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Economic Valuation for Cidanau Watershed Area, Indonesia

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Abstract

The paper describes economic valuation for the Cidanau watershed area of West Java in Indonesia. In this area natural resources deterioration has occurred even faster after the Asian Financial Crisis. The deforestation area and pronounced soil erosion seems to go unhindered because of land use competition among the residents for agricultural space, housing, etc. In order to prevent the area from further degradation, the purpose of this paper is to carry out quantitative evaluation which also attempts to raise the environmental awareness of residents, as well as visitors to the area. Questionnaire surveys were conducted and analyzed according to the Contingent Valuation Method (CVM) and the Travel Cost Method (TCM). The results show all respondents held good attitudes towards the efforts of environmental conservation, but responded negatively if they had to contribute to the environmental service payment. Visitors to the Anyer Beach acted differently because most of them come from faraway locations and have little knowledge of the watershed. However, the Anyer Beach recorded an environmental valuation of about Rp840 billion, which is a potential source for the service payment of Cidanau watershed.

Keywords: economic value, Contingent Valuation Method, Travel Cost Method, Cidanau

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Introduction

Cidanau watershed is located in the Banten Province of Indonesia and has an area of 226.2 km^2. The watershed provides water for industrial and city dwellers' in Cilegon City, which lies about 17 km from the lower Cidanau River (Figure 1). This area is about 120 km west of Jakarta, with the population of 130,000. In the watershed lies a protected natural reserve which is a remaining tropical marsh forest called Rawa Danau. Rawa Danau covers 25 km^2 and is known for its richness of bio-diversity (JICA 1992). Its land cover consist of forest, fruit farms, rice paddy fields, and vegetable farms, with an area of 2,764 ha, 3,633 ha, 6,420 ha, and 9,789 ha, respectively. In the steep area there is agro-forest mainly for the growing of coconut, marinjo, banana, cassava, etc. Most of the residents are farmers or employees in agriculture and few are land-owning farmers. Their social welfare levels are considered low and they earn low income from agricultures. Further, many farmers have only received primary educations. Since the economic crises in the mid-1990s the natural resources, including water quality, has been deteriorating (PT Krakatau Tirta Industri 1999). Such deterioration has been mainly caused by expansion of agriculture and encroachment of new settlers deep into the protected areas (Yoshino & Ishioka 2005).

It is, therefore, indispensable to establish systems and enforce laws and regulations by the local government in order to prevent from further degradations in the area. It is also important to carry out quantitative evaluation which also tries to raise the environmental awareness of residents, as well as visitors to the area. Results from this evaluation may assist in the sustainable development and proper management of this area (Setiawan *at al*. 2007). The environmental evaluation could contribute towards providing information on planning, to implementation and measurement of its success for the natural conservation. The purpose of this study is to determine the economic valuation of Cidanau watershed and hopes that the results provide suitable recommendation and clear direction on solving various environmental problems. Herewith, special attentions were given to find perceptions of visitors to tourism resorts in Anyer Beach using questionnaires.

Method

Environmental economic evaluation methods There will always be a conflict between environmental conservation and economic development. To resolve this issue, it is necessary to carry out a quantitative valuation of the ecosystem, which is in non-market goods, to try to estimate a monetary value (Kuriyama 2005). There are two categories of environmental valuations (Kuriyama 1997; Ono 2000). Firstly, use value (UV) including direct use value (DUV), indirect use value (IUV), and optional value (OV) was employed, and secondly, non-use value (NUV) comprising the existence value (EV), and bequest value (BV) was

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carried out. These relations are shown in the equations below.

