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Chapter

The Hambach Forest in the German Debate on Climate Protection: Is There a Symbolic Value beyond the Environmental Value?

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Abstract

In the late summer of 2018, the Hambach Forest (North Rhine Westphalia/Germany) appeared prevalently in the media due to massive protests against its clearance for lignite mining with for the power generation. Because coal power as a form of energy supply is extremely climate intensive, the Hambach Forest rapidly became a symbol of the fight against climate change and the ongoing destruction of nature and its resources for economic reasons. Due to the extra-ordinarily prominent role of the Hambach Forest in the public opinion across Germany, this research addresses values of the forest to the population in monetary terms as well as the underlying factors that determine those values. For the analysis, a contingent valuation survey was conducted in December 2019 in Germany. The proposed amounts for the preservation of the Hambach Forest are mostly in accordance with previous evaluation studies of woods and forests, although this time almost only passive-use values are decisive. Further, a conversion of the WTP values to the area of the Hambach Forest results in an extra-ordinarily high per-hectare value of about 3.6 million. Thus, the symbolic value of the forest is remarkable and should be considered in future political decisions.

Keywords: symbolic value, environmental valuation, climate movement

1. Introduction

In the late summer of 2018, the Hambacher Forst (Hambach Forest) in Germany appeared prevalently in the media covering the strong protests against the intention of the utility company Rheinisch-Westfälisches Elektrizitätswerk AG (RWE) to grub large parts of the remaining forest in order to mine the lignite underneath. Up to 50,000 people from across Germany as well as neighboring countries gathered for protest marches in order to save the forest and express their position against lignite mining and to demand more political action regarding climate protection. The grubbing was suspended when in October 2018 the Higher Regional Court of Munster issued a provisional stop until there was going to be a decision as to whether

the Hambach Forest falls into a category of the Habitats Directive.[1] This was an option since the forest is habitat to 13 species considered in the Directive, among them the Bechstein's bat (*Myotis bechsteinii*) and eight other bat species, two species of toad, the agile frog (*Rana dalmatina*), and the endangered common dormouse (*Muscardinus avellanarius*). In January 2020, following the recommendations of a caucus, the German government decided to phase out coal power by 2038 at the latest and to preserve the Hambach Forest [2]. Despite this decision, however, scientists expect the forest to be endangered if RWE upholds its plans to continue grubbing in the coming years, thus requiring the further lowering of groundwater (lignite mining requires the lowering of the groundwater levels) and increasing temperatures caused by the declining surrounding vegetation [3]. So far, nearly 60 villages have been relocated or are in the process of relocation at present within the Rheinische Revier due to the exploitation of the lignite underneath. Considering this, the magnitude of the protests against the clearance of the Hambach forest was surprising.

Several factors seemed to be of relevance for the massive protests and the unexpected, high commitment of the population, either as participants in rallies or as debaters in social networks or the like. First, the forest on its own as an old forest and as a habitat for endangered species might be seen as valuable and irreplaceable [4]. Second, worries about climate change have gained in importance and were fostered not least by the extremely hot summer of 2018, and the increasing awareness that coal-fired power generation is among the largest sources of carbon emissions in Germany. Third, for many people, RWE turned into an enemy image, as the company has been made responsible not only for massive carbon emissions, but also for the destruction of nature and villages, despite the efforts of RWE to compensate relocated people and to re-cultivate large areas. This position, however, neglects proprietary rights, which RWE holds based on the acquisition of the Hambach Forest in 1978, operating permits, and mining rights, all negotiated with the provincial government in Dusseldorf, represented by different parties (Social Democrats, Christian Democratic Union, and Green Party). Since 1978, the size of the Hambach Forest has shrunk from 4100 ha to only about 500 ha in 2020, and since 2012, the Hambach Forest has been occupied by about 20–100 people permanently living there in self-constructed tree houses. However, the ownership based on the legal definition may be in contrast to what people perceive as legacy or moral ownership here [5]. The Hambach Forest eventually became a symbolic battleground for climate activists from Germany and other countries. Ten thousands of people have visited the Forest since, and its publicity goes well beyond the borders of Germany [4, 6, 7].

Accordingly, the Hambach Forest has become a location of "meaning," and this meaning can be attributed on vastly different scales. Such "meaning" does not manifest itself in particular physical characteristics, but is instead attributed by humans and may be closely linked to notions of identity and sense of "belonging" [5]. Only places identified as symbolic by a certain number of individuals are socially recognized as such, and a group can form and give itself an identity within this movement of recognition [8]. Most generally, a place can be considered "symbolic" whenever it contributes significantly to giving a group an identity—for example, the stadium of "their" club is something meaningful for football fans. Members of a particular scene are aware of this, and the symbolic meaning of a place is common understanding

[1] This is a European Directive as an EU response to the Berne convention, which intends to protect nature and wildlife. It requires national governments to specify areas that are expected to ensure the conservation of flora and fauna species [1].

among them. Accordingly, the symbolic character of a location is both, a powerful matter and a power instrument: the person who manipulates symbols can also manipulate processes of identification and thus take an influence on the constitution of the group [8]. Further, a symbolic place does not have the same meaning seen from nearby or from a distance, by a small group or by a large community, from inside or from outside, by "us" or by "others," and through time [8]. This symbolic aspect may partly explain the fierce fight over the Hambach Forest, since the topic activates the identification with either one side: following traditional rules or claiming change in order to protect nature and climate.

