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Estimating the Recreational Value of Taal Volcano Protected Landscape, Philippines Using Benefit Transfer

ABSTRACT

When protected landscapes serve as popular recreational resources and destinations, then they may hold significant use values for those people that visit them. Recognition of these recreational benefits of protected landscapes provides a sound economic rationale for their management. This study provides estimates of the recreational value via benefit transfer of Taal Volcano Protected Landscape in the Philippines. One study site in the Philippines was selected and used in a point estimate transfer application. Likewise, a meta-regression transfer function model was estimated based on selected 'study sites' from the US. Results show that point estimate transfer approach provided a conservative estimate of the recreational value of the site than the international meta-regression benefit function transfer approach. The estimated average welfare estimate of recreational access using point estimate transfer was PhP 26 per person per trip in 2011 and PhP 1,696 per person per trip in 2011 using the meta-regression benefit transfer function.

Key words: *access value, benefit transfer, consumer surplus, protected landscape, recreation*

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INTRODUCTION

The Protected Area Management Board (PAMB[1]), the policy and decision-making body of the Taal Volcano Protected Landscape (TVPL), embarked on a comprehensive 10-year (2010-2020) Management Plan. Proponents of the plan boast of its community participation, co-management and local stakeholders' involvement and funding. The PAMB *en banc* approved the plan on September 26, 2009, with a proposed annual administrative budget of PhP 11.7 M and a start-up cost of PhP 97.1 M. The Protected Area Superintendent (PASu), within the Department of Environment and Natural Resources (DENR), serves as the chief operating officer of the TVPL. One set back confronting the PASu Office is its limited staff of seven persons. Funds needed to implement the plan would be generated through available funds from the institutions in the PAMB. These institutions are composed mainly of third, fourth, and fifth class municipalities[2], which in most cases have scarce financial resources.

The critical knowledge gaps identified under management requirements of the Management Plan is measuring visitor's willingness-to-pay (WTP), which may help inform the implementation and collection of user or other fees at the Taal Volcano Island. Beyond visitors' WTP to visit the site, economic contributions to the local economy arising from their trip expenditures would help illustrate the importance of TVPL to affected communities. This paper provides evidence on the total value of recreation at TVPL for visitors to the site. Due to the lack of funds and limited time for the PASu and PAMB to conduct primary researches (first-best strategy), a benefit transfer application is suggested to provide a first approximation of recreational use value. Benefit transfer is the use of recreational benefit estimates and other information from a 'study site' with data to a 'policy site' with little or no data (*Rosenberger and Loomis 2000*). Benefit transfer is considered a 'second-best strategy,' in which already existing estimates from other sites are used to inform decisions at the site of interest. It is a "widely practiced technique that can be a very useful decision-making tool" (*Abt Associates Inc. 2005*) since it is relatively inexpensive to employ and analysts often choose this technique over more costly alternatives such as full-blown original valuation study. Furthermore, benefit transfer is justified when the resource impacts on a given use of natural resources (in this case recreational access) are expected to be low or not significant.

Benefit transfer is increasingly applied to a wide variety of environmental goods and services, such as valuation of ecosystem services (*Richardson et al. 2015; Plummer 2009);*

[1] PAMB membership now stands at 157, with 35 Executive Committee members.

[2] Municipalities are divided into income classes according to their average annual income during the last three calendar years: First class= annual income of PhP 50 million or more; Second class= annual income between PhP 40 M and PhP 49.99 M; Third class= annual income between PhP 30 M and PhP 39.99 M; Fourth class= annual income between PhP 20 M and 29.99 M; Fifth class= annual income between PhP 10 M and PhP 19.99 M. While most of the municipalities that spans TVPL are considered 3rd, 4th or 5th class, the Province of Batangas ranked 6th among 77 provinces in the Philippines in terms of Human Development Index (HDI) for 2000. In 2003, Batangas ranked 16th place in HDI. HDI is the summary measure of human development, which has three basic dimensions: longevity, knowledge, and standard of living.

benefits of agricultural wildlife management (*Brouwer and Spaninks 1999*); water resources (*Muthke and Holm-Mueller 2004*); mortality risk valuation (*Krupnick 2007*); value of statistical life (*Lindhjem and Navrud 2015*); health impacts related to air and water quality (*Ready et al. 2004*); air pollution and acute respiratory illness (*Alberini and Krupnick 1998*); avoided health effects from water pollution (*Barton and Mourato 2003*); valuation of water quality improvements (*Wang et al. 2015*); and outdoor recreation (*Duffield et al. 2013; Shrestha and Loomis 2001*). Most of these authors conclude that value transfer, i.e. single point estimate, worked better than function transfer, although function transfers and meta-analysis transfer functions have been shown to be more broadly accurate than value transfers (*Kaul et al., 2013*; *Rosenberger and Stanley 2006*; *Loomis 1992*;). *Shrestha and Loomis* (*2001*) tested meta-analysis as a method for international benefit transfer applications to recreation valuation and found that the absolute average percentage error of meta-predictions may be within an acceptable range.

This study explores both value and function transfers as means to estimate visitors' recreational benefits at the TVPL, Philippines via benefit transfer, which in part helps inform the importance of the site to the visitors.A single point estimate is derived from a 'study site' in the Philippines, while a meta-regression benefit function[3] based on existing studies in the US is used to derive estimates of recreational values by adapting it to characteristics of the TVPL. Implicit price deflators and purchasing power parity are incorporated to account for income and cost of living differences between the study and policy sites. Exogenous factors, such as differences in individual preferences, and cultural and institutional conditions between countries are beyond the scope of this paper, but they have the potential to invalidate an international benefit transfer.