Total economic value = UV + NUV [1]

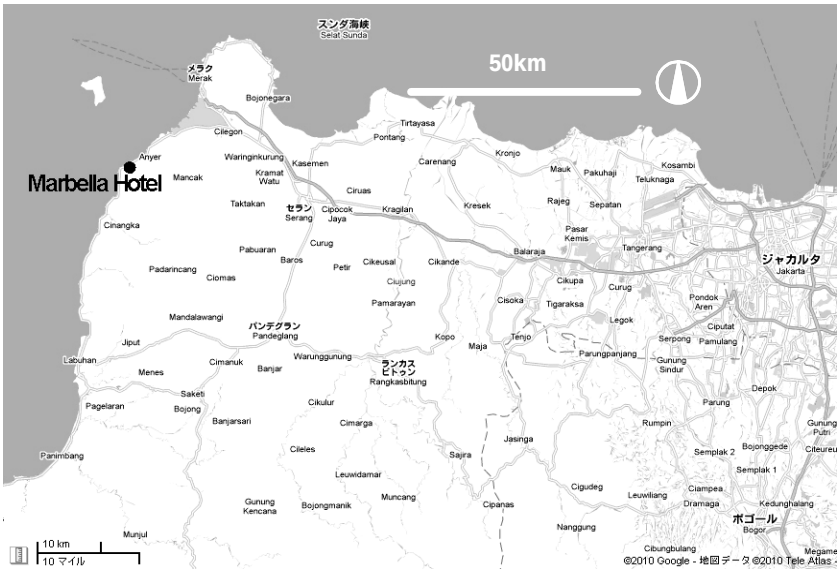
UV = DUV + IUV + OV [2]

NUV = EV + BV [3]

If Rawa Danau is assumed to have existence value and subrogation value then it is applicable to apply Contingent Valuation Method (CVM). This method has been applied to evaluate various tourism resources among world heritage sites (Sibazaki & Nagata 2001, Rolfe & Windle 2003), and it can be used to decide, for example, the entrance fee for the natural park (Herriges & Kling 1999, Walpore *et al*. 2001, Morimoto 2002, Suwa 2006). In this study, the method is based on Stated Preference (SP) method, which embodies a large bias in the calculated result (Yabuta 2006, Cameron 1992), so a revision has to be made by incorporated SP data with Revealed Preference (RP) data, and estimation has to be further conducted (Numata *et al*. 2000). In addition, a double boundary method is employed, which has limits bias from respondents' willingness to pay (WTP). This is done by asking respondents about the amount of WTP for the conservation of Cidanau watershed.

The second method in this study is Travel Cost Method (TCM), which focuses on use value of recreation activities, etc. In this instance, SP data is used to estimate the parameters which would have a high reliability, since it adopts data from actual activities. This method would clarify the relation between the travel cost and the frequency of visit. This is done by asking visitors a condition in how many times they would visit a location under the current condition or under which the environment had been deteriorated.

Outline of questionnaire survey Table 1 shows a summary of the questionnaires. As residents in Cidanau watershed area worked in agricultures, the evaluation and expected responses will be about their living area. Interviews were conducted with tourist in the Marbella Hotel, which is located about 5 km northeast of the mouth of Cidanau River. The questionnaires were distributed to random guests to the hotel and in some occasion interviews were also conducted by our students. This site at the Anyer Beach would be influenced by the environmental deterioration and accumulating garbage from Cidanau River.



Source: Google map

Figure 1 Cidanau watershed area and the surveyed area (Marbella Hotel).

Table 1 Outline of the questionnaire survey

Periode	1st survey	2nd survey
	2004. Dec. 3–7	2006. Mar. 18–19. Apr.1–2
No. of samples	77 (CVM)	80 (TCM)
Method	Interview by IPB Bogor Agricultural University students at the Surrounding area of Sol Elite Marbella Hotel, Anyer Beach	
Sample	Long term and visiting guests of the hotel, employees of the hotel	

Two surveys were conducted with permission from the hotel management. The first and last surveys lasted 4 days and included in 77 and 80 respondents, respectively. The following is the content of the questionnaires:

1 Personal attributes
  a Gender, age bracket, occupation.
  b Travel time and cost to the site.
2 Tourism activity and perception of Cidanau watershed.
  a Frequency of visits per year (for the first survey, to Cidanau watershed; for the second survey, to Anyer Beach as a destination).
  b Perception of the characteristics and function of the natural environment in Cidanau watershed.
  c Perception of the designation of Rawa Danau, a tropical marsh forest with an area of 25 km^2 as natural preserve.
3 Questions by CVM (first survey)
  a Opinions on designation of "nature preservation" by the state.
  b Opinions on the fund bearing the above preservation.
  c WTP amount for environmental conservation.
  Respondents' opinions were collected if they indicated the situation left as it is now, or if the environment of Cidanau watershed deteriorates. To obtain information on WTP amount, double-boundary method was used to avoid bias as well as to secure number of the responses.
4 Questions by TCM (second survey)
  Assuming frequency of visits in case of the degradation of the natural environment, questions were based on the premises that the environmental degradation in Anyer Beach is caused by the natural destruction of Cidanau River. To facilitate the comparison of pre and post the degradation of the environment, pictures of a deteriorated case produced by landscape simulation were shown to the respondents.

Results and Discussion

Personal attributes Table 2 shows number of respondents by gender and age bracket. In each survey men comprised of three fourths of the respondents and the majority group is 30s to 50s. As much as 80–90% of the respondents' occupation is employee of a company (including executive officers and independent self-paid owners). There were few workers in agriculture. The percentage of the respondents by the level of education is as follows: high school 30–40%, and university 50–60%. These respondents were found to visit the Marbella Hotel, which is ranked as relatively high class in the neighboring area of Jakarta, accompanying their family.

Tourism activity and perception on Cidanau watershed As the area where the surveys were conducted was a little bit away from the watershed, the respondents were asked about their perception of the water ship. As much as 19% answered that they knew it very well, 30% responded they had heard about it, and 47% responded that they did not know it in the first survey. Respondents were then asked how many times they had come to Cidanau watershed; the respondents who didn't know it answered either none, or no answer.

Next, using the data of the second survey, Figure 2 shows the distribution of the travel time was made to estimate the respondents' distribution of the residence. They were not the same respondents in the first survey. This data is based on the respondents' oral answers. The average travel time to Anyer Beach was 2.77 hours and the median was 2.75 hours. There were many answers within the range of 2–3 hours, and it is thought that most of them travel from the neighboring area of Jakarta.

The correlation between the travel cost and travel time was calculated as low as $r <= 0.303$. Table 3 shows the frequency of visit to Anyer Beach. The percentage of the respondents which visit once a year was 46.3%, whereas about 30% of the respondents were more than one time. Others responses include "often" and "not regularly".

WTP for nature conservation in the first survey (CVM) Regarding WTP for the conservation of nature, 69 respondents agreed (90%), disagree 1 (1%), and no answer 7 (9%). This result shows awareness of nature conservation was high. Furthermore, the distribution of the reasons for pro/con of nature conservation by free answer method is shown in Table 4.

The major reason for the agreement with conservation

Table 2 Number of sample on each survey

Age	1st survey			%	2nd survey			%
	Female	Male	Total		Female	Male	Total	
20–29	5	1	6	7,8	1	1	2	2,5
30–39	7	23	30	39,0	8	25	33	41,3
40–49	4	16	20	26,0	6	22	28	35,0
50–59	2	15	17	22,1	2	8	10	12,5
60–69	0	2	2	2,6	1	5	6	7,5
70–79	1	0	1	1,3	0	1	1	1,3
N/A	0	1	1	1,3	0	0	0	0,0
TOTAL	19	58	77	100	18	62	80	100
	24,7%	75,3%	100%		22,5%	77,5%	100%	

Table 3 Frequency of visits to Anyer Beach per year

Frequency of visit year^{-1}	No. of samples	Percentage (%)
0	0	0,0
1	37	46,3
2	7	8,8
3	5	6,3
4	3	3,8
5	7	8,8
6	1	1,3
10	1	1,3
50	1	1,3
others	18	22,5
	80	100

