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At a Conservation Crossroad: The Bahoruco-Jaragua-Enriquillo Biosphere Reserve in the Dominican Republic

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Abstract: This paper assesses the Dominican Republic's willingness to pay (WTP) for a conservation, restoration, and sustainable development program for the Bahoruco-Jaragua-Enriquillo Biosphere Reserve (RBJBE). Created in 2002, the RBJBE covers approximately 4858 km^2, of which approximately 900 km^2 correspond to the sea surface. With three core conservation zones, the RBJBE constitutes a complex space with a history of conflicts rooted in exploiting natural resources and social and economic issues. At the same time, it is a biodiversity hotspot of global importance. We present a Contingent Valuation Method to estimate the WTP for a conservation and restoration program called PROBIOSFERA. The non-parametric and parametric estimates of the WTP are DOP 165.00 (≈USD 2.94) and DOP 181.88 (≈USD 3.25), respectively. The socioeconomic variables that positively affect the WTP are income level, educational level, and age. The ecosystem services that are statistically related to WTP are the provisioning and supporting services. Regardless of the monetary valuation scenarios defined, the estimated annual monetized aggregated welfare associated with the RBJBE for Dominican society is DOP 7.2 billion (≈USD 128.1 million).

Keywords: biosphere reserve; Jaragua-Bahoruco-Enriquillo; contingent valuation; Dominican Republic

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1. Introduction

This paper assesses the Dominican Republic's willingness to pay (WTP) for a conservation, restoration, and sustainable development program for the Bahoruco-Jaragua-Enriquillo Biosphere Reserve (RBJBE) by using a Contingent Valuation Method (CVM) to estimate it. The RBJBE is in the southwestern part of the Dominican Republic (DR), along the southern border with the Republic of Haiti (Figure 1).

The United Nations Educational, Scientific and Cultural Organization (UNESCO) created the RBJBE in 2002. It covers approximately 4858 km^2, of which approximately 900 km^2 correspond to sea surface [1]. It originated from UNESCO's Man and the Biosphere Program (MAB), which was launched in 1971, before the emergence of the concept of sustainable development in the late 1980s [2]. Biosphere reserves (BRs) are primarily conservation tools that seek to harmonize the interactions between people and nature [3]. Based on the Seville strategy [4], which aims to strengthen BRs, they are intended to fulfill three primary functions: (1) to serve as conservation tools; (2) to operate as development tools by fostering sustainable development; and (3) to support environmental initiatives for monitoring, training, education, and research aligned with local, national, and global agendas for sustainable development [2]. However, because sustaining BRs can be costly in financial terms and from a political and socioeconomic perspective [5,6], key research questions arise: How does Dominican society value the existence of the RBJBE? What are the key socioeconomic characteristics which could explain the WTP of the Dominican Society? What are de preferences of the local society in the BR's surroundings? What about the perception of the society of the ecosystem services provided by the biosphere reserve? This paper provides some answers to the above research questions based on the analysis of the structure of preference and, at the same time, an estimate of the Dominican society's preference for a long-term commitment to the conservation and the local development of the territories and communities located in the RBJBE. These answers could shed some light on policymaking in complex related to biosphere reserve management worldwide.

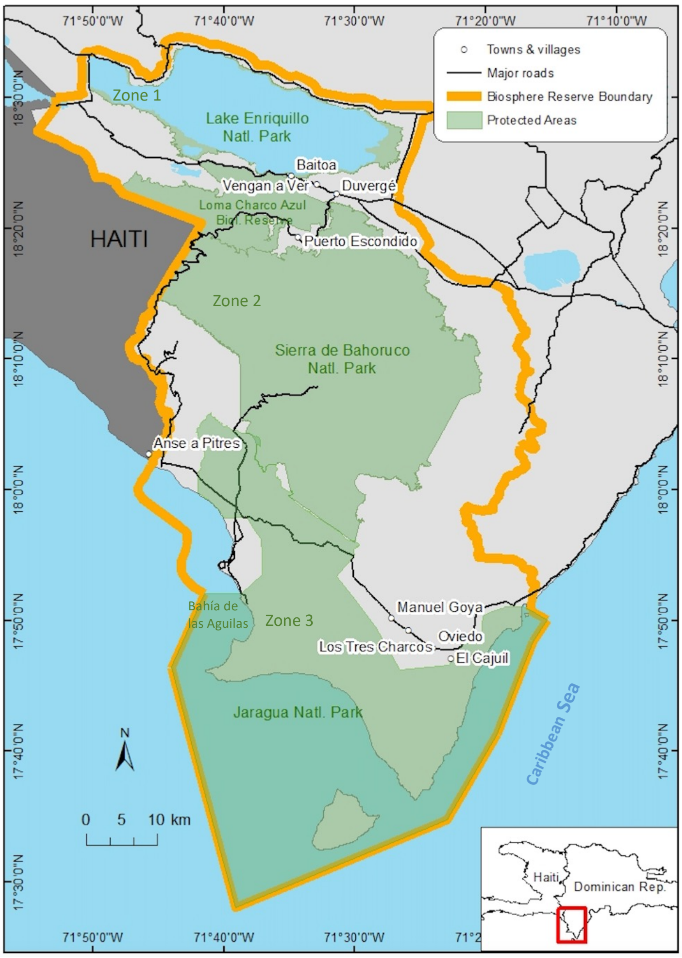

Figure 1. Biosphere Reserve Jaragua-Bahoruco-Enriquillo (Source: Map courtesy of Dr Yolanda Leon, Laboratory of Geomatics and Geographic Information Systems of INTEC).

1.1. The RBJBE Biosphere Reserve at Glance

As can be seen in Figure 1, the RBJBE has three core conservation areas: conservation zone 1 is the Enriquillo Lake National Park and its surroundings; conservation zone 2 is the Sierra de Bahoruco National Park; and conservation zone 3 is the Jaragua National Park. Enriquillo Lake is the most significant wetland in the Caribbean, covering a surface area of approximately 220 km^2, and it is the first RAMSAR site declared in the region [7,8]. The Sierra de Bahoruco National Park covers the provinces of Barahona, Independencia, and Pedernales. The Jaragua National Park in Pedernales Province is a recognized international biodiversity hotspot [9–11]. In addition, the Biological Reserve Loma Charco Azul is also located within the RBJBE [1]. This Reserve is highly biologically diverse, with species that include two endemic species of mammals of Hispaniola: the selenodont *(Solenodon paradoxus)* and the Hutia (*Plagiodontia aedium*), which are both highly threatened by habitat deterioration due to anthropogenic pressure and the expansion, mainly from agricultural encroachment in these protected areas [12].

The biodiversity of Lake Enriquillo and its surroundings (conservation zone 1) includes more than 65 native, endemic, and migratory birds, and endemic species of iguanas (*Cyclura cornuta* and *Cyclura ricordii*) and the American crocodile [8,11,13]. On May 14, 1974, Law 664 created national parks in Lake Enriquillo, Isla Cabrito, and other protected areas. Moreover, the lake basin contains relevant archaeological artifacts left behind by pre-Hispanic settlements of different aboriginal cultures.

Between the end of 2003 and 2014, the surface of Lake Enriquillo expanded, resulting in the flooding of cultivated land and human settlements around the lake. During this time, the lake's water level increased from approximately 42 to 29 m below sea level [14,15]. The social impacts and economic losses of the floods (although there is no precise estimate of the value of the economic losses during the 10-year of flooding, it has globally estimated at around the US $ 70 million [16]) include substantial losses in agricultural and livestock activities directly affecting more than 17,000 productive hectares and close to 22,000 lake inhabitants, with extended impacts to just over 122,000 inhabitants of the nine municipalities of the provinces of Bahoruco and Independencia [17]. It cannot confirm or deny the accuracy of the above estimate of the value of the economic losses caused by the long-term flood of Lake Enriquillo. Still, one of the responses of the Dominican government was to relocate the people of Boca de Cachón, a community located in the northwestern vicinity of the lake. This relocation cost around US $24 million [18], and it probably represents the first human settlement in the Americas relocated because of climate variability in the XXI century. The relocation of Boca de Cachón could be understood as a case of climate justice, considering an analysis of asymmetries capabilities for climate adaptation of the two countries that share the Hispaniola [14], and point out the need of strengthening binational scientific cooperation with the support of regional and global alliances, to address an environmental, climatic and humanitarian problematic that overflowed the limits of the island.

The Sierra de Bahoruco National Park (conservation zone 2) is recognized for the global importance of its herpetofauna and its humid, semi-humid broadleaf and coniferous forests that are unique to the Caribbean [19]. The Sierra de Bahoruco National Park was created in 1983 through Presidential Decree 1315. However, it did not establish its current limits until 2004, when the sectorial law of protected areas 202-04 was enacted. Habitats of protected flora and fauna species, including migratory birds such as the Bicknell's Thrush (*Catharus bicknelli*), have been fragmented due to the expansion of avocado cultivation within the limits of Bahoruco National Park [19]. Moreover, local conservation is hampered by illegal immigration from Haiti, highlighting the complex links between poverty, migration, conservation, and sustainable development in La Hispaniola island [20].

