and the third section included novel motivational questions assessing respondents' relationship to the Oder Delta and nature more broadly.

We prepared final choice sets for our study using an efficient Bayesian design optimized for Mixed Logit models, using the software Ngene 1.3. Prior values were obtained from a pilot study conducted on a sample of 250 respondents; in the pilot study, an

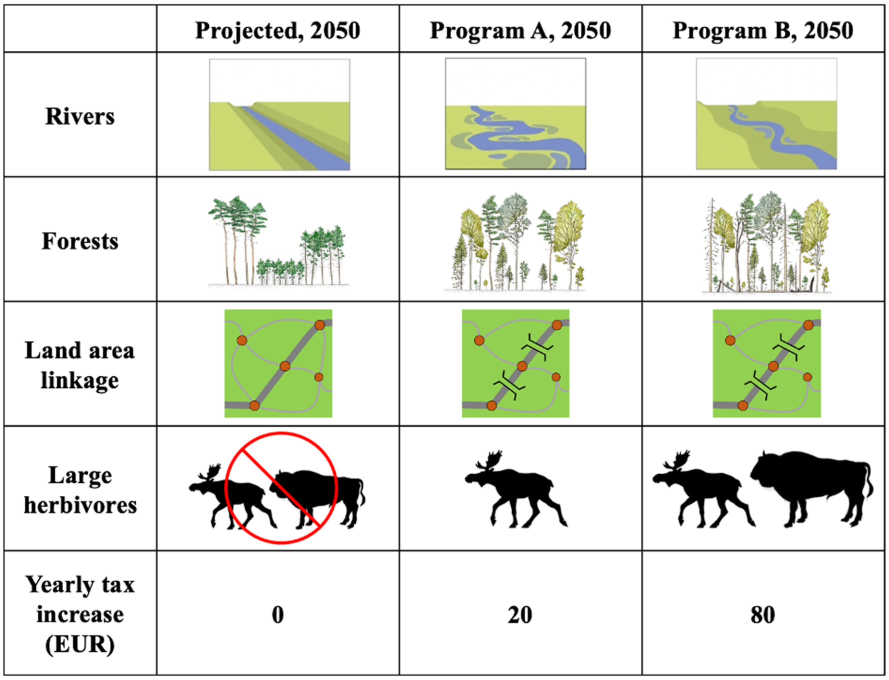


FIGURE 2 Example choice card.

optimal in-difference design was used (Street & Burgess, 2007). A total of 48 choice situations were generated, which were subsequently grouped into four blocks, with each block comprising 12 choice situations. Respondents were presented with a total of 12 different choice situations, each including three alternatives, with one fixed as a 'status quo' option (no change in the current management, leading to intensification by 2050). Each scenario was described using two stochastic disturbance attributes, the dispersal attribute, one trophic complexity attribute and a cost attribute. Attributes levels and icons were carefully selected to be understandable and credible for respondents. As part of this process, we consulted in detail with local experts (including members of the Rewilding Oder Delta local practitioners' association) and rewilding experts. Focus groups formed part of an iterative process, in which the attributes and icons were consistently refined in response to feedback. Before the choice tasks, respondents first carried out a simple ranking exercise using photographs of the different landscape levels. This element of the survey was designed to help familiarize respondents with attribute levels. An example choice card is presented in Figure 2.

Cost was defined as a new annual obligatory tax paid by all citizens in the respondents' country for the foreseeable future. It was explained to the respondent that the tax would be used to help finance the landscape management interventions alongside supporting a local rewilding fund that would offset any associated adverse economic impact on local residents of the proposed changes. Care was taken to ensure that the survey design followed the state of the art recommendations of Johnston et al. (2017) presenting respondents with 'an incentive-compatible valuation exercise that involves a plausibly consequential decision'. Notably, efforts were made to mitigate against hypothetical bias (Carson et al., 2014) such that the respondent perceived the payment vehicle as binding (if the proposed change goes ahead) and that their decisions could plausibly lead to changes in the attributes being valued (Carson & Groves, 2007).

The master version of the survey was written in English and translated into German and Polish by native speakers.

2.4 | Choice experiment data collection

The primary test for Germany and Poland was conducted in August and September 2022, resulting in a total of 1657 completed surveys collected for Germany and 1514 for Poland. Of these, the survey company collected approximately 500 respondents from each country residing within or neighbouring the national state containing the Oder Delta region (e.g. Mecklenburg–Vorpommern in Germany and the West Pomerania Province in Poland). The aim of this was to try and collect respondents living locally to the Oder Delta (within 100 km of the region defined in Figure 1, and in a rural setting).

Quality control questions were included in the survey to ensure respondents were reading the questions and responding accurately. The collected data were then cleaned to remove respondents identified as speeders (those below 50% of the median time), those that failed the quality control questions, or those identified to have given protest responses. After cleaning, there were 1005 completed surveys for Germany and 1066 for Poland.

