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Monetary Valuation of Protected Wild Animal Species as a Contingent Assessment in North Sulawesi, Indonesia

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Abstract: Virtually every country has a problem with preserving protected wild animals, and some countries have their way of protecting animals through legal measures. Animals are a nation's wealth, just as are forest timber and non-timber forest products. This asset has an economic value that is worth quantifying. Ecosystem assessment is becoming an increasingly crucial factor in determining how much the environment contributes to economic value. Such studies require additional monetary modeling and evaluation of non-market services. This research presents a willingness to pay (WTP) approach to calculate the value of protecting wild animal species. The study area was in North Sulawesi, one of Indonesia's provinces located at the northern tip of Sulawesi Island. The questionnaire format for collecting data was the dichotomous choice contingency assessment method (DCCVM), and the sample size was 428 respondents. Based on willingness to pay, we assessed the contingency of single bounded dichotomous choice (SBDC) by estimating each protected animal's average (mean) value in three classes, namely mammals, birds, and reptiles. The mean result of the monetary assessment of protected mammal species was IDR 1,801,870 (USD 124.27), IDR 836,670 (USD 57.70) for protected bird species, and IDR 819,700 (USD 56.53) for protected reptiles. Any loss in wild animals incurs a natural resource debt burden for future generations to repay, just as does forest loss. If we do not want to leave the forest empty for our future generations, we must continue implementing nature conservation measures, including the protection and restoration of wild animals.

Keywords: protected animals; monetary valuation; contingent valuation; ecosystem assessment; forest accounting

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1. Introduction

Valuation of ecosystem services such as those provided by forests has been practiced for almost 30 years since editor, scientist, and researcher Gretchen Daily in the early 1990s provided early examples and highlighted the benefits to society, as well as shared ideas on how to measure the value of ecosystem services [1]. Here she explored the value of two things, namely ecology and economy, as valuable components of the world's ecosystem services [2]. The economic concerns involved assigning values to ecosystem services in the first place, while valuation is a must to arrive at a state of natural resource accounting [3]. The outstanding contribution of ecosystem services to the sustainable improvement of human well-being, quality of life, innovation, social integration, togetherness, and solidarity, must be at the core of the fundamental changes required in theory and practice if we are to understand the transformation of society for a sustainable future, required in theory and practice in order to guide society toward a more sustainable future [4–7].

Virtually all countries have challenges with the preservation of their protected wild animal species or endemic animals, such as pandas (*Ailuropoda melanoleuca*) in China [8], Philippine eagles (*Pithecophaga jefferyi*) in the Philippines [9], Sumatran orangutans (*Pongo abelii*) in Indonesia [10], koalas (*Phascolarctos cinereus*) in Australia [11], North Island brown kiwis (*Apteryx mantelii*) in New Zealand [12], the Patagonian mara (*Dolichotis patagonum*) in Argentina [13], and many more. Some countries have their own way to "fence" animals with some rules or laws; even they make their endemic animals a state symbol.

Animals are the wealth of the state, just as timber and non-timber products are in the forest. This asset has an economic value that is worth calculating. However, in the recent era of ecosystem degradation where wild animals are threatened by agriculture and its expansion [14], illegal hunting [15], habitat destruction [16], pollution [17], mining [18], and diversity loss [19], if species continue to be lost as on the recent trajectory, it will be increasingly difficult to obtain and benefit from information on its economic value. Thus, policy efforts to support protected wild animals from extinction need to be well designed and implemented. One such effort is to measure their economic value. With existing economic values, we can estimate the value of losses when disasters, hunting, or epidemics result in environmental degradation [20,21]. One of the purposes of this valuation is to anticipate losses that may occur, so we can calculate how much liability is generated and compare it with maintenance costs; this is where decision-makers will act by making preventive policies.

Some regulations regarding environmental policies cause a shift in the use and value of ecosystem services in the national environmental account as well as the usefulness of the valuation of benefits [22]. This can cause losses, including payment of monetary compensation, and require an evaluation of how much money is needed to restore environmental integrity. In this way, the price of the assets (such as ecosystem components, in this case wild animals) can be valued by the willingness to pay (WTP) measure, i.e., an amount of money an individual is prepared to pay for access to these services [23].

Regarding economic valuation of protected wild animals [24,25], no systematic approach has been found. However, with ecosystem valuation, which is the leading component in natural capital accounting, there is a broad environmental concept with a breadth of valuation techniques [26]. It is also known that ecosystem service assessment and valuation are integrated into accounting and reporting systems to relate environmental assets to other statistics and data on environmental, economic, and social characteristics already used by analysts and policymakers [27]. A fully integrated economic and environmental analysis is increasingly recognized as crucial for policy design and implementation [28], while valuations are increasingly essential in translating quantitative assessment into monetary terms by choosing an economic valuation technique that has as much consistency as possible with the biophysical model [21,28].

Many people believe that the value of natural resources is limitless. The economy considers this an available opportunity; economists treat natural resources as part of community capital assets, which are less important than other types of capital, such as mines. This human-centered approach is fundamentally different from other perspectives, such as the intrinsic value of deep ecology [29,30]. We may or may not find it difficult to reconcile this approach with our values concerning natural capital. Nevertheless, we will use a monetary valuation approach to the problem of natural resource management [31]. This approach highlights the sacrifices that must be made between competing natural resource uses and users, such as recreation, species habitat, and resource extraction [32]. Monetary valuations [4,33] account for the economic value of what has already been (past), what is current (present), and what will happen (future) to ecosystem services; a summary of monetary assessments tells us what happens in the environment over a period of time.