The Taal Volcano Protected Landscape

Taal Volcano Protected Landscape consists of around 62,292.13 ha of the Taal Lake Basin, with 24,236 ha inside it comprising the lake area (i.e. excluding the islands). Taal Volcano Island has an area of 4,537 ha and a crater lake of about 2 km in diameter at its center (*Yokoyama, Alcaraz, and Peña 1975*). TVPL is designated as number 27 among the 128 Key Priority Biodiversity Areas for protection (O*ng, Afuang and Rosell-Ambal 2002*). There are 65 proclaimed protected areas in the Philippines, 36 of which (including TVPL) are designated as protected landscapes. Howard Hillman, an author specializing in travel, cooking, and wine, consider TVPL as unique in this world because of the positions of its five components: Taal Volcano (caldera), Taal Lake, Volcano Island, Crater Lake, and Vulcan Point.

The TVPL basin spans 13 municipalities and three cities: the Municipalities of Talisay, Laurel, Agoncillo, San Nicholas, Taal, Lemery, San Jose, Santa Teresita, Alitagtag, Cuenca, Mataas na Kahoy, Balete, Malvar, and the Cities of Lipa and Tanauan in the Province of Batangas; and Tagaytay City in the Province of Cavite. These lakeshore municipalities and cities have a scenic view of the volcano ridges. The ridge of the basin is the viewing area of the Taal Volcano Island and Lake, with Tagaytay City considered as the 'town of the ridge.' The Municipality of Talisay is the major jump-off point where boats are available to reach the Taal Volcano Island. TVPL watershed has 38 tributary rivers draining into the lake. The only outlet to Balayan Bay is the Pansipit River. From the Southern Tagalog Arterial Road Tollway, and Batangas-Cavite provincial highways, the lakeshore municipalities and cities are accessible within 15 minutes or more by vehicle. TVPL is about 60 km SSE of the capital Manila. In 1967, the Taal Volcano Island became a National Park through Proclamation No. 235. In 1993, Taal Volcano and its surrounding coastal municipalities were declared tourism zones by virtue of Republic Act 7623. In 1996, Proclamation 235 was amended by Presidential Proclamation 923, declaring the Taal Volcano Island, Taal Lake and the watershed areas as a protected landscape under National Integrated Protected Area System (NIPAS[4]) Act of 1992.

Taal Volcano and Lake are of great interest to tourists, scientists, business investors, and others because of their beauty and the economic opportunities they provide. Fertile land is a natural magnet for tillers, and benefits from tourism and fish cages have attracted more occupants to the volcano. As of 2009, there are more than 5,000 people residing on Volcano Island, despite classification of the area as very high risk due to different volcanic hazards, e.g. lava flows, acidic flashes from crater lake, lakeshore flooding, etc. In 2007, an estimated 343,749 people lived within the boundaries of the TVPL. The TVPL Management Plan envisions population will remain at the 2007 level. The different recreational activities in the TVPL include hiking, day-camping, picnicking, bird watching, horseback riding, fishing, boating, wind surfing, sailing, rowing, and kayaking. Among the recreation activities, sightseeing experiences occur mostly

[3] Meta-analysis was used over the other function transfer model, i.e. demand and benefit function because this method can capture multi-dimensional components (*Nijkamp et al. 2008*), such as differences in the formulation of the research, the size and type of data analyzed, the statistical methods applied, the publication bias, and the temporal and geographical characteristics of the primary studies. Furthermore, meta-analysis has several conceptual advantages over demand function transfers as discussed by *Rosenberger and Loomis* (*2001*).

[4] NIPAS law provides for the establishment and management of national integrated protected areas system, defining its scope and coverage. These include natural park, natural monument, wildlife sanctuary, protected landscapes and seascapes, resource reserve, natural biotic areas, and other categories established by law, conventions or international agreements which the Philippine Government is a signatory. The NIPAS designation is equivalent to the International Union for Conservation of Nature and Natural Resources (IUCN) Category V.

at the town of the ridge-Tagaytay City, Cavite Province. A typical visit to the Volcano Island would require a boat rental for PhP 1,800, which can accommodate five persons. A municipal landing fee of PhP 20 is collected by the municipality at the boat ramp in Talisay. There are three trails in the Volcano Island for hikers/trekkers: the regular tourist/horse trail, the Kalawit trail and the Kristie Kenney trail. About 80% of the visitors rent horses to do the Volcano trek for PhP 700. The regular tourist/horse trail is wide, unpaved, about 1.7 km and closest to the boat ramp from the Municipality of Talisay. The ride to the rim using the regular/ tourist and Kalawit trails takes about 30 minutes each way. The ride into the crater and back, takes over an hour. The Kristie Kenney trail is primarily a walking trail with much more vegetation than the dusty and exposed regular tourist/ horse trail. At present, there are no permanent bathrooms in the area for visitors' use.

The beautiful scenic view that Taal Volcano and Lake provides, attracts more visitors to Tagaytay City, Cavite than to the coastal communities and Volcano Islands. From 692,487 visitor arrivals in Tagaytay City in 2006, it grew to 1,514,683 visitor arrivals in 2011. From 11,828 visitor arrivals in in Talisay, Batangas in 2006, it grew to 59,390 visitor arrivals in 2011 (**Table 1**). There are complementary attractions within the TVPL and adjacent areas. In Tagaytay City, tourists can also visit Peoples Park, Picnic Grove, 11th Airborne Marker, Japanese Garden, Residence Inn Mini Zoo, Tagaytay Highlands/Midlands, and Tagaytay City Museum. Other attractions in the province of Batangas include Mt. Maculot for mountaineers, Fantasy World in Lemery, Mt. Malarayat Golf Course in Lipa City, religious/historical/ cultural sites, and various resorts. *Vista* (*2003*) and *Vista et al.* (*2006*) provides a detailed discussion of other important information on TVPL.