In 1945, the Alcoa Exploration Company was granted a concession for the open-pit mining of bauxite, which started in 1958. It constitutes one of the oldest economic activities with the most significant environmental and economic impacts on the southern slope of the Sierra de Bahoruco, specifically in the community of Las Mercedes in the province of Pedernales [21] (p. 69). It was the first large-scale international mining operation in the DR [22] (p. 222), and it has continued, albeit with less intensity, until the present. In addition, its present activities have diversified to include the manufacture of cement, which is derived from the limestone quarries around Cabo Rojo and Las Mercedes. The Jaragua National Park (conservation zone 3) was created in 1986 through Presidential Decree 157-86 and was ratified with its current limits by sectorial law 202-04. Within its area lies one of the most emblematic sites of the RBJBE, the Bahía de las Aguilas, which is possibly one of the most important nesting sites for sea turtles in the Western Hemisphere. It supports species such as the leatherback, hawksbill, green turtle, and scattered populations of the West Indian manatee, an endangered species [23,24]. The natural wealth and the beauty of the Jaragua National Park have transformed certain places in the Reserve into attractive places for tourism development. Figure 2 shows some key sites of the RBJBE, a mosaic of natural resources exploitation, climate crisis, rich biodiversity, and opportunities for sustainable development.

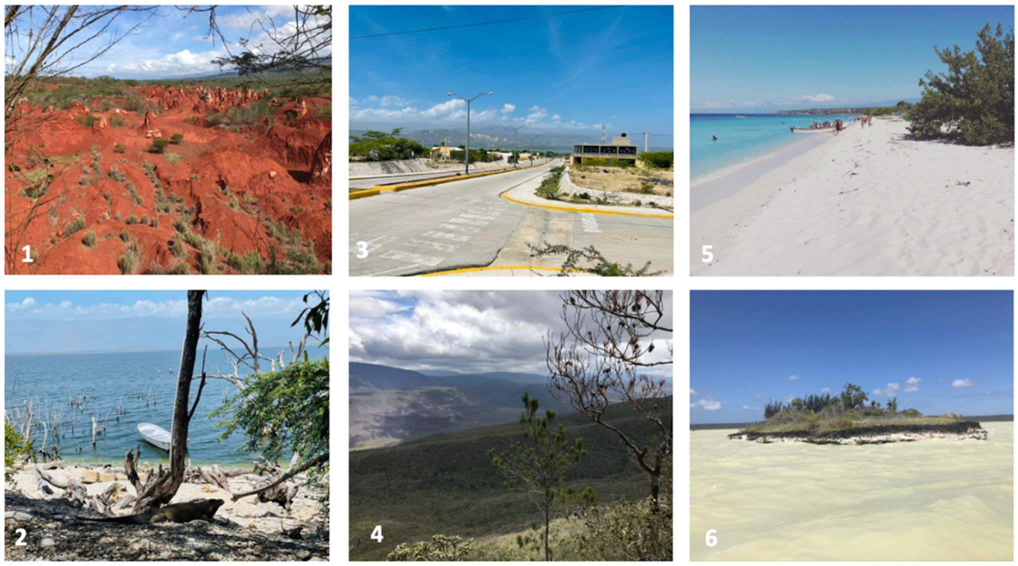

Figure 2. Some essential sites within the Jaragua-Bahoruco-Enriquillo Biosphere Reserve. (**1**). Las Mercedes open pit mining activities. (**2**). Entry Point of Lake Enriquillo in La Descubierta, northwestern side of the lake. (**3**). The new Boca de Cachón main avenue after the resettlement of 2012. In the background lies Lake Enriquillo. (**4**). The Pelempito Hole in Sierra de Bahoruco, Pedernales. (**5**). Partial view of Bahía de la Aguilas beach. (**6**). Islet in the Laguna de Oviedo, Jaragua National Park.

In the second half of the 1990s, it was first considered developing Bahía de las Aguilas for tourism. Since then, the Dominican government has formulated an ambitious plan for developing communications infrastructures and hotel facilities based on a portfolio of investments from public–private alliances and partnerships. In December 2020, through Presidential Decree 724-20, the investment trust "Pro-Pedernales" was formally instituted [25]. According to the media and a press release [26], this effort is expected to raise global investments of around USD 1 billion over 10 years, which will fund the construction of some 3000 hotel rooms in areas surrounding Cabo Rojo and Bahía de las Aguilas, an international airport, and other infrastructure to support tourism.

BRs are complex multi-actor and multi-level spaces that depend on the activities of multiple players acting in multiple levels, as local producers and community-based organizations, or local governments and non-government organizations, or national authorities on the environment and natural resources or agriculture whose interactions around the biosphere reserve shape its governance and institutional life. They are defined by the social, political, economic, and institutional interactions with the ecosystems and conservation units [27]. Thus, different types of potentially conflicting interests may coexist within reserves, depending on the circumstances and the quality of governance specific to the area [27]. The RBJEBE thus constitutes a complex space with a history of conflicts related to the exploitation of natural resources. Meanwhile, it is also a biodiversity hotspot of global importance that both policymakers and investors expect to become the next important tourist destination in the Caribbean.

1.2. The Conservation and Sustainable Development Crossroad

Protecting the ecosystems within the RBJBE poses significantly more significant challenges compared to those in other regions of the DR. These challenges are due mainly to socioeconomic and cultural factors (e.g., the poverty of the communities in the RBJBE) and the tensions generated by the illegal migration of citizens of the Republic of Haiti [1].

Of the 10 poorest municipalities in the DR, 3 are found in the RBJBE: Cristóbal, Postrer Río, and La Descubierta, with poverty rates of 86.2%, 82%, and 78.8%, respectively [28]. Local socioeconomic factors such as poverty and several external policy factors such as the decision-making process of environmental or agricultural national authorities have exerted direct pressure on the natural resources and ecosystem services provided by the RBJBE. These factors have affected the efficiency of the governance of the different conservation zones of the RBJBE, generating local conflicts and limiting the success in achieving the Reserve's conservation and sustainable development goals [1,29]. The creation of the biosphere reserve in 2002 has neither prevented nor mitigated the social and conservation conflicts in the RBJBE. Nevertheless, the creation of the BR was justified, given the biodiversity and the unique environmental values of the region. The RBJBE inherited a complex problem before 2002; this relates to the different conflicts of interest between the stakeholders responsible for protecting the areas within the conservation zones. The origin of these conflicts dates to how they were created.

The protected areas that make up the BR were created during the period of expansion of the national system of protected areas of the DR, especially during the first (1966–1978) and second (1986–1996) periods of Joaquín Balaguer's government, except the Sierra de Bahoruco National Park, which was created in 1983 [30] (p. 4). The first period was a highly repressive semi-dictatorship that banned cutting trees in 1967 through law 206-67. This law gave all trees state ownership, including those on private lands [31] (p. 631). The second period of the Balaguer's regime was less repressive in political terms but equally drastic and conflictive with local communities. In the first year of his second term (1986), the black forest operation was deployed against vegetal charcoal manufacturers, who tended to be poor peasants living under an uneven land tenure system. The alleged aim of the operation was to control the destruction of the dry forest [31,32]. However, the *black forest* operation was a paramilitary operation that imposed strict control over the dry forest and was a questionable system of forest use [32] (p. 21). Some of the socioenvironmental conflicts related to protected areas have become more acute over time; an example is the agricultural frontier expansion in the Sierra de Bahoruco. Other conflicts have become more complex due to factors such as climate variability and socioeconomic factors, as has been the case of Lake Enriquillo and its surroundings. Conflicts, such as the illegal looting of land in Bahía de las Aguilas at the end of the 1990s, although resolved in the courts in 2018, still pose a challenge for tourism development because the communities involved are also a part of the Reserve, with roles and benefits in a sustainable tourism model.

It can also be considered the conservation crossroad perspective from the point of view of the social choice analysis, which has deep roots in economic thought, going back to Jeremy Bentham and his social utilitarian analysis based on the assumption that social welfare can be estimated from the aggregation of individual well-being [33] (p. 191), [34] (p. 118). In public goods, certain externalities and significant information asymmetries may make it challenging to estimate consumer surplus in the market demand functions related to the analyzed goods. Therefore, it is necessary to create a hypothetical market that allows for the analysis of the effects of the equivalent variation of income in individuals to estimate how such variations affect their well-being in terms of their expected consumption surpluses [35–37]. The above valuation approach is the foundation of the CVM. It allows us to elicit the declared preferences of a sample of individuals by directly asking them their WTP (or willingness to accept—WTA) suggested changes in the availability, quantity, or quality of environmental goods. Usually, in this approach, the WTP involves the assurance of an improvement in the quality of the environment. In contrast, the WTA involves the avoidance or acceptance of a certain level of degradation [38].

A growing body of literature can be found in the case of stated valuation methods, including the CVM, choice experiments, and Conjoint Analyses, applied in biosphere reserves for analyzing ecosystem services. In Africa, it highlights the systematic review carried out by Azadi, Van Passel, and Cools [39], including contingent valuation and conjoint analysis as valid approaches for the monetary valuation of ecosystem services in the biosphere reserve. An application of choice experiment to measure the WTP for different management scenarios in BRs can be found in the case of the Urdaibai Biosphere Reserve in the Basque Country in Spain [5]. Similar cases can be found in Iran and Vietnam [40,41]. A novelty of this study is the application of CVM in a biosphere reserve in the context of the Caribbean region, a more complex scenario than a single protected area, due to the mosaic of protected areas that make it up and the challenges it poses for a binational border zone, in the context of developing countries with high socioeconomic asymmetries but that share common challenges in terms of conservation and adaptation, as in the case of the Dominican Republic and the Republic of Haiti [14,42].

2. Materials and Methods

The CVM is a declared and a direct preference valuation technique based on the construction of hypothetical markets. The CVM determines the economic value that society gives to ecosystems or related services. Regular markets cannot allocate an efficient price, specifically for non-use values, requiring a hypothetical market's direct economic valuation approach. Contingent valuation creates a hypothetical scenario in which respondents declare their preferences for a good or service, specifically for services using no market to be exchanged, and by using detailed questionnaires to estimate the WTP for such goods or services [43]. The foundations of CVM are sustained on an interpretation of welfare economics, in which a person can make an economic tradeoff in reaction to a change in the availability, quality, quantity or prices of public goods to ensure that their welfare remains unchanged less affected [36]. Based on these foundations, CVM allows an economic tradeoff to be made in support of a natural place, a protected area, or to preserve endangered species even if that person will never visit the protected site [39,44,45].

