

Anticipating Americans' Willingness to Pay Tropical Forest Protection : Measuring the Non-Use Existence Value

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An Abstract:

This paper is an effort to measure non-use existence value of tropical forest based on Americans' willingness to pay since the forest provides amenities for sequestering carbon. This is an application of contingent valuation model for environmental amenity. Written questionnaire was given to students of Michigan State University who take introduction to forestry courses. The group is considered to be future elite group who has concern in forestry and environment.

The finding shows the non-use existence value of tropical forest or Americans' willingness to pay for protecting tropical forest is between US\$10.8 to US\$ 18 million per day or between \$3.9 to \$6.5 billion annually. The willingness to pay is much higher than the findings of Kramer and Mercer (1997) where on average U.S. residents are willing to make one time payment of approximately \$21-31 per household or between \$ 2. 2 to \$ 3.3 billion nationally to protect an additional 5% of tropical forests. Billy Manoka (2000) has even lower value of one time payments amounting to \$7.7 per household or \$ 8 Billion nationally. The findings can also be used as the benchmark for pricing at the future international carbon trading.

I. Introduction

The US was criticized for not signing the Kyoto Protocol. Furthermore, during previous the Johannesburg Meeting, environmental movement activists protested the US during the main speech of American delegation. The US was criticized for not accepting the issue that industry and the economy of the industrialized countries especially the US is the main cause of green house effect. Developed countries should contribute some financial support as international carbon trading to countries where there is conservation of tropical forest since the forest provides amenities for sequestering carbon.

Although the policy of American government was against it, it does not mean that Americans do not care green house effect and about forest protection. It is reported

that "Since UNCED (United Nations Conference on Environment and Development 1992) several South and Central American countries have commenced JI (joint implementation) projects with a number of electricity companies in the United States of America aimed at managing forests set aside for conservation as carbon sinks" Asumadu (1999).

This paper is an effort to measure the non use existence value of tropical forest by anticipating the willingness to pay (WTP) of American residents for tropical forest in terms of accepting an increase in gasoline tax since the forest provides amenities of sequestering carbon. The mechanism for collecting the hypothetical payment would be an additional gasoline tax. The total payments hypothetically would go to local communities in developing countries that would reduce forest harvesting based on level of payment since the forest provides amenities of sequestering carbon.

Total world oil demand is 76.3 million barrels per day or 2.4 billion gallons per day and most of the demand is from developed countries, especially the US. If one cent (US\$) per gallon additional gasoline tax is incurred, there will be 24 million US\$ generated to support the local economies of the community in the tropical forest areas in the world. These funds would go to people in place of money derived from deforestation. An average U.S. gasoline use per capita is 250 gallon annually (California Energy Commission, 2001) or around \$ 250 - \$500 per year per capita budget for gasoline. An increase of 1 cent means \$2.5 additional gasoline tax per capita annually. Since 1998 the US averaged gasoline excise tax is 40.9 cents (American Petroleum Institute, 1998) per gallon with gasoline price ranges from US\$ 1.00 to US\$ 2.00 per gallon.

Furthermore, if implemented in the international carbon trading system, the impact for forest community can be substantial. The amount can be divided proportionately based on how large the conserved forest is. For example: community in a small area in developing countries having 2 million ha tropical forest (1/1000 global tropical forest) and an annual deforestation rate between 1-2%, can receive around US\$ 24,000 (1/1000 * 24 Million US\$) per day or US\$ 8,760,000 annually which equals to a substantial amount of regional income from timber and other forest resource.

II. Contingent Valuation Model (CVM) by Recording the Individual Willingness To Pay (WTP)

Although most of tropical forest is in developing countries, total economic value of tropical forest can be measured from the people in both developing and developed countries as either the users or the passive users of tropical forest. Total economic value is the summation of use and non-use value. Existence value is a non-

use economic value. Existence value of tropical forest in this study is measured from the people in the US as passive users of tropical forest.

CVM is a direct technique to measure a non—use existence value of environmental amenities. It is measuring an economic concept by an empirical approach (Hanemann (1999)) It is carried out by asking hypothetical questions to acquire the individual willingness to pay to maintain the environmental amenities. Initially CVM is used to value environmental good (Mitchell and Carson, 1989). There is now growing research in the use of CVM to value other public goods such as arts and culture (Thompson (2002)). There is an analogy to the thought of “If the public enjoys certain cultural resources for free, CVM can help determine how much these goods are actually worth to the public” (Coursey (2002)). If Americans enjoys tropical forest amenity to sequester carbon, CVM can reveal how much tropical forest service is worth to them.