Recreational Values Used in the Analyses

Recreational values used in the analyses are obtained from primary valuation studies that reported economic measure of direct-use access value for different recreation activities. Access values are measures of the current level of benefits enjoyed by people using a resource in a recreation activity. These valuation studies used revealed preference (RP) methods that rely on observed behavior (e.g., travel cost models) and/or stated preference (SP) methods that rely on hypothetical behavior (e.g., contingent valuation models) (see *Champ et al. 2003* for a discussion on RP and SP methods of nonmarket valuation).

Suppose the primary valuation study employed a travel cost model (TCM). This is referred here as the 'original model,' wherein the primary analysis was based on a regression model:

Table 1.Number of visitors in Tagaytay City, Cavite and Talisay, Batangas, Philippines, 2006-2011.

Year	Tagaytay City, Cavite	Talisay, Batangas
2006	692,487	11,828
2007	1,172,181	98,589
2008	1,203,845	59,128
2009	1,387,381	25,677
2010	1,517,080	47,246
2011	1,514,683	59,390

Source: Tagaytay Tourism Office, Talisay Tourism Office.

$$TRIPS = X\beta + \varepsilon \quad \text{Equation 1}$$

where TRIPS is the *nx1* dependent variable - a vector of recreation demand, X is the *nxm* matrix of explanatory variables, β is the *mx1* vector of coefficients that was estimated and assumed fixed, and ε is the random error. In a single-site TCM, the relevant explanatory variables are trip costs (i.e. the access price), income, and a vector of some demographic variables. The estimated benefits (or monetary measure) of a recreational activity are measured by the area underneath the estimated recreation demand curve and above the access price faced by each individual. If multiple primary studies are conducted, then a collection of recreation use value estimates are available. Gathering all of these primary study estimates into a single database then creates the foundation for use of meta-analysis in a benefit function transfer. In meta-analysis, the estimated benefits, or consumer surplus per person per day, reported in the primary studies now constitute the dependent variable (i.e. the covariate j in the original model) of the meta-regression model employed:

$$b_j = \beta + \sum_{k=1}^{K} \alpha_k Z_{jk} + e_j \quad (j = 1,2,\ldots,L) \quad \text{Equation 2}$$

where b_j is the reported estimate of welfare of the j^{th} study's sample in the recreational use value database comprised of L studies, β is the 'true' value of the parameter of interest, Z_{jk}'s is the meta-independent variables which measure relevant characteristics of an empirical study and explains its systematic variation; α_k's is the meta-regression coefficients which reflect the biasing effect of particular study characteristics, and e_j is the meta-regression disturbance term.

Benefit Transfer Techniques and Convergent Validity

Benefit transfers[5] starts with a conceptual definition of value to be estimated associated with economic consequences, say a change in environmental quality (qj) and willingness to pay defined as:

$$V_i\left(P, x, q_j, I_i - WTP_{i,j}; d_i\right) = V_i\left(P, x, q, I; d\right) \quad \text{Equation 3}$$

[5]'Benefit' transfer and 'value' transfer means the same. Other authors use the word 'value' and not 'benefit' to make a distinction between 'costs' and 'benefits.'

where V is the indirect utility function for individual *i, P* is a vector of market prices, *x* is a vector of other quality attributes, q_j is the dimension of environmental quality that is changing (q_j"<q_j'), *I* is income, $WTP_{i,j}$ is willingness to pay for the increase in q_j, d_i is demographic characteristics of individual *i*. Let us assume that q_j is a change in park quality due to the improvement in its facilities, which can positively affect the desirability of this park for a variety of recreational opportunities and non-market valuation methods discussed above can be used to estimate the recreational benefits of visitors associated with the improved facilities.

Benefit transfer follows the framework given in Equation 3, where studies are selected to and benefits estimated via value or function transfers. Estimated WTP in any benefit transfer that may depend on the demographic characteristics of consumers (d_i), the levels of other site characteristics (X_j), a vector of coefficients or parameter estimates ($\hat{\beta}_j$), and quality (q_j):

$$WTP_{i,j} = f\left(d_{i,j}, q_j, X_j, \hat{\beta}_j\right) \quad \text{Equation 4}$$

where the observed relationships have been estimated from study site(s) j based on Equation 3. Equation 4 indicates similarity between the study sites and policy sites, such as characteristics of affected individuals (d_i), site and other location characteristics (q_j and X_j), and preferences of affected individuals (B_j). Benefit transfer uses the relationship in Equation 4 to predict the benefits from a change in *q* that is calibrated to policy site *k*'s condition.

In essence, benefit transfer methods use estimated measures from study site *i*, VS_i, to estimate the needed measure for policy site *j*, VP_j. When VS_i is transferred to the policy site *j*, the study site value becomes the transfer value, i.e. (*Rosenberger and Loomis 2003*). In this benefit transfer application, TVPL is the policy site, (the area or resource for which benefit estimates are needed but do not exist).

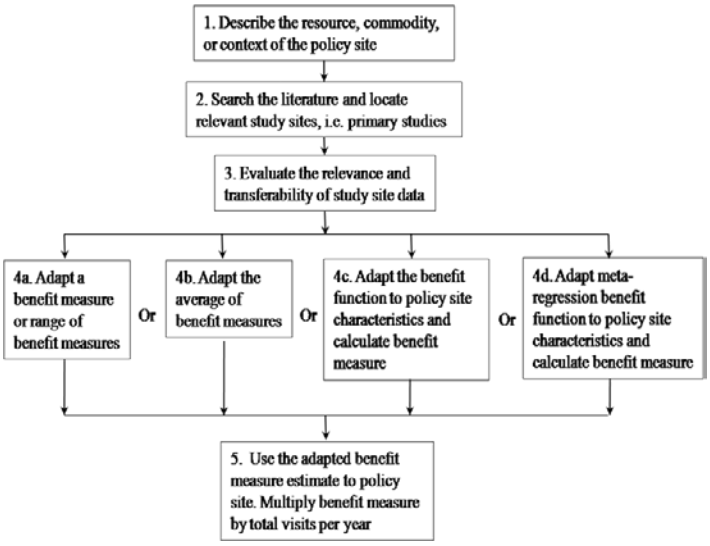

Figure 1. Steps to performing benefit transfers.

