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Social valuation of regulating and cultural ecosystem services of Arroceros Forest Park: A man-made forest in the city of Manila, Philippines

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ABSTRACT

Investment in urban green spaces such as street trees and forest park may be viewed as both sustainable adaptation and mitigation strategies in responding to a variety of climate change issues and urban environmental problems in densely urbanized areas. Urban green landscapes can be important sources of ecosystem services (ES) having substantial contribution to the sustainability of urban areas and cities of developing countries in particular. In the highly urbanized City of Manila in the Philippines, Arroceros Forest Park (AFP) is a significant source of regulating and cultural ES. In this study the perceived level of importance of 6 urban forest ES, attitude to the forest park non-use values, and the factors influencing willingness to pay (WTP) for forest park preservation were explored through a survey conducted on January 2018 to the college students (17–28 years, $n = 684$) from 4 universities in the City of Manila. Survey showed that air quality regulation (mean = 3.73) and climate and temperature regulation (mean = 3.71) were the two most important urban forest ES. Binary logistic regression showed significant relationship of WTP with natural log allowance ($p = 0.000$), air quality regulation ES and residence ($p = 0.007$), and option value ($p = 0.008$). The protest response was mainly influenced by economic reason and reliance to the government. The natural log of the positive WTP was weakly but highly significantly correlated with the natural log of students' allowance ($r = 0.193$, $p = 0.000$). Male students had higher WTP than female despite the lower allowance of male students. This study provided evidence that pro-environment decision was significantly influenced by attitude and socio-economic factors. The high importance value of air quality regulation, climate and temperature regulation, bequest value, and ecological value may be viewed as the students' demand for these urban green ES.

1. Introduction

The human society is directly and indirectly benefitted by the ecological functions and ecosystem goods and services of natural ecosystems and man-made ecosystems. Ecosystem functions "refer variously to the habitat, biological or system properties of

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ecosystems", while ecosystem services (ES) "represent the benefits human populations derive, directly or indirectly, from ecosystem functions" (Costanza et al., 1997). The Philippines' Expanded National Integrated Protected Areas System Act of 2018 (RA 11038) defined ecosystem goods and services as "the multitude of material and nonmaterial provisions and benefits from healthy ecosystems necessary for human sustenance, well-being, and survival including support processes, provisioning and environmental regulating services, and cultural resource preservation services". ES are broadly grouped into renewable and non-renewable. ES are particularly important for rural communities living closely to forest and coastal ecosystems and for urban dwellers experiencing the impact of urban environment. The most obvious ES are the direct and consumptive goods and services in which the economic values can be easily quantified. In terms of appreciation of the indirect and non-use values often the public has a wrong impression that ecosystems neighboring human populations are considerably more important than distant ecosystems because the indirect benefits and non-use value of distant ecosystems are seldom experienced by the people. For example in the study of Subade and Francisco (2014) only 46% of all 597 respondents from a city in the Philippines hundreds of kilometers away from Tubbataha Reefs National Marine Park (a marine protected area in the Philippines and a UNESCO World Heritage Site) were willing to pay for the conservation of the reef. Costanza et al. (1997) grouped renewable ES into 17 categories while the millennium Ecosystem Assessment (MEA) grouped the ES into 4 categories (MEA, 2005). On the other hand, de Groot et al. (2012) ES classification did not include supporting services and instead added habitat services to their ES category.

Considered as serious problems in a highly urbanized area are waste disposal, waste treatment, heat island effect, and congestion due to limited space. The regulating and supporting ES such as water supply regulation, gas regulation, waste treatment, and nutrient cycling are critically important to cities and urban areas to sustain the supply of clean air and water and to ensure the physical and mental well-being of urban residents. Urban forests which can be defined as "networks or systems comprising all woodlands, groups of trees, and individual trees located in urban and peri-urban areas" (Food and Agriculture Organization FAO, 2016) are often more valued for their aesthetic and recreation than for their ES. Among the significant contribution of urban forest to large cities is air pollution removal and air quality improvement in terms of removal of gaseous air pollutants and particulate matter (Uni & Katra, 2017; Yli-Pelkonen, Scott, Viippola, & Setala, 2017a; Yli-Pelkonen, Setala, & Viippola, 2017b; King, Johnson, Kheirbek, Lu, & Matte, 2014) and reduction of health problems associated with air pollution (Nowak, Hirabayashi, Doyle, McGovern, & Pasher, 2018; Nowak, Hirabayashi, Bodine, & Greenfield, 2014). Other important ES of urban trees are cultural and recreational services which are important for outdoor social activities which serve as stress reliever due to urban activities. The positive influence of urban trees and green space on residential property value has also been reported in various studies (Mei, Hite, & Sohngen, 2017; Czembrowski & Kronenbert, 2016). The view of green spaces and proximity to urban forest also contribute to higher market value of properties (Jim & Chen, 2006) and can have spatial spillover impacts (Votsis, 2017). Homebuyers and real estate investors value natural amenities, aesthetics, shade, privacy, cooling effect to the surrounding, and traffic noise reduction (Maleki & Hosseini, 2011; Samara & Tsitson, 2011) that are provided by urban trees and vegetation. Thus to ensure the sustainability of the ES of woody vegetation and urban forest to cities and urban areas, urban vegetation and green spaces should be set aside not only for aesthetic reason but for ecological and life support functions.

Population growth and urbanization have resulted to the conversion of open green spaces into built-up areas. Urban land conversion, urban sprawl, and encroachment of green spaces resulted to scarcity of green spaces. Urbanization also resulted to decreased plant and tree biodiversity, occupation of exotic plant species, eradication of native and indigenous plant species, and elimination of cultural and historical sites.

The City of Manila in the Philippines is a highly urbanized city that has a number of historic and culturally significant public green spaces and parks that include the Rizal Park, Intramuros, Paco Park, and Arroceros Forest Park (AFP, the subject of this study). AFP, a gated urban forest park and dubbed as the 'last lung of Manila' (Roces, 2007) has a high potential for providing free recreational experience and outdoor social activities to Manila residents, tourists, and students. However public access to AFP is limited which made it less visible to the public. AFP is a habitat of local and migratory birds, snakes, and plants. Among the birds spotted in AFP according to Liuag (2003) of the Wild Bird Club of the Philippines were yellow-vented bulbuls, pied fantails, arctic warbler, brown shrike, white-collared kingfisher, common kingfisher, rufous night heron, glossy starlings, black-naped orioles, and kingfishers. When the forest park was closed to the public and left undisturbed for years it became a habitat of snakes and birds (Mr. T. Magno, pers. commun.). At the time of this study, there is no local ordinance recognizing AFP as a protected forest park (Ancheta, Membrebe, Santos, Valeroso & Vizmanos, 2016; Ancheta, Membrebe, Santos, & Valeroso, 2017). The local government view AFP as an unused land and its economic value is underutilized (Mr. T. Magno, pers. commun.). The absence of a local ordinance declaring AFP as a protected area, space limitation in the City of Manila, and lack of sustainable management plan threaten the existence of the forest park which may conflict with the original purpose for the creation of AFP.

The primary aim of the study is to investigate how socio-economic variables and perception to urban green ES and its non-use values influence the decision and willingness to pay (WTP) of an individual to support the preservation of AFP. The respondents of this study were the university students from four universities (one private university, one city government funded university, and two state subsidized universities) in the City of Manila. AFP was chosen mainly because there is not enough information on its non-use values and is the only relatively large green space occupied by man-made forest in the City of Manila. At the time of this study, published literatures on ES valuation of AFP is scarce and only three open-access research articles related to AFP are available online (Ancheta et al. 2017; Membrebre et al., 2017). However this study is distinguished from the existing literature in that the focus is on the social valuation of regulating ES, cultural ES, and non-use values of the forest park.

This paper assumed that the students were aware and knowledgeable of the ecological functions and social services of urban trees on human society. The author also hypothesized that students studying in the four universities have high appreciation of the ES of urban trees because AFP and other urban green spaces are relatively close to the universities. To the author's knowledge local studies

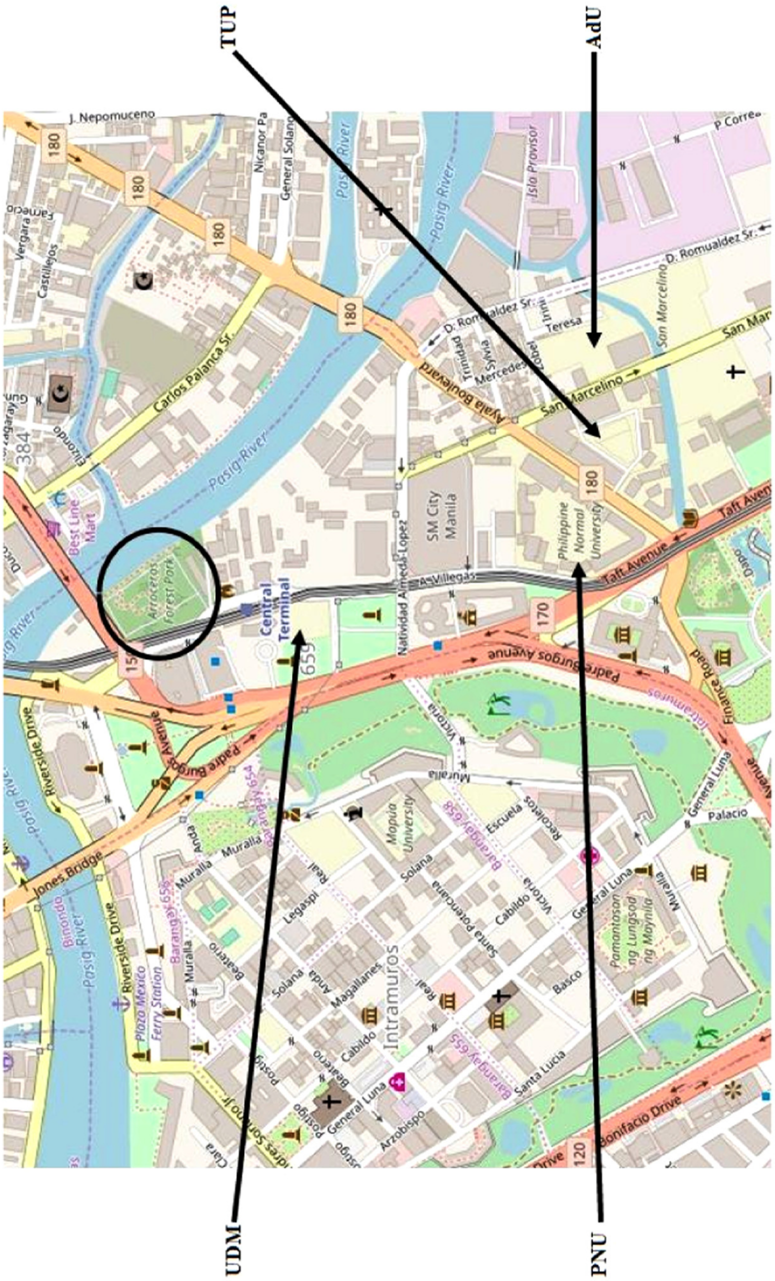

Fig. 1. Portion of the map of Ermita City of Manila and the location of Arroceros Forest Park (AFP) (circled) and the four universities (Adamson University (AdU), Philippine Normal University (PNU), Technological University of the Philippines (TUP), and Universidad de Manila (UDM).

a

b.