The natural resource balance sheet is recorded as an asset or liability at the end of this flow. This is all the result of implementing policies and rules. Rules to save animals from extinction must be implemented; if not, or ignored, this will produce liability rather than assets. A key aspect of ecosystem valuation is to show the full potential of the balance sheets

in order to examine the trade-offs faced when making development decisions between the benefits generated by turning natural capital into productive assets and the losses associated with decreasing ecosystem services provided by natural capital. Such a study requires additional monetary modeling and valuation of non-market services. Forest and ecosystem accounts show that protected animals will be suitable candidates for more in-depth analyses. When the animal population increases or decreases it will affect the entire environment including the food chain. If the environmental balance can be maintained properly, then the ecosystem services will be good too, then nature will offer better results including economic improvement. Developing, strengthening, and evaluating a system balanced between the environment and the economy can provide information to improve environmental policies for our ecosystem [34,35], emphasize the need to better understand the relationship between economics and the environment [36], and develop a comprehensive value analysis of opportunities for environmental development and green growth through a comprehensive calculation of ecosystem units. Applying natural capital accounting is part of a more comprehensive set of current policies and regulations (see Costanza et al. (1997) [37] and ref. [38] for a more in-depth discussion of wildlife's assessment and economic importance, and ref. [39] for a summary of the monetary valuation of protected wild animal species).

The lack of appropriate valuation [40] of the cost incurred for an environmental ecosystem makes it difficult to price environmental externalities effectively and integrate these environmental costs into the calculation of the actual cost of capital [23,26,41]. Fundamental characteristics of ecosystem valuation [42], including the process of listing all services derived from ecosystems, can help ensure their recognition in public policy. This makes ecological system service values more transparent and may help inform decision-makers about the relative benefits of various choices. However, monetary evaluation of holistic benefits from ecosystem services is still a key challenge for economic methods, and economic methods are too narrow to measure the full breadth of how people benefit from ecosystem services [43]. Further, assigning market prices to measure wild animals in terms of monetary value is generally not performed and such data are not otherwise available.

In various kinds of literature, there are many examples of taking an economic approach to nature, and the WTP approach is a common one. To measure the WTP for nature, ideally the analysis can be done on the number of individuals willing to pay through structured and reliable communication. Information could be gathered from all citizens, but this is too expensive or even impossible; one way to conduct a survey and maintain reasonable representation of the population is to take a sample of the survey population and to estimate the aggregate availability in which the population is represented [44–46]. This is the basis on which the "contingency assessment" approach is defined [47]; this concept is interesting because it has a potential that allows analysts to have several arguments involving active and passive populations in the availability of the amount of WTP.

This study's objective was to calculate the monetary value of protected wild animal species by estimating the willingness to pay for them. This represents a proxy for the ecosystem services they provide in forest ecosystems. The assessment reported in this study was not intended to obtain the value of protected wild animals for trading, but to obtain the monetary value as the aggregate price of existing forest resource assets. In North Sulawesi (known and abbreviated as Sulut), Indonesia, as in other parts of the world, the value of wild animals has been forgotten or is considered to be low; some think that wildlife value is only limited to esthetics and tourist value, while they have an essential role in ecosystem services [38]. Specifically, this work aims to (1) describe the results of surveys conducted online and offline in the North Sulawesi community that meet the criteria and (2) present WTP calculations using the contingent valuation method (CVM), specifically the dichotomous choice contingency valuation method (DCCVM). In doing so, this study will give attention to the current sensitivity and awareness of the community concerning wild animals, and may build public understanding that wild animals can have economic value too (just as the trees), even though these animals may commonly be considered otherwise meaningless to them or principally valued by their hunting and/or consumptive values.

2. Materials and Methods

Using the willingness to pay (WTP) method to determine the value of protected species conservation is typically based on the idea of straight protection of a species and is rarely explicitly conducted in the context of habitat preservation of protected species [39]. However, it uses direct preference elicitation by asking respondents their WTP for a quality or quantity improvement or willingness to accept a decrease in quality or quantity of the specific ecosystem service. This method can be applied to both use and non-use values; stated preference relies on individuals' responses to hypothetical scenarios involving ecosystem services and contingent valuation and structured choice experiments. These two methods are both based on human perceptions or preferences [43].

In the collection of information on monetary valuation of protected wildlife, the discrete-choice technique of stated preferences is used as respondents make decisions about hypothetical scenarios. Stated preference, also called contingency valuation, is a survey-based assessment technique in which subjects are asked a series of questions about how well they rate the object of study, choosing the 'best' alternative from a series of possible answers to questions and hypothetical scenarios. These questions and scenarios are fully explained through questionnaire-style experimental designs. It is understandable that the answers are based on many things and may differ significantly from the actual behavior, and that the valuation is limited to non-market prices. This method is different if the study requires that protected wildlife products are traded and the respondents' behavior requires a response to a buying decision; then the revealed preference method would be used. The revealed preferences method uses observations of actual decisions to measure preferences. This method avoids the potential problems associated with hypothetical responses, such as relying on real decisions and not considering strategic responses or behavioral constraints [48,49]. However, the revealed preference method was not used in this study to measure preferences.