Based on polls and sampling techniques, a hypothetical market could be created by asking about changes in the maximum WTP for ecosystem services, specifically for ecological restoration programs as in the case of the well-known Exxon Valdez case in 1989 [46], as well as the more recent case of the oil spill in the Gulf of Mexico in 2010 [47]. CVM has not been without legitimate academic criticism. However, there is a robust scholarly consensus about its legitimacy, even in developing countries such as the DR [44,45,48]. Considering information asymmetries, negative externalities affecting the estimation of consumer surplus, as it happens with environmental and natural resources issues, stated preference methods of CVM seem to be a reliable alternative [49,50]. The CVM is a suitable approach for determining the economic value that society gives to certain ecosystem goods and services; it considers individual uncertainty and has been recognized as a reliable approach for a market that cannot efficiently allocate prices due to externalities and information asymmetries [39,43,51–53].

2.1. Questionnaire Design and Sampling

The CVM was used to estimate the WTP of the Dominican society for PROBIOSFERA, which is a hypothetical program intended to support the institutional strength and the sustainable management of the RBJBE. It focuses on supporting the Reserve's conservation and sustainable development goals within its role as a geographical planning space. It is an internationally recognized territory for its biodiversity values while facing unsolved acute social and economic challenges. The questionnaire is a fundamental component in a CVM. The PROBIOSFERA questionnaire included questions that address critical socioeconomic and demographic variables distributed in several sections. It followed a referendum format ("yes" or "no") to estimate the WTP for several bids; thus, the voters were asked to vote "yes" or "no" on each bid to determine if each one exceeds their WTP for the PROBIOSFERA program [47,54,55]. Based on a pilot study, the final bid vectors for PROBIOSFERA were DOP 70.00, DOP 110.00, DOP 150.00, DOP 190.00, DOP 230.00, DOP 260.00, and DOP 300.00 as the truncating point. The different bids were randomly distributed among respondents. The RBJBE's questionnaire consisted of two main sections with 37 questions. The first section concerned general information on the BR, specifically, its conservation zones and protected areas, and the primary ecosystem and its related biodiversity. The interviewers shared information about the RBJBE using visual aids such as maps and photographs [43,45].

The second section contained four blocks of questions: block "A" consisted of 10 questions in a semantic scale format (scale values from 1 to 10) about the respondent's level of knowledge of the RBJBE [56]. Block "B" consisted of six questions about the WTP for the PROBIOSFERA program. The questions were preceded by a detailed explanation of the program, including its benefits, in a referendum format of defined bids [50,57]. Block "C" consisted of 12 questions about the socioeconomic characteristics of the participants, including their educational attainment, income level, employment, economic activities, and others [51,52,54]. Block "D" consisted of seven questions in semantic scale format (scale value from 1 to 10) about the perceived value of the ecosystem services provided by the RBJBE [52,58,59]. Table 1 shows selected socioeconomic variables used in the RBJBE monetary valuation survey.

Table 1. Selected socioeconomic variables in the RBJBE valuation survey.

Variable	Categories
Gender	(0) Female; (1) Male
Age and age group	(1) 8 to 30
	(2) 31 to 45
	(3) 46 to 60
	(4) 61 or more
Marital status	(1) Single
	(2) Married
	(3) Separated
	(4) Widow
Place of residence	(1) Urban zone; (2) Rural areas
Macro-regions	(1) North; (2) South; (3) Santo Domingo Metropolitan area; (4) East
Homeownership	Own
	Rented
	Loaned
	Other
Type of house	Single-family unit
	Apartment
Number of people living in the house	
Educational level	Illiterate
	Primary education (K8)
	Secondary education (K12)
	Vocational education
	College/university education
	N/A (not applicable or no answer)

Table 1. *Cont.*

Variable	Categories
Economic activity	Unemployed
	Public worker
	Private worker
	Trader
	Self-employed
	Informal activities
	N/A
Are you the only person working in the family?	No; (1) Yes
Family month income level	≤DOP 10 k . . . ; (4) DOP 30 k–DOP 40 k . . . ; (8) DOP 71 k–DOP 80 k . . . ; (14) ≥DOP 151 k
Membership to social or environmental organizations	No; (1) Yes

The survey was conducted as follows: the interviewers appropriately identified themselves and asked if the potential respondents were interested in participating in the survey. Respondents who agreed to participate were first asked their age because only adults were allowed to participate.

The survey followed a random sample design that included the four Dominican macro-regions: North, South, Santo Domingo Metropolitan area, and East regions [43,53]. Participants were all Dominican citizens who were over 18 years old and in the job market. A pilot study with 60 respondents was conducted in Santo Domingo during the first and second weeks of September 2020 to validate the CVM survey. The reached sample consisted of 1104 individuals equally distributed among the four macro-regions (251 for each macro-region). The fieldwork was conducted during October, November, and December of 2020 and January of 2021 for a hired professional team following the COVID-19 protocols of the Dominican government. In addition, 100 interviews were conducted in the 4 provinces of the Enriquillo region, in proportion to the demographic weight of each province. The Enriquillo region is part of the southern macro-region. The final analysis was carried out in March of 2021.

2.2. Modeling the WTP

To provide a robust check, we used two approaches to analyze the PROBIOSFERA's WTP: the parametric and non-parametric approaches [55,60]. *Parametric approach.* The parametric approach assumes that fixed parameters determine the WTP in the yes/no survey responses. We calculated the means and standard deviations and assumed a normal distribution, affecting the probabilistic model in the randomly assigned bids. We used a random utility framework in unobservable factors such as measurement error and response uncertainty. The error term was added to complete the random utility formulation, implying that an individual responds "yes" to the bid only if the utility in favor of the PROBIOSFERA is higher than the utility in a situation with no PROBIOSFERA. It is expressed in the following terms:

$$V\left(q_{\text{yes PROBIOSFERA}},\ \text{income} - \text{DO\$bid}\right) + \varepsilon \geq V\left(q_{\text{n PROBIOSFERA}}, \text{income}\ \right) + \varepsilon \quad (1)$$

where V represents the random utility concerning "yes" or "no" responses, in the parametric approach, the WTP is estimated by assuming that the random element of respondents' utility (i.e., the ε in the equation) typically follows a normal or logistic distribution. Thus, the probability of a positive response to a suggested bid is defined by:

$$P[\text{yes}] = P\left[Vq_{\text{yes PROBIOSFERA}}, (\text{income} - \text{bid\$}) - V\left(q_{\text{no PROBIOSFERA}}, \text{income}\right) + \varepsilon_1 - \varepsilon_0 \geq 0\right] \tag{2}$$

where P represents the probability of a positive response within the logistic distribution approach, therefore, the utility function has a linear formulation, which is expressed as $V_j = \alpha_j + \beta_j q_i + \mu_j \text{Income}_j$, where V_j represents the linear formulation of the utility function, and the logistic probability distribution of the error term, ε, is defined as follows:

$$P[\text{yes}] = P\left[\alpha_j + \beta_j\left(q_{\text{yes PROBIOSFERA}} - q_{\text{no PROBIOSFERA}}\right) - \mu * \text{bid\$} + \ \varepsilon_{\text{yes PROBIOSFERA},j} - \ \varepsilon_{\text{no PROBIOSFERA},j} > 0\right] = \frac{1}{1+e^{-\left(\frac{\alpha}{\tau} + \frac{\beta}{\tau}\left(-q_{\text{no PROBIOSFERA}}\right) - \frac{\mu}{\tau}\text{bid\$}\right)}} \tag{3}$$

where the terms $\propto\beta$ and μ represent the logit regression coefficients (τ represents a scale parameter). The right side in Equation (3) follows a logistic *cumulative density function* called the logistic survival function. A typical Maximum Likelihood approach estimates the utility function's average parameters that likely define the pattern of yes/no responses in the survey. In Equation (3), the scale parameter is a spreader encompassing socioeconomic variables and related characteristics of the individuals considered. It affects the structure of the preference for the implementation of the PROBIOSFERA in favor of RBJBE. We also estimated the coefficients corresponding to a specific level of knowledge and the socioeconomic variables [39,61,62]. We used the following formula to estimate the average WTP for the $\propto\beta$ and μ parameters:

$$E[\text{WTP}] = \frac{\alpha + \beta\left(q_{\text{yes PROBIOSFERA}} - q_{\text{no PROBIOSFERA}}\right)}{\mu} \tag{4}$$

where β represents the marginal utility of the PROBIOSFERA, and μ corresponds to the marginal utility of income as disutility or welfare losses from paying the bid. The parameter $\propto$ represents a constant calculated from the following Equation:

$$E[\text{WTP}] = \frac{\alpha_0 + \alpha_1 * X_1 + \alpha_2 * X_2 + \beta\left(q_{\text{yes PROBIOSFERA}} - q_{\text{no PROBIOSFERA}}\right)}{\mu} \tag{5}$$

where X_1 and X_2 represent independent variables, if X_1 is a dummy variable equal to 1 to capture the female preference in an estimation based on gender preference, then setting X_1 = 1 in Equation (5) will result in the average WTP estimate for female respondents—in the parametric approach, assuming a given probability distribution [38,61,63].

Non-parametric approach. The non-parametric approach estimates the proportion of yes/no responses if larger bids take the shape of a monotonically decreasing curve. The empirical survival function allows for estimating the WTP in the area under the curve without assuming a normal distribution for the observed variables [55,60]. Finally, although the CVM is based on surveys of individuals, the generalization on the WTP considers the households rather than the number of inhabitants. Thus, the benefits of any environmental change are represented in the household expenditure function and the non-separability of the individual utility function from the household utility function [36] (p. 696), [64] (p. 658).