Previous Studies

Kramer and Mercer (1997) using contingent valuation assessed the willingness to pay of the U.S. residents for tropical forest protection since tropical forest gives benefit that are global in nature such as absorbing carbon dioxide. The payment card and the referendum format were used in this study. Both formats give consistent findings. On average U.S. residents were willing to make one time payment of approximately \$21-31 per household to protect an additional 5% of tropical forests.

Billy Manoka (2000) extended further the study of Kramer and Mercer (1997) by carrying out a comparative study of assessing the willingness to pay of residents of the United States and of the Papua New Guinea for the preservation of an additional five percent of the world's tropical forest. This is framed as a developed versus developing countries issue. Manoka discussed on the existence value and his findings were lower than the estimates of Kramer and Mercer (1997), it is only \$7.70 per household to preserve tropical forest. His research is based on the assumption that “... the rich nations of the world (including the US) should bear the responsibility of preserving tropical rain forest.” (Manoka, 2000:1) Manoka also looked at cross culture comparison and made a comparative study between willingness to pay Americans (represented by residents of Portland, Oregon) and people from developing countries (represented by residents of Port Moresby, Papua New Guinea).

Objectives:

This study is different from both Kramer and Mercer (1997) and Billy Manoka (2000) in several aspects: 1) it is intended to capture the service of tropical forest to absorbed carbon dioxide as an externality of using gasoline. 2) It is not considering altruism and availability of fund in the US. 3) Instead of a one-time payment, it is an

addition to gasoline tax. 4) The survey can be done everywhere in developed countries not only in the US.

This study is motivated by several concerns: 1) It is intended to find the role of tropical forests play in global environment problem such as climate change. 2) It is to internalize the externalities of using gasoline. 3) It is to test the carbon trading vision of "Tokyo Protocol" that developed countries especially the US extravagant use of energy should be charged for the service of tropical forests. 4) It is an attempt to find out the solution to an unresolved issue of valuation of carbon sequestration global benefit of tropical forests.

III. Conceptual Framework

People in developed countries such the US may hypothetically be willing to pay for tropical forest protection for a variety of reasons. However, in this paper it is assumed that the most important thing is the forests' role in absorbing carbon dioxide. This means that tropical forest has a future value for absorbing carbon dioxide. This is to value the willingness to pay of American people to reduce tropical forest deforestation. Reduced deforestation may translate into increased carbon sequestration and decreased global warming.

Assuming that utility of consuming goods and services can be combined with the utility of consuming tropical forest amenities, the consumption of the amenities is inserted in individual preference functions and the willingness to pay for preserving stock of existing forest can be inserted into individual budget constraints. The existence value of tropical forest enters as the non-purchased argument in individual budget constraint. If American People enjoy tropical forest to absorb carbon dioxide at no direct cost, the revealed willingness to pay to preserve the forest is the price of the non-use value or the existence value of forest. When the stock of tropical forest decreased the existence value is reduced. The different between the current stock and when the stock of forest if it has been driven to zero reflects the amount of compensation required to make the individual indifferent between losing tropical forest or conserving at the current condition.

The question for the current study is "How much American people 's willingness to pay to insure that the stock of tropical forest is protected so that services of tropical forest to absorb carbon dioxide will continue?" This study estimates American willingness to pay to insure the existing tropical forest is conserved. It is assumed that American people should be willing to pay a certain amount, if their utility with lower budget income is balanced with conserved stock of tropical forest. The utility is at least as large as their current income with tropical forest stocks felt to zero. The empirical problem is how to measure the willingness to pay in term of

additional gasoline tax.

From the measurement, the means or the median of the willingness to pay of the additional gasoline tax is the non-use existence value for tropical forest. To get the total existence value, it is multiplied with the daily or annual consumption of Gasoline in the US. Furthermore since the forest provides amenities of sequestering carbon, the amount can also become the benchmark for pricing the international carbon trading..