This research presents a WTP approach to calculate the value of protected species [50] in the forests of North Sulawesi Province, Indonesia. An approach that uses WTP aims to evaluate the intangible costs of an economic condition to avoid an 'illness' or overcome 'anxiety' that occurs in the act of conducting a monetary valuation [51]. To overcome WTP obstacles, economists have traditionally addressed this valuation problem by adopting methodologies that rely upon surveys, as is the case of the contingent valuation method. However, it is possible to simulate a market for these areas through the contingent valuation method (CVM), and will allow the presence of a hypothetical demand [52]. By summarizing the basic concepts and methods of valuation, this study introduces the CVM, which is widely used in valuing non-market public goods in the valuation of consumers' personal information. In the empirical research process, a combination of the dichotomous choice contingency valuation (DCCVM) method and a questionnaire was adopted [53]. North Sulawesi (Sulut) is one of the provinces located at the northern tip of Sulawesi Island, Indonesia, with the capital city located in Manado (Figure 1). The Maluku Sea and Pacific Ocean border Sulut to the east, Sulawesi Sea and Gorontalo Province to the west, Davao del Sur (Philippines) Province to the north, and Maluku Sea and Tomini Bay to the south. The population of Sulut in 2019 was 2,506,981 people [54]. Based on the Sulut forest resource balance data in 2014, the area of the forest area determined by the Ministry of Forestry was 762,059.42 hectares (ha) [55] with the composition of the area as follows: nature reserves and nature conservation areas (41.18%), limited production forest (27.31%), protected forests (21.15%), production forest (8.44%), and converted production forest (1.92%).

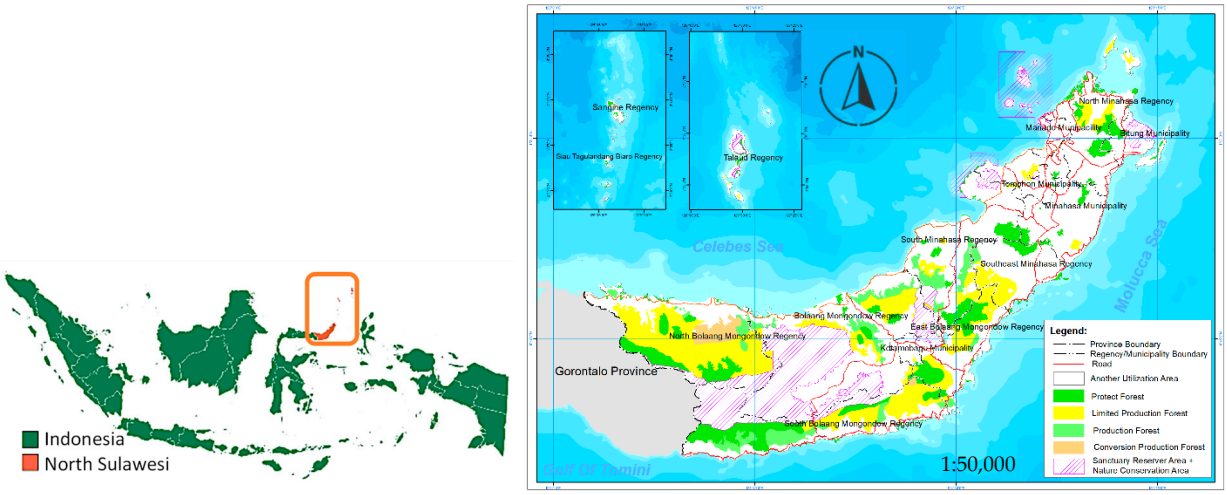

Figure 1. Forest cover of the province of North Sulawesi in Indonesia, the site for research on the monetary valuation of protected wild animals.

This paper discusses people's attention toward the high rate of extinction and the willingness to contribute to saving animals from extinction. Respondents who participated through social media were first introduced to the study material, as were those who participated offline, ensuring that respondents understood the research objectives before giving their opinion, because some might think (wrongly) that this study was to determine the selling price of protected wild animal species. The research subjects were classified according to socioeconomics, and surveys were conducted related to forest protection and protected areas [3]. The survey was carried out in Sulut in 2020. Sulut has 15 administrative regions, divided into 4 municipalities and 11 regencies. Due to the COVID-19 pandemic, researchers had difficulty physically accessing all 15 government areas; access was, however, made to 11 regions, and online participation in another region brought the total representation to 12 regions. Data collection was carried out through a questionnaire survey conducted by researchers using the modified Dillman method. The questionnaire survey was designed on Google Forms. Questionnaires were then distributed using the purposive sample method [56]. The questionnaires were distributed via WhatsApp and Facebook Messenger. Additionally, questionnaires were also printed and distributed personally to the target respondents who were selected based on the criteria: (1) North Sulawesi native living in North Sulawesi, or (2) Non-North Sulawesi ethnicity individual born, raised, and living in North Sulawesi, or (3) Non-North Sulawesi ethnicity individual who has lived in North Sulawesi for at least 15 years. The target respondents were residents who had settled in Sulut for more than 15 years and were more than 16 years old; respondents were selected from all walks of life and had various professional, educational, and income backgrounds. From the questionnaires distributed online and offline, after verifying the sample, 428 respondents met the criteria. The sample size was considered to be representative of the population, as determined by Slovin's formula [57].