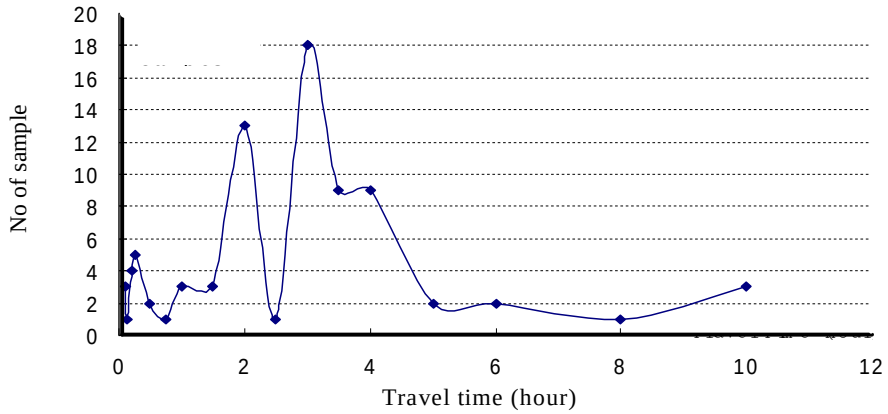


Figure 2 Travel time distribution from home to Anyer Beach (mean 2.77h, median 2.75h).

is related to the importance of nature conservation. There are two features in this result. The first is that some respondents thought about the importance of nature conservation from the view point of next generation. This means the value of nature is not only for the current generation, but carries to the next generation. The second is that many respondents show consideration to the local residents.

Table 5 shows the result for the payment intention for natural conservation of Cidanau watershed area. Many respondents have no intention to pay. The reasons for disagreement are shown in Table 6.

Some respondents were not aware that they were being asked a hypothetical question. Many respondents claimed that the government should take some measures regarding taxation system, and the parties concerned to take measures. On the other hand, only 13 respondents answered about WTP. As the number in the sample is not enough, the statistical analysis could not be conducted. But in the answers of 13 respondents by CVM, their WTP amounts range between Rp10,000 and Rp1,000,000. Respondents who knew Cidanau watershed area, or frequently visit there, had higher WTP than others.

There are a lot of comments about the government in charge of the conservation of natural surroundings and on how to make payment. Few respondents had WTP, although they showed high awareness of nature conservation and an interest in the preservation of Rawa Danau and Cidanau watershed area. Some respondents answered the questions on the ways to pay through the Islamic community and as the fee for the charity party. It is difficult to assume these types of questions on the surveys in Japan. Thus, it is considered that the procedure to pay is important in the WTP survey.

Analysis of TCM Survey for the second survey For the estimation of the environmental monetary value, we further conducted the Travel Cost Method survey. In this survey, respondents were asked about differently hypothetical conditions. Tourism demand for the specific area depends on the level of attractiveness and maintenance of the site. If it was found that there is the relationship between the frequency of visits and the level of environment, it is possible to estimate the monetary value of natural environment by generalized trip cost.

Respondents answered about their present frequency or visits to Anyer Beach during the year and the possible frequency in the case of environmental deterioration. If the water quality deterioration of the valley and the outflow of

Table 4 Reason for pro/con of nature conservation

Reason for pro/con	No. of sample	Percentage (%)
Nature conservation	18	23
I like nature, so I would like to make contribution	7	9
Natural resource are important	1	1
Nature conservation is important	10	13
Water resource	16	21
Biologic purification of the lake can be experted	1	1
Water crisis	2	3
Water preservation	13	17
Touris	5	6
To promotion to tourism	4	5
To conserve tourism resource	1	1
Next generation	4	5
For the next generation	3	4
Natural resource are important for future	1	1
Regional society	3	4
Necessary for residential living	1	1
It is important for regional society	1	1
Necessary for residance	1	1
Multi purposes	3	4
Water resource and tourism important	2	3
Healt promotion and tourism are important	1	1
Water resource an natural resource conservation are important	2	3
Other	27	35
Don't know about Cidanau	1	1
N/A	26	34
Total	77	100

Table 5 Intention of payment for natural conservation

Payment intention	No. of sample	Percentage (%)
Disagree to pay	49	64
Agree to pay	13	17
N/A	7	9
Total	69	90

Table 6 Reasons for disagreement to pay

The reason for disagreement to pay	No. of sample	Percentage (%)
The responsibility for the section in charge	14	29
The responsibility of the government	6	12
The government should pay	1	2
Need the regulation of goeverment	5	10
The company should pay	1	2
The stakeholders should pay	1	2
Payment form	8	16
It should pay by tax.	8	16
Others	8	16
I do not have money	5	10
I have no plan for the donation	1	2
The organization is unclear	2	4
N/A	19	39
Total	49	100

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Respondents answered about their present frequency or visits to Anyer Beach during the year and the possible frequency in the case of environmental deterioration. If the water quality deterioration of the valley and the outflow of the surface soil are generated in Cidanau River Valley, abnormal generation of the alga and garbage with adjoining Anyer beach is predicted to happen. A virtual image describing the environmental deterioration is presented to the examinees.