Against this background and given the described unusually high empathy for the forest, the question about its value for the German population arose. We therefore intended to find out whether it was possible to measure the meaning of the forest in the view of the population and to translate it into quantifiable values in order to make it comparable. These values are to represent its role in the controversial political debate on climate protection, transformation strategies, and coal phase-out in Germany. It thus may indicate the non-use and probably symbolic value of the Hambach Forest. Furthermore, stated values can also be considered as an indicator of how important the protection of the forest for single individuals is. Since no similar case is known to us so far, this study has a rather explorative character.

The structure of the paper is as follows: In section 2, we provide a literature review about valuation studies of forests. Methods and procedure are described in detail in section 3, followed by the results in section 4. This paper ends with a discussion and conclusion section.

2. Literature review

In order to elucidate the values of environmental goods, several methods have been developed depending on the values to be considered. Although the importance of environmental goods to humankind has many dimensions (e.g., ecological, sociocultural, or economic), the values are usually expressed in monetary units as an important tool to raise awareness and convey the (relative) importance of ecosystems and biodiversity to policymakers [9]. Economists have recognized the possibility that individuals who make no active use of a particular forest, river, certain species, or other such natural resources may, nevertheless, derive satisfaction from their mere existence, even if they never intend to make active use of them [10–16]. This concept has come to be known as "existence value," and it is the major element of what is now referred to as "non-use" or "passive-use" values [17]. The most common methods for the evaluation of environmental goods, which comprise also non-use values, are direct methods such as the contingent valuation method (CVM) or Choice Experiments (CE). As part of these methods, individuals are presented a hypothetical scenario for which they are asked to state their willingness to pay (WTP) and/or their preferences for a change in the provision of a specific environmental good [18].

Many surveys have been carried out during the last four decades about values of sylvan ecosystems and their ecological services. However, the WTP values are hardly transferable due to several reasons: First, they are scenario-dependent. Second, WTP values normally depend on individual characteristics, such as attitudes and sociodemographic variables. Third, the values may change quite a bit over time according to circumstances [19]: for example, about 40 years ago, there were hardly any protests against the cutting of the Hambach Forest, because, on the one hand, there was

still a large part of the forest remaining, and on the other hand, climate change and the impact of coal-fired power generation were almost unknown, at least for large parts of the population. Fourth, by conducting a survey, previously unknown and/or unexpected correlations may be revealed. Nevertheless, procedures and results of comparable studies are useful for the design and the interpretation of new surveys.

In a first step, we analyzed a database of more than 80 surveys about preferences for wooden areas applying CVM, CE, travel-cost method (TCM), or benefit transfer method (BTM) within German-speaking countries during the last three decades [20]. Most of the studies measure recreational values by directly asking for the WTP for entrance fees [21–25], or they evaluate minor changes in attributes such as the introduction of environmental protection programs by asking for additional taxes or the like [26–28]. None of the studies deal with pure existence values only, and thus, no directly comparable values could be extracted from the studies listed in the database.

In a second step, we searched the Environmental Valuation Reference Inventory (EVRI)[2] database, which compiles environmental valuation studies from all over the world, for studies about values of woods and forests in order to find comparable studies to the case of the Hambach Forest. As search criteria, we chose "plants," since this comprised both forests and woodlands, "willingness to pay," "passive uses," and "stated preference" or "simulated market price" in order to identify comparable studies. Altogether, 182 studies were found (January 2020), of which 94 indicated "forest" as environmental asset, 88 "trees," 50 "woodland," and 16 "rainforest." Since some studies consider more than one environmental asset, overlaps occurred. After deleting those, 171 studies remained. Most of them address preferences for specific aspects such as species diversity, infrastructure, preferences for leisure activities, or forest protection schemes. In most of the studies on rain forests, the researchers surveyed the willingness to pay for the preservation of a certain minimum area. Only five studies dealt with the total value of a forest rather than values for single characteristics.

The first study in chronological order was a cost-benefit analysis about the option to log the Aorangi-Awarua-Forest in New Zealand (**Table 1**). A CV among 500 New Zealanders was conducted via mail in 1991 by Beanland [30] in order to find out whether the total economic value of the forest was higher than the revenues from logging it. The mean WTP to preserve the forest was 13.12 New Zealand $ as a yearly payment, with 41% of the respondents willing to pay at all. This amount is comparable to roughly 10€ currently when accounting for exchange rates and inflation. However, since in this New Zealand mail survey, the return rate of questionnaires was just around 50%, and normally those who are less interested in the topic are more likely not to send back the questionnaire [35], an interpolation of the mean WTP to the total population did not appear advisable.