Fig. 2. a. Arroceros Forest Park (right side, viewed from Pasig river) neighbouring high rise residential condominiums, b. woody trees and vegetation of the forest park (photo by the author, April 17, 2018).

on the social valuation of urban vegetation ES from the perspective of college students are scarce. The limitations of this study are the following: first, this study is limited to the university students of four universities in the City of Manila with age range from 17 to 28 years, and second the sample size is not representative of the total population of students. Nevertheless by making the ES and social valuation of AFP visible in the literature, the present paper could gain policy appreciation in the context of sustainable and resilient urban environment.

2. Methodology

2.1. Location and description of study area

The study was conducted in Ermita in the City of Manila (Fig. 1). The City of Manila is a densely populated coastal city and is the capital of the Philippines. Located in the west coast of Luzon Island, the city is divided into six administrative districts and is bordered by Manila Bay and the cities of Makati, Mandaluyong, Pasay, San Juan, and Quezon City. Based on the year 2015 data of the Philippine Statistics Authority, the population of the City of Manila was about 1.78 million with an annual growth rate of 1.43% (year 2010 to 2015) and a population density of 71,263 persons per km2 or about 3.43 times the population density of the National Capital Region of the Philippines. Manila ranked as the fourth largest built-up urban area in the world (Demographia, 2018). Ermita is home to national government offices, international agencies, green landscapes and culturally significant sites, and higher education institutions (Morley, 2018; Munarriz, Perez, & Caguimbal, 2015).

Arroceros Forest Park (Fig. 2, abbreviated AFP) is a two hectare man-made forest along Arroceros Street and Pasig River in Ermita, Manila. Frequently it is a venue for social gathering (Fig. 3) such as the annual Earth Day celebration, tree walk, and other environmental activities. The forest park is near Binondo, Intramuros, Mehan Garden, and Metropolitan Theatre which are Manila's cultural heritage sites. It was established in the year 1993 through an agreement (15 year development plan, 1993–2008) by the city government of Manila and Winner Foundation (the caretaker of the park). The city government purchased the land in 1992 for 60

a

b

Fig. 3. (a & b): Social activities in Arroceros Forest Park during Earth Day Celebration on April 15, 2018 (photo by C. Sy-Quia Mabanta with permission to use).

million pesos from the Land Bank of the Philippines (Philippine Daily Inquirer (PDI), 2017; Roces, 2007; Roces, 2005). It was planted with 60 tree species (Roces, 2007) and has 1088 mature trees (Gonzales & Magnaye, 2017) including native and endangered tree species such as rainbow eucalyptus (*Eucalyptus deglupta*), bitaog (*Callophyllum inophyllum*), molave (*Vitex parviflora* Juss. an endangered tree species, Mendoza, Lagbas, & Buot, 2016; Department of Environment and Natural Resources DENR, 2007), *Ficus concinna* (red balete) and *Pterocarpus indicus* (narra) (PSCNPI, 2018). The forest park was envisioned to provide environmental education, social and recreational activities for the people of Manila (Roces, 2007). In the year 2008 the 15 year development plan of the forest park lapsed and was extended until 2013. In 2017, the city government announced that a sports gymnasium will be constructed on a 2000 m^2 portion of the forest park for the use of the students and faculty of Universidad de Manila (Philippine Daily Inquirer (PDI), 2017).

2.2. Respondents

The respondents of this study were students of Adamson University (AdU), Philippine Normal University (PNU), Technological University of the Philippines (TUP), and Universidad de Manila (UDM). AdU is a private university located along San Marcelino Street. It was founded in 1932 as Adamson School of Industrial Chemistry and became a university in 1941. PNU and TUP are state funded universities located along Ayala Boulevard and San Marcelino Street. PNU was founded in 1901 as the Philippine Normal School by Act No. 74 and became a university in 1991 by Republic Act No. 7168. TUP was founded in 1901 as Manila Trade School and became a university in 1978 by Presidential Decree No. 1518. UDM is a city government university located along Arroceros Street and inside its campus is Mehan Garden (a declared significant cultural heritage site). Closest to UDM are the art deco building Metropolitan Theater (a declared national cultural treasure) and AFP. Ayala Boulevard is a four-lane road lined with matured woody trees (*Pterocarpus indicus* and *Swietenia macrophylla* King) while San Marcelino Street is a three-lane road. Both roads are frequently used as routes for heavy cargo trucks, delivery trucks, buses, and light vehicles. Taft Avenue is a busy road in front of Rizal Park and has few woody trees along the sidewalk of Santa Isabel College to United Nations Avenue. During monsoon season these roads are very vulnerable to flooding and are not passable to light vehicles.

2.3. Research instrument

The survey instrument is a one page questionnaire that consists of four sections. The language used was English in the survey instrument while Filipino was used during the interviews. The instrument was pre-tested to 50 undergraduate students of TUP and was revised after pre-testing. The structure of the survey is as follows: Section A asked to rate the importance of the 6 ES of AFP using four point Likert scale to categorize the perception of the respondents (4 = extremely important, 3 = very important, 2 = somewhat important, 1 = not important). The 6 ES are 1. climate and temperature regulation (regulating service), 2. air quality regulation (regulating service), 3. flood prevention (regulating service), 4. education and research (cultural service), 5. outdoor recreation (cultural service), and 6. inspiration for culture and art (cultural service). Section B asked to state their level of agreement or disagreement to six statements about the non-use values of the forest park (modified from Subade & Francisco, 2014) using four point Likert scale (4 = strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree). The six statements captured the altruist value ("value attached by individuals to the fact that other people of the present generation have access to the benefits provided by species and ecosystems"), bequest value ("value attached by individuals to the fact that future generations will also have access to the benefits from species and ecosystems"), existence value ("value related to the satisfaction that individuals derive from the mere knowledge that species and ecosystems continue to exist"), moral value and option value ("the importance that people give to the future availability of ecosystem services for personal benefit") (Note: the definitions were derived from The Economics of Ecosystems and Biodiversity TEEB, 2010) (see Table 2). Section C asked the willingness to pay (WTP) or the amount to be given in order to preserve

Table 1
Explanatory variables for binary logistic regression.

Variable Code	Definition	Mean	Median	SD	Skewness	Kurtosis
CT	Climate and temperature regulation	3.7135	4	0.4684	-1.16	-0.11
AQ	Air quality regulation	3.7266	4	0.4621	-1.24	0.11
FP	Flood prevention	3.6243	4	0.5498	-1.17	0.67
ER	Education and research	3.5322	4	0.5956	-0.96	0.36
OR	Outdoor recreation	3.4035	4	0.6720	-0.80	0.00
CA	Inspiration for culture and art	3.3655	3	0.6787	-0.74	0.00
EcV	Ecological function value, reflected in the statement "I want to preserve AFP because of its ecological function.	3.6374	4	0.4901	-0.68	-1.24
BV	Bequest value, reflected in the statement "I want to preserve AFP for the future generations."	3.6462	4	0.4906	-0.76	-1.05
ExV	Existence value, reflected in the statement "I take personal pleasure in knowing that AFP exists."	3.3509	4	0.5800	-0.33	-0.16
OV	Option value, reflected in the statement "I have not yet visited AFP but I want to contribute money to preserve it to have the option of visiting it in the future."	3.2178	4	0.6611	-0.42	-0.10
MV	Moral value, reflected in the statement "It is my moral duty to preserve AFP."	3.2500	3	0.6360	-0.37	-0.18
AV	Altruist value, reflected in the statement "I want to preserve AFP because I am concerned about the people who depend on the ecosystem services of the forest park."	3.4825	3	0.5502	-0.46	-0.55
ALW	Natural log of the students' daily allowance	5.1219	5.1930	0.5304	0.08	5.43
AGE	Natural log of the students' age	2.9671	2.9444	0.0707	1.19	3.30
RES	If student is resident of Manila = 1, otherwise = 0	0.5175	1	0.5001	-0.07	-2.00
FAM	If student is familiar to AFP = 1, otherwise = 0	0.4094	0	0.4921	0.37	-1.87
MBR	If student is a member of environmental organization = 1, otherwise = 0	0.07310	0	0.26049	3.29	8.83
G	If respondent is 1 = Male, otherwise = 0	0.4956	0	0.5003	0.02	-2.01
VST	If respondent had visited AFP = 1, otherwise = 0	0.1608	0	0.3676	1.85	1.43

Table 2
Descriptive statistics of the profile of respondents.