Figure 3 is scatter chart showing the frequency relationships between the present and assumed cases. In this figure the size of circle and Italics number show the number of respondents. In the present case, some people come to Anyer beach more than twice per year. But there are a lot of people who would decrease the frequency of visits to Anyer beach because of environmental deterioration in the assumed case.

Next, the TCM was applied to evaluate the environmental value by measuring the tourism behavior. In the TCM, frequency of visits to Anyer Beach depended on the travel time and attraction level of this beach. At this time, it is not considered that the influence of tourism trip changing or the competition among the sightseeing areas are due to environmental deterioration in Anyer Beach.

There are 2 categories of the demand function. The first one is based on an individual model. The second is a zonal model. In this paper, the individual model is applied because of the constraints of the small sample size. The explanatory variable is travel time (x) from home to Anyer beach and the objective variable is frequency of visits to Anyer beach per year. The demand functions *[4]* are estimated in each case; the present case and the assumed case.

$$Visit\ frequency(X) = \hat{a}1 \times X + \hat{a}0 \qquad [4]$$

In the present case as shown in Table 7, r square and t-value are not so high, but the sign condition is appropriate. Moreover, when the general travel cost was used as the explanatory variable, neither the sign condition nor t-value was appropriate.

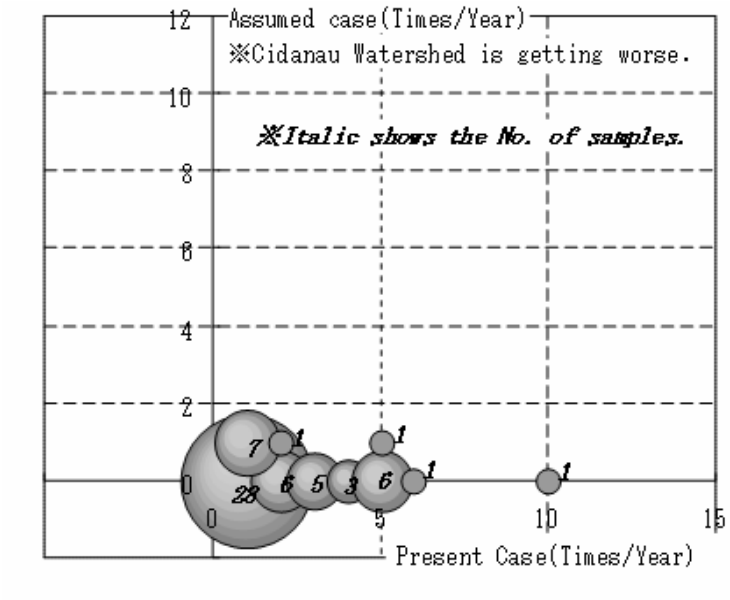

Figure 3 Present and assumed visit frequency for Anyer Beach per year.

Table 7 Demand function for Anyer Beach by TCM

	Present case	Assumed case
Parameter (travel time)	-2.155E-01	-3.535E-02
t-value	-1.350	-1.269
Parameter (constant)	3.353E+00	3.190E-01
t-value	5.563	2.992
multiple correlation coefficient	0.217	0.159
No of sample	39	39