Given the nature of this study, and in compliance with university guidelines at the time, ethics approval for this study was granted by the lead supervisor responsible for the project. Care was taken to ensure that all data collected were anonymized that no personal or sensitive data were collected, and all participants were over the age of 18. Individual respondents were only identifiable in the results through a unique numerical ID. Participants took part in the survey voluntarily and by submitting the survey gave consent for their anonymized data to be used. They could back out at any time before submitting.

2.5 | Choice experiment analysis

We used the data from our DCE to estimate respondents' WTP for rewilding interventions in the Oder Delta. In a DCE, respondents are presented with a set of available alternatives and asked to choose their preferred option. Discrete choice models are founded in the theories of economic value (Lancaster, 1966) and random utility theory (McFadden, 1974).

We employed the mixed logit (MIXL) model to analyse the data. Mixed logit models were estimated for the individual rewilding attribute levels of the pooled populations in Germany and Poland and for respondents living locally (rural, within 100 km) to the Oder Delta in both countries. The expressions for MIXL probabilities are the integrals of standard logit probabilities over a density of parameters:

$$P_{ni} = \int \frac{e^{\beta_n' x_{ni}}}{\sum_j e^{\beta_n' x_{nj}}} \phi(\beta \mid b, \Omega) d\beta. \quad (1)$$

For the MIXL model, we used the panel specification proposed by Revelt and Train (1998). The parameters (β_n) vary across respondents but remain constant across choices for the same respondents.[1] We assumed a mixture of normal and log-normal density with mean b and unrestricted covariance Ω.

All non-price coefficients were assumed to follow a normal distribution, while the price coefficient followed a log-normal distribution. From a behavioural perspective, the lognormal distribution assumption for the price coefficient is plausible since it requires all respondents to have negative price sensitivity. This assumption is standard practice in DCE and guarantees that the resulting distributions of WTP have finite moments (Daly et al., 2012). Since all models were estimated in WTP-space, obtained means of random distributions are directly interpreted as mean WTP.

We asked respondents to choose between management alternatives in the Oder Delta in 12 different choice situations. Following cleaning of the data to remove speeder surveys and individuals that failed the comprehension questions, MIXL models were estimated from a representative sample of 1005 respondents in Germany and 1066 respondents in Poland. Of these, 108 were classed as local in Germany, and 103 in Poland. Descriptive statistics are reported in the Supporting Information (S1).

3 | RESULTS

3.1 | Respondent comprehension

In general, our results suggested respondents believed that their responses would have some impact on the future Oder Delta landscape and would determine increases in taxes (see Supporting Information, S2). All of the attributes included in the choice sets were important in respondent decision-making (Table 2). The status quo scenario was selected rarely (12% of all choice tasks). Only 40 respondents selected the status quo option in all of their choice tasks (four in Poland and 36 in Germany), of these 5% gave the reason 'understanding the alternatives was difficult' as their explanation.

[1]More details on this specification can be found in Train (2009).

TABLE 2 Attribute importance for respondent decision-making (% respondents).

	Not important at all	Quite important	Very important
Poland			
Rivers	11.72	44.65	43.63
Forests	10.95	42.94	46.11
Agriculture	15.91	51.67	32.42
Land area linkage	11.98	50.21	37.81
Large carnivore	11.12	41.66	47.22
Large herbivore	10.01	38.84	51.15
Yearly tax	24.38	44.05	31.57
Germany			
Rivers	11.32	50.94	37.74
Forests	8.27	49.87	41.87
Agriculture	13.03	54.99	31.99
Land area linkage	14.82	58.31	26.86
Large carnivore	16.53	53.28	30.19
Large herbivore	15.99	54.45	29.56
Yearly tax	23.99	47.17	28.84

3.2 | National sample

The estimation results of the Germany-specific MIXL model are presented in Figure 3 and for Poland in Figure 4. This model compares preference for a given level against the status quo option level. The results for Poland are adjusted for Purchasing Power Parity. The results table is provided in the Supporting Information (S3). Respondents were willing to pay for each rewilding attribute level versus the status quo level, and we typically saw increasing WTP with level of rewilding intervention. A detailed comparison of statistical significance of the differences between levels is presented in the Supporting Information (S4).

For forests, German (€67.08) and Polish (€49.16) respondents recorded highest WTP for the most natural rewilding level in which stochastic disturbance regimes were reintroduced through leaving deadwood on the soil.

For rivers in Germany, the highest WTP was recorded for the upper rewilding level (€52.33), in which rivers were re-meandered and stochastic disturbances, in the form of natural flooding regimes, were fully restored. This was closely followed by the semi-natural river level (€51.59). In Poland, WTP was highest for the middle (semi-natural) river level (€40.67), in which rivers were re-meandered but natural flooding regimes were only partially