Variable	Min	Max	Mean	Median	Mode	CV	Skewness	Kurtosis
Allowance	10	3500	197.34	180	200	96.10	10.28	151.64
Age	17	28	19.485	19	19	7.41	1.64	5.52
Gender (1 = male, 0 = female)	0	1	0.4956	0	0	100.95	0.02	-2.01
Residence (1 = Manila, 0 = others)	0	1	0.5175	1	1	96.62	-0.07	-2.00
Familiarity to AFP (1 = yes, 0 = no)	0	1	0.4094	0	0	120.21	0.37	-1.87
Visited AFP (1 = yes, 0 = no)	0	1	0.1608	0	0	228.60	1.85	1.43
Member of environmental organization (1 = yes, 0 = no)	0	1	0.07310	0	0	356.35	3.29	8.83

the forest park.

The scenario presented was "Arroceros Forest Park is called the 'Last Lung of Manila'. Suppose the city government decided to remove all trees in the Arroceros Forest Park to make space for development. If a non-government organization proposed that Arroceros Forest Park be acquired for the purpose of preservation, how much would you be willing to pay per month to support this action? You would be assured that all money you paid would be devoted to the preservation of Arroceros Forest Park" (modified from Lo and Jim, 2015). An assurance that all money donated would be devoted to the preservation of the forest park was included. The choices were from 25 pesos to 500 pesos and other amount as other option. Choices were provided because in the preliminary survey the respondents gave extreme WTP values. In case a respondent does not want to donate, a 'no' option was provided and the respondent was asked to choose one reason for his/her refusal to donate. Lastly, Section D asked the average daily allowance, gender, address, familiarity to forest park, visitation to forest park, membership to environmental organization, course, year level, and age.

2.4. Data collection

Data were collected by the undergraduate students of TUP. First, an orientation was given to the students about the aim of the activity. The students were divided into 4 groups by lottery sampling method (Fig. 3). The group assignments were as follows: Group A (n = 11) was assigned to AdU students, Group B (n = 12) was assigned to UDM students, Group C (n = 12) was assigned to the students of TUP, and Group D (n = 12) was assigned to the students of PNU. The students randomly selected a respondent. Initial survey was conducted in the first week of December 2017 to randomly selected students of AdU, PNU, and TUP (n = 548 students). The main objectives of the initial survey were to assess the reliability of the survey and to allow the students to gain survey experience. From this activity and students' feedback, the instrument was revised and the survey was repeated in the first and second week of January 2018 during the students' vacant time in the afternoon. A total of 684 completely accomplished survey questionnaires were used in this study. Results of survey were presented per group on March 7, 2018 Fig. 4.

2.5. Statistical analysis

The following descriptive statistics were determined: minimum (min) and maximum (max) values, mean, median, mode, coefficient of variation (CV), standard deviation (SD), skewness, and kurtosis. To test the null hypothesis that means are equal, two-sample t-test and One-way analysis of variance (ANOVA) were performed at 95% confidence level with the assumption of equal variances. If at least one mean is significantly different, Tukey pairwise comparison was performed to determine which groups were significantly different. P-value was interpreted significant if $p < 0.05$ significance level. Pearson correlation coefficient (r) was interpreted as follows: weak ($0 < /r/ < 0.3$), moderate ($0.3 < /r/ < 0.7$), and strong correlation ($/r/ > 0.7$). Binary logistic regression was performed to examine the relationship of the variables (Table 1) to the students' WTP decision (1 = yes, 0 = no) for forest park preservation. The variables were standardized by subtracting the mean and dividing by SD and were fitted to the logistic models. Chi-square (χ^2), deviance R^2, Akaike Information Criterion (AIC), Variance Inflation Factor (VIF), Deviance, and Pearson statistic were determined to assess goodness-of-fit of data. Statistical analyses were performed using MINITAB version 17.

3. Results

3.1. Profile of respondents

The descriptive statistics of the profile of the students are shown in Table 2. A total of 684 college students composed of students from AdU (n = 168, 24.56%), PNU (n = 168, 24.56%), TUP (n = 180, 26.32%), and UDM (n = 168, 24.56%) were interviewed. The average age of the students was 19.49 years (min = 17, max = 28, SD = 1.44) and 89.77% were in the age group of 18–21 years. The mean and median daily allowance of the students was 197.34 PhP (SE mean = 7.25) and 180 PhP, respectively. About half of the students' daily stipend (48.68%) was above the mean and median values. The mean (201.59 PhP) and median (200 PhP) allowance of female students were higher than male (mean = 193.01 PhP, median = 150 PhP). There was a good balance of female (345 or 50.44%) and male (339 or 49.56%) respondents, and residents (354 or 51.75%) and non-residents (330 or 48.25%) of the City of Manila. The proportion of the students who were familiar to AFP (59.06%) was higher than the students who were not familiar to AFP (40.94%). The proportion of the students who have claimed to visit AFP (16.08%) was smaller than the students who have not yet visited the

Fig. 4. Undergraduate students (third year BS Environmental Science) who conducted the survey (photo by the author, March 7, 2018).

Table 3
Perception of college students to the ES and non-use values of AFP.

Ecosystem services	AdU (n = 168)		TUP (n = 180)		PNU (n = 168)		UDM (n = 168)		All students (n = 684)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Climate and temperature regulation	3.7560	0.4445	3.6833	0.4898	3.7262	0.4604	3.6905	0.4764	3.7135	0.4684
Air quality regulation	3.6905	0.4764	3.7722	0.4463	3.7143	0.4531	3.7262	0.4733	3.7266	0.4621
Flood prevention	3.6786	0.5053	3.6222	0.5508	3.6190	0.5560	3.5774	0.5842	3.6243	0.5498
Education and research	3.5774	0.5739	3.5500	0.5816	3.5000	0.6093	3.5000	0.6191	3.5322	0.5956
Outdoor and recreation	3.5595	0.6353	3.3743	0.6866	3.3333	0.6716	3.3571	0.6771	3.4035	0.6744
Inspiration for culture and arts	3.5119	0.6473	3.3333	0.6601	3.3095	0.6652	3.3095	0.7255	3.3655	0.6787
Non-use values										
Ecological value	3.6667	0.4853	3.6000	0.5025	3.7143	0.4531	3.5714	0.5083	3.6374	0.4901
Bequest value	3.6250	0.5096	3.6722	0.4707	3.7202	0.4502	3.5655	0.5207	3.6462	0.4906
Existence value	3.3869	0.6086	3.3333	0.5790	3.2381	0.5711	3.4464	0.5445	3.3509	0.5800
Option value	3.3690	0.6244	3.1444	0.6860	3.1369	0.6374	3.2262	0.6720	3.2178	0.6611
Moral value	3.3333	0.6627	3.2222	0.6031	3.1488	0.6624	3.2976	0.6050	3.2500	0.6360
Altruist value	3.5417	0.5878	3.4944	0.5124	3.4107	0.5508	3.4821	0.5469	3.4825	0.5502

forest park (83.92%). Only 50 (7.31%) students claimed to have membership in an environmental organization. Lastly, the respondents of this study were pursuing Science courses (n = 184, 26.90%), Engineering courses (n = 141, 20.61%), Management courses (n = 102, 14.91%), Technology courses (n = 83, 12.13%), Arts courses (n = 70, 10.23%) and other courses (n = 104, 15.20%).

3.2. Perceived importance value of the ES of AFP

The perception of the college students to the importance value of the regulating and cultural ES is shown in Table 3 and Fig. 5. The students of AdU perceived that the most important urban forest ES was climate and temperature regulation (mean = 3.756, SD = 0.4445) and second was air quality regulation (mean = 3.6905, SD = 0.4764) but the mean difference was not significant (t = -1.09, adj. p = 0.887). The students perceived that the least important ES was inspiration for culture and art (mean = 3.5119, SD = 0.6473) but was not significantly different to flood prevention (mean = 3.6786, SD = 0.5053), education and research (mean = 3.5774, SD = 0.5739) and outdoor recreation (mean = 3.5595, SD = 0.6353). For TUP students the most important ES was air quality regulation (mean = 3.7722, SD = 0.4463) but the mean was not significantly different to climate and temperature regulation (mean = 3.6833, SD = 0.4898) and flood prevention (mean = 3.6222, SD = 0.5508). The least important ES was inspiration for culture and art (mean = 3.3333, SD = 0.6601) but was not significantly different to outdoor recreation (mean = 3.3743, SD = 0.6866). For the students of PNU the most important ES was climate and temperature regulation (mean = 3.7262, SD = 0.4604) but was not significantly different to air quality regulation (mean = 3.7143, SD = 0.4531) and flood prevention (mean = 3.6190, SD = 0.5560). The least important ES was inspiration for culture and art (mean = 3.3095, SD = 0.6652) but the mean difference was not significant to outdoor recreation (mean = 3.3333, SD = 0.6716). Lastly, the students of UDM perceived that the most important ES was air quality regulation (mean = 3.7262, SD = 0.4733) but was not significantly different to climate and temperature regulation (mean = 3.6905, SD = 0.4764) and flood prevention (mean = 3.5774, SD = 0.5842). The least important ES was inspiration for culture and art

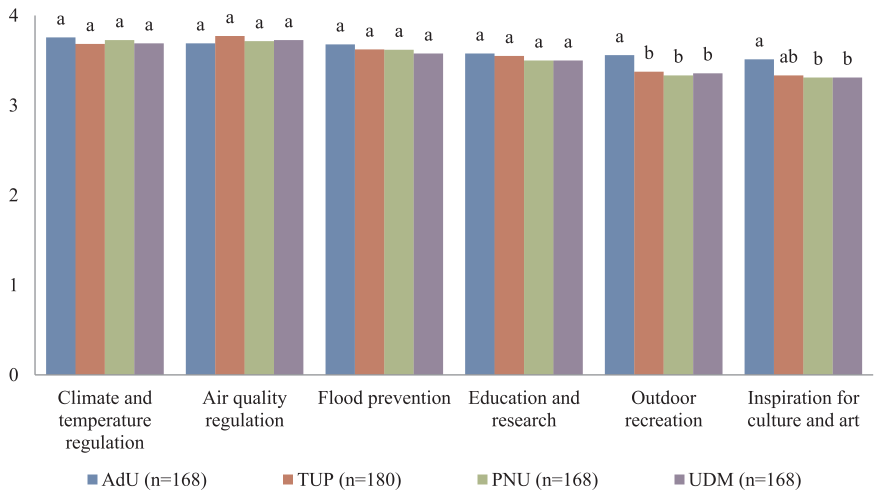

Fig. 5. Importance value of regulating and cultural ES of AFP as perceived by the students grouped according to specific ES. For each group, bars that do not share a letter are significantly different based on Tukey pairwise comparison.