3. Results

Our goal was to understand how Dominican society values the existence of the RBJBE. We accomplished this goal by determining the economic tradeoff in reaction to hypothetical changes in the quality, quantity, or prices of public environmental goods represented by the BR [36]. As described in Sections 2.1 and 2.2, we estimated the WTP for PROBIOSFERA, which enabled us to approximate society's social preference and then measure the welfare associated with the RBJBE [38,65]. Consequently, the models described in this section focus on assessing the construction of the RBJBE, as the addition of its conservation zones, protected areas, and other relevant sites form the foundation for the eventual implementation of PROBIOSFERA [46,47]. A list of statistically significant socioeconomic variables is in Table 2.

Table 2. The proportion of positive responses.

Suggested Bids in DOP	Number of "Yes" Answers	The Proportion of Positive Answers
70.00	128	0.69
110.00	117	0.62
150.00	103	0.56
190.00	86	0.47
230.00	73	0.41
260.00	63	0.34
300.00	0	0.00

3.1. Nonparametric Modeling of the WTP

Table 2 shows the more intuitive non-parametric statistical results based on the proportion of "yes" answers supporting the PROBIOSFERA program. These positive responses are the foundation of the WTP estimate, calculated from the area under the survival curve, which defines the non-parametric approach [55].

The results in Table 2 were used to generate a probabilistic survivor function; the function assumes the reasonable top bid of DOP 300.00, which operates as a "truncating point" [63]. Figure 3 shows the probabilistic survivor function for RBJBE; it is monotonically decreasing as expected [55].

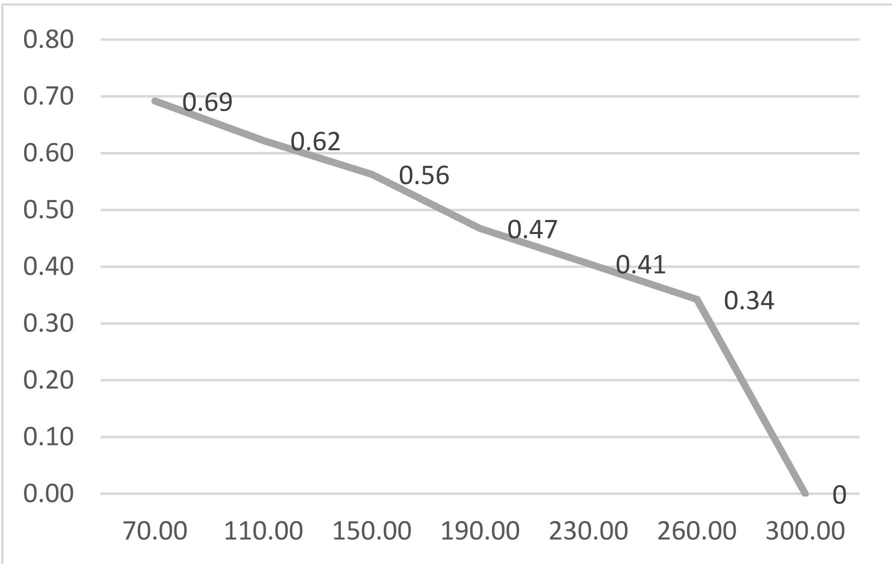

Figure 3. Probabilistic survival function of the WTP for PROBIOSFERA.

The non-parametric WTP was estimated from the area below the survivor curve (Figure 3), i.e., approximately DOP 165.00 or USD 2.94 per family per month [58,63]. Next, we developed a utility function using the probability of positive responses as the dependent variable. Thus, a positive and significant coefficient implies that increasing the corresponding exogenous variable increases the likelihood of a positive response.

3.2. Parametric Modeling of the WTP

In our parametric model, the intercept and the bid are independent variables. As indicated in the section about methodology, the estimated parameters and the mean WTP are calculated using Equation (4). Because $q_{\text{yes PROBIOSFERA}} - q_{\text{no PROBIOSFERA}} = 1$

(indicating a dummy transformation with or without PROBIOSFERA), it is estimated jointly with the intercept, and the expected WTP y is given by EWTP = $\frac{\alpha+\beta}{\mu} = \frac{A}{\mu}$, where $\alpha, \beta,$ and μ represent the parameters to be estimated using logistic regression, and the outcome of this Equation provides the average of the WTP. In the model, the socioeconomic characteristics of respondents, shown in Table 1, were added as independent variables. The mean WTP is given by Equation (5), where $A = \alpha + \beta$, where A assumes the linear estimation of the coefficients. Table 3 shows the results of the model and lists only the significant variables.

Table 3. Parametric estimation of the WTP for PROBIOSFERA.

Coeff.	Independent Variables	Simple Model (i)	Semi-Full Model (ii)	Full Model (iii)
		WTP of the Suggested Bids		
A	Constant or intercept	1.402 (0.000) ***	0.414 (408)	0.396 (0.498)
μ	Suggested bids DOP (70 ǀ 110 ǀ 150 ǀ 190 ǀ 230 ǀ 260)	−0.007 (0.000) ***	−0.008 (0.000) ***	−0.008 (0.000) ***
$\propto_1$	Living in the Enriquillo region		0.200 (0.379)	0.202 (0.378)
$\propto_2$	Urban population		0.080 (0.701)	−0.024 (0.908)
$\propto_3$	Level of knowledge RBJBE (1−10, where 1 is the lowest level of information and 10 very well informed)		0.292 (0.027) **	0.290 (0.032) **
$\propto_4$	Importance of the RBJBE (1–10, where 1 is the lowest level of importance and 10 de maximum level)		0.038 (0.358)	0.029 (0.505)
$\propto_5$	Visits to protected areas (yes or no)		0.283 (0.096) *	0.234 (0.176)
$\propto_6$	Membership to social or environmental organizations (yes or no)		0.468 (0.111)	0.570 (0.056) **
$\propto_7$	Income level (dummy variable: 1 = high; 0 = l)		0.063 (0.099) *	0.056 (0.143)
$\propto_8$	The educational level of the interviewee (1–5, where 1 = illiterate and 5 = college education)		0.202 (0.003) ***	0.209 (0.002) ***
$\propto_9$	Gender (male = 1; female = 0)		−0.129 (0.373)	−0.109 (0.457)
$\propto_{10}$	Age range		−0173 (0.019) **	−0.165 (0.027) **
$\propto_{11}$	Level of importance of the provisioning ecosystem services (dummy variable: 1 = high; 0 = low)			−0.293 (0.045) **
$\propto_{12}$	Importance of the regulating ecosystem services dummy variable: 1 = high; 0 = low)			−0.087 (0.693)
$\propto_{13}$	Importance of the supporting ecosystem services dummy variable: 1 = high; 0 = low)			0.641(0.001) ***
$\propto_{14}$	Importance of the cultural ecosystem services dummy variable: 1 = high; 0 = low)			0.103 (0.618)
Significance of the model (H0: coefficients = 0)		*p*-value = 0.000		*p*-value = 0.000
Number of observations		1082	1082	1082

p-values in parentheses *p*: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3 describes three different models. The purpose of this presentation of the three models is to clearly show the WTP estimation process and its validation from the point of view of the empirical testing process of the research questions [59]. The first is a simple model with a single variable, i.e., the bid vector; the second model is a semi-full model that includes socioeconomic variables. The third model is a full model that includes socioeconomic and attitudinal variables related to ecosystem services. In general, the three models behaved as expected, considering the negative and statistically significant (*p*-value at 1%) coefficient for the marginal (dis)utility of (reduced) income (μ), which reflects a decreasing demand curve. It reflects economic theory, which states that the probability of saying "yes" to the question of WTP decreases as the bids increase in the estimated models shown in Table 2 [38,65,66]. It also indicates that the respondents' desire to implement PROBIOSFERA depends on the size of the required declared contribution in terms of the suggested bids, i.e., increasing the size of the bids will likely reduce the level of support for PROBIOSFERA, and vice versa. The results are shown in Table 3 respond to the first research question in terms of a favorable monetary valuation and acceptance of the existence of the RBJBE on behalf of the Dominican society.

Concerning the second research question about the role of socioeconomic characteristics, we validated the different socioeconomic variables and their levels of correlation. We then tested them in different logistic regression models. Variables that were either highly correlated or those that did not contribute to the statistical significance of the model were excluded from the full model. Among these excluded variables are macro-regions, marital status, the importance of tourism for the RBJBE, economic activity, and other variables. The Enriquillo region is included in the full model because it contains the RBJBE. It is one of three regions that make up the southern macro-region of the country; the two other regions are El Valle and Valdesia.

As shown in Table 3, respondents with higher knowledge and information about RBJBE (and are aware of this) are willing to pay more for the PROBIOSFERA ($\propto_3$). This preference is statistically significant at a 5% *p*-value. It provides an opportunity to socially disseminate the ecosystem values of the RBJBE to support conservation efforts. All three models in Table 3 clearly show how the independent variables affect the WTP, even in the first or simple model, which only has the vector of payments. The second or semi-full model incorporates socioeconomic variables, while the third model or full model incorporates socioeconomic and attitudinal variables on ecosystem services. The effect of the attitudinal variables on ecosystem services is seen in the statistical significance of socioeconomic variables. For example, visitation to protected areas ($\propto_5$) is significant at a 10% *p*-value in the second model but not in the third model. Meanwhile, the social membership variable ($\propto_6$) is significant at a 5% *p*-value in the third model but not in the second model. The income level variable ($\propto_7$) is significant at a 10% *p*-value in the second model but not in the third model, which means that WTP increases as the income level increases.