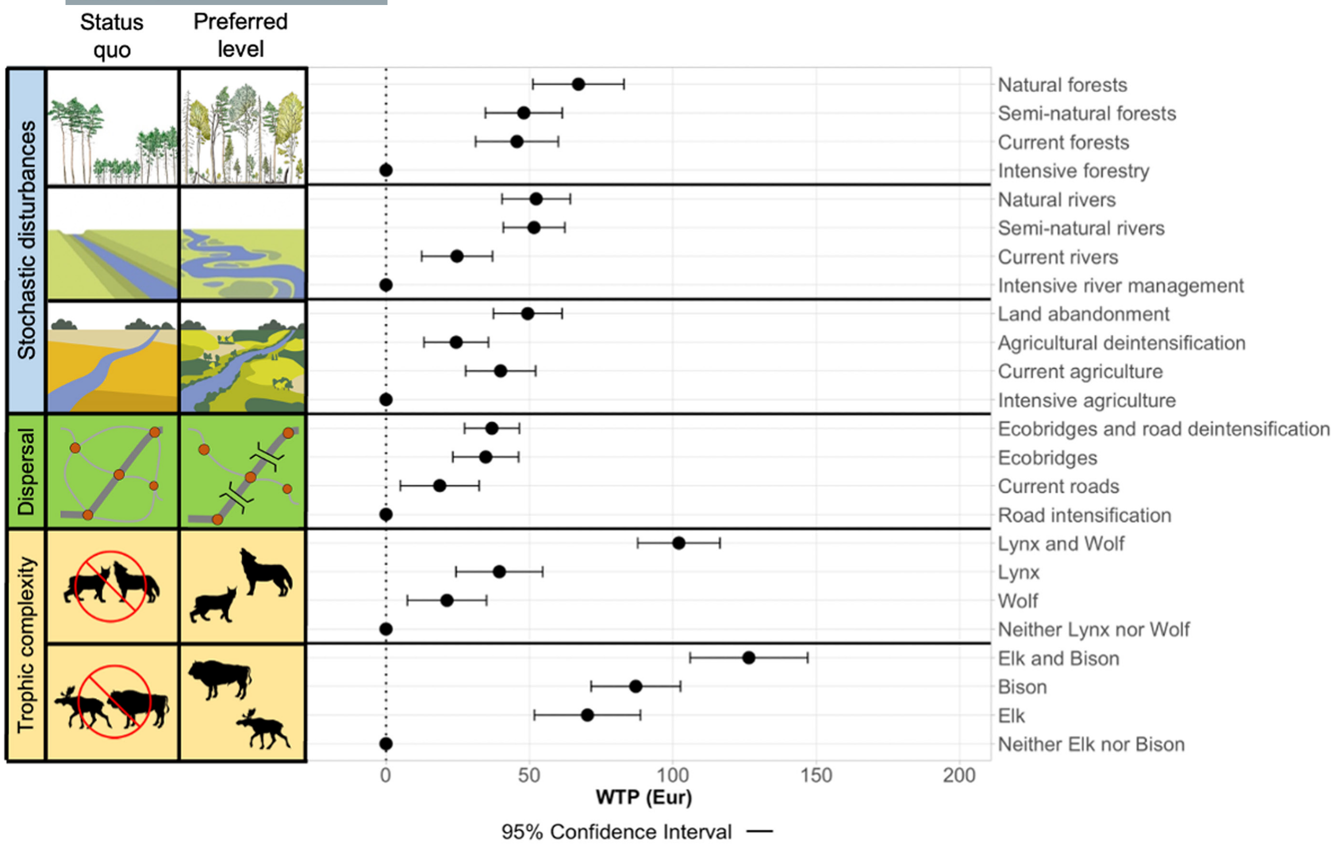


FIGURE 3 Pooled German respondents' willingness to pay (WTP) for management interventions in the Oder Delta. WTP (Euros) and 95% confidence interval. Status quo column presents the status quo management option the attribute level is valued against; preferred level column presents the highest WTP level for each attribute.

restored. In both countries, the current river level recorded the lowest WTP when compared against the status quo intensification option.

For agriculture, both German (€49.39) and Polish (€42.88) respondents had highest WTP for the most natural rewilding level, land abandonment, in which human control on the ecosystem was released. The low-intensive with nature corridors level recorded the lowest WTP when compared against the status quo intensification level in both countries.

The upper dispersal level, de-intensification and eco-bridges, had the highest WTP in Germany (€36.90), while the middle rewilding level, eco-bridges (no road de-intensification) recorded the highest WTP in Poland (€43.35). In both countries, the current road level recorded the lowest WTP compared against the status quo (road intensification).

For both Germany and Poland, the highest overall WTP values across all attributes were recorded for the trophic complexity attributes. In both countries, the highest trophic complexity attribute level was preferred. The difference in WTP for this level compared against the other levels (presence of just one of the large animals) was statistically significant in all cases. In these scenarios, both of the identified key herbivore or carnivore species are present. In Germany, the mean WTP for the presence of both large herbivores (elk and bison) was €126.48 and for both carnivores (lynx and wolf) €102.07. There is positive WTP for presence of just the wolf (€21.24) and just the lynx (€39.50). In Poland, the mean WTP for the presence of both large herbivores was €163.21 and for both carnivores €119.11. The presence of just wolf (€51.59) had a slightly higher WTP than for just the lynx (€48.45).

Statistically significant standard deviations (Supporting Information, S3) were recorded for most attribute means, indicating heterogenous preferences across respondents.