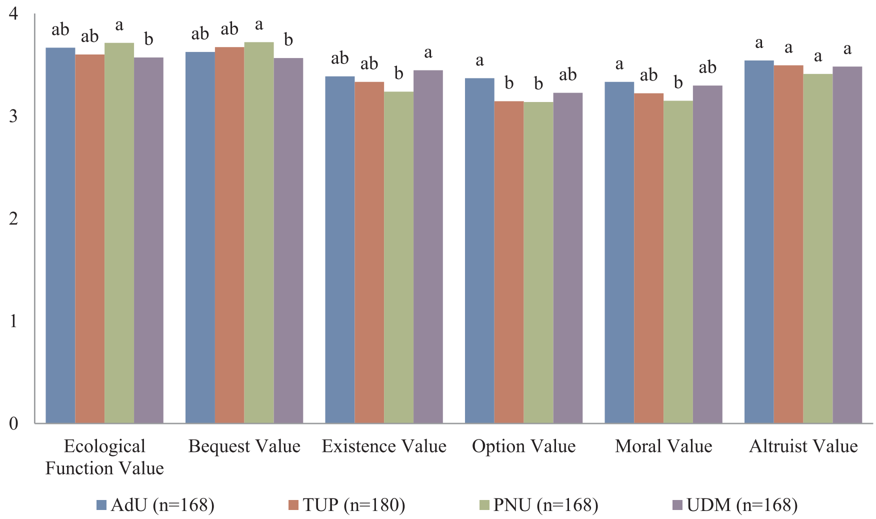

Fig. 6. Attitude of students to the non-use values of AFP grouped according to specific non-use value. For each group, bars that do not share a letter are significantly different based on Tukey pairwise comparison.

(mean = 3.3095, SD = 0.7255) but was not significantly different to outdoor recreation (mean = 3.3571, SD = 0.6771).

For all students the importance of the forest park ES is ranked in the following order: air quality regulation (mean = 3.7266, SD = 0.4621) > climate and temperature regulation (mean = 3.7135, SD = 0.4684) > flood prevention (mean = 3.6243, SD = 0.5498) > education and research (mean = 3.5322, SD = 0.6727) > outdoor recreation (mean = 3.4035, SD = 0.6744) > inspiration for culture and art (SD = 0.6787 to SD = 0.5956). Looking at the SD the perception of students to air quality regulation (most important) has the least scattering while perception to culture and art (least important) is more variable. Tukey pairwise comparison showed that the following means were not significantly different: air quality regulation and climate and temperature regulation (t = 0.42, adjusted p = 0.998), and inspiration for culture and arts and outdoor recreation (t = -1.22, adjusted p = 0.829). On the other hand, significant mean difference was only observed in the two ES: inspiration for culture and art (UDM and AdU: t = -2.78, adj. p = 0.028, TUP and AdU: t = -2.61, adj. p = 0.044, PNU and AdU: t = -3.10, adj. p = 0.010) and outdoor recreation (AdU and UDM: t = -2.75, adj. p = 0.031, AdU and TUP: t = -2.75, adj. p = 0.031) (Fig. 6).

For all female and male students the most widely perceived and the most highly valued ES was air quality regulation and the least important was inspiration for culture and art. The mean difference to flood prevention (t = 2.60, df = 682, p = 0.009) was significant while others were not significant ($p > 0.05$). The female and male students of AdU perceived climate and temperature regulation (female: mean = 3.7317, SD = 0.4727; male: mean = 3.7791, SD = 0.4173) and flood prevention (female: mean = 3.7317, SD = 0.4727) as the most important and inspiration for culture and art as the least important (female: mean = 3.5122, SD = 0.6712; male: mean = 3.5116, SD = 0.6277). TUP students perceived that the most important ES was air quality regulation (female: mean = 3.7531, SD = 0.4618; male: 3.7879, SD = 0.4350) and the least important was inspiration for culture and art (female: mean = 3.4198, SD = 0.5446; male: mean = 3.2626, SD = 0.7366). PNU students perceived climate and temperature regulation (female: mean = 3.7387, SD = 0.4615) and air quality regulation (male: mean = 3.7193, SD = 0.4533) as the most important while inspiration for culture and art (female: mean = 3.3243, SD = 0.6764; male: mean = 3.2807, SD = 0.6479) as the least important. Lastly, UDM students ranked air quality regulation (female: mean = 3.7606, SD = 0.4918; male: mean = 3.7010, SD = 0.4602) as the most important while inspiration for culture and art (female: mean = 3.3380, SD = 0.7357; male: mean = 3.2887, SD = 0.7211) as the least important (Table 4).

Correlation analysis of the importance value of the ES showed weak to moderate (r = 0.198–0.653) but highly significant positive correlation ($p < 0.001$). Highest correlation coefficients were observed between outdoor recreation and inspiration for culture and art (r = 0.653) and education and research and inspiration for culture and art (r = 0.500).

3.3. Attitude to the non-use values of AFP

The perception of the college students to the non-use values of the forest park is shown in Table 3 and Fig. 6. In general high level of agreement for the preservation of AFP was observed for bequest value (TUP and PNU students) and ecological function value (AdU and UDM students) while low level of agreement was noted for option value (TUP, PNU, UDM students) and moral value (AdU students). For all students highest level of agreement was observed for bequest value (mean = 3.6462, SD = 0.4906) while lowest level of agreement was noted for option value (mean = 3.2178, SD = 0.6611). The attitude of female students (mean = 3.45315) was higher than male students (mean = 3.4081). Comparison of the perception of female and male students showed significant mean difference in ecological function value (t = 1.73, df = 682, p = 0.084) at 0.10 level only while no significant mean difference was observed for non-use values ($p > 0.05$) (Table 4).

Pearson correlation showed highly significant ($p < 0.001$) weak to moderate positive correlation (r = 0.202 to 0.543). Highest

Table 4
Perception of female and male students to the ES and non-use values of AFP.

Ecosystem services	**Female (n = 345)**					**Male (n = 339)**				
	AdU (n = 82)	**TUP (n = 81)**	**PNU (n = 111)**	**UDM (n = 71)**	**All (n = 339)**	**AdU (n = 86)**	**TUP (99)**	**PNU (n = 57)**	**UDM (n = 97)**	**All (n = 345)**
Climate and temperature regulation	3.7317 (0.4727)	3.6420 (0.4824)	3.7387 (0.4615)	3.7465 (0.4381)	3.7159 (0.4643)	3.7791 (0.4173)	3.7172 (0.4957)	3.7018 (0.4616)	3.6495 (0.5009)	3.7109 (0.4732)
Air quality regulation	3.7195 (0.4785)	3.7531 (0.4618)	3.7117 (0.4550)	3.7606 (0.4918)	3.7333 (0.4684)	3.6628 (0.4755)	3.7879 (0.4350)	3.7193 (0.4533)	3.7010 (0.4602)	3.7198 (0.4563)
Flood prevention	3.7317 (0.4727)	3.6667 (0.5000)	3.6937 (0.5008)	3.6056 (0.5472)	3.6783 (0.5037)	3.6279 (0.5324)	3.5859 (0.5892)	3.4737 (0.6298)	3.5567 (0.6118)	3.5693 (0.5887)
Education and research	3.5854 (0.5432)	3.6543 (0.5282)	3.5586 (0.5983)	3.4789 (0.6516)	3.5710 (0.5820)	3.5698 (0.6047)	3.4646 (0.6113)	3.3860 (0.6197)	3.5155 (0.5971)	3.4926 (0.6075)
Outdoor recreation	3.5976 (0.6057)	3.4691 (0.6342)	3.3423 (0.6808)	3.4225 (0.6689)	3.4464 (0.6498)	3.5233 (0.6638)	3.2929 (0.7179)	3.3158 (0.6589)	3.3093 (0.6825)	3.3569 (0.6919)
Inspiration for culture and art	3.5122 (0.6712)	3.4198 (0.5446)	3.3243 (0.6764)	3.3380 (0.7357)	3.3942 (0.6612)	3.5116 (0.6277)	3.2626 (0.7366)	3.2807 (0.6479)	3.2887 (0.7211)	3.3363 (0.6959)
Non-use values										
Ecological value	3.6951 (0.4891)	3.6543 (0.4786)	3.7297 (0.4461)	3.5634 (0.4995)	3.6696 (0.4772)	3.6395 (0.4830)	3.5556 (0.5195)	3.6842 (0.4690)	3.5773 (0.5171)	3.6047 (0.5016)
Bequest value	3.6341 (0.5332)	3.7160 (0.4537)	3.7387 (0.4413)	3.5352 (0.5023)	3.6667 (0.4842)	3.6163 (0.4891)	3.6364 (0.4835)	3.6842 (0.4690)	3.5876 (0.5353)	3.6254 (0.4968)
Existence value	3.4756 (0.6131)	3.3210 (0.6088)	3.2342 (0.5714)	3.4789 (0.5307)	3.3623 (0.5899)	3.3023 (0.5955)	3.3434 (0.5563)	3.2456 (0.5757)	3.4227 (0.5559)	3.3392 (0.5704)
Option value	3.4756 (0.5715)	3.2346 (0.6571)	3.1171 (0.6287)	3.1972 (0.6238)	3.2464 (0.6335)	3.2674 (0.6584)	3.0707 (0.7035)	3.1754 (0.6580)	3.2474 (0.7076)	3.1888 (0.6878)
Moral value	3.3780 (0.6600)	3.2469 (0.6231)	3.1351 (0.6394)	3.3239 (0.5800)	3.2580 (0.6335)	3.2907 (0.6663)	3.2020 (0.5887)	3.1754 (0.7102)	3.2784 (0.6249)	3.2419 (0.6394)
Altruist value	3.5732 (0.5672)	3.5556 (0.5000)	3.4054 (0.5457)	3.5775 (0.5254)	3.5159 (0.5396)	3.5116 (0.6086)	3.4444 (0.5195)	3.4211 (0.5653)	3.4124 (0.5544)	3.4484 (0.5596)

Note: Numbers inside parenthesis are standard deviation (SD).

correlation was observed for ecological function value and bequest value (r = 0.543) and option value and moral value (r = 0.504). The result suggests that the students' attitude toward the preservation of AFP was influenced by bequest value, ecological value, and altruism while the students were least motivated by the option value of the urban forest. As expected, option value was least favoured because there was money contribution involved in the survey. The result of this study is coherent with the result of Song, Lv, and Li (2015) that motivation of residents to conserve urban green spaces in Jinan China is mainly based on existence value and supplemented by option value and bequest value.