The summarized benefit transfer procedures for estimating the access value of recreation in TVPL, as suggested by previous studies (*Boyle and Bergstrom 1992*; *Brouwer 2000*; *Rosenberger and Loomis 2001*), are illustrated in **Figure 1**. The first step is to describe the resource, commodity or context of the policy site. Here, the researchers need to specify the theoretical definition of the value(s) to be estimated and needed at the policy site *j*. In this study, all welfare estimates[6] are expressed in units of per person per trip (2011 PhP). Primary studies reporting benefit estimates other than CS per person per trip are adjusted to per trip units, and estimates derived from earlier studies are converted to 2011 PhP using the Implicit Price Deflator[7]. The information needed in this step include description of the environmental resource. Moreover, factors that can influence benefit estimates are defined, such as socio-economic characteristics of the affected population (e.g., income, education, age, and gender) and physical characteristics of the policy site (e.g., environmental quality, geographic location, and accessibility conditions). Depending on resource conditions and informational needs, the level of required accuracy of benefit transfer estimates can be determined in this step (*Kask and Shogren 1994*).

The second step involves conducting a thorough literature search to locate relevant study sites with estimated welfare measures. Primary studies on the access value of recreation in the US and The Philippines are collected through searching databases (EVRI, USAID Development Experience Clearinghouse, Google Scholar), formally requesting documents/ references via e-mail, list serves, postal mail and/or phone, analysis of citations, and careful study of references. The primary studies are composed of journal articles, theses, dissertations, working papers, government agency reports, consulting reports, and proceedings papers.

The third step is to *evaluate study site data in terms of relevance and transferability*. Primary studies obtained from the literature search are screened whether they are relevant to the policy site *j*. Transferability needs to be evaluated using benefit transfer criteria and in terms of the overall quality of the study site data, such as adequacy or scientific soundness. For example, unbiased estimates are preferred for a valid benefit transfer. Some bias may be acceptable in a benefit transfer; the level of which depends on the circumstances of decision settings and ultimate usage of benefit transfer estimates. State-of-the-art guides on non-market valuation can be useful in this evaluation (e.g. *Champ, Boyle and*

[6] The researchers are using welfare measure in a generic sense by not differentiating between Marshallian and Hicksian surplus measures though theoretically Marshallian and Hicksian surplus measures are different. But as *Willig* (*1976*) reported, when income effects are small, the measures converged. Outdoor recreation is arguably low of income effect.

[7] Consumer Price Index for areas outside the National Capital Region is available at http://www.census.gov.ph.

Brown 2003; *Haab and McConnell 2002*).

The fourth step is to adapt the benefit measure(s) or function to policy site characteristics. Depending on the benefit transfer approach used, whether value transfer or function transfer, necessary adjustments may be needed to reflect the differences in the study and policy sites to get a more reliable and valid benefit transfer estimates for the policy site *j*. Value transfer consists of transferring a single point estimate from study site *i* or a measure of central tendency (e.g. average value) for several benefit estimates from study site(s) *i* to the policy site *j*. Value transfer approaches are suggested when key information for function transfers is missing, including policy site *j* measures the regression independent variables, or the study site regression model. On the other hand, function transfers include the transfer of an entire demand or benefit function estimated for a study site, or estimation of a meta-regression benefit function across multiple study sites. Function transfers then adapt the function to fit the specifics of the policy site, such as socioeconomic characteristics, extent of market and environmental impact, and other measurable characteristics that systematically differ between the study site and the policy site.

The fifth step is to apply the adapted benefit measure estimate to policy site. This is the final stage where actual benefit transfer estimates for the policy site are calculated and can be aggregated by multiplying the benefit measure (CS/person/day in 2011 PhP) by total visits per year (or total number of affected population). To test the soundness of benefit transfer estimates, convergent validity tests are recommended.

Convergent validity is about the accuracy of generalization; i.e., measures of the same theoretical construct correspond to each other - they converge. Convergent validity tests provide confidence in transferring measures to unstudied sites (*Desvousges, Johnson and Banzhaf 1998*). The associated error (ε) with the benefit transfer is defined as:

$$\varepsilon = \frac{V_{BT} - V_S}{V_S} \qquad \text{Equation (3)}$$

In particular, the forecast performance of the benefit transfer technique employed is judged using the percentage transfer error (PTE), defined as:

$$PTE = \left[\frac{CS_{estimated} - CS_{observed}}{CS_{observed}}\right] * 100\% \qquad \text{Equation (4)}$$

where $CS_{estimated}$ is the transferred (predicted) CS value from the adjusted value (point or average of benefit measures) or the meta-regression benefit transfer function while $CS_{observed}$ is the reported *CS* value in a primary study. A jackknifedata splitting technique is used to estimate X_i*-1* separate meta-regression benefit transfer functions (MRBTFs) defined in Equation 7 to predict the omitted observation in each case (*Brander et al. 2006*; *Johnston and Duke 2009*; *Loomis 1992*). The jackknife technique focuses on the samples that leave out one observation at a time: $X_{(i)} = (X_1, X_2, ...X_{i-1}, X_{i+1}, ...X_n)$ for i=1,2,… n jackknife samples. The i^{th} jackknife sample consists of the data set with the i^{th} observation removed. If $\hat{\theta}_{(i)} = s(X_{(i)})$ be the i^{th} jackknife replication of the estimator $\hat{\theta}$, then the standard error of the jackknife estimate is defined by:

$$\hat{se}_{jack} = \left[\frac{n-1}{n}\sum\left(\hat{\theta}_i - \hat{\theta}_{(\cdot)}\right)^2\right]^{1/2} \text{ where } \hat{\theta}_{(\cdot)} = \sum_{i=1}^{n}\frac{\theta_{(i)}}{n} \text{ (}Efron\ 1982\text{).}$$