3.3 | Local sample

For the local samples, we see negative WTP for certain rewilding attributes (Figures 5 and 6). Respondents have positive WTP for the presence of all levels of large herbivores; however, there is negative WTP for specific large carnivore levels. In Germany, WTP for the presence of just the wolf was negative (€3.12). Similarly, this was the case in Poland (€22.39). For the upper rewilding level for large carnivores, in which both wolf and lynx were present, recorded WTP was negative in both Germany and Poland (€82.41; €42.33).

For the landscape attributes, WTP for the upper river and agriculture levels in Germany (€19.34; €15.45) and Poland (€19.29; €20.38) were negative for just local respondents. In addition, we recorded negative WTP for the upper dispersal level (eco-bridges and

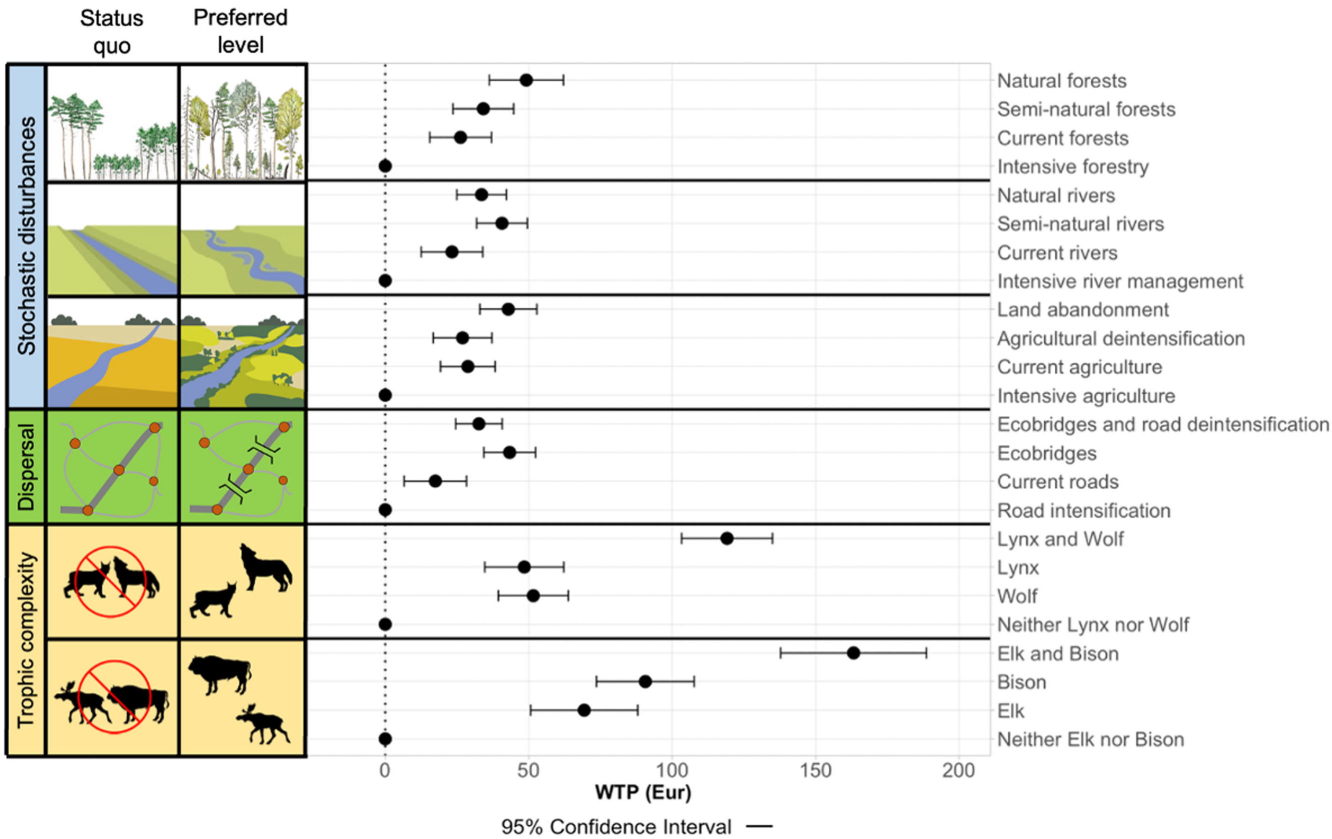


FIGURE 4 Pooled Polish respondents' willingness to pay (WTP) for management interventions in the Oder Delta. WTP (Euros) and 95% confidence interval. Status quo column presents the status quo management option the attribute level is valued is against; preferred level column presents the highest WTP level for each attribute.

road de-intensification) in Germany (€16.28) and for the middle (just eco-bridges) and upper levels in Poland (€28.95; €30.54).

4 | DISCUSSION

To the best of our knowledge, there have been no DCE studies that take into account the complete breadth of the rewilding approach in a case study area. To address this knowledge gap, we employed a DCE approach to assess public WTP for rewilding interventions in the Oder Delta. Our results suggest that the general public in Germany and Poland are willing to pay for rewilding interventions across all three elements of the rewilding framework. The results for Germany and Poland were broadly comparable, indicating preferences for rewilding hold across political and cultural contexts. These findings provide support for rewilding as an alternative ecosystem restoration approach that should be considered when planning future land management interventions across Europe.