Table 5
Descriptive statistics of WTP amount.

	WTP amount (n = 684)					WTP > 0 amount (n = 478)				
	AdU (n = 168)	TUP (n = 180)	PNU (n = 168)	UDM (n = 168)	All students (n = 684)	AdU (n = 138)	TUP (n = 125)	PNU (n = 95)	UDM (n = 120)	All students (n = 478)
Mean	118.8	82.03	109.5	83.3	98.1	144.6	118.1	194	116.7	140.4
Median	75	37.50	25	50	50	100	75	50	75	75
Mode	0,100	0	50	0	0	100	100	50	25	25
Min	0	0	0	0	0	25	5	1	25	1
Max	1000	1000	10000	800	10000	1000	1000	10000	800	10000
CV	134.45	162.93	705.20	157.61	409.19	114.32	124.10	527.37	122.09	337.74
Skewness	2.94	3.38	12.73	2.89	22.13	2.84	3.03	9.62	2.55	18.99
Kurtosis	10.99	14.92	164	9.11	543.68	9.91	11.61	93.32	6.58	393.91
r[a]	0.216**	0.148*	-0.015	0.044	0.040	0.281*	0.096	-0.035	-0.031	0.030

[a] correlation coefficient (WTP and allowance).
** $p < 0.01$.
* $p < 0.05$.

3.4. Willingness to pay for forest park preservation

The descriptive statistics of the willingness to pay (WTP) for forest park preservation are presented in Table 5. Two WTP are shown in the table, WTP (including zero WTP) and WTP $_{>0}$ (excluding zero WTP). For WTP, the mean WTP of TUP and UDM students were relatively similar. The mean WTP of AdU and PNU students were above the mean WTP of 98.1 PhP (all students). The proportion of the students with WTP > 98.1 are as follows (in decreasing order): TUP (33.89%) > UDM (30.95%) > AdU (27.38%) > PNU (10.71%). Only the median WTP of AdU was above the median WTP of 50 PhP (all students). The proportion of the students with WTP > 50 are as follows (in decreasing order): TUP (50%) > AdU (45.24%) > PNU (41.07%) > UDM (36.90%). The coefficient of variation (CV) suggests that the WTP of AdU student was less variable compared to other WTP. The skewness and kurtosis of the WTP of AdU and UDM students were relatively similar. Comparison of the WTP of female and male students revealed that the mean WTP of male (mean = 115.6 PhP) was greater than female (mean = 80.90 PhP) and was above the mean WTP of 98.1. However the female WTP had smaller CV, skewness and kurtosis than male WTP. For WTP $_{>0}$, the mean WTP $_{>0}$ of TUP and UDM students were nearly equal. The mean WTP $_{>0}$ of AdU and PNU students were above the mean WTP $_{>0}$ of 140.4 PhP and only the median WTP $_{>0}$ of AdU was above the median WTP $_{>0}$ of 75 PhP. The skewness and kurtosis of the WTP $_{>0}$ of AdU and TUP students were also comparatively similar. Comparison of the WTP $_{>0}$ of female and male students revealed that the male mean WTP $_{>0}$ was above the mean WTP $_{>0}$ of 140.4 PhP. Female WTP $_{>0}$ was less variable than male WTP $_{>0}$.

The general trend was the students were willing to pay at a lower bid price (25 to 100 PhP) and at higher bid price fewer students were willing to pay. It was found in this study that natural log of positive WTP (lnWTP $_{>0}$) and natural log allowance (ln allowance) have significantly weak positive correlation (r = 0.193, p = 0.000). It is interesting to note that the WTP and allowance of AdU and TUP students have significantly weak positive correlation. The WTP and allowance of UDM are weakly positively correlated but not significant while the WTP and allowance of PNU students is negatively correlated but not significant.

Another noteworthy result is that despite the lower mean and median allowance of male students (male: mean = 193.01, median = 150; female: mean = 201.59, median = 200) the mean WTP of male (mean WTP = 115.6, mean WTP $_{>0}$ = 167.5) was higher than female (mean WTP = 80.90, mean WTP $_{>0}$ = 114.39). The result is comparable to the study of Chen and Qi (2018) suggesting that males were more willing to pay an urban forest park usage fee than females while in the study of Subade and Francisco (2014) women respondents have a higher tendency to say "no" to WTP for Tubbataha Reefs conservation.

3.5. Protest beliefs

Protest responses or zero WTP (WTP = 0) in this study accounted for 30.12% (n = 206) of all the 684 respondents (Table 6). A balanced proportion of protest response was noted between female (51.46%) and male students (48.54%) and between TUP (25.24%) and UDM students (23.79%). PNU students accounted highest protest respondents (35.92%). The protest belief 'economic reason' was the concern of 48.11% of female students, 42.31% of TUP students, 44.59% of PNU students, and 36.73% of UDM students. On the other hand the protest belief 'government responsibility' was the concern of 36% of male students, 34.69% of UDM students, and 48.39% of AdU.

A variety of reasons may explain protest responses for environmental preservation such as type of payment method, free riding attitude, socio-economic status, and level of knowledge, awareness, and attitude to the environmental issues and problems (Chen & Qi, 2018; Chen & Nakama, 2015; Lo & Lim, 2015; Song et al., 2015). In the study of Chen and Qi (2018) protest responses were grouped into true zero responses (responses about the negative attributes of the park) and protest zero response (refusal of the individual to pay due to economic, fairness, personal reason, and other reason). In this study the zero WTP refers to protest zero response. The rank order of protest beliefs of the students are as follows: 1. economic reason (f = 80 or 38.83%), 2. government responsibility (f = 67 or 32.52%), 3. free riding (f = 20 or 9.71%), 4. trust issue (f = 16 or 7.77%), 5. approach ineffective (f = 13 or 6.31%), and 6. unfairness (f = 5 or 2.43%). The first and second protest beliefs accounted for 71.36% of the protest response. The first protest belief 'economic reason' is not surprising because the students' capacity to pay is limited by their daily expenses such as transportation, foods, and expenditure for academic projects. Another possible reason is that students are not willing to pay because the expected benefit is low and they will not directly receive the benefits of park preservation. The second reason is a reflection of the

Table 6
Frequency and proportion of protest beliefs of the students.

Protest belief	AdU (n = 31)		TUP (n = 52)		PNU (n = 74)		UDM (n = 49)		All students (n = 206)			
									Female (n = 106)		Male (n = 100)	
	f	%	f	%	f	%	f	%	f	%	f	%
1. Economic reason	7	22.58	22	42.31	33	44.59	18	36.73	51	48.11	29	29
2. Unfairness	0	0	3	5.77	3	4.05	0	0	3	2.83	3	3
3. Approach ineffective	2	6.45	0	0	9	12.16	3	6.12	5	4.72	9	9
4. Trust issue	4	12.90	3	5.77	4	5.41	6	12.24	9	8.49	8	8
5. Free riding attitude	3	9.68	9	17.31	4	5.41	5	10.20	6	5.66	15	15
6. Government responsibility	15	48.39	15	28.85	21	28.38	17	34.69	32	30.19	36	36
Total	31	100	52	100	74	100	49	100	106	100	100	100

high expectation to the government and the preservation cost of the forest park should not be passed on to the people. The third reason is related to free riding attitude of the individual that preservation of the forest park will happen even without his or her money contribution. The other protest beliefs 'trust issue', 'approach ineffective' and 'unfairness' accounted for 16.50% of protest response.

3.6. Factors influencing WTP

The relationship of WTP (1 = yes, 0 = no) and the variables in Table 1 was initially assessed by correlation model. Result of correlation analysis showed weak but highly significant ($p \leq 0.001$) association of WTP and ER (r = 0.127), OV (r = 0.202), ExV (r = 0.128), MV (r = 0.173), and ALW (r = 0.140).

The WTP of the students was modelled by binary logistic regression (stepwise method) to model the relationship of the variables and WTP (Table 7). In all models the p-value of the regression chi-square (χ^2) are highly significant ($p < 0.001$). The VIF in all models are close to 1 indicative that multicollinearity is not a problem. The Pearson goodness-of-fit statistics have p-values greater than 0.05 indicating that there is insufficient evidence for lack-of-fit. The Logit model has relatively highest deviance R^2 (7.49%) and lowest Akaike Information Criterion (AIC) (790.29). On the basis of the statistics the Logit model seems to adequately fit the data. In this model six variables ($p < 0.05$) are significantly associated with WTP. The highly significant variables with positive coefficients are ALW (p = 0.000, coef = 0.3408, SE coef = 0.0961), OV (p = 0.001, coef = 0.332, SE coef = 0.101) and ER (p = 0.003, coef = 0.301, SE coef = 0.101). The other significant variables with positive coefficients are RES (p = 0.013) and MV (p = 0.023, coef = 0.229, SE coef = 0.101) while CA (p = 0.014, coef = -0.254, SE coef = 0.106) has a negative coefficient and also is the least variable relative to its mean. Positive coefficients indicate that predictor variables with high values are more likely to influence the WTP or the decision to support AFP preservation. For instance, the students with high daily allowance are more likely to have a higher WTP. On the contrary, negative coefficient of the variable CA and VST indicate that students perceiving low importance value to the cultural ES and low visitation frequency to AFP are less willing to pay for the forest park preservation.