The standard error of the jackknife is a measure of the precision of the parameter estimates of the X_i *- 1* separate MRBTFs (*Vista and Rosenberger 2013*). Finally, the overall mean and median absolute PTE is generated for all predictions in the two meta-regression models, i.e. classical ordinary least squares (OLS) and weighted least squares (WLS) as discussed below.

Benefit Transfer Applications to Taal Volcano Protected Landscape

Value Transfer: Single Point Estimate

Previous evaluations suggest that, in general, transfers conducted within a country perform better than transfers conducted between countries (*Johnston and Rosenberger, 2010*). In this regard, an in-depth search for relevant study sites reporting an economic measure of direct-use value estimates for 'nature-based' recreation in the Philippines was performed. A list of valuation studies conducted in the Philippines between 1988 and 2002, categorized in terms of environmental services, is provided by *Rosales* (*2003*). Three of the seven potential study sites on protected landscape are available and were collected (*Predo et al. 1999*; *Navarro, Paca and Rimas 2008*; *and Rosales 2001*). However, only one study site (*Predo et al. 1999*) passed the relevance and transferability criteria. The studies by Navarro, Paca and *Rimas* (*2008*) and *Rosales* (*2001*) were excluded because these 'potential study sites' estimated the recreational benefits derived from a mountain ecosystem. The study by *Predo et al.* (*1999*) provides an estimate of annual WTP for the protection of environmental attributes of Lake Danao National Park (LDNP) in Ormoc City, Leyte, Philippines. This WTP for various motives of protection of LNDP include recreational use, option use, existence, and bequest values. The study used CVM with three WTP question formats: open-ended, payment card, and iterative bidding. Tobit (censored regression) model was used to analyzed the different factors affecting WTP bid for protecting LDNP based on 203 respondents. The total WTP for protecting environmental attributes of LNDP annually was PhP 108.45 in 1993. When broken down into its components, the annual mean WTP in 1993 for recreation value, option value,

existence value, and bequest value were calculated at PhP 18.10, PhP 27.65, PhP 29.70, and PhP 33.30, respectively.

There is some degree of correspondence between TVPL (policy site) and LDNP (study site)in terms of resource conditions, site characteristics and market characteristics (**Table 2**) (*Desvousges, Naughton and Parsons 1992*). Both sites were included in the conservation and research propriety area of the country, similar in land tenure and land uses. Furthermore, TVPL and LNDP have the same volcanic soil type and both are very close to nearby population centers/cities.

The policy site value based on *Predo et al.* (*1999*) is PhP 26.03 per person per trip or PhP 72.89 per person per year in 2011. At 95% confidence interval, the policy site value ranges from PhP 33.35 per person per trip to PhP 57.56 per person per trip or between PhP 57.30 to PhP88.40 per person per year in 2011. In benefit transfer applications, the use of 'generic study sites' may be considered lower bounds given the 'uniqueness' factor associated with TVPL. Hence, this single point transfer based on *Predo et al.* (*1999*) study site is a conservative estimate.

Function Transfer: Meta-Regression Analysis

Benefits are more often transferred from developed countries, e.g. the US where numerous primary studies have been conducted, to developing countries, e.g. The Philippines with limited number of available primary studies. An important prerequisite for conducting a robust meta-regression analysis for the purpose of benefit transfer is the availability of sufficient studies on recreation valuation, which is true for US. While a number of valuation studies have been conducted in the Philippines and the Southeast Asia region, the reality is that the vast majority of the recreation literature originated from developed countries.

In this study, primary studies ('study sites') included in the metadata were based on the broader North American recreation use values database. 'Study sites' were selected based on recreation activity, climate, and/or site characteristics/environment. The following recreation activities were selected: freshwater fishing in lakes, swimming, boating, camping, floating/rafting/canoeing, hiking, picnicking, sightseeing, and general recreation. 'Study sites' with hot, humid or dry regional climate, which mimics the climate in Taal Volcano Protected Landscape were selected[8]. These sites include the southeast region (Florida, Georgia, Alabama, Tennessee, South Carolina, and North Carolina); southern region (Mississippi, Louisiana, Arkansas, Texas, and Oklahoma); and southwest region[9] (Arizona, California, Nevada, New Mexico, and Utah). After excluding five possible outliers (CS> $350), there are 213 benefit measures from 47 separate primary studies in the metadata that spans from 1958 to 2006. *Vista* (*2010*) provides a summary of selected characteristics and bibliography of the original study used in international benefit transfer.