The second study by Kniivilä et al. [31] assessed the regional and local user and non-user benefits of the current conservation of old forests in the region of Ilomantsi/Finland in 1999 by surveying 800 people in North Karelia. The response rate was 59.2%, the median WTP was 19€, and the mean WTP 48.6€ per person/year, which corresponds to 25€ and 65€, respectively, in 2019. The WTP values were taken by the dichotomous choice (DC) question format, which normally leads to higher WTP values [33]. However, 18.5% of the respondents chose an "I don't know" option when they were asked whether they would be willing to pay a certain amount for the preservation of the forest and were excluded from further analysis. About 45% of the

[2] https://www.evri.ca/, last time accessed in September [29].

	1	2	3	4	5
	Beanland [30]	**Kniivilä et al. [31]**	**Amirnejad et al. [32]**	**Veisten and Navrud [33]**	**Broberg [34]**
Survey year	1991	1999	2004	1995	2005
Country	New Zealand	Finland	Iran	Norway	Sweden
Method	Mail survey	Mail survey	Personal interview	Mail survey	Mail survey
Selected sample	500	800	n.a.	2,498	2,000
Participation rate	50%	59%	n.a.	71%	49%
Sample size	225	472	950	1776	930
WTP method	Open ended	DC	DC	DC/open ended	Open ended
% pos. WTP	41%	36.5%	65%	25–39%	45%
WTP value	10€	65€	40€	27–61€	35€
Forest size	5142 ha	20,000 ha	1,900,000 ha	n.a.	126,000 ha

Source: own compilation.

Table 1.
WTP surveys about forest areas with mainly non-use values.

remainder had a true zero WTP. Indeed, recreational values of the evaluated forests there are non-negligible, since the forests are popular tourist destinations [31].

Amirnejad et al. [32] conducted a CV in order to estimate the existence value of north forests in Iran. By analyzing the answers from personal interviews of about 950 residents of Iran, the mean WTP for the protection of the forests was 30.12 US$ annually (corresponding to roughly 40€ in 2020), which is quite high considering that the GDP per capita in Iran in 2004, when the interviews for this survey were conducted, was only 2500 US$. However, the WTP values appear more valid when considering that the sample is highly biased in terms of education and income. The rate of respondents with a positive WTP is indicated with 65%, of whom 80% have already visited the north forests of Iran. The rather high mean amount can at least partly be reasoned by the survey design (talking about and showing pictures of the beauty of the forest and of future scenarios of damage) and the double-bounded DC questionnaire, and the occurrence of direct use values due to the high rate of visitors cannot be excluded. Also an interviewer effect cannot be denied, since the WTP in personal interviews usually is higher than in e-mail or mail surveys [36]. Furthermore, cultural conditions in this country may have influenced the stated WTP positively [37].

Veisten and Navrud [33] analyzed the WTP for the protection of old forests in Norway, a good nearly exclusively linked to passive-use values, using a mail survey among 2498 people in Norway conducted in 1995. The efficient total sample and overall response rate were 1792 and 71.7% respectively. According to the payment question format (open ended or dichotomous choice), estimated WTP values ranged from a mean of 20.5 US$ to 41.6 US$ in form of a one-time payment to the WWF's Forest Fund. This corresponds to roughly 27€ to 61€ in 2020 with a rate of positive WTP of 29–46%. With an additional invoice for the stated WTP value, this value changed to 24–37% and a mean WTP value of 5$ to 11$, corresponding roughly to 7€ and 14€ in 2020. These values indicate that CV values are not only sensitive to the question format, but also to the scenario setting and the payment vehicle.

Broberg [34] used contingent valuation to estimate the public benefit derived from preserving 126,000 ha of state-owned old-growth forest in the sub-mountainous region of Sweden. In this mail survey, the response rate was 49%. About 45% of the 905 respondents had a positive WTP with an average of approximately SEK 300 (35€ in 2020) for the preservation program as an annual tax increase over the next 5 years. Males were significantly less likely to hold a positive WTP, and the likelihood decreased with age for both, males and females. Education, income, and membership in any environmental NGO were correlated positively with the likelihood of observing a positive WTP.

Table 1 provides an overview of the studies.

Although we searched broadly for comparable studies about environmental objectives with a symbolic character, besides few direct use values, we did not find any. Laplante et al. [38] surveyed the value of the Armenian lake Sevan for US American Residents with Armenian origin. They asked 6000 people about their willingness to participate in a mail survey, of which 1325 agreed to participate, but only 389 returned a completed questionnaire. The WTP was surveyed in form of DC as a one-time donation and led to a mean value between 80 US$ and 280 US$, which corresponds to 47€–118€ nowadays. Most significant variables for the WTP were past visits and the option of future visits of the lake. Thus, although the lake has a highly symbolic character, use values seemed to be most important for the WTP.