This study used the classification of endangered and protected wild animals according to the State of Indonesia (Table A1 in the Appendix A). At the time of conducting the questionnaires, only one species from each taxonomic family was introduced to the respondent as a representative example for three principal reasons: (1) introducing all species during the survey would increase the number of questions asked and probably risk losing participant interest, (2) the species which are present in each region surveyed are a little different, and therefore, it seems more logical to enquire about local species that are generally recognized in the community, and (3) although survey areas may not have the species present, the respondent was most likely to be familiar with certain species more than others. To ensure familiarity, the question before they were asked to set a price was to ask whether they knew the animal well. The questionnaire was arranged with basic

questions at the beginning, followed by questions directed toward the main question, and at the climax, the main question was asked (Table A2 in the Appendix A). Then, correlation analysis was used to identify possible relationships between factors, including correlations on the level of recognition, knowledge, and attractiveness of each classification of animals.

In analyzing the data based on the results of the questionnaire survey, a database was made and interpreted through descriptive statistics. The study also estimated statistical relationships between variables using dependency correlations with confidence levels of 95%. Then, the correlation coefficient calculation was also carried out to confirm the interdependence of the pairs of variables and describe the direction of the linear relationship between variables by using the Pearson correlation coefficient [3,58]. Only relevant variables having correlation are shown in the results and discussion, and the basis for the conclusions of the research was made on significant correlations only ($p < 0.05$). In this study, the JASP statistical analysis program was used [59]. In this study, based on willingness to pay, we assessed the contingency of single bounded dichotomous choice (SBDC) [53] by estimating the average (mean) price of each protected animal family, divided into three classifications, namely mammals, birds, and reptiles.

3. Results

3.1. Respondent Demographic

Contingency assessment using the dichotomous choice approach determines the probability of representative consumers who are willing to provide information on the amount of the nominated price or are willing to pay a certain amount of money to ensure that environmental changes occur, or at least that they can be avoided, or estimate the price of the environment of interest. This assessment occurs because of an analysis of the dichotomous choice contingency assessment data by adjusting the parametric distribution to reflect personal demand for representative non-market goods.

In accordance with the results obtained, the population of the questionnaire survey was aged at least 16 years old. The representative sample used 428 respondents who qualified as meeting the criteria and whose responses were verifiable (via quality screening). Verification of survey results was carried out only on mandatory questions except for names, contact numbers, and suggestions.

Introductory part, where the research and its purpose were introduced, was followed by three parts: (1) environmental issues about protected species; (2) monetary valuation for protected species and willingness to pay; and (3) socioeconomics of respondents (the demographic descriptions are listed in Table 1). To obtain truthful and accurate information and to maximize response rates, respondents were told that their information was truly confidential and for academic purposes to measure the economic value of resources, and that there were no right or wrong answers [53,60]. DCCVM variables of respondent socioeconomics included gender (male or female), age, level of education, family status (father/husband, mother/wife, child), current occupation/profession, average monthly income after tax (in rupiahs/IDR) and status of income.

3.2. Response to the Environment and Protected Animals

We needed to know how concerned the respondents were about the material that was the focus of the study. Therefore, some basic things needed to be known, such as the level of concern for the environment and protected wild animals. In responding to these questions, most respondents had a positive response to the study. There is an interesting point to note on the number of respondents. We only wanted to interview respondents who were really concerned about the ecosystem/environment and protected wild animals. In our total sample, 2.3% and 0.7% of respondents were not concerned about ecosystems (Q2) or protected species (Q5). This made them unable to participate in providing their responses to subsequent questions; hence the sample size was lower (Table 2). This study also analyzed the correlation of factors such as socioeconomic, mean price, guiding questions to WTP, and WTP main question (Table 3). When combining respondents who answered "strongly

agree" with those who "agreed", we found high public awareness of North Sulawesi (Sulut) ecosystems (92.1%), that many people felt environmental issues were well handled (43.5%), and were well aware of Sulut protected wild animal species (96.0%).

Table 1. Socioeconomics factors of the sample population (n = 428).

Variable	% of Respondents
Gender	
Male	50.35%
Female	48.96%
Age	
16–20 yrs	14.15%
21–25 yrs	13.46%
26–30 yrs	9.51%
31–35 yrs	11.37%
36–40 yrs	11.37%
41–45 yrs	14.62%
46–50 yrs	12.30%
>50 yrs	12.53%
Level of education	
Primary/secondary	19.26%
Post-secondary	23.90%
Undergraduate	43.39%
Graduate	10.67%
Postgraduate	2.09%
Family status	
Father/husband	35.73%
Mother/wife	29.70%
Child/unmarried/childless	33.88%
Profession	
Student	17.17%
Employed	51.51%
Self-employed	18.79%
Unemployed	7.66%
Other	4.18%
Average monthly income	
≤2.9 M	58.70%
3–5.9 M	28.31%
6–8.9 M	7.19%
9–11.9 M	1.62%
12–14.9 M	2.09%
≥15 M	1.39%
Income status	
Fixed income	32.95%
Non-fixed income	42.00%
Fixed income plus additional income	5.57%
Not available/not earning	18.79%

In fact, people felt that environmental problems were the most important problems they faced compared to other problems (70.6%), and flooding was the greatest concern within this issue (65.1%), while forest destruction was the second (55.5%). Concerning protected wild animals, the study results show that the most well-recognized mammals, birds, and reptiles were Cercopithecidae, Rallidae, and Cheloniidae, respectively. As for the preservation of protected wild animal species, it was felt that the leading causes of decline/disappearance of Sulut animals were illegal hunting (85.06%), forest destruction (62.89%), and tree felling (56.39%).