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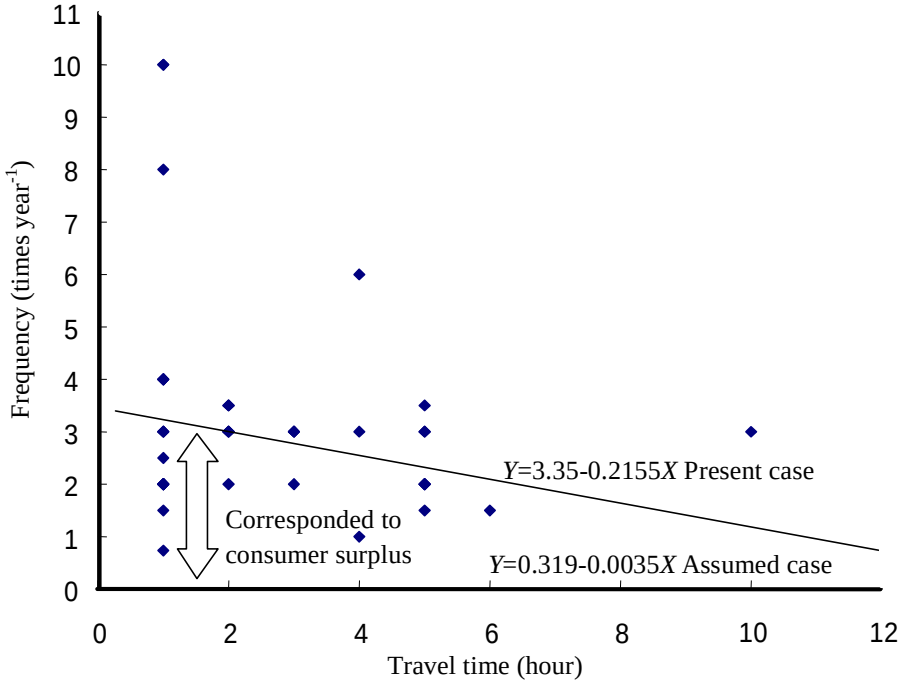

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The estimation was carried out of the demand function in the environmental deterioration case by using the same samples. The parameter of the travel time was about 1/10 compared with the present case. Figure 4 shows the demand function for Anyer Beach. The present demand function is greater than the assumed case because of the changing attractiveness in Anyer Beach.

Estimation of environmental value The environmental value of Anyer Beach was estimated by the demand function. A map with the population of each city shows the size of circle is used for the estimation of population distribution. The population distribution taken from these maps were reasonably accurate since access distance was taken accurately. The following is 3 steps to get the quantitative population data from the map.

1 Scanning the map and save as JPEG format file.
2 Latitude, longitude information is given to the JPEG data by Geographical Information System software (ERDAS IMAGINE), and the circle, the size of which indicates the population size, is extracted by the cluster classification technology as raster data format.
3 Raster data format is converted to the polygon data format to identify the circle size. In this paper, we tried to identify the center of circle with latitude, longitude information and the class of the population legend by “Definiens” and “Arc GIS” software for personal computer.