A linear specification fits[10] the data better. Since the metadata resembles a panel type, the metadata was stratified 'by study' and 'by underlying data structure' to capture dependency among estimates provided in a single document. Results of Hausman's Chi-square statistic test, based on 'by study' stratification, favored fixed-effect specification but only one of 28 study dummy variables and only one of the 42 estimated panel constants was statistically significant. On the other hand, only five of the 28 study dummy variables were retained in the panel model when the stratification was based on the 'underlying data structure.' In this regard, panel effects in the metadata are not significant (*Rosenberger and Loomis 2000b*). Moreover, classical OLS and WLS meta-regression models were estimated. There are 18 significant variables in an OLS meta-regression model and only 10 significant variables in the WLS MR model. To further test the performance of the two meta-regression models, an out-of-sample benefit prediction using a jackknife data splitting technique[11] was employed. In the WLS meta-regression model, all independent estimates were given weights equal to one, while the assigned weights to dependent estimates were based on the number of observations obtained from each primary study. At 95% confidence level, the median and mean absolute percentage transfer error (PTE) for the OLS meta-regression model were 17.86% and 30.51%, with standard error of 2.39%, which is statistically the same with *Shrestha and Loomis* (*2001*). On the other hand, the median and mean absolute PTE for the WLS meta-regression model were, 34.20% and 43.16%, with standard error of 2.77%. Therefore, the classical OLS meta-regression model was used.

[8] Ideally, factors such as socio-economic characteristics and physical characteristics of the 'policy site' should closely match those of the 'study sites.' Benefit transfer performance may be improved with the inclusion of policy-relevant measures in the metadata through augmentation using secondary data (*Brander et al. 2006*; *Ghermandi et al. 2010*). However, there is poor reporting on policy-relevant characteristics within primary research documentation and publication (*Vista 2010*; *Loomis and Rosenberger 2006*). This general lack of policy-relevant measures in metadata may be a more limiting factor in benefit transfer performance than statistical issue…" (*Vista and Rosenberger 2013*).

[9] Colorado was excluded in the selection criteria since the over-all climate of the state is different from the targeted policy site.

[10] Since different functional forms imply differences in means and variances (*Adamowicz, Flecther and Graham-Tomasi 1989*), both unweighted linear and semi-log MR models were estimated. Unweighted linear and semi-log MR models were compared using Akaike's Information Criterion (AIC), which is: $AIC = \log \frac{1}{N}\sum e_i^2 + \frac{2K}{N}$
AIC calculates the sum of a measure of the goodness-of-fit (i.e. squared residual error for observation i) and a penalty term for the number of free parameters (K) in the model. This criterion penalizes for increases in the number of estimators. The rule-of-thumb is to choose the model with the lower AIC.

[11] Purchasing Power Parity conversion factor used was $1=PhP24.94 (*World Bank 2012*). There's a caveat in PPP adjusted benefit measures since it will not be able to correct for differences in individual preferences, and cultural and institutional conditions between the two countries that they have the potential to invalidate an international benefit transfer.

Table 2. Significant features of Taal Volcano Protected Landscape (policy site) and Lake Danao National Park (study site).

Characteristics	Taal Volcano Protected Landscape	Lake Danao National Park
Conservation and research priority area in inland waters?	Yes, #11th of 24	Yes, # 19th of 24
Land Tenure	Government owned, under NIPAS[a]	Government owned, under NIPAS[a]
Land Use	Aquaculture, fishing, outdoor recreation, agroforestry, etc.	Fishing, outdoor recreation, forestry, etc.
Biophysical		
Location	Batangas, Philippines	Leyte, Philippines
Landscape area (ha)	4,537	2,193
Distance to nearest city (km)	13 (Tagaytay City)	17 (Ormoc City)
Geology: soils	Volcanic	Volcanic
Climate		
Average rainfall/year (mm)	1,833	2,592
Average temperature (°C)	28.0	24.2
Population (2007 census)	343,749	177,524

[a]National Integrated Protected Area System

Sources: *Garcia et al. 2005*; *Ong, Afuang and Ambal 2002*; *Predo et al. 1999*; *Vista 2003*.

The estimated meta-regression model equation is, in matrix notation:

$$CS_{ij} = \alpha + \beta_1 SITE_{ij} + \beta_2 METHOD_{ij} + \beta_3 ACTIVITY_{ij} + u_{ij} \quad \text{Equation (5)}$$

where subscript *ij* stands for estimate *i* from study *j*, α is the constant term, μ a vector of residuals, and the vectors β containing all the estimated coefficients of the respective explanatory variables. SITE represents a vector of site-specific variables that identifies the primary environment, geographic location of the natural resource setting in which the recreation takes place, and site aggregation. METHOD represents a vector of method variables, which controls the SP and RP valuation methods used, survey type employed, visitor type, and value unit. ACTIVITY represents a vector of recreation activity variables that are modeled in the study (**Table 3**).

Table 4 presents the final estimated MR model including the standard errors estimated using White's heteroskedastic corrected covariance matrix estimator and mean of the dependent and independent variables. The explanatory power (adjusted-R^2) of the MR model is 0.50, considerably above that of *Shrestha and Loomis* (*2001*) and *Rosenberger and Loomis* (*2001*). An adjusted-R^2 of 50% indicates that about half of the variance in benefit measures is explained by the model. For the dummy variables, the mean value represents the proportions of the 'study sites' with a value of one. For instance, the mean of 0.35 for the dummy variable lake denotes that 35% of the 'study sites' were from a lake environment. Following similar interpretation, 93% were located on public lands, 15% were designated as park, 70% were aggregated as single-site or sub-sites, etc. The estimated MR model is statistically significant at $p \leq 0.01$ based on F-tests.