What needs to be noted from the correlation between factors is that the first one had a unidirectional relationship. A unidirectional relationship that has a very strong correlation occurred in those who recognized and also had knowledge of protected wild birds (0.991 ***) and mammals (0.977 ***). Even though education and income factors

were weak, they had a correlation to the average price of mammals, birds, and reptiles. An interesting phenomenon occurred relating to knowledge: that a person's interest in mammals, birds, and reptiles, and their respective average WTP value were positively correlated with a very high probability ($p < 0.001$).

Table 2. Responses to environmental concerns and regulations, and protected species in Sulut ($n = 428$).

Question/Response (Indented)	% of Respondents
Q1. What are the main significant problems that Sulut has faced over the past 3 years?	
Environment	70.6%
Health	52.3%
Education	43.7%
Works/job	42.1%
Poverty	22.9%
Social security	15.0%
Transportation	9.8%
Others	0.9%
Q2. I am well aware of the Sulut ecosystems	
Strongly agree	52.8%
Agree	39.3%
Neutral	5.6%
Disagree	2.3%
Strongly disagree	0.0%
Q3. What are the main natural environmental issues that Sulut faced in the 3 years?	
Flood	65.1%
Forest destruction	55.5%
Landslide	44.3%
Wildlife hunting	36.1%
Air pollution	28.9%
Water pollution	16.5%
Drought	6.9%
Others	3.1%
Q4. Environmental issues have been handled well	
Strongly agree	18.4%
Agree	25.1%
Neutral	27.8%
Disagree	26.6%
Strongly disagree	2.2%
Q5. I am well aware of the Sulut protected species	
Strongly agree	54.1%
Agree	41.9%
Neutral	3.3%
Disagree	0.7%
Strongly disagree	0.0%
Q6. How many protected wild animals do you recognize well? (n = 415)	
Mammals	
Cercopithecidae	68.67%
Pteropodidae	64.82%
Tarsiidae	59.52%
Cervidae	56.63%
Suidae	49.64%
Phalangeridae	35.90%
Bovidae	33.49%
Viverridae	17.35%
no opinion	3.37%

Table 2. *Cont.*

Question/Response (Indented)	% of Respondents
Birds	
Rallidae	84.82%
Tytonidae	72.77%
Accipitridae	65.78%
Strigidae	64.82%
Psittacidae	60.96%
Megapodiidae	42.65%
Alcedinidae	27.23%
Corvidae	26.51%
Bucerotidae	23.13%
no opinion	3.37%
Reptiles	
Cheloniidae	69.88%
Crocodylidae	67.23%
no opinion	20.72%
Q9. What is the leading cause of the decline or disappearance of Sulut protected wild animals?	
Illegal hunting	85.06%
Forest destruction	62.89%
Tree felling	56.39%
Mining	25.30%
Urban/population growth	19.52%
Global warming	8.43%
Others	0.96%

Table 3. Table of Pearson's correlation for socioeconomic factors, protected wild animal species, and mean price.

Factor	Mammals' Mean Price	Birds' Mean Price	Reptiles' Mean Price	Q6M	Q6B	Q7M	Q7B	Q8M	Q8B	Q8R
Age	-	-	-	-	-	0.143 **	-	-	-	-
Level of education	0.177 ***	0.16 ***	0.155 **	-	-	0.103 *	-	0.154 **	0.1 *	0.14 **
Average monthly income	0.115 *	0.104 *	0.13 **	-	-	0.142 **	0.098 *	0.158 **	0.126 **	0.099 *
Q7M	0.181 ***	0.223 ***	0.16 ***	0.977 ***	-	-	-	-	-	-
Q7B	0.219 ***	0.236 ***	0.206 ***	-	0.991 ***	-	-	-	-	-
Q7R	0.203 ***	0.196 ***	0.204 ***	-	-	-	-	-	-	-
Q8M	0.318 ***	0.289 ***	0.267 ***	0.74 *	-	0.71 *	-	-	-	-
Q8B	0.308 ***	0.298 ***	0.255 ***	-	0.857 **	-	0.883 **	-	-	-
Q8R	0.293 ***	0.274 ***	0.282 ***	-	-	-	-	-	-	-

Q6M = Question no. 6 mammals. Recognize protected wild mammal species; Q6B = Question no. 6 birds. Recognize protected wild bird species; Q7M = Question no. 7 mammals. Knowledge about protected wild mammal species; Q7B = Question no. 7 birds. Knowledge about protected wild bird species; Q7R = Question no. 7 reptiles. Knowledge about protected wild reptile species; Q8M = Question no. 8 mammals. Protected wild mammals that are likable and attract attention; Q8B = Question no. 8 birds. Protected wild birds that are likable and attract attention; Q8R = Question no. 8 reptiles. Protected wild reptiles that are likable and attract attention; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. "-" indicates no correlation.

3.3. Monetary Value

The monetary value of the mean price of protected animals is that estimated by the respondent per animal family and per animal class (Table 4). As far as we know, this was the first time in Sulut that protected animals have been assessed in monetary terms using the WTP method. The results of this assessment are in thousand rupiah (IDR) and the USD to IDR exchange rate was 14,500 (April 2021).