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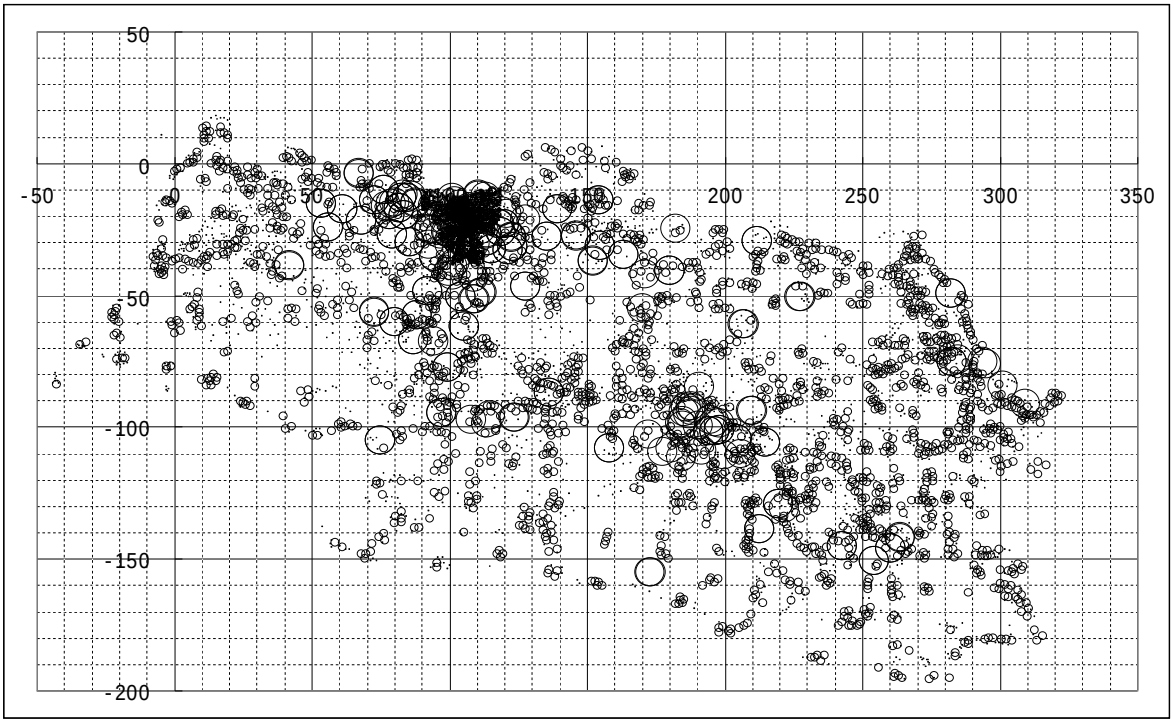

Figure 5 Population distribution (unit in figure: km).

Figure 5 shows the population distribution surrounding the Anyer Beach (0,0). The smallest circle size represents ten people and the largest is 100,000 people. The target area on the estimation is roughly set 360 km^2 from Anyer Beach. In the fringe of this area there are some alternative sites for sightseeing places. It is estimated 43.1 million people live in this area. This estimation of population is based on a rough approximation of 23.6 million people lived in the Jakarta metropolitan areas (2005), and 9.08 million people lived in Banteng state which is located in the west of Jakarta metropolitan area.

The trip time from the resident area to Anyer Beach for each Origin-Destination pair is also needed. It is assumed that the average speed by vehicle is set as 20 km h^{-1} for the north and south axis, and as 80 km h^{-1} for the east and west axis because the expressway can be used. Distance is calculated by rectilinear distance. The persons whose travel time from the resident area to Anyer Beach is set as *x* hours, and their environmental value is estimated as below.

$$Environmental\ value(x) = \{F_P(x) - F_A(x)\} \times time\ vValue \times (trip\ upper\ boundary - x) \quad [5]$$

In the equation *[5]*, environmental value(x) is personal environmental value in the case of person, whose trip time from home to Anyer Beach is x hour (Rp year^{-1}), $F_P(x)$ visit frequency for Anyer Beach per year in present condition. $F_A(x)$ is supposed visit frequency for Anyer Beach per year in assumed deterioration condition, time value is Rp29,420 per hour calculated by income approach, while trip upper boundary is no difference of visit frequency in the before and after case (8.75 hours).

The most expensive environmental value of a person is Rp44,150 per year. For the estimation of total value in this area, if the demand function and the environmental evaluation method were appropriable to whole area then total environmental value can be integrated by summing the total residents in the objective area, resulting in Rp840 billion.

Conclusions

Economical valuation of Cidanau watershed has been carried out using CVM and TCM based on questionnaire surveys. The purpose of this study is to determine the economic valuation of Cidanau watershed to halt further deterioration of the watershed which lies inside a protected area. All respondents responded positively on the importance of nature conservation, but were uncertain about willingness for financial contribution. Evaluation by TCM has shown a direct utility value that corresponded to the recreation value. The demand function was capable to relate the travel time and the frequency of visits in the present case and after any circumstances on further environmental degradation. Further deterioration can be expected to come as visitors were unwilling to pay for the nature preservation. However, a scenario of environmental service payment by tourism industries along Anyer Beach would be possible since potentially they earn about Rp840 billion per year. It

is necessary then to implement environmental service payment for the improvement of environmental conditions of Cidanau watershed, involving tourism industries.

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