IV. The Survey

Two methods were used to elicit respondent willingness to pay to reduce tropical forest deforestation: a dichotomous choice (a referendum format) and a second bound increasing path of dichotomous choice (Bateman et.al.(2001)). The mechanism for collecting the hypothetical payment is an addition to gasoline tax assuming the use of gasoline creates an amount of carbon and it increases global warming. The survey (see the questionnaires in the Appendix) is given to students of Michigan States University who are taking courses in introduction to forestry. The choice of samples is based on the notion that students who take introduction to forestry will shape American vision of conserving tropical forest in the future. Anticipating American willingness to pay for conserving tropical forests in the future can be reflected in the willingness to pay for conserving tropical forests among current college students who take courses in introduction to forestry or other related subjects. They will be an elite group in the US that concern global environment.

Besides recording the willingness to pay (both referendum and upper bounded dichotomous choice) for an additional gasoline tax, several demographic questions were added in the survey. Some other background questions are environmental attitude, adoration to nature, vision of nature and physical environment of the neighborhood. To record some objections and concerns, comment is requested.

In the first round of the survey, 92 students filled in the questionnaire. The questionnaire includes several elements, i.e.: market participation, value alternative, other thoughts, demographic background, environmental attitude, adoration to nature, vision of nature, and physical environment of neighborhood. Detail indicator variables and

Table I
Indicator Variables and Operational Definitions of the
questionnaires

Model Element	Variable	Definitions
Market Participation	WTP (Yes)	0 if respondents bid positive amount to sequester carbon tropical forests, 0 otherwise
Increasing Market Participation	More WTP (Yes)	1 if respondents would be willing to pay more than prescribed, 0 otherwise
Value Alternative	WTP Bid	Amount of final bid
Other Thoughts	Reason not to bid positive	Open ended answer
Demographic	Age	Years of ActualAge
Demographic	Residence	1 if Southern Lower Michigan, up to 3 if Upper Peninsula
Demographic	Gender	1 if male and 0 if female
Demographic	College Major	1 if natural resources, 0 otherwise
Demographic	Marriage	0 if other or refused to answer, 1 if single, 2 if married
Demographic	Income	0 if do not know or prefer not to say, 1 if less than US\$ 30,000 annually up to 4 if over US\$ 100,000
Environmental Attitude	Environmental Activity	0 if not an environmental activist, 1 if an environmental activist, and 2 if a strong environmental activist
Adoration of Nature	Camping	1 if ever been on an overnight camping trip in a forest, 0 otherwise
Vision of Nature	Knowledge of Tropical Forest	1 if never heard of it, up to 3 if ever heard, read, or watched programs about forest.
Physical Environment	Community Neighborhood	

The operational definitions are shown in Table I. For further validating the research findings questionnaire should also be given to students in other colleges in the US. To crosscheck the real willingness to pay of all Americans, modified questionnaire should also be given to random samples of American residents in the future. Since the gasoline consumers are around the world, further research around the world is recommended.

V. The Findings

For the referendum format dichotomous choice (see Table II), 93.48 % agreed to pay an additional on 1 cent or more to gasoline tax but 6.52% objected to pay any additional tax on gasoline. In detail, 39.13 % agreed to pay one cent of additional tax and 54.35% agreed to pay more than one cent of additional tax on gasoline. Those who agreed to pay more than one cent of additional tax on gasoline, answered an open-ended question as of how much they are willing to pay. Since the payment question in the increasing path of a second bound dichotomous choice is open-ended, the WTP figures is averaged out to get an estimation of the mean WTP. The mean of the WTP is 3.76 cents with standard deviation of 5.84 cents (See Table. III). If two extreme cases, it is called the outliers in statistics, are omitted then the means is 2.98 cents. The median of the WTP is 2.25 cents.

Analyzing the frequency (see Table.IV), two big groups chose are identified. One group chose 1 cent for additional excise gasoline tax and another group chose 5 cents (23%). The fact that more than 50 % of residents chose more than one cent, the referendum of one cent seems too low. Further question which in open-ended gives higher number.

With total world oil demand of 76.3 million barrels per day or 2.4 billion gallons per day, 3.76 cents cent (US\$) per gallon additional gasoline tax means approximately from US\$ 54 to US\$90 million additional tax revenue daily. This amount reflects the how high existence value of protecting tropical forest is. Americans consumed approximately one fifth of the world oil consumption, and the willingness to pay or the non use existence value of tropical forest from sequestering carbon for Americans is then between US\$10.8 to US\$ 18 million per day.