Table 4. Mean monetary value of protected animals.

Class/Family (Indented)	Mean Price (1000 IDR)	Mean Price (USD)	Std. Dev. (IDR 1000)	Std. Error (IDR 1000)
Mammals	1801.87	124.27	2163.99	36.98
Bovidae	3158.14	217.80	3454.38	166.97
Cercopithecidae	1711.13	118.01	1807.76	87.38
Cervidae	2148.95	148.20	1932.05	93.39
Phalangeridae	1474.35	101.68	1792.58	86.65
Pteropodidae	610.35	42.09	961.91	46.50
Suidae	1539.03	106.14	1774.74	85.79
Tarsiidae	1989.25	137.19	2017.64	97.53
Viverridae	1783.75	123.02	1907.54	92.20
Birds	836.67	57.70	1087.12	17.52
Accipitridae	897.27	61.88	1113.23	53.81
Alcedinidae	732.46	50.51	1008.31	48.74
Bucerotidae	864.17	59.60	1096.28	52.99
Corvidae	833.01	57.45	1081.52	52.28
Megapodiidae	960.4	66.23	1144.39	55.32
Psittacidae	966.39	66.65	1172.57	56.68
Rallidae	592.52	40.86	938.33	45.36
Strigidae	694.46	47.89	987.80	47.75
Tytonidae	989.31	68.23	1157.34	55.94
Reptiles	819.7	56.53	1295.03	44.26
Cheloniidae	709.81	48.95	859.88	41.56
Crocodylidae	929.59	64.11	1610.75	77.86

In this study, eight mammal families were declared protected. The monetary value of the mean price of Bovidae was IDR 3158.14 or USD 217.80—the highest among mammals—then Cercopithecidae with a value of IDR 1711.13 (USD 118.01), and the lowest mean price was for Pteropodidae (IDR 610.35 or USD 42.09).

Nine bird families were declared protected. We were a little surprised by the results of this classification because the resulting numbers were higher than what we expected. The results of the monetary value of the mean prices include Accipitridae (IDR 897.27 or USD 61.88), and Alcedinidae (IDR 732.46 or USD 50.51).

Last were reptiles. In this classification, there are two families declared protected in this study: Cheloniidae and Crocodylidae. The mean monetary value of Cheloniidae was IDR 709.81 (USD 48.95), and Crocodylidae with a value of IDR 929.59 (USD 64.11). In contrast to birds, we actually expected high values to be given by respondents to these two reptile families, but the results were different. We also concluded that the mean result of the monetary assessment of protected mammals, birds, and reptiles was IDR 1801.87 (USD 124.27), IDR 836.67 (USD 57.70), and IDR 819.70 (USD 56.53), respectively.

Our study provides an opportunity to further assess accounting and monetary valuations, especially of environmental assets and services that do not yet have a monetary value, such as protected wild animal species. The assessment was carried out on environmental assets and services that have no accounting and monetary value in a more comprehensive manner. In some cases, the value of the liabilities from the environment and ecosystems can also be calculated. This provides support for further studies of physical and monetary valuation of natural resources. The results of this assessment are very helpful for us to conduct further studies on estimating the wealth value of forest resource assets. The estimated assessment will combine all forest resources that already have monetary value, such as wood and non-wood.

4. Discussion

Regarding the implications of the research results and monetary valuation of protected wild animals for long-term sustainability, there are several key points to note. (1) Results show that most people (70.6%) consider that the level of environmental damage is a major

problem compared with other problems. Beyond environmental sustainability, this will greatly affect the level of household economic stability [61]. Floods and forest destruction were the top environmental issues of concern, and only 43.5% of questionnaire participants stated that these issues had been handled properly. (2) The community is very aware of environmental issues and issues of protected wild animals. We are encouraged by this as it likely means there are good opportunities for decision-makers to tackle these issues [48]. (3) Due to the high level of public awareness of the issue of protected wild animals, most respondents openly gave opinions about prices for each animal. Notably, we successfully demonstrated through the collection of 415 (of a possible 428) independent monetary valuations across broad demographics that these animals have a current price and measurable value that can be recorded in the forestry balance sheet as tangible asset accounts, just as wood, non-wood, and carbon stocks also presently have [49]. Presenting such information is highly relevant, has corresponding implications, and will make it easier for the government or other entities to cooperate with the community in determining appropriate decision-making in conservation. One such example, involving the metropolitan government in Seoul, South Korea, is the release of an illegally-captured dolphin (*Tursiops aduncus*) back into the wild, which although it required substantial public expenditure, post-release, the measured WTP for the release was higher than the actual cost, interpreted as overall (financial) support from local residents for such wild animal conservation initiatives [62].

A little explanation about the order of questions in Table 2: respondents were directed to fill in socioeconomic data if in question 2 (Q2) the respondent chose to disagree or strongly disagree. The same applied to question 5 (Q5). The result was that there were 13 respondents who did not participate in determining the monetary assessment. Why we consider this important is because respondents did not have the right responses and attitudes towards the environment. This method has also been followed by previous researchers, with confidence and attention showing respondents' character in the stated preferences, which in part can affect the value of their attitudes and the objectivity of the assessment [63].