The level of education ($\propto_8$) is statistically significant at a 1% *p*-value in the first model and in the second one, indicating that higher levels of education tend to result in more substantial commitment to conservation. Therefore, individuals' higher average level of education results in a higher WTP for programs such as PROBIOSFERA. The models found no significant differences between genders ($\propto_9$). However, the sign of gender ($\propto_9$) is negative, indicating that women may have a greater propensity for conservation. Other studies have found a solid social preference for paying in favor of conservation based on gender, including studies in the DR; social preferences may also depend on age range ($\propto_{10}$), which was negative and significant at a 5% *p*-value in models 2 and 3. This finding indicates that the young population supports conservation initiatives [59,67–69]. These findings concerning socioeconomic characteristics affecting the WTP are similar to those found in the Cat Ba Biosphere reserve in Vietnam, in which gender, education level, participation of respondents, and attitudes towards climate change were significant variables in their WTP for mangrove restoration in the reserve [41] (p. 273).

Among the attitudinal variables related to the importance of ecosystem services of the RBJBE, only two of the four elicited services were statistically significant: the provisioning services ($\propto_{11}$) at a 5% *p*-value and the supporting services ($\propto_{13}$) at a 1% *p*-value. The regulating and ecosystem cultural services were not statistically significant. The Millennium Ecosystem Assessment [61] describes provisioning services as material goods and products obtained from ecosystems, such as timber and non-timber forest products (e.g., wood, firewood, fibers, medicinal plants, and others); foods of various types and scales, such as fisheries; and raw materials such as mineral resources of different types and water for human consumption [62,70]. Meanwhile, supporting services are those that are the basis for other ecosystem services. These include the recycling and production of nutrients, soil formation, the cycling of water, nitrogen, and other elements, photosynthesis, and habitats for species [66,71]. According to Equation (5), the average WTP values for the simple, semi-full, and full models are DOP 177.14 or USD 3.16, DOP 181.81 or USD 3.24, and DOP 181.88 or USD 3.25, respectively (Table 3). The difference between the estimates from models 1 and 2 is minimal, indicating statistical consistency. WTP values from models 2 and 3 are very similar; thus, the most interesting effect is the change in the statistical significance of the socioeconomic variables affected by the inclusion of attitudinal variables related to ecosystem services.

Table 4 shows that the WTP of respondents living in the Enriquillo region is significantly higher than the average WTP of the full model ($\propto_1 =$ DOP 204.23 $\approx$ USD 3.65). Similarly, people familiar with the RBJBE have a higher WTP than the average ($\propto_{3a} =$ DOP 198.82 $\approx$ USD 3.55), while those unfamiliar with the RBJBE have a lower average WTP ($\propto_{3b} =$ DOP 163.61 $\approx$ USD 2.92). These results respond to the research question about the local preference concerning the existence of the RBJBE, indicating a positive acceptance of its existence. The lower average of the WTP of those unfamiliar with the RBJBE is essential to design environmental dissemination policies on RBJBE. People who visit protected areas or carry out ecotourism activities have the highest WTP ($\propto_5 =$ DOP 270.16 $\approx$ USD 4.82). Table 4 clearly shows, as mentioned earlier, that the WTP increases as the income level of respondents increases ($\propto_{7d} > \propto_{7c} > \propto_{7b} > \propto_{7a}$). Similarly, the WTP increases significantly with the respondents' formal level of education. People with only a primary level of education have the lowest average WTP of the entire sample ($\propto_{8c} =$ DOP 223.00 $\approx$ USD 3.98 $> \propto_{8a} =$ DOP 146.88 $\approx$ USD 2.62). Among the attitudinal variables related to ecosystem services, the WTP for supporting services is higher than that for provisioning services ($\propto_{13} =$ DOP 197.33 $\approx$ USD 3.52 $> \propto_{11} =$ DOP 166.21 $\approx$ USD 2.96).

Table 4. Average WTP for the models and selected population groups.

WTP for Selected Groups	Monthly Household Average WTP	Confidence Interval at the 95%
WTP for the simple model (i)	177.14	(162–193)
WTP for the semi-full model (ii)	181.81	(166–198)
WTP for the full model (iii)	181.88	(166–198)
WTP for inhabitants of the Enriquillo region ($\propto_1$)	204.23	(151–257)
WTP of people who know the RBJBE ($\propto_{3a}$)	198.82	(176–221)
WTP of people who do not know the RBJBE ($\propto_{3b}$)	163.61	(141–186)
WTP of people who used to visit protected areas ($\propto_5$)	270.16	(192–348)
WTP according to the income level ($\propto_7$)	WTP income level 1 = 166.71 ($\propto_{7a}$)	
	WTP income level 4 = 187.35 ($\propto_{7b}$)	
	WTP income level 8 = 214.87 ($\propto_{7c}$)	
	WTP income level 14 = 256.15 ($\propto_{7d}$)	
WTP according to educational level ($\propto_8$)	WTP primary education = 146.88 ($\propto_{8a}$)	
	WTP sec ondary education = 172.25 ($\propto_{8b}$)	
	WTP College education = 223.00 ($\propto_{8c}$)	
WTP according to the importance of provisioning ecosystem services ($\propto_{11}$)	166.21	(145–188)
WTP according to the importance of supporting ecosystem services ($\propto_{13}$)	197.33	(178–216)

The average WTP of the full model is DOP 181.88 ≈ USD 3.25, and the total number of households of the DR in 2020 was 3,287,016 [72] (p. 25). Therefore, the aggregate WTP for the PROBIOSFERA is DOP 597,842,470.08 per month, which is equivalent to around USD 10,675,758.3. Annually, the aggregate WTP is DOP 7,174,109,640.96, equivalent to around USD 128,109,100.7, without applying a social discount rate. The estimation of the aggregated WTP shows the validity of using the Contingent Valuation Method (CVM) to estimate the support of Dominican society for PROBIOSFERA in favor of the RBJBE as a means of reaping the benefits of the ecosystem services of the BR. These benefits stem from the biodiversity, natural resources, and other environmental values of the RBJBE [48,73].

Respondents who have previously visited the protected areas have the highest WTP ($\propto_5 =$ DOP 270.16 ≈ USD 4.82), which is an indicator of the high potential for ecotourism. This preference is statistically significant at a 10% *p*-value in the semi-full model (Table 3) as $\propto_5$, whose value ranges from DOP 192.00 (≈USD 3.43) to DOP 348.00 (≈USD 6.21) for people highly interested in visiting protected areas. People in the Enriquillo region tend to be sensitive to ecotourism in the BR, an economic activity that the government has promoted for the last two decades. August 2020 marks the creation of the PROPEDERNALES trust, which aims to promote public-private partnerships to support tourism investment. The greatest challenge in developing tourism in Pedernales is to find the point of balance that allows the development of the local tourist sites while ensuring that the communities become active participants through programs that stimulate the local hospitality industry. Therefore, the tasks of the PROPEDERNALES trust should include seeking support for local initiatives and sources of foreign capital.

Similarly, income levels ($\propto_7$) and education ($\propto_8$) are related to WTP, i.e., people with higher income and education levels tend to have higher WTP values. Therefore, demographic groups with high levels of income and formal education are central to promoting sustainable tourism (ecotourism). At the same time, people with higher incomes and education levels may have a higher relative expenditure during their visits to the communities.

The Millennium Ecosystem Assessment defined four types of ecosystem services: provisioning, regulating, supporting, and cultural services [61]. Regulating and cultural services were not statically significantly. Provisioning and supporting services refer to those services involving consumption activities, such as the extraction of water and raw materials, forest fruits, wood, medicinal plants, the hydrological cycle, soil formation, pollination, biodiversity protection, and other ecosystem services [70,74]. Provisioning services ($\propto_{11}$) are statistically significant at a 5% *p*-value; its value is negative and results in an average WTP of DOP 166.21 ≈ USD 2.96, which is below the average WTP estimated for the full model. Meanwhile, supporting services ($\propto_{13}$) are also statistically significant at a 1% *p*-value; this results in an average WTP of DOP 197.33 ≈ USD 3.52, which is more than the average WTP of the full model. The negative sign of the provisioning service indicates discrimination. The surveyed population views the provisioning service as troubling for the RBJBE as a conservation space. This view may be associated with the history of natural resources exploitation, conflict, and crisis in the three conservation zones of the RBJBE, as briefly described in the Introduction. Specifically, the negative sign of the provisioning services may be due to the more than 50 years of mining activity in the province of Pedernales, the long road of the Bahía de las Aguilas, and the flooding problems experienced by areas surrounding Lake Enriquillo. In the case of the supporting services, the surveyed population recognizes the environmental values of such ecosystem services to the BR and the latter's importance as a source of wealth and well-being for Dominican society. The above findings indicate a moderate perception about the role of the ecosystem services provided by the RBJBE, perhaps conditioned at the same time by the recognition of its biodiversity and by sending a message of care of its natural resources and diversity.

According to the Dominican Household Income and Expenditure Survey, the average income of a family of 3.2 members is about DOP 41,164.00 ≈ USD 735.00 [75] (pp. 52–53).

This family size corresponds to that of the elementary family model identified in the household projection study of the National Statistical Office [72] (p. 29).

4. Discussion: Hypothetical Valuation Scenarios

Departing from the results discussed in Section 3.2, we use that information to construct at least three hypothetical scenarios for the monetary valuation of the RBJBE, including households in the Enriquillo region, as shown in Table 5 [59]. Table 5 shows the results of the hypothetical valuation scenarios considered. The first scenario corresponds to the aggregate WTP estimate according to the full model and the total number of households. In the second scenario, the average WTP is that of people earning at income level 4 ($\propto_{7b}$), which approximates the average income of a Dominican household. In the third scenario, the WTP is that of respondents living in the Enriquillo region ($\propto_1$) and their households. These three scenarios represent different perspectives and possible scales to shed some light on the monetary valuation of the RBJBE as a complex construct by the Dominican society [40,76], which facilitates a better understanding of the role of the reserve as an instrument of conservation and sustainable development based on the analytical scale from which this role is considered [2,39].