To improve the Logit model the interaction effects among the variables were analyzed. The stepwise method with variable interactions yielded improved model. Based on the goodness-of-fit model indicators the WTP can be better explained by Model 4. In Model 4 all variables were included while in Model 5 the variables ER, CA, OV, MV, ALW, RES, and VST were fitted in the model. Model 4 detected 42 significant variables ($p < 0.05$) and all variables except MBR and ALW*MBR have large VIF (VIF > 10) suggestive of serious multicollinearity (Danao, 2013, p. 289). Model 5 detected 10 significant variables with VIF between 1.08 to 3.50. The highly significant variables were ALW (p = 0.000), OV*MV (p = 0.003), ER*ALW (p = 0.005), and OV*ALW (p = 0.008). As predicted by Model 4 the variables natural log allowance, air quality regulation ES, and option value of AFP have high significant relationship with WTP Fig. 7.

4. Discussion

A highly urbanized city is a stressful environment due to climate change impact, congestion, island heat effect, flood, pollution (including noise pollution), and disconnection from the natural environment. These urban environmental problems can trigger biophysical health problems and psychological disorders. The most vulnerable are the children, sick people, and urban poor sectors. For the students in particular, the negative impacts of urban environmental problems are discomfort, inconvenience, tardiness, frequent absences in school due to interruption of classes, low level of interest and motivation to attend classes, and poor academic performance.

Properly maintained urban trees and public green spaces ensure the sustainable supply of regulating and cultural ES which are important for the well-being of urban residents. Public urban green landscapes provide free recreational and relaxation experience to people with limited purchase power to nature relaxation. Urban green spaces are potential breeding areas of endemic and migrant birds (Vallejo, Aloy, & Ong, 2009) and native plants (Gonzales & Magnaye, 2017) and also enhance the real estate price of adjacent properties. Valuation studies of Nowak et al. (2014) revealed that in the year 2010, trees and forest in the coterminous United States removed 17.4 million tons of air pollutants which is equivalent to 6.8 billion US dollar health benefits while the total amount of pollution removed by trees in 86 Canadian cities in 2010 was 16,500 t with a human health value of 227.2 million dollars (Nowak et al., 2018). On the other hand studies suggest that frequent contact of the students with urban trees and green landscape enhances academic performance at the school level (Hodson & Sander, 2017) and facilitates learning (Sampaio, de la Fuente, Albuquerque, da Silva Souto, & Schiel, 2018) which are crucial for the students' academic success.

In this study the perception of the university students to the importance of the 6 ES of AFP and non-use values were determined. The perception of the students can be viewed as the reflection of the local environmental and social issues and can reveal their daily experiences and the actual impacts of local environmental problems to their lives. Perception pertaining to local issues could be useful for assessing misconceptions and factors that cannot be easily estimated by models. Furthermore, perceptions are likely to differ among people because it can be influenced by various socio-economic and socio-cultural dimensions (Lagbas & Habito, 2016; Parilla, Laude, de Guia, Espaldon, & Florece, 2016; Bertram et al. 2015; Manandhar, Pratoomchai, Ono, Kazama, & Komori, 2015). Investigating local perceptions and relating it with empirical data or factual data (Manandhar et al., 2015) and integrating social and ecological perspectives in environmental management will more likely lead to successful conservation initiatives (Parilla et al., 2016).

The ES of urban trees can be broadly categorized into direct and indirect services which are further classified into provisioning, regulation and maintenance, and cultural services. Many of these ES can be obtained freely. This study only included 6 ES of urban

Table 7
Significant variables associated with WTP (stepwise binary logistic regression, n = 684).

Variables	Model 1 (Logit, stepwise)			Model 2 (Gompit, stepwise)			Model 3 (Probit, stepwise)		
	χ^2	Coef	VIF	χ^2	Coef	VIF	χ^2	Coef	VIF
ER	9.00	0.301**	1.39	11.78	0.1975**	1.37	10.01	0.1898**	1.38
CA	6.01	-0.254*	1.47	6.65	-0.1569*	1.46	6.35	-0.1574*	1.47
OV	11.00	0.332**	1.32	7.40	0.1594**	1.44	10.10	0.1905**	1.35
MV	5.14	0.229*	1.31	4.68	0.1293*	1.41	5.17	0.1382*	1.34
ALW	13.35	0.3408***	1.06	14.14	0.1924***	1.06	13.26	0.1989***	1.06
RES (1 = yes)	6.23	0.453*	1.09	5.48	0.283*	1.04	6.24	0.269*	1.08
Deviance	774.29	p = 0.005 (df = 676)		779.33	p = 0.004 (df = 677)		774.92	p = 0.005 (df = 676)	
Pearson	692.57	p = 0.321 (df = 676)		687.82	p = 0.378 (df = 677)		691.81	p = 0.328 (df = 676)	
Hosmer-Lemeshow	10.26	p = 0.247 (df = 8)		5.83	p = 0.666 (df = 8)		8.50	p = 0.386 (df = 8)	
Regression χ^2	62.72	p = 0.000*** (df = 7)		57.69	p = 0.000*** (df = 6)		62.09	p = 0.000*** (df = 7)	
Deviance R^2		7.49%		6.89%			7.42%		
Deviance R^2 (adj)		6.66%		6.18%			6.58%		
AIC		790.29		793.33			790.92		

Variables	Model 4 (Logit, stepwise)		
	χ^2	p	VIF
AQ	7.23	-0.400**	2.08
OV	6.98	0.494**	3.22
ALW	13.05	0.463***	1.27
RES (1 = yes)	7.23	0.613**	1.27
MBR (1 = yes)	31.49	9.19***	34.78
Interaction effect			
CT*OR	12.21	0.515***	2.20
CT*CA	5.72	-0.343*	2.21
CT*AGE	9.75	0.404**	1.61
AQ*FP	14.12	-0.450***	1.64
ER*ALW	8.59	0.382**	1.35
CA*EcV	6.23	0.302*	1.50
EcV*ALW	8.06	0.395**	1.66
ExV*MV	6.24	0.309*	1.92
ExV*AV	4.80	0.247*	1.61
OV*MV	15.87	-0.478***	1.61
OV*ALW	11.32	-0.506**	1.82
OV*AGE	17.35	0.537***	1.60
AV*AGE	10.93	-0.511**	1.96
CT*VST	7.03	0.867**	1.47
FP*G	4.04	0.473*	2.87
CA*G	4.96	-0.527*	2.43
EcV*RES	4.19	0.496*	2.64
EcV*FMR	4.96	-0.582*	2.20
OV*RES	5.15	-0.619*	3.33
OV*MBR	16.74	-2.576***	2.59
MV* RES	6.10	0.696*	3.26
MV*FAM	6.87	-0.729**	2.72
ALW*MBR	23.55	7.61***	16.42
AGE*FAM	6.30	0.623*	2.17
AGE*MBR	7.95	-1.996**	2.73
G*VST	5.22	1.656*	2.54
G*MBR	9.55	-3.89**	4.28
VST*MBR	14.36	-6.02***	4.04
Deviance	587.43	p = 0.875 (df = 628)	
Pearson	625.29	p = 0.523 (df = 0.523)	
Hosmer-Lemeshow	10.26	p = 0.247 (df = 8)	
Regression χ^2	249.58	p = 0.000*** (df = 55)	
Deviance R^2		29.82%	
Deviance R^2 (adj)		23.25%	
AIC		699.43	

Model 5 (Logit, stepwise)			
Variables	χ^2	p	VIF
ER	5.52	0.264*	
CA	0.04	-0.027	1.59
OV	4.26	0.266*	2.42
MV	4.75	0.239*	1.47
ALW	18.32	0.439***	1.44
RES (1 = yes)	4.52	0.429*	1.13
VST (1 = yes)	5.44	-0.990*	3.07
Interaction effects			
ER*ALW	7.92	0.2566**	1.11
OV*MV	8.82	-0.2516**	1.08
OV*ALW	6.94	-0.261**	1.11
ER*VST (1 = yes)	2.97	0.441	1.29
CA*RES (1 = yes)	4.73	-0.404*	1.93
RES(1 = yes)*VST(1 = yes)	3.05	0.921	1.93
Deviance	742.68	p = 0.026 (df = 670)	
Pearson	674.35	p = 0.446 (df = 670)	
Hosmer-Lemeshow	6.57	p = 0.583 (df = 8)	
Regression χ^2	94.34	p = 0.000*** (df = 13)	
Deviance R^2		11.27%	
Deviance R^2 (adj)		9.27%	
AIC		770.68	

*** $p < 0.001$.
** $p < 0.01$.
* $p < 0.05$.

forest in valuation studies: climate and temperature regulation, air quality regulation, flood prevention, education and research, outdoor recreation, and inspiration for culture and art. Two well-known urban forest ES air quality maintenance (by removal of gaseous and particulate pollutants) and climate change mitigation (by carbon sequestration) are supported by empirical data and scientific studies. For instance, the study of Yli-Pelkonen et al. (2017b) revealed that ozone levels were significantly lower in tree-