The difference in mean prices between animal groups is very striking, whereby the assigned price of mammals far exceeded the prices of birds and reptiles. Comparing the values given to species by our respondents with the price of species sold on the black market may not be scientifically reasonable as it likely introduces bias, because many ecosystem services and products do not have market prices. In other words, they are subject to prices which are highly distorted from the real value [64]. Information from several local "extreme markets" (the name given to markets which sell wild animal meat) can be accessed easily, but for protected wild animals it is very difficult to find because of strict government control and severe legal consequences. Further, when it comes to the price of protected wild animals on the black market, we do not have ethical reasons to compare market values in these two markets with different scopes.

Our utility of the contingent valuation method (CVM) model confirms what Engeman et al. [31] and Decker and Watson [39] found in their study of rare species in threatened ecosystems. Even though they were concerned with different species, they had the same idea in preserving these animals by determining the monetary value of these animals. However, there is a difference between our study and these two studies. Specifically, they openly determined that there is a payable value or price for a rare species and that the method and period of payment will be adjusted. This is very different from what we did in that we asked the respondents to determine the price of the protected wild animals without expecting the respondent to decide on the time period and method of payment. This is because our study only wanted to know the asset value to account for protected wild animals in the forest area after an inspection was carried out, as for wood, non-wood, and carbon assets.

The preference method, which is generally used in monetary valuation studies, has become a popular method used for contingent valuation of environmental goods [63], in contrast to conventional goods, which are valued in the market using various price

valuation methods such as cost pricing or market pricing. The contingency valuation itself uses a single bounded dichotomous choice format which is correlated with socio-economic variables (Table 3). Interesting results were obtained from the factors that influenced the determination of the mean value of each species. Education and income factors need to be considered because they have a positive correlation with determining the mean price of each species, although the strength of the correlation was relatively weak. These two factors were more useful than the other factors, which had no correlation at all. These two factors also had a correlation with knowledge about protected wild mammal species, and protected wild mammals, birds, and reptiles that are likable and attract attention. The results show that respondents who had knowledge of species will give a good and valuable assessment. These results are in line with the answers on questions in studies carried out related to knowledge of the Formosan pangolin, which is very informative [65]. The factors that influence WTP in respondents who have education and income may be a correlation observed in the future. We also realize that this research has limitations. There are two limitations that can be given: the first is that the benchmark assessment was only carried out on local residents without involving domestic and foreign tourists. The second is the limitation on the application of the results, which does not involve the community WTP the cost of preserving and conserving the species because it only focuses on the price of the species. This topic will continue to be of interest in future work which will focus on the ability to pay to finance the conservation of forests where protected wild species exist.

More broadly, the results of this study have significance in the future. There are three things in particular to note: (1) The results of this study will help determine the characteristics of the community regarding their awareness, care, and concern for the situation of protected forests and wild animals, so that we can easily ask them to proceed to the next stage such as the method, time period, and the amount to be donated to protect forests and protected wild animals. (2) This study has helped to estimate the monetary value of tangible assets of forests, specifically protected wild animals. (3) The motivation for this work responds to an observation that protected wild animals are not included in forest products that have economic value when land conversion occurs, which can be seen from the lack of studies on monetary valuation of animal species in contrast to research on wood, non-wood, or carbon assets. Consequently, this research and research design can assist the government in assessing the monetary aspects of the environment during the process of forest conversion by reviewing the long-term economic impacts.

5. Conclusions

Natural resource liabilities will burden future generations with debts to be repaid. Forests are one such resource. Conservation action to protect wild animals must be continuously carried out if we do not want to leave the forest empty and uninhabited for our generation and the future generations. It is needed to maintain/restore the necessary conditions and extent of the ecosystem and can lead to changes in the capacity to provide regulatory ecosystem services.

Problems often arise due to the use of wild animals as consumptive and non-consumptive products because they are assessed and valued in terms of their nutritional content, medicinal properties, as accessories, and clothing. Some wild animals are exploited and traded outside of the region, but some are consumed locally. Key alternatives must be found, and stakeholders must be brought together; government is the foremost of these and it is required to make resolutions and comprehensive policies that will be implemented. This study was not intended to promote legalization of wild animals for commercialization, especially those with protected status; in fact, quite the opposite (the aim was to prohibit the exploitation of wild animals). Finding ways to use financial accounting knowledge can help assess estimated natural resource assets or liabilities in monetary terms, on which innovative and sustainable uses can be based.

Estimating willingness to pay (WTP) is more difficult when the impact of the policy does not match changes in the market for traded goods [47]. For example, although

most people will be willing to pay a substantial amount to improve the quality of the environment, there is no market for this public good, or the item is not worth trading. Nevertheless, people can convey information about their WTP for changes in environmental quality by their actions. So, for example, the value of animals can change to reflect changes in the level of scarcity in their habitat [66], thus giving a 'shadow' price to their availability. In general, shadow prices refer to the conclusion of marginal social value when it is not expressed through market prices. Forests have unlimited wealth, both tangible and intangible forest wealth. The wealth of the forest with all the inventory contained therein is like a protected animal. The assessment of it is carried out to measure the value of the inventory in monetary terms. When interpreting the results, we want to remind readers of our main goal. As stated in the introduction, our main objective is to estimate the average monetary value of protected wild animal species. The results of this study will greatly assist our further studies in estimating the value of the wealth contained in the forest. Despite the fact that there are limitations in that not all protected wild animal species are included in this study, we believe that this can represent our goal. This study is a step to help improve our understanding of the monetary valuation of natural resources. Our work has led us to evidence that the people of North Sulawesi (Sulut) themselves are aware of and support monetary assessments.