Even though the population of Germany is known for its love of wild forests [39, 40], there is currently no German study that explicitly addresses non-use values of forests. Compared with the studies above, the Hambach Forest is rather small given its size of only about 500 ha, and to almost all Germans, its value comprises passive-use values only. Therefore, even though it may be ecologically valuable, it is hardly comparable to the other evaluated woods and forests from an ecological point of view. Instead, it is especially its symbolic character that makes it a highly interesting research subject that justified its evaluation. Since no comparable situation analyzed by an evaluation survey so far was found, our study is of highly explorative character.

3. Methods and procedure

According to the literature review, CVM proposed itself to be the method of choice, since a high rate of existence value of the Hambach Forest was presumed for the German population. Ideally, the surveyed sample corresponds to the distribution of these variables across the basic population. In mail surveys, the sample selection bias is usually stronger than in telephone or personal inquiries [41, 42], making the latter more advisable as survey methods, although they are normally more expensive. We therefore decided to conduct the survey via telephone with strong instructions regarding the representativeness concerning age, gender, education, and place of residence (federal state). Furthermore, questions regarding attitudes toward environmental values and behavior, renewable and nonrenewable energy systems as well as political issues were included in our questionnaire.

Moreover, protest responses occur regularly in environmental valuation surveys [43]. They can be reduced by the survey design, however, since they are usually lower when voluntary payment schemes are provided [44]. As a procedure, it appeared useful in our case to contact participants personally following a random selection scheme in order to guarantee the representativeness due to the self-selection bias of online and mail surveys. Voluntary contributions to a fund seemed to be most adequate

as a payment vehicle for several reasons: First, because of an expectedly high rate of passive-use values, payment vehicles linked to a certain kind of use dropped out. Second, due to a high level of politicization of the issue, a rather "neutral" instrument for the protection of the forest seemed to be preferable to a tax, for example. Third, the voluntary character of the payment scenario fit better to the climate protection movement, since the latter is strongly characterized by the perception that "policy isn't doing enough to fight climate change" and that it is instead the people who need to take action now.

Therefore, the developed CV scenario was the following: "A bit over a year ago, the Hambach Forest was prevalently in the media, because it was uncertain whether vast parts of it should be cleared in favor of lignite mining and its electricity generation. Assume that a private forest conservation initiative would be founded, which relies on private donations to buy and maintain the forest, thereby preventing the lignite below it from being mined. Would you be willing to donate to such an initiative?"[3] If respondents answered with "yes," they were asked to indicate their hypothetical donation in Euros. Furthermore, based on the observed factors of relevance for the WTP from the literature survey, we also included questions about attitudes and habits regarding climate change, energy, and environmental issues, as well as the usual sociodemographic queries in our questionnaire.

The initial idea of our study was to conduct a cost-benefit analysis (CBA) under consideration of the use- and non-use values evaluated by the CV as well as of opportunity costs arising from the preservation of the forest for RWE and the region. The intention was to provide a rather neutral perspective on the highly politicized issue and support decision-makers in finding solutions by considering all aspects adequately. However, only four weeks after the survey was conducted in December 2019, the German government decided the early coal phase-out, also proposing that the preservation of the Hambach Forest should be guaranteed. Therefore, the focus of our analysis was broadened from the evaluation of the forest as such to the assessment of factors for a positive WTP for the Hambach Forest and the role of attitudes toward different forms of energy generation. Since the CV was part of a bigger survey about the German energy transition and the bioeconomy, questions regarding preferences for power generation technologies, methods from the field of bioeconomy as well as general attitudes regarding the environment were also included.

4. Results

The survey was conducted by a professional agency in December 2019. Altogether, 1,002 people participated in the telephone survey. Data obtained from the national survey were analyzed using the statistical package IBM SPSS 19. The sample is almost representative of the German population in terms of age, gender, education, and city size and residence in the 12 German federal states. Regarding the number of people per household, single households were underrepresented in our sample (27.9% as compared with 41.9%), whereas households with two persons were overrepresented (40% as compared with 33.8%) [45]. The household income was approximately representative of the German population, with the restriction that 10% of the respondents refused to answer this question. Accordingly, the lowest and the highest

[3] Since the survey was conducted among the German population, the original language of the survey was German.

income classes are underrepresented in our survey, which is in line with the common observation that people in extreme classes of income more often refuse to reveal their household income [46].