In our DCE, respondents in Germany and Poland generally preferred the stochastic disturbance levels closest to natural regimes. In contrast to alternative restoration approaches, the introduction of stochastic disturbances is a novel element within the rewilding approach. The loss of stochastic regimes over time has been linked to increased severity of hazards, for example, flooding caused by the artificial river straightening. While there is acceptance in the scientific literature that reversing these trends can reduce the impact of such events (e.g. Brown et al., 2018; Gilvear et al., 2013), this often comes with the caveat that the modified ecosystems can have significant cultural value (Drenthen, 2009). This study provide evidence for a potential win-win solution in the Oder Delta, that is, stochastic disturbance regimes could be restored, in turn reducing the severity of hazards, while also being a socially desirable land transformation.

Rivers in Europe have been altered by humans in order to provide socially desirable outcomes, such as drainage and flood protection (Brown et al., 2018; Gilvear et al., 2013). However, there is growing awareness of the ecological benefits that can be provided by re-naturalizing these rivers (Gilvear et al., 2013; Vermaat et al., 2016), which is reflected in the results of our study. In both countries, the highest WTP values were recorded for attribute levels in which flood regimes were either completely, or partially restored.

Our findings align with previous studies that have demonstrated public preference for natural forest attributes (e.g. Giergiczny et al., 2015, 2022; Hjerpe & Hussain, 2016), and we similarly found this in our study, with WTP for the forest attribute levels increasing with naturalness. Across Europe, human use has transformed forest ecosystems (Kaplan et al., 2009). It is estimated that only 0.7% of Europe's primary forests remain (Sabatini et al., 2018; Watson et al., 2018). Our findings suggest that public preference, both at the