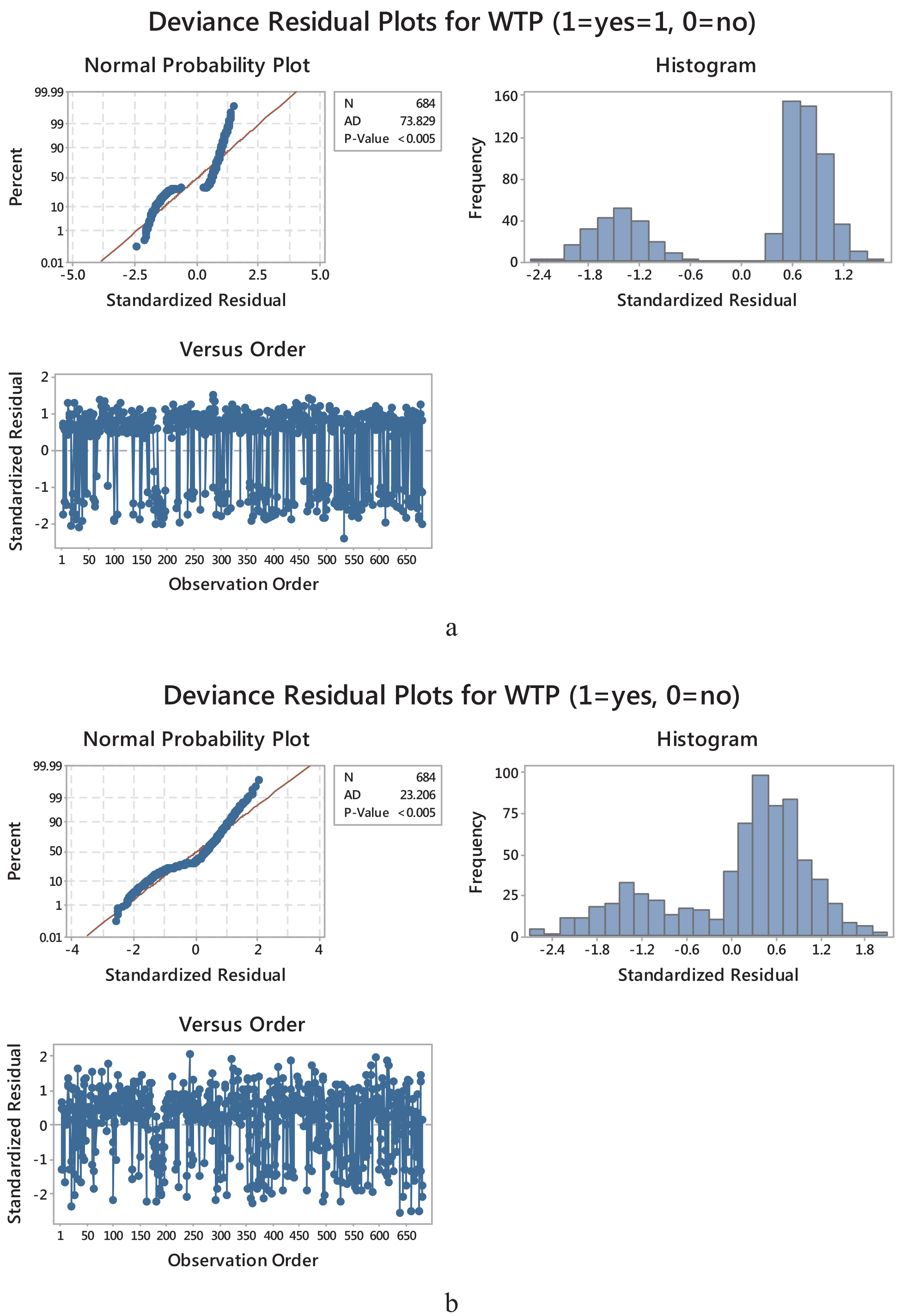

Fig. 7. Residual plots for (a) without interaction (Model 1, stepwise logit regression) and (b) with interaction of variables (Model 4, stepwise logit regression).

covered areas compared to open areas while in a similar study of the same author concluded that tree cover can significantly lower particle pollutant levels. Contrary to this, while urban vegetation is commonly cited for its potential for improving air quality through air filtering of airborne dust (Uni & Katra, 2017) and gaseous pollutants (Nowak et al. 2014; Yang, McBride, Zhou, & Sun, 2005) the effect on NO_2 is not significant and empirical evidence is limited (Yli-Pelkonen et al. 2017b; King et al., 2014). On the other hand, carbon dioxide sequestration by urban trees and vegetation has significant contribution to the global carbon cycle and is an adaptation strategy to lessen the impacts of climate change. The stored carbon in the biomass of urban trees can be estimated using

Fig. 8. Flood water at Kalaw Street and Taft Avenue Ermita Manila during monsoon rain enhanced by Tropical Depression 'Henry' (taken on July 17, 2018 by the author).

allometric regression models (Rutishauser et al., 2013; Chave et al., 2005).

The high appreciation of the students to the air quality regulation function of urban trees may be explained by their knowledge of the air quality of Metro Manila and their daily observation at the street level. In a study of Kecorius et al. (2017) the level of externally mixed refractory particles at street site in Manila is alarming that may subject the urban people to higher exposure to carcinogenic species. The significant sources of ultrafine particles are the public utility jeepneys, which are the most popular and among the cheapest transportation in the city. Furthermore a recent study concluded significant association between increased air pollution particulate matter ($PM_{2.5}$) exposure and the risk of diabetes (Bowe et al., 2018).

On the other hand the perception that climate and temperature regulation service of urban trees is highly important may be explained by the cool microclimate and tree shading provided by the trees along the streets and parks in Manila. The roadside trees in Ayala Boulevard and Taft Avenue where AdU, TUP, and PNU are located provide protection to the students against intense sunlight and also serve as temporary shelters of street vendors. Tree cover and shade provide protection by reducing the exposure to ultraviolet rays (Na, Heisler, Nowak, & Grant, 2014). During summer season the effect of urban island heat in Metro Manila is severe. Urban heat effect is primarily caused by the loss of vegetation cover, increases in built up cover, and may be exacerbated by climate change (Ichinose & Liu, 2018; Estoque, Murayama, & Myint, 2017; Santamouris 2015). From year 1989 to 2002 the mean land surface temperature in Manila increased from 25.0 °C to 33.5 °C (Pereira & Lopez, 2004). The impacts of heat island to urban people are increased energy consumption due to high demand for cooling systems, discomfort, heat stroke, dehydration, and heat-related problems (United States Environmental Protection Agency (USEPA), 2017).

The third most important urban trees ES perceived by the students is flood prevention. Flood events in Manila are frequent during the monsoon season (June to October) (Fig. 8). Monsoon can bring moderate to heavy rain and can be enhanced by tropical cyclone. Based on the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), the National Meteorological and Hydrological Services agency of the Philippines, about an average of 19 tropical cyclones entered the Philippine Area of Responsibility (PAR) from year 2008 to 2017. Historical photos during the 19th century revealed knee-deep floodwater in Manila which is an evidence that flooding is a feature of the city since the 19th century (Bankoff, 2003). Street flood is an annual problem in the City of Manila that is traditionally blamed to garbage clogged drainage and streams (Lagmay et al., 2017). The vulnerability of the city to flood has also been exacerbated by its below sea level topography and land subsidence which was strongly linked to severe extraction of groundwater (Bankoff, 2003). A study of Pornasdoro, Silva, Munarriz, Estepa, and Capaque (2014) estimated that in the year 2030, 57.5% and 15.2% of 897 total barangays in Manila will be high and very high flood risk, respectively. The negative impacts of flood to the students are poor attendance, disruption and frequent suspension of classes, health risk and diseases associated with exposure to unsanitary flood water (Cadag et al., 2017; Ardales, Espaldon, Lasco, Quimbo, & Zamora, 2016).

In this study the importance value of flood prevention ES of urban trees to female is significantly higher than male ($t = 2.60$, $df = 682$, $p = 0.009$). This result may reflect that more problems and inconvenience are frequently experienced by women (Reyes & Lu, 2017) during flood events like being stranded in flooded areas, difficulty in riding public transportation, and road hazards (uncovered manholes, open canal, live electrical wire) (Zoleta-Nantes, 2002).

Lastly, the least important ES are outdoor recreation (mean = 3.40) and inspiration for culture and art (mean = 3.37). The result is not surprising because majority of the students are non-users of the forest park. In the City of Manila the recreational parks frequently visited by the students and tourists are Rizal Park, Fort Santiago, and Paco Park which are maintained by the National Parks Development Committee. Rizal Park is an open access national park while Fort Santiago and Paco Park charge entrance fee. But unlike these parks AFP is not an open access park and the park management require permit to use the park for recreation and education purpose.

This study showed that income (in the form of students' allowance) and positive attitude on the regulating ES and non-use values significantly affect the WTP and is coherent with the other studies. The factors that significantly influence the WTP for urban forests, urban parks, and urban trees preservation and the relationship of the factors to WTP have been studied in other valuation studies. Among these factors are geographical location of residences, household income, education, and positive environmental attitude and awareness to local environmental issues for homestead tree conservation in Ryukyu Island Japan (Chen & Nakama, 2015), age and gender for culturally significant urban trees in Hong Kong (Lo & Lim, 2015), education, income, and frequency of visits for the conservation of green spaces in Jinan China (Song et al., 2015), income for the conservation of Mt. Malindang Range Natural Park in the Philippines (Ureta et al., 2016), age for WTP to enjoy an urban park within a medium-sized French conurbation (Sirina et al., 2017), and age and gender for a park usage fee to support the management and maintenance of an urban forest in Fuzhou City China (Chen & Qi, 2018). It is not unusual for the students and residents of a developing country to express low WTP for the preservation of natural resources because of relatively low income in which daily survival is their priority. Another explanation is the free rider problem attached to natural resources and public goods hence people are unwilling to give a conservation fee or user fee since the ES will still be provided to them freely and without financial obligation (Ahmed, Umali, Chong, Rull, & Garcia, 2007).

5. Conclusion

The social valuation result of this paper maybe used to raise the awareness of stakeholders, in particular the students about the importance of regulating and cultural ES of AFP and other urban green space in the context of urban environmental management and policy. Promotion of the ES of AFP and green spaces as critical component of the urban environment and allowing full public access to the forest park may enhance the WTP of students. The concept of ES could be perceived by the students as an abstract concept, hence making ES more visible and perceptible by treating ES as tradable goods or commodity may improve the attitude of the students and stakeholders to support urban greenification and green space preservation. Regarding the socio-economic benefits of preserving public urban forest parks is particularly important for elders, students, urban dwellers with stressful lifestyle, people with respiratory diseases and mental health problems, and low income groups who have limited opportunities to experience nature tourism. In a highly urbanized city where access to open space is limited by the privatization and commodification of land, public green spaces serves as venue that promote social integration and connectivity of the urban dwellers to the natural environment (Camps-Calvet, Langemeyer, Calvet-Mir, & Gomez-Baggethun, 2016).