Table 5. Hypothetical valuation scenarios.

Valuation Scenarios	Monthly DOP WTP	Annual DOP WTP	Number of Households	Annual (Millions DOP)	Annual USD Millions
(i) Total number of national households	181.88	2182.56	3,287,016	7,174,109,640.96	≈128,109,100.73
(ii) Number of households at national level	187.35	2248.20	1,372,040	3,084,620,328.00	≈55,082,505.86
(iii) Total number of households in the Enriquillo region	204.23	2450.76	106,899	261,983,793.24	≈4,678,282.02

The three scenarios in Table 5 do not consider any social discount because, for general purposes in environmental valuation, the discount rate turns irrelevant when respondents compare the annual stream of benefits with the annual flow of costs [77] (p. 133). The first scenario assumes the already known WTP for PROBIOSFERA, which is about USD 128.1 million per year. The second and third scenarios assume WTP values of about USD 55.1 and USD 3.8 million, respectively. The welfare analysis described in Section 3.1 estimates WTP by assuming the compensatory variation and the consumer surplus as welfare measures [64,78]. The numbers of the three scenarios in Table 5 describe in monetary terms the estimates of the benefits that Dominican society expects to reap from the implementation of PROBIOSFERA.

PROBIOSFERA was intended to strengthen the RBJBE as an area where the conservation objectives of its protected areas are compatible with local and regional economic development objectives. Therefore, scenarios 1 and 2 justify rational investments in conservation and local development programs that can enhance the value of the attractions within the RBJBE and realize their potential for sustainable tourism [40,79]. These scenarios recognize both the environmental value of the Reserve and the high WTP of social groups that support the objectives of the RBJBE as a space for conservation and sustainable development. Scenario 3 may be limited by the small number of households; however, it indicates a WTP that is even higher than that for the national sampling estimated by the full model [41,80]. In scenario 3, the inhabitants of the Enriquillo region seek to ensure that the benefits of the RBJBE as a space for conservation are compatible with local economic development needs. Therefore, the RBJBE could play a role as a regional development tool [81] (p. 48).

The DR seeks to develop environmentally sustainable and productive activities, which include environmentally responsible tourism. Our findings shed some light on the social choices involved in implementing conservation in the RBJBE. These choices should favor local and sustainable development [82]. Hence, the design and implementation of a program such as PROBIOSFERA are of significant regional importance. This program considers a regional public goods perspective associated with the RBJBE's role in the recently created La Selle and Jaragua-Bahoruco-Enriquillo Transboundary Biosphere Reserve. Created in 2017 by UNESCO, this reserve coordinates the management efforts between the La Selle Biosphere Reserve (created in 2012 in the Republic of Haiti) and the bordering RBJBE. The success of this transboundary BR implies a lessening of tensions and negative interactions between Haiti and the DR, countries with significant cultural and socioeconomic differences [83,84]. Thus, the conservation issues in the southern border of Hispaniola Island and the RBJBE constitutes a complex problem and raises the value of RBJBE as a regional asset for the public good [85].

The protected status of some of the protected areas within the RBJBE precedes the establishment of the Reserve by decades. Nevertheless, through the CVM, we have shown that those familiar with the RBJBE tend to have a higher WTP than those unfamiliar with the RBJBE. This result indicates a possible route for disseminating information regarding the importance of the Reserve's heritage as a resource for sustainable development and strengthening social cohesion and local communities' identity [80,86]. The fact that the inhabitants of the Enriquillo region have a higher WTP than the national average indicates that the former have a better understanding of the Reserve's potential as a space for conservation and development. In other words, the inhabitants of the Enriquillo region are willing to pay more to reap the social, economic, and environmental benefits of the implementation of PROBIOSFERA. The CVM also provides evidence that exposure to other protected areas through ecotourism activities increases the WTP. In addition, higher-income and educational levels and lower age are associated with higher WTP values for the RBJBE.

5. Conclusions

The three monetary valuation scenarios precisely estimate the annualized monetization of welfare that Dominican society wishes to implement with PROBIOSFERA. The welfare estimates cannot be understood separately and independently of the WTP. Similarly, the social, political, economic, environmental, and institutional contexts should also be considered when judging the effectiveness over time of the governance of the RBJBE because of the development challenges and demands of the communities around the Reserve. In other words, the monetized estimates of well-being that are expressed through the WTP and its aggregation are the results of the historical management of the Reserve and the levels of social appropriation of its known values in the Dominican society. Dominican society recognizes the importance of the RBJBE within the different scenarios defined in this study, despite the unsolved and rather aggravated conservation problems in the BR. Therefore, the results of monetary valuation scenarios should be viewed as a call to strengthen the role of the Reserve as a space of conservation and development and for fostering the well-being of the surrounding communities and the Dominican society.

The history of the RBJBE since its creation in 2002 has been one of constant struggles to fulfill its purpose, i.e., to make conservation compatible with local development. However, despite the checkered history of conservation, development, and management of natural resources of its three central conservation units, it has exceeded the Reserve's capacity fulfill its function. In the RBJBE, the protected areas count more than the Reserve, meaning that the whole is lesser than the sum of its parts, which is manifested in the preliminary evidence of the loss of forest cover in the Sierra de Bahoruco National Park because of the expansion of the agricultural frontier within the protected area and forest fires.

The PROPEDERNALES trust is an instrument that can support responsible investment in sustainable tourism within a strict framework of environmental regulation, perhaps the strictest in the DR. Unfortunately, the decree that created the PROPEDERNALES trust does not refer to the BR as a space where conservation can be compatible with development. Finally, it is essential to affirm that the economic valuation we performed is about numbers that can help in social and economic decisions that will realize the sustainable development objectives in a complex space such as a BR. Therefore, this assessment should be viewed as an analytical instrument for facilitating more informed and balanced decision making.

Our analysis associates a negative sign with the valuation of the provisioning ecosystem service. However, our results also clearly show that Dominican society recognizes and values the RBJBE for the products, goods, and raw materials that its ecosystems have provided. The recognition of the supporting ecosystem services indicates a greater appreciation of the services that sustain the biological diversity and richness of the resources within the RBJBE. Therefore, conservation decisions depend strongly on the attitude of Dominican society toward any project or initiative that may affect the biodiversity and quality of the Reserve's ecosystems. As highlighted, a positive attitude in terms of the WTP and the acceptance of the Reserve depends on the level of education, information, and knowledge about the Reserve. It suggests that at the conservation crossroads where the Reserve is located, the path to choose is environmental, economic, and social sustainability over the spurious interests around the exploitation of natural resources in the RBJBE.

Finally, the RBJBE is at the heart of a complex regional environmental, climate and humanitarian problem because of the shared challenges in terms of climate adaptation of local social, economic, and productive systems in the two sides: on the side of the Haitian communities that are on the side of the La Selle biosphere reserve, and those found on the Dominican side in the RBJBE. The two biosphere reserves make up a continuum of ecosystems and biodiversity, but also of people who do not know political boundaries but respond differently to adaptation challenges due to the asymmetric capacities of the two countries. The climatic and socioeconomic pressures in the biosphere system highlight the singularity of the crossroads in terms of sustainable development that the RBJBE faces and that requires the mobilization of social, financial, and institutional capital of the Dominican society that pushes towards a virtuous cycle of local development compatible with the conservation purposes that created it in 2002.

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References

1. Leon, Y.M.; Rupp, E.; Arias, Y.; Perdomo, L.; Incháustegui, S.J.; Garrido, E. *Estrategia de Monitoreo para Especies Amenazadas de la Reserva de Biosfera Jaragua-Bahoruco-Enriquillo*; Grupo Jaragua: Santo Domingo, Dominican Republic, 2011; p. 80.
2. Ishwaran, N.; Persic, A.; Hoang Tri, N. Concept and practice: The case of UNESCO biosphere reserves. *Int. J. Environ. Sustain. Dev.* **2008**, *7*, 118–131. [CrossRef]
3. Cuong, C.V.; Dart, P.; Hockings, M. Biosphere reserves: Attributes for success. *J. Environ. Manag.* **2017**, *188*, 9–17. [CrossRef]
4. UNESCO. *Biosphere Reserves: The Seville Strategy and the Statutory Framework of the World Network*; UNESCO: Paris, France, 1996; p. 19.