4.1 Willingness to pay—yes or no

Altogether, 47.2% of the surveyed people stated to be willing to pay an amount between 3€ and 1000€ for the preservation of the Hambach Forest. Furthermore, 49.7% answered the question about their WTP with "no," and 3.1% refused to provide an answer. In this case, a clear distinction between true zeros and protest zeros was not possible, since we did not ask for the reasons based on which they would refuse to pay. However, an indication for the occurrence of protest answer can be seen in the fact that 20% of the survey participants who stated a WTP of zero refused the further run of coal-fired power plants completely. For those with a positive WTP, the rate was 38%. According to a meta-analysis of Meyerhoff and Liebe [44], the mean share of protest responses in CV surveys is about 18% with a median value of 16%. The share is higher in scenarios with taxes or entrance fees as payment vehicle, and also the survey method may have an impact with onsite-, web-, and phone surveys leading to a lower share of protest zeros [44].

In order to observe differences between those with and those without a positive WTP for the preservation of the forest, we excluded all participants who did not answer this question with either "yes" or "no," which resulted in a total of 971 cases. We observed no differences regarding the WTP per se in terms of sociodemographic aspects except that females were more likely to state a positive WTP than males ($p = .05$). Highly significant differences between the two groups were observed for revealed activities listed in question 5.2 (**Table 2**): "Which of the following did you do within the last 12 months?" People with a positive WTP were much more likely to confirm those. Correlation coefficients are calculated as Pearson's r, since the variables were dichotomous (yes-no).

Participants with a positive WTP also favored nearly all surveyed aspects of a renewable energies, including the application of biogas, biofuels, and renewables in the industry, more than those who were not willing to pay. Those who stated they were willing to pay rated themselves as more informed regarding the energy

Measurement	Pearson's r	Significance
(a) Selective buying of regional food	.185	.000
(b) Selective buying of packages made of renewable materials	.247	.000
(c) Purchase of green electricity	.164	.000
(d) Avoidance of packaging	.185	.000
(e) Adaptation of the mobility behavior (e.g., to abandon the car or to use the bicycle more often)	.234	.000
(f) Purchase of bio-products	.271	.000
(g) Carbon compensation (payment to a specific organization for carbon offsetting projects)	.079	.014

Source: own.

Table 2.
Correlation between reported pro-environmental behavior (Q5.2) and a positive WTP.

transition. Furthermore, they had a more positive attitude toward solar energy, wind turbines, water turbines, and energy from biomass. Accordingly, the same was observed with a negative correlation for coal-fired and nuclear power generation. Furthermore, they rated themselves as more informed regarding the coal phase-out. All of those correlations were significant at the 0.01%level. No significant differences between the two groups were found for attitudes toward conventional and nonconventional natural gasoline.

Those who refused to answer the question whether they would be willing to pay at all apparently have strong pro-environmental attitudes, even compared with those who stated a positive WTP. For example, all of the 31 respondents from this category answered Q5.2e whether they changed their mobility behavior, e.g., by taking more often the bicycle instead the car, with "yes," while around 65% of those with a positive and 42% with a negative WTP affirmed this question. A similar distribution was observed for Q5.2d, whether respondents had consciously forgone packaging while doing groceries during the last 12 months. Those who refused and those who stated a positive WTP answered most other questions regarding attitudes and behavior toward environmental issues similarly.

4.2 Willingness to pay: amount

For the analysis of the amount of the WTP, we omitted those 31 cases with no answer as to whether they would be willing to pay. Of the 971 considered cases, 498 (51.3%) declined a willingness to pay. For further analyses, we treated these values as true zeros, although it cannot be ruled out that, by doing so, protest zeros are neglected. Therefore, the results should be considered a conservative estimate, and real preferences might be higher. In a first step, we checked the theoretical validity of the stated amounts by analyzing some of the variables, such as the income and attitudinal variables [47]. The mean WTP for all participants, including the zero values, was 26.83€, and the most frequently stated positive value was 50€, provided by 124 participants (12.8%). The mean WTP considering only positive values was 55.08€, whereas about 10% of the sample had a WTP higher than 50€. The highest stated amount was 1000€, expressed by three survey participants. Since none of the three profiles provided an indication for unreliable values, due to high income, high education, and a strong attitude toward environmental issues, we did not exclude them from further analyses. The same correlations were also checked for the whole sample. As expected, significant positive correlations were observed between stated pro-environmental behavior of Q5.2 and the level of income. Furthermore, also significant positive correlations were observed for preferences for renewable energy technologies such as solar, wind, biomass, and hydro, and negative correlations for coal power and nuclear engineering. Here, again, no significant differences in attitudes regarding conventional and nonconventional natural gas were found. People who rated themselves as more informed regarding the coal phase-out also had a significantly higher WTP. When considering only cases with a positive WTP, no significant differences regarding preferences for energy technologies were observed. Regarding stated pro-environmental behavior, only minor significant correlations were observed for the acquisition of green energy Q5.2c (positively) and the adaptation of the mobility behavior Q5.2e (negatively). Furthermore, people living in an owned house or flat, bigger household size, and higher income were linked to a significantly higher WTP. Although

females had a significantly higher WTP overall, males with a positive WTP stated significantly higher amounts.