The average age of the respondents is 21 year old. It is expected, since most of them are freshmen or sophomore in the college. Most of them reside in Southern Lower Michigan. Most of the respondents are male. Most of them are students in natural resources major

Table II.
**Distribution of American Willingness To Pay in term of
 Additional Gasoline Tax to Preserve Tropical Forest**

Willingness To Pay	Frequency	Percentage	Cumulative
Yes (> 1 cent)	50	54.35	54.35
Yes (1 cent)	36	39.13	93.48
No (0 or < 0)	6	6.52	100
Total	92	100	

Table III.
Descriptive Statistics of the Data

Variable	Obs.	Mean	Std. Dev.	Min	Max
wtp1	92	.923913	.26659	0	1
wtp2	92	3.76087	5.835887	0	50
commen	92	.423913	.4968847	0	1
age	92	21.30435	2.803997	18	40
reside	92	1.467391	.9311589	1	4
gender	92	.7282609	.4472937	0	1
group	92	1.684783	.8635392	1	4
status	92	1.978261	.2956929	1	3
income	92	2.380435	1.50342	0	4
activi	92	1.608696	.6454664	1	3
camping	92	.9565217	.2050486	0	1
knowle	92	3.065217	.6077222	1	4

TABLE IV
**Frequency and Percentage of Responses to Willingness
to Pay Question**

Willingness to Pay	Frequency	Percentage	Cumulative
0	6	6.52	6.52
1	36	39.13	45.65
2	4	4.35	50
2.5	2	2.17	52.17
3	6	6.52	58.7
3.5	3	3.26	61.96
4	4	4.35	66.3
5	21	22.83	89.13
7.5	1	1.09	90.22
10	7	7.60	97.82
20	1	1.09	98.91
50	1	1.09	100
Total	92	100	

and members of any nature or conservation group. Most of the respondents are still single. The family income mostly ranges from US\$ 30,000 to 100,000 annually. They are mostly environmental activists. More than 90 % have been in a camping trip and they are an elite group in term of nature and environment concern.

VI. Conclusion

The role of tropical forests play in global environment problem such as climate change especially in sequestering carbon can be anticipated to be considered high by

Americans given that their willingness to pay for protecting tropical forest is between US\$10.8 to US\$ 18 million per day or between \$3.9 to \$6.5 Billion annually. This amount is also the non-use existence value of tropical forest from the American point of view. The fact that 93.4 5% voted for an additional 1 cent of gasoline tax reflects Americans strong view for forest conservation to sequester carbon.

The willingness to pay in this research is much higher than the findings of Kramer and Mercer (1997) where on average U.S. residents are willing to make one time payment of approximately \$21-31 per household or between \$ 2, 2 to \$ 3.3 nationally to protect an additional 5% of tropical forests. Billy Manoka (2000) has even lower value of one time payments amounting to \$7.7 per household or \$ 8 Billion nationally.

The valuation is based on hypothetically internalize the externalities of using gasoline. The vision of "Tokyo Protocol" that developed countries especially the US extravagant use of energy should be charged for the service of forests or in term of carbon trading seems acceptable among the elite environmental group of Americans in the future. These findings can then be considered as a pre-feasibility study for international carbon trading.

In the attempt to find out the solution to an unresolved issue of valuation of carbon sequestration global benefit of tropical forests and if this valuation can be true in the future, as well as this additional amount of gasoline tax is also enacted around the world using American standards, the amount that can be derived from carbon trading is substantial to support forest communities so that they do not deforested their land.

Our conclusions are limited in several ways. First, it ignored the sample selection bias. The samples do not represent the population of the US, It only represent future American elite group for forest protection. Since this paper is meant to anticipate future Americans, more college students and other environmental activists across The US should be included in the sample. Second, the referendum questions followed up only by the second bound increasing path to higher than one cent, the decreasing path was excluded in the survey. It was assumed that an addition of one cent gasoline tax was the lowest possible preference. It ignored the group who might protest the idea and vote negatively to this referendum.