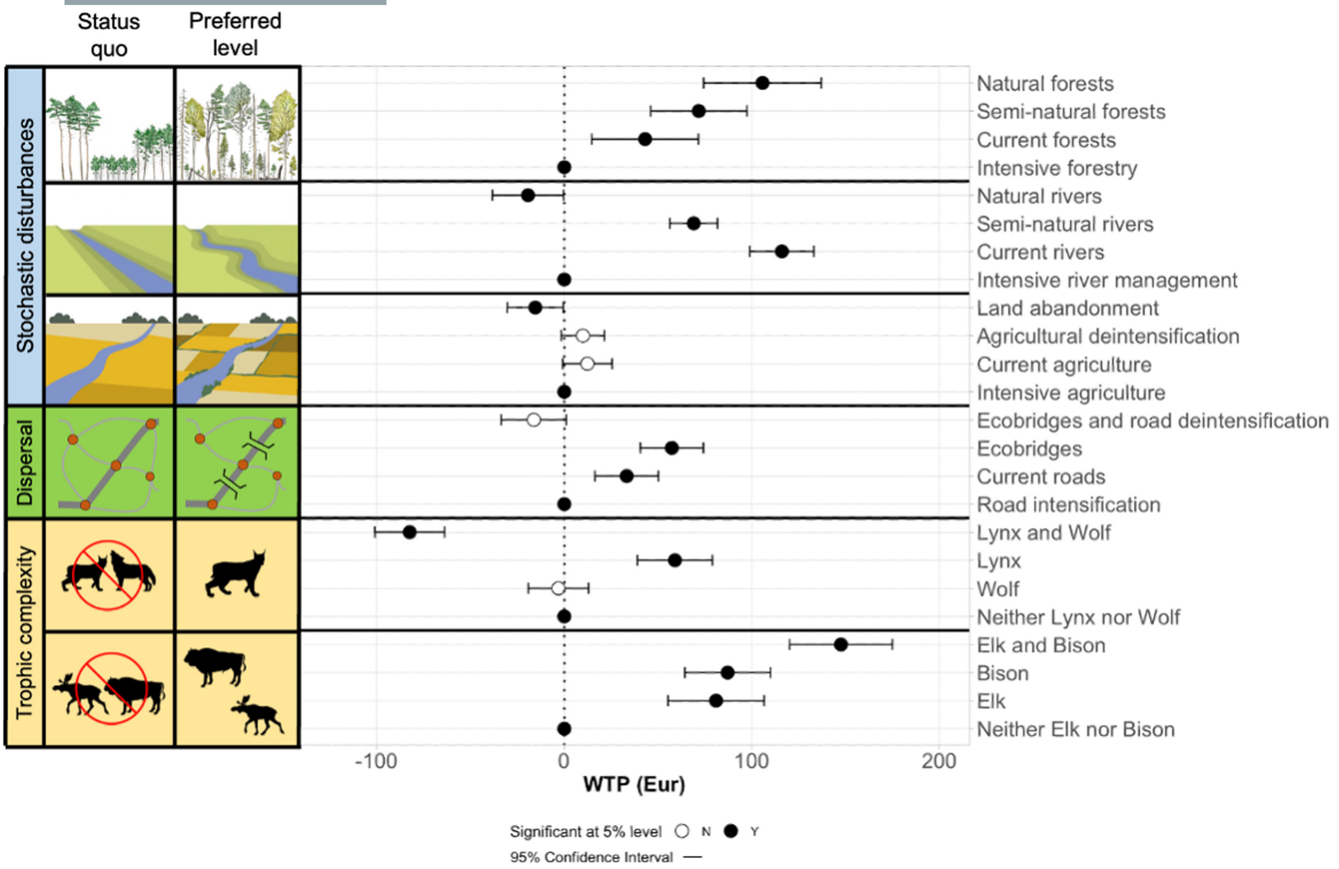


FIGURE 5 German local (<100 km, rural) respondents' willingness to pay (WTP) for management interventions in the Oder Delta. WTP (Euros) and 95% confidence interval. Status quo column presents the status quo management option the attribute level is valued is against; preferred level column presents the highest WTP level for each attribute.

national and local scale, is against forest intensification and instead would be for forest management to focus on restoring forests with more natural characteristics, such as a diversity of species and ages, and including stochastic disturbance regimes.

European landscapes have been engineered to produce greater quantities of food (Kaplan et al., 2009), which has led to a reduction in wildness. Respondents in our study preferred the highest stochastic level for the agriculture attribute, land abandonment, in which there was no agricultural production. Increasing demand for food caused by population growth will mean that agriculture will need to undergo sustainable intensification in certain areas (Godfray et al., 2010). However, in areas where agricultural production is marginal, or declining, there exists the opportunity to alter land management to achieve alternative goals, such as ecological restoration. In Europe, passive rewilding has been highlighted as an alternative avenue for subsidy programmes that currently promote agriculture, particularly in marginally productive areas (Merckx & Pereira, 2015). A reimagining of Europe's Common Agricultural Policy to support passive rewilding on abandoned agricultural lands is a possible mechanism to upscale rewilding in Europe (Dunn-Capper, Quaas, et al., 2023). Our results suggest this strategy could be considered in the Oder Delta as the national sample is willing to pay for land abandonment in both Germany and Poland.

Broadly comparing between countries, we find that WTP for landscape attributes is higher in Germany. In Germany, the mean income is approximately three times higher than in Poland (Eurostat, 2021); thus, this finding could be down to respondents having more to spend on nature. Further (Biczkowski et al., 2023), credit neo-colonial pressures as fostering a feeling of abandonment and appropriation among rural populations in Poland, fostering indifference to ecological considerations.

However, our results also found that locals recorded negative WTP for some elements of the rewilding approach, particularly in agricultural landscapes and rivers. While some studies have shown that transitioning from agriculture or forestry to rewilding can lead to reduced costs (Schou et al., 2021), it is clear that some elements of the rewilding approach are undesirable for both locals and landowners. Granado-Díaz et al. (2022) demonstrate that farmers would only be willing to participate in rewilding schemes on their land if they were reimbursed at very high payments levels, while Collas et al. (2023) suggest farmers require greater compensation to participate in land sparing schemes, when compared against land sharing alternatives. While locals are willing to pay for rewilding of forests, there is negative WTP for the closest to natural rewilding river and agriculture (land abandonment) levels, with preference for management interventions