4.3 Willingness to pay: extrapolation

Even though the Hambach Forest seems to no longer be immediately threatened in the near future, an extrapolation of the stated WTP values is of high interest, for example, in order to be able to compare the stated value to those of other natural goods. As discussed, the estimation is rather conservative, since we did not exclude potential protest zeros, which generally account for between 5% and 50% [43, 48]. Given the representative character of the survey for the German population, an extrapolation of the mean value of 26.83€ for the full-age population of Germany, which is about 67 million people [49], would result in roughly 1.8 billion € without considering benefits for future generations and people outside of Germany. This correlates to roughly 3.6 million € per ha. However, the following points may have led to a higher estimated value:

- Protest zeros are not considered.
- Non-respondents hold above-average pro-environmental values in this case, which could be an indication for a high estimation for the preservation of the Hambach Forest, although they apparently would not or could not monetarize their preferences.
- People with preferences for the scenario outside of Germany are not considered.

On the other hand, we did not provide the opportunity to state a quasi-negative WTP for our scenario to account for the fact that people might also be willing to pay in order to avoid the preservation of the Hambach Forest and favor instead the continuation of the original lignite mining plan. Just to compare these values, in North Rhine-Westphalia, the prices for forest areas—mainly working forest—in 2020 range from 10,000 to 30,000€ per ha according to a sales platform.

4.4 Willingness to pay: yes or no—a binary logistic regression

In order to generate an understanding of the importance of different factors influencing the willingness or non-willingness to pay, we conducted a binary logistic regression. Our hypotheses were that people with more pro-environmental behavior, pro-environmental attitudes, preferences for fossil-free power generation, and younger people are more willing to pay. Accordingly, attitudes toward the environment and energy technologies appeared to be important as impact factors, as well as gender and age. We also tested both, schooling and vocational education, but neither had significant impact on the dependent variable within the binary logistic regression model and were thus left out (**Table 3**). Our final model consists of six variables and considers 971 cases, representing roughly 97% of the sample. The remaining cases were excluded due to missing values regarding the dependent variable. A check for multicollinearity of the explaining variables showed no critical values. Using our binary logistic regression model, the rate of correctly predicted values rose from 51.3% to 66.9%. The pseudo-R squared (Nagelkerke) is 0.207, which is "acceptable" according to Backhaus et al. [50].

	B	S.E.	Wald	df	Sig.	Exp(B)
Attitudes toward renewables Q2.1 a-d	.300	.112	7.189	1	.007	1.350
Age (years) Q8.1.2	−.009	.004	4.078	1	.043	.991
Gender (male) Q8.1.1	−.245	.144	2.899	1	.089	.783
Pro-environmental behavior Q5.2	.371	.045	68.672	1	.000	1.449
Eco-centered conviction Q7.8.3	.128	.051	6.375	1	.012	1.136
Attitude toward lignite Q2.1e	−.156	.043	12.953	1	.000	.856
Constant	−1.397	.398	12.350	1	.000	.247

B: coefficient for the standard; S.E.: standard error for the coefficient around the constant; Wald: Wald Chi Square statistics; df: degree of freedom for the Wald Chi Square test; Exp (B): exponentiation of B coefficient, which is an odds ratio. Source: own.

Table 3.
Parameter estimate of the binary logistic regression.

Table 3 illustrates the influence of nearly each predictor variable, except gender, to the logistic model and the statistical significance ($p < .05$) of the Wald Chi Square test, which is obtained by squaring the ratio of the regression coefficient (B) to its standard error (S.E.). According to our analysis, the stated pro-environmental behavior, which normally correlates with strong pro-environmental attitudes, has the strongest impact on the WTP. This observation is not surprising, and this strong relationship has been shown by various studies (e.g., [51, 52]). The Odds Ratio (Exp(B)) indicates that, if the stated pro-environmental behavior increases by one unit, the probability to state a positive WTP increases by roughly 45%. The second largest impact factor is the attitude toward renewable energies (solar, wind, hydro, and biomass), which is also correlated significantly with stated pro-environmental behavior; an increase of one unit here implicates an increase of probability by 35%. This observation supports the assumption that not only values of the forest, but also a favor for the energy transition may have played a role in the decision to state a positive WTP. Further, an eco-centered conviction, measured by a statement regarding the perception of the vulnerability of the earth (Q7.8.3), has a clear positive impact on the WTP, although it is comparatively small. The acceptance of the use of lignite as an energy source (Q2.1e), instead, has a negative impact on the WTP; an increase by one unit of acceptance implies a decrease of roughly 14% in the probability to state a positive WTP. A negative impact on the probability to state a positive WTP can be observed for age and being male, although on a rather low level of significance. According to the literature, no general impact of gender on the WTP for environmental goods can be observed, since other factors such as attitudes, education, or income are generally more important [53]. However, a recent survey found that females probably are more pro-environmental in both Germany and the Netherlands [54]. By separating age from other factors, sometimes a negative impact can be observed, which means that older people are less willing to pay for environmental issues [53]. In these regards, our results are thus in line with previous findings.