Despite these limitations, the empirical evidence on the hypothetically value of tropical forest amenities can become the benchmark for carbon trading. It also gives insights to policymakers regarding the non-use value of tropical forests as consideration for sustainable management of forest resources. For natural resource accounting this non-use value is added to the use value of natural resource to attain the total value.

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* This survey will take less than 10 minutes to complete *

What People in Developed Countries think about Tropical Forest Protection: A Survey

This questionnaire will ask you how much you are willing to pay for tropical forest deforestation. Reduced deforestation translates into increased carbon sequestration and decreased global warming.

Worldwide, over 50 million acres of tropical deforestation occurs annually (World Watch Institution, 2001) The State of Michigan is 36 million acres in size.

Deforestation often occurs because forest utilization supports the economy of local communities.

The mechanism for collecting your hypothetical payment would be an additional gasoline tax. The total payments would go to local communities which would reduce harvesting based on levels of payment.

Please answer all questions. To preserve your anonymity, please do not write your name on the questionnaire. Please pass in your completed questionnaire when requested.

We appreciate your time and effort. Thank you!

Tropical forest carbon sink protection: a hypothetical opportunity

Few people realize that tropical forest covers about 15 % total earth land area. Tropical forest area is 50% of total forest area in the earth. Ninety-five (95) % global deforestation occurs in the tropical forest. Tropical forest loss amounting to around 750 acres per minute. This loss means the decrease of the capacity of nature to capture carbon. This means that there will be an increase in global warming. We ask you to imagine that you have an opportunity to help developing countries that have to protect the tropical forest against deforestation, so that the forest will remain as a carbon sink.

Total world oil demand is 76.3 million barrels per day or 2.4 billion gallons per day and most of the demand is from developed countries. If one cent (US\$) per gallon additional gasoline tax is incurred, there will be 24 million US\$ generated to support the local economies of in the tropical forest areas in the world. These funds would go

to people in place of money derived from deforestation. Note: An average U.S. gasoline use per capita is 250 gallon annually (California Energy Commission, 2001) or around \$ 250/year for gasoline or \$2.5 additional gasoline tax per capita annually.

For example: people in Berau East Kalimantan (Indonesia) having 2 million ha tropical forest (1/1000 global tropical forest) and deforestation rate between 1-2%, can receive around US\$ 500 per day or US\$ 182 Million annually which equals about 100% of their regional income from forest resource.

After receiving this support, they cannot utilize their forest timber. There will not be any deforestation and the tropical forest can become sustainable global carbon sink.

Although this example is hypothetical, it is not unrealistic. If you have any question, please ask them now.

* Please continue *

Please answer the following questions

1. Would you be willing to pay people to sequester carbon tropical forests by adding one cent gasoline tax per gallon, so that they do not do deforest?
(please check)
 Definitely yes
 Possibly yes
 Not certain
 Possibly no
 Definitely no
2. If you answered definitely yes would you be willing to pay more?
 Yes
 No
3. If yes, ho much per gallon additional tax? _____cents.
4. If you did not answer definitely yes, please briefly explain your reason(s)

Additional questions

Please answer *all* of the remaining questions as accurately and as completely as you can. These questions are necessary for analyzing your responses..

(please fill in the blank)

5. What is your age? _____ Years.
6. Residence: Southern Lower Michigan
 Northern Lower Michigan
 Upper Peninsula Michigan

7. Gender: Male Female (check all that applies)
8. You are: A student/academician in a natural resources major.
 A member of any nature or conservation-oriented group
9. You are: Single
 married/once married
 Other or refused to answer
10. Please estimate your parents annual income
 Less than 30,000
 Between 30,000 and less than 50,000
 Between 50,000 and less than 100,000
 Over 100,000
 Do not know or prefer not to say
12. Do you consider yourself:
 A strong environmental activist
 An environmental activist
 Not an environmental activist
13. Have you ever been on an overnight camping trip in a forest? (check one)
 Yes
 No
14. How would you characterize your knowledge of tropical deforestation?
(check one)
 I have never heard of it.
 I have heard of it, but I have *never* read or watched anything about it.
 I have heard of it, and I have read articles or watched programs about it.
15. Have you ever been to a tropical forest? (check one)
 Yes
 No
16. In what type of community did you spend *most* of your life? (check one)
 Rural
 Suburban
 Urban

*** Thank you for participating in this survey ***