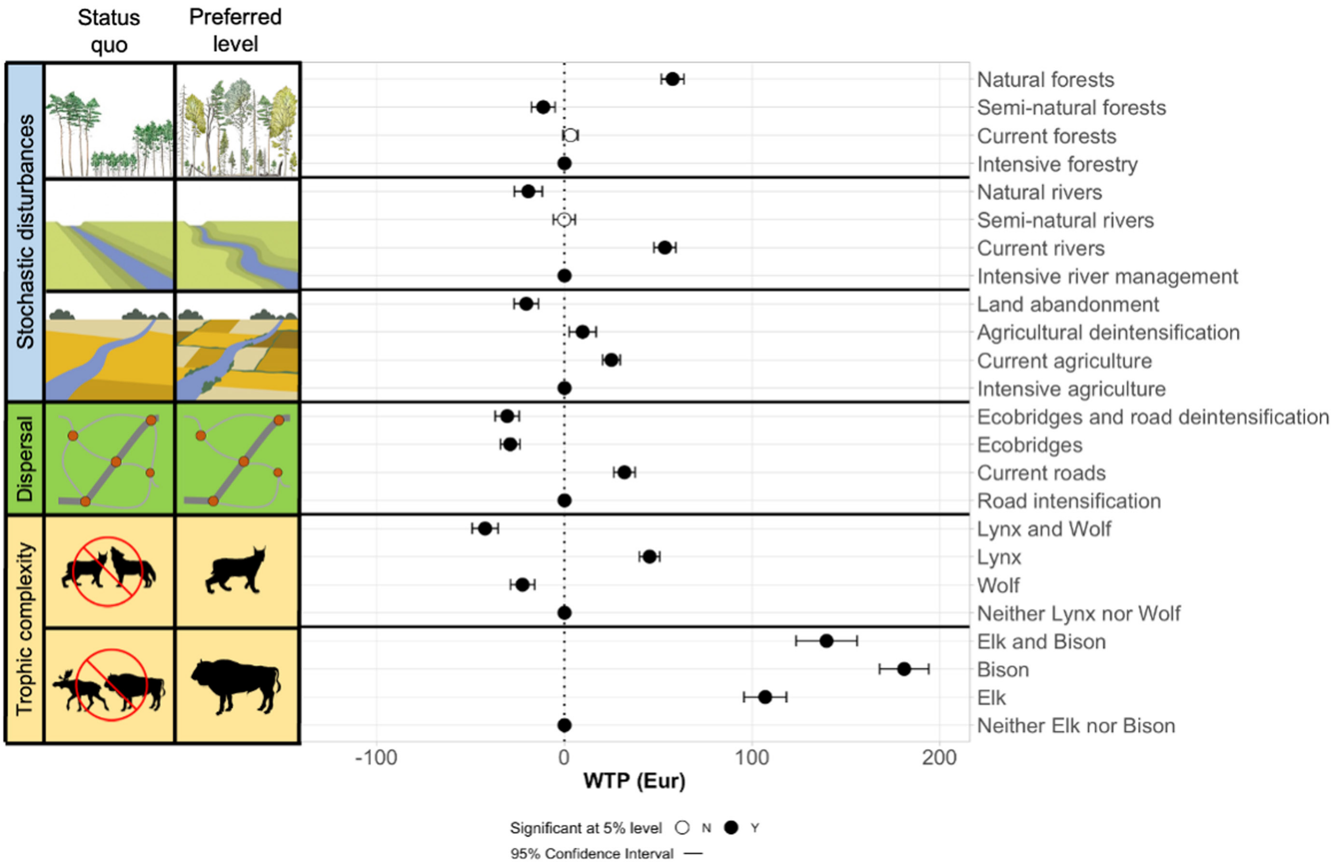


FIGURE 6 Polish local (<100 km, rural) respondents' willingness to pay (WTP) for management interventions in the Oder Delta. WTP (Euros) and 95% confidence interval. Status quo column presents the status quo management option the attribute level is valued is against; preferred level column presents the highest WTP level for each attribute.

that to some extent mitigate against natural disturbances. In many rural communities, agriculture is seen as essential for a way of life and critical to an individuals' sense of place (Chapman et al., 2019; Drenthen, 2009). Therefore, passive rewilding of agricultural land through land abandonment is likely to be perceived negatively by some local stakeholders, which is in contrast to the general consensus from the nationwide sample. This dichotomy illustrates the difficulty in landscape management at the socio-ecological level, and the significant need to democratically integrate locals into decision-making processes (Dotson & Pereira, 2022). For rivers, the highly publicized mass mortality event in the Oder River (e.g. Oltermann, 2022), where a number of fish and animal species were reported to have died in both the German and Polish sections, likely influenced the choices of local respondents and underscores the importance of effective communication and stakeholder engagement in rewilding projects, particularly those involving sensitive or contentious issues.

Our findings demonstrate that WTP for the presence of large animals is significantly higher than for any other rewilding attribute. This suggests that trophic complexity is a socially desirable rewilding element according to both surveys at the national scale. The attraction individuals have for large animals is well-studied (e.g. Berti et al., 2020; Macdonald et al., 2015). While other studies have shown significant global preference for large cats and primates (Macdonald et al., 2015), this study focusses on WTP for the presence of large animals within a respondent's country of residence, leading to an expectation of more polarization in respondent preferences.

Large carnivore species are naturally returning across Europe (Chapron et al., 2014). Given the extent of human use within European landscapes, species expansion overlaps with human-modified and agricultural landscapes (Salvatori et al., 2021). Therefore, large carnivores comeback is often controversial and highly politicized, leading to the literature's focus on human–carnivore conflicts (Chapron & López-Bao, 2014; Pooley et al., 2017; Salvatori et al., 2021). The assessed economic impacts of large carnivores are often negative, for example, due to livestock depredation (Lozano et al., 2019; Rode et al., 2021). Despite this, we found that not only were the general public willing to pay for the presence of large carnivores in the Oder Delta but WTP for the presence of both large carnivore species was higher than for any other rewilding attribute level besides the presence of both large herbivores. This finding contradicts the literature that has presented generating human tolerance for large carnivores as a challenge (e.g. Bruskotter & Wilson, 2014). While Giergiczny et al. (2022) show that forest visitors are willing to pay for the presence of large carnivores in forests, our findings show that individuals with no intention of ever visiting the site are also willing to pay for the comeback of large carnivores, likely driven by an existence value for the presence of large carnivores in the Oder Delta. This finding provides further evidence of shifting attitudes towards predators, with increasing interest in restoring species that have previously disappeared (George et al., 2016; van Eeden et al., 2021) among both the general public and landscape managers.

Given the general negative framing of the wolf in the German and Polish press (especially among tabloids, e.g. Roth & Socher, 2023; Wiekiera, 2023), and increasingly hostile government policy to population expansion (e.g. Connolly, 2023), the expectation was that WTP for the presence of the wolf would be negative. However, this study instead showed positive WTP for the wolf at the national scale. We suggest that since most individuals surveyed lived far from the study site and therefore had no, or minimal, perceived risk associated with the presence of the wolf in the Oder Delta, they gain a net benefit from its presence (Bruskotter & Wilson, 2014) in the form of existence value.