In summary, our work has shown that protected animals in Sulut have received sympathy and response from people of all walks of life with various socioeconomic backgrounds in more than four-fifths of the municipalities/regencies. The response to the need for ecosystem protection reached 92.1%, and for wild animal protection it reached 96.0%. The results of the mean monetary value for the classification of protected wild animals were arrived at using the single bounded dichotomous choice contingency assessment method, with a mean price result of IDR 1801.87 (USD 124.27) for mammal species, a mean price for birds of IDR 836.67 (USD 57.70), and for reptile species, IDR 819.7 IDR (USD 56.53).

Furthermore, our future work will concentrate on monetary valuations of intangible assets and other tangible assets, including monetary valuations of liabilities, both natural and man-made. In addition, we have not discussed forest opportunity loss, such as the total value of reserves and forest probabilities that are not utilized. Forests provide beautiful places that are very valuable; as intangible assets they can be valuable from the perspective of esthetics, recreation, and development of tourist facilities. We hope that our research will serve as part of future studies that make meaningful contributions.

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Appendix A. Additional Tables

Table A1. Protected wild animal species in North Sulawesi Indonesia, based on the Regulation of the Ministry of Environment and Forestry of the Republic of Indonesia [67].

Class/Family (Indented)	Indonesian Name	Scientific Name
Mammals		
Bovidae	Anoa gunung	*Bubalus quarlesi*
	Anoa dataran rendah	*Bubalus depressicornis*
Cercopithecidae	Monyet boti	*Macaca tonkeana*
	Monyet yaki	*Macaca nigra*
Cervidae	Rusa timor	*rusa timorensis*
Phalangeridae	Kuskus talaud	*Ailurops melanotis*
	Kuskus tembung	*Strigocuscus celebensis*
Pteropodidae	Codot talaud	*Acerodon humilis*
	Codot gigi kecil	*Neopteryx frosti*
	Kalong talaud	*Pteropus pumilus*
Suidae	Babirusa	*Babyrousa babyrussa*
Tarsiidae	Krabuku sangihe	*Tarsius sangirensis*
	Krabuku tangkasi	*Tarsius tarsier*
	Tarsius siau	*Tarsius tumpara*
Viverridae	Musang sulawesi	*Macrogalidia musschenbroekii*
Birds		
Accipitridae	Elang Sulawesi	*Nisaetus lanceolatus*
	Elang laut perut putih	*Haliaeetus leucogaster*
	Elang bondol	*Haliastur indus*
	Elang paria	*Milvus migrans*
	Sikep madu sulawesi	*Pernis celebensis*
	Elang ular sulawesi	*Spilornis rufipectus*
Alcedinidae	Rajaudang sangihe	*Ceyx sangirensis*
	Cekakak talaud	*Todirhamphus enigma*
Bucerotidae	Kangkareng sulawesi	*Rhabdotorrhinus exarhatus*
	Julang sulawesi	*Rhyticeros cassidix*
Corvidae	Gagak sulawesi	*Corvus typicus*
Megapodiidae	Maleo senkawor	*Macrocephalon maleo*
Psittacidae	Nuri talaud	*Eos histrio*
	Serindit sangihe	*Loriculus catamene*
	Kringkring bukit	*Prioniturus platurus*
	Perkici dora	*Trichoglossus ornatus*
Rallidae	Kareo talaud	*Amaurornis magnirostris*
	Mandar talaud	*Gymnocrex talaudensis*
Strigidae	Celepuk sangihe	*Otus collari*
	Celepuk siau	*Otus siaoensis*
	Celepuk sulawesi	*Otus manadensis*
Tytonidae	Serak minahasa	*Tyto inexspectata*
Reptiles		
Cheloniidae	Penyu hijau	*Chelonia mydas*
	Penyu sisik	*Eretmochelys imbricata*
	Penyu lekang	*Lepidochelys olivacea*
	Penyu pipih	*Natator depressus*
Crocodylidae	Buaya muara	*Crocodylus porosus*

Table A2. Systematic Research Questions. WTP: Willingness to Pay.

Basic Research Questions	Guiding Questions to WTP	WTP Main Question (SBDC)
Q1. What are the main significant problems that Sulut has faced over the past 3 years? Q2. Are you aware of natural environmental issues? Q3. What are the main natural environmental issues that Sulut faced in the 3 years? Q4. Do you agree that the issues of the natural environmental and the protected animals in Sulut have been appropriately handled? Q5. Are you aware of protected wild animal species?	Q6. How many protected wild animals (mammals, bird, and reptiles) do you recognize well? Q7. How much information/knowledge do you have about protected wild animal species (mammals, bird, and reptiles)? Q8. Which of these protected wild animals (mammals, bird, and reptiles) do you like and attract your attention? Q9. What is the leading cause of the decline or disappearance of Sulut protected wild animals?	Q10. There should be a separate method in economic terms, but at this time, we ask for your willingness to provide an opinion. If we can ask your opinion about willingness to pay, how much would you pay for this animal per head, per protected wild animal species? Can you give your opinion? Your opinion in this study is not intended to promote trade and commercialize protected wild animal species.

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