5. Castillo-Eguskitza, N.; Hoyos, D.; Onaindia, M.; Czajkowski, M. Unraveling local preferences and willingness to pay for different management scenarios: A choice experiment to biosphere reserve management. *Land Use Policy* **2019**, *88*, 104200. [CrossRef]
6. Barbosa, A.; Martín, B.; Hermoso, V.; Arévalo-Torres, J.; Barbière, J.; Martínez-López, J.; Domisch, S.; Langhans, S.D.; Balbi, S.; Villa, F.; et al. Cost-effective restoration and conservation planning in Green and Blue Infrastructure designs. A case study on the Intercontinental Biosphere Reserve of the Mediterranean: Andalusia (Spain)—Morocco. *Sci. Total Environ.* **2019**, *652*, 1463–1473. [CrossRef]
7. SISR. Lago Enriquillo. Available online: https://rsis.ramsar.org/es/about (accessed on 28 May 2021).
8. Rupp, E.; Incháustegui, S.; Arias, Y. *Preliminary Report of the Distribution and Situation of Cyclura ricordii on the Southern shore of Enriquillo Lake*; Grupo Jaragua, Inc.: Santo Domingo, Dominican Republic, 2006; p. 11.
9. Perdomo, L.; Arias, Y. República Dominicana. In *Priority Sites for Biodiversity Conservation*; Devenish, C., Díaz Fernández, D.F., Clay, R.P., Davidson, I., Yépez Zabala, I., Eds.; BirdLife Conservation Series BirdLife International: Quito, Ecuador, 2009; Volume 16, pp. 171–178.
10. Perdomo, L.; Arias, Y.; León, Y.; Wege, D. *Areas Importantes para la Conservación de las Aves en la República Dominicana*; Grupo Jaragua, Inc.: Santo Domingo, Dominican Republic, 2010; p. 84.
11. Powell, R.; Ottenwalder, J.A.; Incháustegui, S.J.; Henderson, R.W.; Glor, R.E. Amphibians and reptiles of the Dominican Republic: Species of special concern. *Oryx* **2000**, *34*, 118–128. [CrossRef]
12. Kennerly, R.J.; Nicoll, M.A.C.; Young, R.P.; Turvey, S.T.; Nuñez-Miño, J.M.; Brocca, J.L.; Buttler, S.J. The impact of habitat quality inside protected areas on distribution of the Dominican Republic's last endemic non-volant land mammals. *J. Mammal.* **2019**, *100*, 45–54. [CrossRef] [PubMed]
13. Anonymous. *Preliminary Report on Cyclura ricordi in the Barahona Peninsula*; Grupo Jaragua, Inc.: Santo Domingo, Dominican Republic, 2004; p. 17.
14. Sheller, M.; León, Y.M. Uneven socio-ecologies of Hispaniola: Asymmetric capabilities for climate adaptation in Haiti and the Dominican Republic. *Geoforum* **2016**, *73*, 32–46. [CrossRef]
15. Mendez-Tejeda, R.; Delanoy, R.A. Influence of Climatic Phenomena on Sedimentation and Increase of Lake Enriquillo in Dominican Republic, 1900–2014. *J. Geogr. Geol.* **2017**, *9*, 19–36. [CrossRef]
16. Gil Pichardo, F.D.; Lo Conte, L.; Regio, G. *Alternativas Productivas a Mediano y Largo Plazo para las Familias Afectadas por la Crecida del Nivel del Lago Enriquillo*; OXFAM International: Santo Domingo, Dominican Republic, 2012; p. 75.
17. PNUD. Cuando los Desastres se Quedan. Comprendiendo los Vínculos Entre la Pobreza, y los Choques Climáticos en el Lago Enriquillo, República Dominican. 2014, p. 66. Available online: https://www.do.undp.org/content/dam/dominican_republic/docs/Pobreza/publicaciones/pnud_do_cuandodesastresquedan.pdf (accessed on 29 May 2021).
18. DGCP. Presidente Medina entrega Nuevo Boca de Cachón a sus pobladores. Available online: https://www.dgcp.gob.do/noticias/presidente-medina-entrega-nuevo-boca-de-cachon-a-sus-pobladores/ (accessed on 29 May 2021).
19. León, Y.M.; Garrido, E.; Almonte, J. *Monitoring and Mapping Broadleaf Mountain Forests of Southern Sierra de Bahoruco, Dominican Republic*; Grupo Jaragua, Inc.: Santo Domingo, Dominican Republic, 2013; p. 36.
20. Wooding, B.; Morales, M.A. *Migración y Sostenibilidad Ambiental en Hispaniola*; OBMICA (Centro para la Observación Migratoria y el Desarrollo Social en el Caribe): Santo Domingo, Dominican Republic, 2014; p. 79.
21. Sagawe, T. Mining as an agent for regional development: The case of the Dominican Republic. *Geography* **1989**, *74*, 69–71.
22. Peña, M.; Lizardo, M. Extractive industry in the Dominican Republic: A history of growth, regression and recovery. *Extr. Ind. Soc.* **2018**, *5*, 218–227. [CrossRef]
23. Revuelta, O.; Leon, Y.M.; Feliz, P.; Godley, B.J.; Raga, J.A.; Tomas, J. Protected areas host important remnants of marine turtle nesting stocks in the Dominican Republic. *Oryx* **2012**, *46*, 348–358. [CrossRef]
24. León, Y.M.; Diez, C.E. Population structure of hawksbill turtles on a foraging ground in the Dominican Republic. *Chelonian Conserv. Biol.* **1999**, *3*, 230–236.
25. Presidencia_Dominicana. Decreto 724-20 Fideicomiso ProPedernales. Available online: https://presidencia.gob.do/decretos/724-20 (accessed on 29 May 2021).
26. MITUR. Listo el Fideicomiso para Construir 10 mil Habitaciones en Pedernales. Available online: https://www.mitur.gob.do/listo-el-fideicomiso-para-construir-10-mil-habitaciones-en-pedernales/ (accessed on 29 May 2021).
27. Loft, L.; Mann, C.; Hansjürgens, B. Challenges in ecosystem services governance: Multi-levels, multi-actors, multi-rationalities. *Ecosyst. Serv.* **2015**, *16*, 150–157. [CrossRef]
28. Morillo Pérez, A. *El Mapa de la Pobreza en la República Dominicana*; Ministerio de Economía, Planificación y Desarrollo (MEPyD): Santo Domingo, Dominican Republic, 2014; p. 383.
29. Pasachnik, S.A.; Carreras De León, R.; León, Y. Protected only on paper? *Three case studies from protected areas in the Dominican Republic. Caribb. Nat.* **2016**, *30*, 1–19.
30. Holmes, G. Defining the forest, defending the forest: Political ecology, territoriality, and resistance to a protected area in the Dominican Republic. *Geoforum* **2014**, *53*, 1–10. [CrossRef]
31. Holmes, G. The Rich, the Powerful and the Endangered: Conservation Elites, Networks and the Dominican Republic. *Antipode* **2010**, *42*, 624–646. [CrossRef]
32. Roth, L.C. Enemies of the Trees? Subsistence Farmers and Perverse Protection of Tropical Dry Forest. J. For. **2001**, *99*, 20–27. [CrossRef]

33. Kneese, A.V.; Schulze, W.D. Chapter 5 Ethics and environmental economics. In *Handbook of Natural Resource and Energy Economics*; Elsevier: Amsterdam, The Netherlands, 1985; Volume 1, pp. 191–220.
34. Williams, A.; Dupuy, K. Deciding over nature: Corruption and environmental impact assessments. *Environ. Impact Assess. Rev.* **2017**, *65*, 118–124. [CrossRef]
35. Carson, R.T.; Flores, N.E.; Martin, K.M.; Wright, J.L. Contingent valuation and revealed preference methodologies: Comparing the estimates for quasi-public goods. *Land Econ.* **1996**, *72*, 80–99. [CrossRef]
36. McFadden, D. Contingent valuation and social choice. *Am. J. Agric. Econ.* **1994**, *76*, 689–708. [CrossRef]
37. Carson, R.T. Contingent Valuation: A Practical Alternative when Prices Aren't Available. *J. Econ. Perspect.* **2012**, *26*, 27–42. [CrossRef]
38. Ebert, U. Approximating WTP and WTA for environmental goods from marginal willingness to pay functions. *Ecol. Econ.* **2008**, *66*, 270–274. [CrossRef]
39. Azadi, H.; Van Passel, S.; Cools, J. Rapid economic valuation of ecosystem services in man and biosphere reserves in Africa: A review. *Glob. Ecol. Conserv.* **2021**, *28*, e01697. [CrossRef]
40. Dehghani, M.; Farshchi, P.; Danekar, A.; Karami, M.; Aleshikh, A.A. Recreation Value of Hara Biosphere Reserve using Willingness-to-pay method. *Int. J. Environ. Res.* **2010**, *4*, 271–280. [CrossRef]
41. Pham, T.D.; Kaida, N.; Yoshino, K.; Nguyen, X.H.; Nguyen, H.T.; Bui, D.T. Willingness to pay for mangrove restoration in the context of climate change in the Cat Ba biosphere reserve, Vietnam. *Ocean Coast. Manag.* **2018**, *163*, 269–277. [CrossRef]
42. Turvey, S.T.; Fernández-Secades, C.; Nuñez-Miño, J.M.; Hart, T.; Martinez, P.; Brocca, J.L.; Young, R.P. Is local ecological knowledge a useful conservation tool for small mammals in a Caribbean multicultural landscape? *Biol. Conserv.* **2014**, *169*, 189–197. [CrossRef]
43. Johnston, R.J.; Boyle, K.J.; Adamowicz, W.V.; Bennet, J.; Brouwer, R.; Cameron, T.A.; Hanemann, M.W.; Hanley, N.; Ryan, M.; Scarpa, R.; et al. Contemporary Guidance for Stated Preference Studies. *J. Assoc. Environ. Resour. Econ.* **2017**, *4*, 319–405. [CrossRef]
44. Portney, P.R. The contingent valuation debate: Why economists should care. *J. Econ. Perspect.* **1994**, *8*, 3–17. [CrossRef]
45. Whittington, D. Administering contingent valuation surveys in developing countries. *World Dev.* **1998**, *26*, 21–30. [CrossRef]
46. Carson, R.T.; Mitchel, R.C.; Hanemann, M.; Kopp, R.J.; Presser, S.; Ruud, P.A. Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill. *Environ. Resour. Econ.* **2003**, *25*, 257–286. [CrossRef]
47. Bishop, R.C.; Boyle, K.J.; Carson, R.T.; Chapman, D.; Hanemann, W.M.; Kanninen, B.; Kopp, R.J.; Krosnick, J.A.; List, J.; Meade, N.; et al. Putting a value on injuries to natural assets: The BP oil spill. *Science* **2017**, *356*, 253. [CrossRef] [PubMed]
48. Adams, C.; Seroa da Motta, R.; Arigoni Ortiz, R.; Reid, J.; Ebersbach Aznar, C.; de Almeida Sinisgalli, P.A. The use of contingent valuation for evaluating protected areas in the developing world: Economic valuation of Morro do Diabo State Park, Atlantic Rainforest, São Paulo State (Brazil). *Ecol. Econ.* **2008**, *66*, 359–370. [CrossRef]
49. Adamowicz, W.; Boxall, P.; Williams, M.; Louviere, J. Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *Am. J. Agric. Econ.* **1998**, *80*, 64–75. [CrossRef]
50. Louviere, J.J.; Hensher, D.A.; Swait, J.D. *Stated Choice Method. Analysis and Application*, 1st ed.; Cambridge University Press: New York, NJ, USA, 2010.
51. Mahieu, P.-A.; Riera, P.; Kriström, B.; Brännlund, R.; Giergiczny, M. Exploring the determinants of uncertainty in contingent valuation surveys. *J. Environ. Econ. Policy* **2014**, *3*, 186–200. [CrossRef]
52. Hanemann, W.M. Valuing the environment through contingent valuation. *J. Econ. Perspect.* **1994**, *8*, 19–43. [CrossRef]
53. Scheaffer, R.L.; Mendenhall III, W.; Ott, R.L.; Gerow, K.G. *Elementary Survery Sampling*, 7th ed.; Cengage Learning, Inc.: Florence, KY, USA, 2011.
54. Harrison, G.W.; Kristrom, B. On the interpretation of response to contingent valuation surveys. In *Current Issues in Environmental Economics*; Johansson, P.O., Kristrom, B., Maler, K.G., Eds.; Manchester University Press: Manchester, UK, 1995; pp. 35–57.
55. Kriström, B. A non-parametric approach to the estimation of welfare measures in discrete response valuation studies. *Land Econ.* **1990**, *66*, 135–139. [CrossRef]
56. Fujii, S.; Kitamura, R.; Suda, H. Contingent valuation method can increase procedural justice. *J. Econ. Psychol.* **2004**, *25*, 877–889. [CrossRef]
57. Carson, R.T.; Louviere, J.J. A Common Nomenclature for Stated Preference Elicitation Approaches. *Environ. Resour. Econ.* **2011**, *49*, 539–559. [CrossRef]
58. Creel, M.; Loomis, J. Semi-nonparametric Distribution-Free Dichotomous Choice Contingent Valuation. *J. Environ. Econ. Manag.* **1997**, *32*, 341–358. [CrossRef]
59. Gómez-Valenzuela, V.; Alpízar, F.; Bonilla, S.; Franco-Billini, C. Mining conflict in the Dominican Republic: The case of Loma Miranda. *Resour. Policy* **2020**, *66*, 101614. [CrossRef]
60. Crooker, J.R.; Herriges, J.A. Parametric and Semi-Nonparametric Estimation of Willingness-to-Pay in the Dichotomous Choice Contingent Valuation Framework. *Environ. Resour. Econ.* **2004**, *27*, 451–480. [CrossRef]
61. MEA. *Ecosystems and Human Well-Being: Wetlands and Water Synthesis.*; World Resources Institute: Washington, DC, USA, 2005; p. 69.
62. Tao, Z.; Yan, H.; Zhan, J. Economic Valuation of Forest Ecosystem Services in Heshui Watershed using Contingent Valuation Method. *Procedia Environ. Serv.* **2012**, *13*, 2445–2450. [CrossRef]