The resulting meta-regression model (**Table 4**) was used to calculate the meta-predicted value for the TVPL. Prior to adapting the meta-regression benefit function model, the income level between the two countries was adjusted using purchasing power parity (PPP[11]). PPP is the exchange rate that equalizes market prices and is appropriate for converting into a common currency. On average, resident visitors made only 1.6 trips per year and 1.75 days per trip (*NSO-DOT 2006*). Then, a benefit measure for the TVPL was calculated by adapting the meta-regression function to the specific characteristics of TVPL, constrained by the availability of policy relevant variables in the meta-regression model (in particular, if variables important to identifying key differences between the policy site and study site remain unmeasured). In this step, all variables were set to their sample mean values except for those with corresponding measures at the TVPL, in which case were set to the TVPL levels. For instance, the policy site is designated as park, so the adaptation value was set to one. The explanatory variable park is an adjustment factor that directly addresses some of the characteristics of the policy site- protected, unique, and high quality. Likewise, the policy site has a lakeenvironment setting, so the adaptation value was set to one. Fishing variable, the targeted recreation activity, was set to one, while all other recreation activity variables were set to zero. In sum, the following variables were set to zero – river, grass, mail, phone, camping, hiking, floating, swimming, boating, picnicking, sightseeing, and waterskiing.The calculated benefit measure per fishing day, after adapting the international MR model specifically to the policy site, is PhP 1,575 per person. The average recreational benefit at TVPL is PhP 1,696 per person per day or between PhP 1,489 – PhP 1,904 per person per day (**Table 5**).

These estimated recreational access values estimated via international MR model were much higher than that estimated using single point estimate. Possible discrepancy may be attributed to uniqueness factor associated with TVPL. In particular, TVPL's uniqueness and designation as a 'priority protected landscape' may have higher value

Table 3. Description of variables tested in the meta-regression analysis.

Variables	Description
Dependent variable:	
CS	Consumer surplus per person per day (2011 PhP)
Site variables	
Lake	Qualitative variable: 1 if primary environment is lake, pond or reservoir resource; 0 if otherwise
River or stream	Qualitative variable: 1 if primary environment is river or stream; 0 if otherwise
Grassland	Qualitative variable: 1 if primary environment is grassland; 0 if otherwise
Public	Qualitative variable: 1 if the resource is owned publicly; 0 if otherwise
Park	Qualitative variable: 1 if the resource is designated as park (national or state) ; 0 if otherwise
SE Region	Qualitative variable: 1 if the study site is Southeast Region (Florida, Georgia, Alabama,Tennessee,South Carolina, North Carolina); 0 if otherwise
Single-site	Qualitative variable: 1 if the primary study is single-site or sub-site; 0 if regional studies.
Method variables	
Stated Preference	Qualitative variable: 1 if stated preference (SP) valuation approach used; 0 if otherwise
Individual TCM	Qualitative variable: 1 if RP and an individual travel cost model is used; 0 if otherwise
Substitute price	Qualitative variable: 1 if RP and substitute price, index or variable included in regression; 0 if otherwise
Open-ended	Qualitative variable: 1 if stated preference (SP) and open-ended elicitation method was used; 0 if otherwise
Dichotomous choice	Qualitative variable: 1 if SP and dichotomous choice elicitation method is used; 0 if otherwise
Iterative bidding	Qualitative variable: 1 if SP and iterative bidding elicitation method is used; 0 if otherwise
Price or quality substitute	Qualitative variable: 1 if SP and substitute in price or quality treatment is used; 0 if otherwise
Mail	Qualitative variable: 1 if used mail survey type; 0 if otherwise
In-person	Qualitative variable: 1 if used in-person survey type; 0 if otherwise
Phone	Qualitative variable: 1 if used phone survey type; 0 if otherwise
Resident	Qualitative variable: 1 if visitor type is resident; 0 if otherwise
Value Unit	Qualitative variable: 1 if CS is originally estimated as per person per day; 0 if otherwise
Activity variables	
Fishing….waterskiing	Qualitative variables: 1 if the relevant recreation activity was studied; 0 if otherwise. The recreation activities are: fishing, swimming, boating, camping, floating/rafting/canoeing, waterskiing, hiking, pic-nicking and sightseeing.

than 'generic protected landscapes' due to its proximity to population centers such as Manila and the provinces of CAvite, LAguna, BAtangas, Rizal, and QueZON (CALABARZON). Other exogenous factor that may have influenced such results could be attributed to social, cultural and institutional differences between USA and the Philippines. The adjustments made using PPP may have not fully captured differences between the US study sites and TVPL.

Recreational Value of Taal Volcano Protected Landscape

The aggregate recreational value of TVPL equals the consumer suplus per person per year times the number of visitors in 2011. Separate estimates of aggregate consumer surplus in 2011 were provided for the Cavite (Tagaytay City) and Batangas (Talisay) sides since the visitation and recreation activity patterns for these two provinces were quite different. Since visitation data in the Batangas Province was only available from the Municipality of Talisay, the estimated aggregate recreational value of TVPL can be considered lower bound (a conservative estimate). For the Batangas Province alone, the estimated 2011 recreational access value ranges from PhP 4.3 M to PhP 299 M. For the Cavite side, the estimated 2011 recreational access value ranges from PhP 110 M to PhP 7.646 B. In sum, the estimated 2011 recreational access value in TVPL was about PhP 114 M using single point transfer or about PhP 7.945 B using international meta-regression transfer.

CONCLUSION

Benefit transfer methods are increasingly used to aid decision-making, especially when time and resource constraints the conduct of primary study. It has many potential applications in developing countries, wherein collecting primary data is significantly constrained by limited financial resources. This paper has used benefit transfer to estimate the recreational access value of Taal Volcano Protected Landscape, Philippines. Two benefit transfer methods were employed: single point estimate transfer based on a Philippines 'study site' and meta-regression benefit transfer function based on selected US 'study sites.'

Following benefit transfer protocol, the adapted welfare measures, reported in 2011 PhP consumer surplus per person per trip and per year, were adjusted to the policy site conditions. A smaller welfare estimates per person per trip and per year was estimated using single point transfer than the international meta-regression transfer. Indeed, a wide range of welfare estimates was generated with these two BT methods.