In general, Polish respondents had higher WTP for large animals than in Germany. We suggest that this is driven by the increased familiarity that respondents have with large animals within the landscape. While in Germany, the appearance of large animal species is relatively novel, with wolf and lynx populations expanding into Germany only recently, and elk and bison still missing in the wild, they have remained a stable part of the Polish landscape (Chapron et al., 2014).

For respondents living locally to the Oder Delta region, we see that this positive valuation of the wolf does not hold and WTP for all carnivore attribute levels that include the wolf were negative. In part, this could be driven by the perceived risk of the wolf being much higher at the local level. However, given the small sample size, it is difficult to make detailed conclusions, and we recommend future work could specifically assess the socio-economic value of the wolf in the Oder Delta at the local scale. Recent approaches have led to a paradigm shift in conflict management, framing conflict over large carnivores as driven by cultural tensions, values and underlying power structures and emphasizing an approach to finding solutions based on cooperation as opposed to coercion (Redpath et al., 2017; Salvatori et al., 2021). Participatory approaches such as those employed by Salvatori et al. (2021), who demonstrate that local stakeholders are generally willing to engage in co-planning management interventions to help facilitate large carnivore populations as long as conditions are improved for those most affected by species return, could similarly be employed in the Oder Delta, supplementing national scale insights from a DCE approach.

Although our study's results suggest high WTP values for rewilding, the DCE approach also entails limitations that should be considered when interpreting our findings. For example, hypothetical bias can occur when the respondent does not fully understand the context of their choice and has no obligation to back up their choices with real-world commitments (Hensher, 2010). Additionally, framing effects can influence preferences, as the presentation of choices in the survey can impact responses (Rolfe et al., 2002). Furthermore, social desirability bias, in which respondents provide what are perceived as socially desirable, as opposed to honest, answers, has been shown to emerge when respondents value environmental attributes (Lopez-Becerra & Alcon, 2021). Despite these limitations, the DCE remains a useful tool for eliciting complex values for non-market goods.

While the exact WTP results reported in this study may not directly correspond with real-world behaviour (e.g. Sakurai & Uehara, 2023), such values provide important insights into public preferences for rewilding, and conservation more broadly. Another caveat is the economic framing of respondents' value for nature. It is well-recognized that values of nature are multiple and complex (Díaz et al., 2018; Hill et al., 2021; Kenter et al., 2015). Caution should thus be taken when using only the results of stated preference studies to make conclusions about future land use. We recommend a more holistic approach to landscape planning, that incorporates both WTP alongside more novel values, for example, using innovative participatory methodologies that can account for diverse nature values (e.g. Dunn-Capper, Quintero-Uribe, et al., 2023; Quintero-Uribe et al., 2022).

In this study, we highlight that the general public is willing to pay for management interventions across a suite of rewilding attributes when compared against a status quo intensification scenario. Notably, at the national scale, trophic complexity is a highly valued element of the rewilding approach that is often overlooked in alternative ecological restoration strategies. Our findings strengthen the case for rewilding to be considered alongside alternative ecosystem restoration options during landscape planning. However, our study also illustrates the difficulties inherent within restoration planning in socio-ecological systems. For locals to our case study region, restoration of flooding regimes, land abandonment, and the presence of the wolf record negative WTP, and while there is often preference for increasing naturalness, it is with the caveat of controlling certain ecosystem processes, or the exclusion of specific species. Given the limitations of sampling rural local populations implicit within the online survey approach, the findings from this study would be further strengthened through a similar survey being carried out in person within the Oder Delta, alongside participatory processes with key stakeholders, which would allow for a more comprehensive comparison of local and national preferences for rewilding interventions and a more thorough exploration of the motivations underlying preferences.

AUTHOR CONTRIBUTIONS

Rowan Dunn-Capper conceived the idea for the research; Rowan Dunn-Capper and Marek Giergiczny designed the methodology, supported by Néstor Fernández, Fabian Marder and Henrique M. Pereira; Fabian Marder led the data collection; Marek Giergiczny led the data analysis; Rowan Dunn-Capper led the writing of the manuscript, supported by Marek Giergiczny, Néstor Fernández and Henrique M. Pereira. All authors contributed critically to the drafts and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT

The authors have no competing interests.

DATA AVAILABILITY STATEMENT

The data used in this study were collected from online survey responses; as part of the survey, each respondent completed 12 choice tasks. Anonymised choice experiment data and results may be found in Dryad Digital Repository: https://doi.org/10.5061/dryad.5mkkwh7cx.

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SUPPORTING INFORMATION

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

Supporting Information S1: Descriptive statistics of respondents in Germany ($N = 1005$) and Poland ($N = 1066$) in 2022.

Supporting Information S2: Results of the respondent consequentiality questions.

Supporting Information S3: Results of the mixed logit model for pooled population in Germany ($N = 1005$) and Poland ($N = 1066$).

Supporting Information S4: Results of comparison analysis between attribute levels (yellow highlight is statistically significant).

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