4.5 Willingness to pay—ordinary least squares (OLS) regression analysis

In order to detect significant impact factors on the stated monetary values for the protection of the Hambach Forest, we conducted an OLS regression analysis. The

dependent variable, the stated amount of those willing to pay, was rather log-normal than normally distributed. Therefore, we logarithmized the dependent variable and applied a semi-log model. The following explanatory variables were considered:

- stated behavior regarding the environment (Q5.2),
- household income (Q8.6),
- age (Q8.1.2),
- gender (Q8.1.1),
- stated preferences for the renewables (Q2.1),
- attitudes toward lignite (Q2.1e),
- trust in the national and federal government (Q6.1a and Q6.1b),
- political party, which was chosen during the national election in 2017 (Q7.3),
- satisfaction with the way political decisions are conducted in Germany (Q7.4),
- perception of the vulnerability of the earth (Q7.8c).

However, only a very low rate of explained variation with an R^2 of .081 and a corrected R^2 of .057 could be reached using an OLS regression approach. The results are displayed in **Table 4**. No more than three variables with significant impact on the stated amount of the WTP were observed: gender ($p = .01$), household income ($p = .001$), and the degree of agreement with statement Q7.8c about the vulnerability of the earth ($p = .05$). As generally the case in CVs, household income has a positive effect on the WTP: the higher the income, the more easily people can afford to pay for environmental goods and services. Compared with the other variables, income had the strongest impact on the WTP, but only when considering the average household income. In other models, when per-capita income was considered the explaining variable, no significant impact was observable. Furthermore, in our case also being male had a positive impact on the WTP. It is important to note that males had a significantly higher household income in our survey. However, testing for collinearity did not reveal problematic values. Finally, the impact of perceived higher vulnerability of the earth on the WTP can be considered as an indicator for a higher estimation of existence values as well as fears of losses of environmental goods and services. Stronger agreement with this statement normally goes along with a more nature-centered point of view, which also could explain a higher WTP. The low rate of explained variation leads to the assumption that other factors, which we did not consider in our survey, may be of strong relevance for the stated amount. Imaginable are issues regarding personal budget constraints, a general estimation of woods and forests, or dissatisfaction with climate policies, as well as embedding effects resulting from our payment scenario. Alternatively, the group of respondents with a positive WTP is more homogeneous regarding attitudinal values compared with the same values over all respondents, as an analysis of variance showed.

Modell	Non-standardized coefficients		Standardized coefficients	T	Sig.
	Regression coefficient B	Standard error	Beta		
Constant	2.401	.434		5.531	.000
Attitude toward lignite Q2.1e	.031	.030	.051	1.021	.308
Trust in the national government Q6.1a	−.027	.047	−.049	−.570	.569
Trust in the federal government Q6.1b	.069	.049	.120	1.415	.158
Perception of the vulnerability of the earth Q7.8c	.088	.035	.124	2.512	.012
Age (years) Q8.1.2	.003	.003	.054	1.085	.279
Summary of pro-environmental behavior Q5.2	.001	.032	.002	.045	.964
Summary of attitudes toward solar power, wind power, water power, and energy from biomass Q2.1	−.001	.056	−.001	−.010	.992
Voted the Green party at the last national election Q7.3	.087	.119	.036	.726	.468
Gender: Male Q8.1.1	.272	.097	.137	2.793	.005
Household income Q8.6	.000	.000	.184	3.799	.000
Attitude toward the end of lignite mining Q4.3	−.143	.097	−.077	-1.470	.142

[a]*Dependent Variable: LogNormal_0_WTP.*
Source: own.

Table 4.
Parameter estimate of the OLS regression.

5. Discussion

Striking outcome of our survey results is that, against our expectations, no clear differences in the results were found compared with earlier surveys about stated WTP values of forests. All of the results are more or less in line with previous findings about values for environmental goods [20, 55]. This is especially interesting, since in this case nearly exclusively existence values are of relevance, whereas the other cited surveys mostly consider also direct use values. Kriström [56] found that respondents who expressed only a use motive stated a higher WTP on average than respondents stating only a non-use motive. Those who expressed both, use and non-use motives, stated the highest WTP. Since the stated values here are quite similar to those of the other cases described in the literature review section, this may be seen as an indicator for the existence of a premium for a symbolic value on top of already known non-use values. The variable with the highest impact on the WTP was income, which can be interpreted as an indicator for reliability of the stated amounts [57]. However, in contrast to most other surveys about environmental goods, this time only passive-use values