Table 4. Ordinary least squares regression model result.

Variable	Coefficient[a]	Standard error[b]	Mean of variable
CS	-	-	1,041.16
Constant	1,043.82	1,439.96	1.00
Lake	569.20*	320.44	0.35
River or stream	1,358.26***	527.73	0.26
Grassland	-1,742.18**	712.45	0.03
Public	-1,164.58***	423.98	0.93
Park	1,120.11***	375.42	0.15
SE Region	-452.63**	222.40	0.26
Single-site aggregation	5.69	312.18	0.70
Stated Preference	-122.12	1,263.86	0.22
Individual TCM	1,036.04***	252.12	0.27
Substitute price	262.70	233.16	0.46
Open-ended	-614.85	1,289.08	0.07
Dichotomous choice	678.50	1,299.46	0.12
Iterative bidding	-834.19	1,749.23	0.03
Price or quality substitute	-1,497.14	1,333.29	0.00
Mail	1,053.18***	359.85	0.36
In-person	1,052.91***	344.40	0.50
Phone	681.32	1,383.35	0.03
Resident	-754.47***	258.77	0.41
Fishing	-210.25	438.33	0.10
Camping	-16.81	305.10	0.17
Hiking	513.46	499.96	0.05
Floating	24.66	580.03	0.21
Swimming	-219.85	532.86	0.03
Boating	-1,412.64***	368.91	0.12
Picnicking	650.58	549.77	0.03
Sightseeing	377.35	527.09	0.04
Waterskiing	-508.17	1,241.85	0.00
Value unit	-622.59**	262.92	0.43
Adjusted-R^2	0.50		
F-stat [28,184]	8.62***		
Number of observations	213		

Note: Dependent variable = consumer surplus (CS) per person per day (2011 PhP)

[a]***Statistically significant at the 1% level or better; **at the 5% or better, * the 10% level or better.

[b]Standard errors are calculated using White's heteroskedastic corrected covariance matrix estimator.

Table 5. Estimated consumer surplus (CS) for different recreation activities at the Taal Volcano Protected Landscape employing the international meta-regression benefit transfer function.

Recreation activity	**CS/person/day** (2011 PhP)	**CS/person/trip** (2011 PhP)	**CS/person/year** (2011 PhP)
Fishing	1,575	2,756	4,410
Camping	1,769	3,095	4,952
Hiking	2,299	4,023	6,437
Floating	1,810	3,168	5,068
Swimming	1,566	2,740	4,383
Boating	373	652	1,044
Picnicking[a]	2,436	4,263	6,821
Sightseeing[a]	2,163	3,785	6,056
Waterskiing	1,277	2,235	3,576
Average	1,696	3,155	5,048
Range	1,489 – 1,904	2,605 – 3,332	4,168 – 5,331

[a]Experiences occur mostly at Tagaytay City, Cavite.

Table 6. Recreational access value of Taal Volcano Protected Landscape, 2011.

	Total no. of visitors in 2011	Aggregate CS (2011 PhP)	
		Single Point Transfer	Meta-Regression Transfer
Batangas (Talisay)	59,390	4,328,850	299,800,720
Cavite (Tagaytay City)	1,514,683	110,403,031	7,646,119,784
	Total	114,731,881	7,945,920,504

The estimated recreational value of TVPL is not equivalent to economic resources that can be generated when visitor use fees[12] or recreational boat licenses are imposed to the users. User fees should be based on a willingness-to-pay study that captures public perceptions and willingness-to-pay fees, among others. Hence, given the time and funding, it is important to get an accurate assessment of the recreational access value at TVPL. This can be done through the conduct of primary valuation studies that captures visitor perceptions and WTP fees. In particular, future research may focus on: determining the extent to which current users are willing to pay for access to Taal Volcano Islands and Taal Lake under various mechanisms, their support and opposition for these mechanisms; estimating the demand for current user groups and evaluating their recreation experiences in the site; and examining local community residents' WTP for protection of Taal Volcano Islands and Taal Lake, attributes that would increase involvement and participation, and their perceptions of values and benefits of the landscape. To capture part of these estimated recreational values, institutional instrument(s) should be made that specifies user charges and fees. This may be in the form of a PAMB resolution or a Municipal/ City Ordinance on User Fees for TVPL Facilities, Goods and Services (applicable within the municipal/city jurisdictions), which may be used to cover for the management, protection and preservation of the natural resources of TVPL.

Tagaytay City mainly benefits from the scenic beauty of TVPL through tourism surplus, including rise in land values, tourism-related livelihoods, business permits, and taxes. About 80% annual revenue of the City Government of Tagaytay are generated from tourism alone. However, Tagaytay City is currently a `free rider' to the positive externalities of Taal Volcano Island and Lake, while the DENR-PASu and other municipalities/cities within the basin pay the cost of protection in the area. Interestingly, the PASu office and Provincial Government Task Force, with the help of Municipalities of Talisay, Laurel, Agoncillo and Tanauan City are the ones regulating the intensive cage culture, infrastructure development, and pollution within Taal Volcano Island and Lake but they have no share in the tourism suplus.

PAMB and local government units would need funding to ensure protection and conservation of TVPL as well as provision of alternative employment opportunities for affected local residents who are barred from cage farming given limitations on the total number of cages in Taal Lake. Two possible sources of funds are: user fee collection; and internal revenue allotments of concerned municipalities and cities. Between the two fund sources, the most feasible one is user fee.

In determining the financial commitments by the different municipalities and cities within TVPL, the visitation data and estimated aggregated value per province may be useful to PAMB and PASu. In particular, Tagaytay City may be asked to provide more funding towards the implementation of the management plan since the city captures more investments and revenues associated with tourism in the area.

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