63. Bengochea-Morancho, A.; Fuertes-Eugenio, A.M. A comparison of empirical models used to infer the willingness to pay in contingent valuation. *Empir. Econ.* **2005**, *30*, 235–244. [CrossRef]
64. Chilton, S. Contingent valuation and social choices concerning public goods: An overview of theory, methods and issues. *Rev. D'Économie Polit*. **2007**, 117, 655–674. [CrossRef]
65. Bateman, I.J.; Langford, I.H.; Munro, A.; Starmer, C.; Sugden, R. Estimating Four Hicksian Welfare Measures for a Public Good: A Contingent Valuation Investigation. *Land Econ.* **2000**, *76*, 355–373. [CrossRef]
66. Fisher, B.; Turner, R.K. Ecosystem services: Classification for valuation. *Biol. Conserv.* **2008**, 1167–1169. [CrossRef]
67. Martín-López, B.; Iniesta-Arandia, I.; García-Llorente, M.; Palomo, I.; Casado-Arzuaga, I.; García Del Amo, D.; Gómez-Baggethun, E.; Oteros-Rozas, E.; Palacios-Agundez, I.; Willaarts, B.; et al. Uncovering Ecosystem Service Bundles through Social Preferences. *PLoS ONE* **2012**, *7*, e38970. [CrossRef]
68. Nandagiri, J.L. Evaluation of Economic Value of Pilikula Lake using Travel Cost and Contingent Valuation Methods. *Aquat. Procedia* **2015**, *4*, 1315–1321. [CrossRef]
69. Kamri, T. Willingness to Pay for Conservation of Natural Resources in the Gunung Gading National Park, Sarawak. *Procedia Soc. Behav. Sci.* **2013**, *101*, 506–515. [CrossRef]
70. La Notte, A.; D' Amato, D.; Mäkinen, H.; Paracchini, M.L.; Liquete, C.; Egoh, B.; Geneletti, D.; Crossman, N.D. Ecosystem services classification: A systems ecology perspective of the cascade framework. *Ecol. Indic.* **2017**, *74*, 392–402. [CrossRef] [PubMed]
71. de Groot, R.S.; Wilson, M.A.; Boumans, R.M.J. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecol. Econ.* **2002**, *41*, 393–408. [CrossRef]
72. ONE. *Proyección de Hogares 2010–2025*; Oficina Nacional de Estadística (ONE): Santo Domingo, Dominican Republic, 2019; p. 41.
73. Arkema, K.; Fisher, D.; Wyatt, K. *Economic Valuation of Ecosystem Services in Bahamian Marine Protected Areas*; BREEF. The Nature Conservancy. Bahamas National Trust. Natural Capital Project. Stanford University: Stanford, CA, USA, 2017; p. 87.
74. Czúcz, B.; Arany, I.; Potschin-Young, M.; Bereczki, K.; Kertész, M.; Kiss, M.; Aszalós, R.; Haines-Young, R. Where concepts meet the real world: A systematic review of ecosystem service indicators and their classification using CICES. *Ecosyst. Serv.* **2018**, 145–157. [CrossRef]
75. BCRD. *Encuesta Nacional de Gastos e Ingresos de los Hogares ENGIH 2018*; Banco Central de la República Dominicana: Santo Domingo, Dominican Republic, 2020; p. 102.
76. Han, F.; Yang, Z.; Wang, H.; Xu, X. Estimating willingness to pay for environment conservation: A contingent valuation study of Kanas Nature Reserve, Xinjiang, China. *Environ. Monit. Assess.* **2011**, *180*, 451–459. [CrossRef]
77. Egan, K.J.; Corrigan, J.R.; Dwyer, D.F. Three reasons to use annual payments in contingent valuation surveys: Convergent validity, discount rates, and mental accounting. *J. Environ. Econ. Manag.* **2015**, *72*, 123–136. [CrossRef]
78. Fisher, B.; Polasky, S.; Sterner, T. Conservation and Human Welfare: Economic Analysis of Ecosystem Services. *Environ. Resour. Econ.* **2011**, *48*, 151–159. [CrossRef]
79. Catibog-Sinha, C.; Wen, J. Sustainable Tourism Planning and Management Model for Protected Natural Areas: Xishuangbanna Biosphere Reserve, South China. *Asia Pac. J. Tour. Res.* **2008**, *13*, 145–162. [CrossRef]
80. Maikhuri, R.K.; Nautiyal, S.; Rao, K.S.; Saxena, K.G. Conservation policy–people conflicts: A case study from Nanda Devi Biosphere Reserve (a World Heritage Site), India. *For. Policy Econ.* **2001**, *2*, 355–365. [CrossRef]
81. Kušová, D.; Těšitel, J.; Matějka, K.; Bartoš, M. Biosphere reserves—An attempt to form sustainable landscapes: A case study of three biosphere reserves in the Czech Republic. *Landsc. Urban Plan.* **2008**, *84*, 38–51. [CrossRef]
82. Obradović, S.; Stojanović, V.; Kovačić, S.; Jovanovic, T.; Pantelić, M.; Vujičić, M. Assessment of residents' attitudes toward sustainable tourism development—A case study of Bačko Podunavlje Biosphere Reserve, Serbia. *J. Outdoor Recreat. Tour.* **2021**, *35*, 100384. [CrossRef]
83. Norman, L.M.; Villareal, M.L.; Lara-Valencia, F.; Yuan, Y.; Nie, W.; Wilson, S.; Amaya, G.; Sleeter, R. Mapping socio-environmentally vulnerable populations access and exposure to ecosystem services at the U.S.-Mexico borderlands. *Appl. Geogr.* **2012**, *34*, 413–424. [CrossRef]
84. López-Hoffman, L.; Varady, R.G.; Flessa, K.W.; Balvanera, P. Ecosystem services across borders: A framework for transboundary conservation policy. *Front. Ecol. Environ.* **2010**, *8*, 84–91. [CrossRef]
85. Arriagada, R.; Perring, C. Paying for International Environmental Public Goods. *Ambio* **2011**, 798–806. [CrossRef] [PubMed]
86. Van Cuong, C.; Dart, P. Using Enhancing our Heritage Toolkit for assessing management effectiveness of the Kien Giang Biosphere Reserve. *Int. J. UNESCO Biosph. Reserves* **2017**, *1*, 56–76.