were of relevance. Further, the area of the Hambach Forest is rather small compared with other woods and forests evaluated so far. Thus, WTP values referring to the area lead to an exceptionally high value compared with previous surveys [20] based on passive-use values only. There is a long-lasting discussion about the sensitivity of scope in contingent valuation surveys [55, 58–65]. Inconsistencies are quite often a result of a lack of spatial sense: only a minority has a clear image of, e.g., 10,000 ha or 50,000 cormorants. However, in cases where existence values dominate over use values, scope is usually of minor relevance for the stated WTP [61, 63]. Lindhjem [35] found in a meta-analysis of Scandinavian WTP surveys for woods and forests only minor scope effects, whereas he argues that woods and forests are complex environmental goods, and simplified indicators such as area size or percentage may not easily capture their scope. Hjerpe et al. [63], in contrast, found that individuals are typically sensitive to the scope of ecosystem service provision, in both quality and quantity. Also Ojea and Loureiro [65] found that CV results are sensitive to the scope of the good being valued, but the results depend on how the environmental change is measured: absolute sizes are preferable over relative ones. Further, Barrio and Loureiro [55] found out that, among others, recreational aspects play an important role for the WTP of people for the preservation of forests. It is therefore possible that the following two effects might have led to "normal" WTP values in our case: the nearly total absence of direct use values might have lowered the WTP for the Hambach Forest, whereas the threat of a drastic change in form of a complete annihilation might have had an opposite effect. Further, the already mentioned symbolic value is reflected in the stated WTP values.

Regarding the results from the regression analyses, the remarkable difference in the rate of explained variance is astonishing: while the decision to be willing to pay or not could reach an acceptable level of explained variance by a regression model, the explained variance for the stated amount remained on a low level. This means that some underlying factors seem to exist, which are not covered by the survey. Imaginable are attitudes toward the procedure of the policy administration in this case, which initiated a strong and disproportionate police operation, in which the Hambach Forest should be freed from occupants and thus also be prepared for a quick clearance, in case of need. Another possible explanation may be a considerable rate of protest responses in our survey. Furthermore, in the view of parts of the population, RWE is often portrayed as voracious based on the fact that it is responsible for having already effaced the largest part of the Hambach Forest and for planning to annihilate it completely. Therefore, the will to contribute to a fund, which prevents the complete annihilation of the forest, may also result from a desire to stop RWE in following its operating plan. The concern of climate change and its mitigation may have played an additional role, since 2018 and 2019 were the first and the third hottest year in Germany since the beginning of the weather recordkeeping. Furthermore, this development was accompanied by the Fridays for Future movement initiated by Greta Thunberg and may thus also have contributed to the wish to combat climate change. Altogether, an interplay of different influencing factors on an individual basis seems to have led to the rather low level of explained variance of the stated WTP values.

6. Conclusions

We conducted a representative CV survey within the German population in order to find out whether there is a symbolic value of the Hambach Forest. It is a remarkable statement for the preservation of the Hambach Forest that at least 47% of the

respondents stated a positive WTP, considering that the forest does not provide any direct use values to almost all of the surveyed people. The mean value of the positive WTP was rather high with 55.08€, whereas the standard deviation of the stated values with about 76€ indicates considerable differences regarding attitude and estimation toward the Hambach Forest. Due to the almost complete absence of use values, the stated WTP can be seen as a premium for the existence of the Hambach Forest and as a vote against political decisions regarding lignite mining operation, climate protection, and the acceptance of coal fired power plants, as our regression analyses showed. Further, since the Hambach Forest provides nearly exclusively passive use values, and the WTP values are at least at the same level as in previous surveys with larger forests comprising also direct use values, this can be considered an indication for a premium for its symbolic value. Not least the strong media coverage with very different views reflects the broad spectrum of attitudes toward the Hambach Forest. People who are trying to act more environmentally benign also were significantly more likely to be willing to pay for the preservation of the Hambach Forest. Furthermore, their attitudes toward renewable energies were significantly more positive compared with those without a positive WTP. The symbolic status of the Hambach Forest can be characterized by opposites. For those who rather support the protests, the contrasts might be nature—destruction, climate protection—climate catastrophe, small (population)—big (RWE and provincial government), commons/common welfare—greed/profit. For those who are rather critical toward the protests, the case may represent the defense of jobs, welfare, law, and order against chaos, cadgers, and violent anarchists. Thus, a stated positive WTP can be an indicator for the self-identification of the respondents, whereas due to the unknown rate of protest zeros, the opposite is not so easy to state. A more in-depth analysis would be needed in order to answer the question about the motives of the respondents more profoundly.

Through our survey, we were able to show that the Hambach Forest holds a high valuation among the German population, which is nearly exclusively based on non-use values only, in which a premium for its symbolic value might be included. Considering the results of the CV question and bearing in mind that there is probably a non-negligible proportion of protest zeros, the valuation of the forest as a symbol against climate change is remarkable and should be considered in future political decisions. Especially for the background of the European Green Deal, which means that the European Union aims to become the world's first "climate-neutral bloc" by 2050, these values might be understood as a hint for people's support of an ambitious environmental and climate policy.

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