The ES of AFP could be viewed by the students as free environmental goods primarily important for air quality maintenance, climate change mitigation, and regulation of urban island heat phenomenon. On the other hand, the students' high preference for regulating ES and non-use values maybe viewed as their demands for these environmental services. In contrast other stakeholders perceived the landscape as an unused high value commodity and that its economic value should be optimized. The case of AFP is similar to the case of Las Piñas-Parañaque Critical Habitat and Ecotourism Area, a Ramsar wetland of international importance in the adjacent city of Las Piñas and Parañaque City in the Philippines in which the surrounding area is influenced and shaped by economic, social, and political factors (de Leon & Kim, 2017). Considering the critical role of the ES of urban trees and green spaces to human well-being, AFP and other urban green spaces in Metro Manila deserve legal protection to ensure the sustainable flow of its ES.

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References

Ahmed, M., Umali, G. M., Chong, C. K., Rull, M. F., & Garcia, M. C. (2007). Valuing recreational and conservation benefits of coral reefs – The case of Bolinao, Philippines. *Ocean Coastal Management, 50*, 103–118. https://doi.org/10.1016/j.ocecoaman.2006.08.010.

Ancheta, A., Membrebe, Z., Santos, A., Valeroso, J., & Vizmanos, C. (2016). Sustainability of Forest Park as space break: A case study of Arroceros Forest Park in congested city of Manila. *OIDA International Journal of Sustainable Development, 9*(5), 63–81.

Ancheta, A. A., Membrebe, Z. O., Santos, A. J. G., & Valeroso, J. C. (2017). Institutional arrangements in managing an urban forest park: Arroceros Forest Park, Manila, Philippines. *Journal of Nature Studies, 16*(2), 14–23.

Ardales, G. Y., Jr., Espaldon, V. M. O., Lasco, R. D., Quimbo, M. A. T., & Zamora, O. B. (2016). Impacts of floods on public schools in the municipalities of Los Baños and Bay, Laguna, Philippines. *Journal of Nature Studies, 15*(1), 19–40. 〈http://www.journalofnaturestudies.org/files/JNS15-1/15(1)%2019-40%20Ardalesetal-fullpaper.pdf〉.

Bankoff, G. (2003). Vulnerability and flooding in Metro Manila. IIAS Newsletter. Retrieved 19 June 2018 from 〈https://iias.asia/sites/default/files/IIAS_NL31_11.pdf〉.

Bertram, C., & Rehdanz, K. (2015). Preferences for cultural urban ecosystem services: Comparing attitudes, perception, and use. *Ecosystem Services, 12*, 187–199. https://doi.org/10.1016/j.ecoser.2014.12.011.

Bowe, B., Xie, Y., Li, T., Yan, Y., Xian, H., & Al-Aly, Z. (2018). The 2016 global and national burden of diabetes mellitus attributable to PM2.5 air pollution. *Lancet*

Planet Health, 2, 301–312. (Retrieved 02 July 2018 from) ⟨https://www.thelancet.com/pdfs/journals/lanplh/PIIS2542-5196(18)30140-2.pdf⟩.

Cadag, J. R. D., Petal, M., Luna, E., Gaillard, J. C., Pambid, L., & Santos, G. V. (2017). Hidden disasters: Recurrent flooding impacts on educational continuity in the Philippines. *International Journal of Disaster Risk Reduction, 25*, 72–81. https://doi.org/10.1016/j.ijdrr.2017.07.016.

Camps-Calvet, M., Langemeyer, J., Calvet-Mir, L., & Gomez-Baggethun, E. (2016). Ecosystem services provided by urban gardens in Barcelona, Spain: Insights for policy and planning. *Environmental Science Policy, 62*, 14–23. https://doi.org/10.1016/j.envsci.2016.01.007.

Chave, J., Andalo, C., Brown, S., Cairns, M. A., Chambers, J. Q., Eamus, D., Folster, H., Fromard, F., Higuchi, N., Kira, T., Lescure, J. P., Nelson, B. W., Ogawa, H., Puig, H., Riera, B., & Yamakura, T. (2005). Tree allometry and improved estimation of carbon stocks and balance in tropical forests. *Oecologia, 145*, 87–99.

Chen, B., & Nakama, Y. (2015). Residents' preference and willingness to conserve homestead woodlands: Coastal villages in Okinawa Prefecture, Japan. *Urban Forestry Urban Greening, 14*, 919–931. https://doi.org/10.1016/j.ufug.2015.08.008.

Chen, B., & Qi, X. (2018). Protest response and contingent valuation of an urban forest park in Fuzhou City, China. *Urban Forestry Urban Greening, 29*, 68–76. https://doi.org/10.1016/j.ufug.2017.11.005.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature, 387* (doi: 253-260. 10.1038/387253a0).

Czembrowski, P., & Kronenbert, J. (2016). Hedonic pricing and different urban green space types and sizes: Insights into the discussion on valuing ecosystem services. *Landscape and Urban Planning, 146*, 11–19. https://doi.org/10.1016/j.landurbplan.2015.10.005.

Danao, R. A. (2013). *Introduction to statistics and econometrics* (Second Edition). Quezon City: The University of the Philippines Press.

de Groot, R., Brander, L., van der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L., Hussain, S., Kumar, P., McVittie, A., Portela, R., Rodriguez, L. C., ten Brink, P., & van Beukering, P. (2012). Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services, 1*, 50–61. https://doi.org/10.1016/j.ecoser.2012.07.005.

de Leon, R. C., & Kim, S. M. (2017). Stakeholder perceptions and governances challenges in urban protected area management: The case of the Las Piñas-Parañaque Critical Habitat and Ecotourism Area, Philippines. *Land Use Policy, 63*, 470–480. https://doi.org/10.1016/j.landusepol.2017.02.011.

Demographia (2018). Demographia world urban areas. In: *Proceedings of 14th annual edition*. Retrieved from ⟨http://www.demographia.com/db-worldua.pdf⟩.

Department of Environment and Natural Resources (DENR) (2007). Administrative Order No. 2007-01 Establishing the national list of threatened Philippine plants and their categories, and the list of other wildlife species. Retrieved from ⟨https://server2.denr.gov.ph/uploads/rmdd/dao-2007-01_200.pdf⟩.

Estoque, R. C., Murayama, Y., & Myint, S. W. (2017). Effects of landscape composition and pattern on land surface temperature: An urban heat island study in the megacities of Southeast Asia. *Science of the Total Environment, 577*, 349–359. https://doi.org/10.1016/j.scitotenv.2016.10.195.

Food and Agriculture Organization (FAO) (2016). Guidelines on urban and peri-urban forestry, by F. Salbitano, S. Borelli, M. Conigliaro and Y. Chen. FAO Forestry Paper No. 178. Retrieved 3 April 2018 from http://www.fao.org/3/a-i6210e.pdf.

Gonzales, L. P., & Magnaye, D. C. (2017). Measuring the urban biodiversity of green spaces in a highly urbanizing environment and its implications for human settlement resiliency planning: The case of Manila City, Philippines. *Procedia Environmental Sciences, 37*, 83–100. https://doi.org/10.1016/j.proenv.2017.03.024.

Hodson, C. B., & Sander, H. A. (2017). Green urban landscapes and school-level academic performance. *Landscape and Urban Planning, 160*, 16–27. https://doi.org/10.1016/j.landurbplan.2016.11.011.

Ichinose, T., & Liu, K. (2018). Modeling the relationship between the urban development and subsurface warming in seven Asian megacities. *Sustainable Cities and Society, 38*, 560–570. https://doi.org/10.1016/j.scs.2018.01.009.

Jim, C. Y., & Chen, W. Y. (2006). Impacts of urban environmental elements on residential housing prices in Guangzhou (China). *Landscape and Urban Planning, 78*, 422–434. https://doi.org/10.1016/j.landurbplan.2005.12.003.

Kecorius, S., Madueño, L., Vallar, E., Alas, H., Betito, G., Birmili, W., Cambaliza, M. O., Catipay, G., Gonzaga-Cayetano, M., Galvez, M. C., Lorenzo, G., Muller, T., Simpas, J. B., Tamayo, E. G., & Wiedensohler, A. (2017). Aerosol particle mixing state, refractory particle number size distributions and emission factors in a polluted urban environment: Case study of Metro Manila, Philippines. *Atmospheric Environment, 170*, 169–183. https://doi.org/10.1016/j.atmosenv.2017.09.037.

King, K. L., Johnson, S., Kheirbek, I., Lu, J. W. T., & Matte, T. (2014). Differences in magnitude and spatial distribution of urban forest pollution deposition rates, air pollution emissions, and ambient neighbourhood air quality in New York City. *Landscape and Urban Planning, 128*, 14–22. https://doi.org/10.1016/j.landurbplan.2014.04.009.

Lagbas, A. J., & Habito, C. Dl (2016). Ecosystem services of coastal and fisheries resources: Perspectives of high school students in municipality of Panukulan, Polillo Island, Quezon, Philippines. *Journal of Marine and Island Cultures, 5*, 145–158. https://doi.org/10.1016/j.imic.2016.09.005.

Lagmay, A. M., Mendoza, J., Cipriano, F., Delmendo, P. A., Lacsaman, M. N., Moises, M. A., Pellejera, N., Punay, K. N., Sabio, G., Santos, L., Serrano, J., Taniza, H. J., & Tingin, N. E. (2017). Street floods in metro manila and possible solutions. *Journal of Environmental Sciences, 59*, 39–47. https://doi.org/10.1016/j.jes.2017.03.004.

Liuag, N. (2003). A birder looks at the city. Retrieved on 13 December 2017 at ⟨http://www.birdwatch.ph/html/trip/trip20030111.html⟩.

Lo, A. Y., & Lim, C. Y. (2015). Protest response and willingness to pay for culturally significant urban trees: Implications for contingent valuation method. *Ecological Economics, 114*, 58–66.

Maleki, K., & Hosseini, S. M. (2011). Investigation of the effects of leaves, branches and canopies of trees on noise pollution reduction. *Annals of Environmental Science, 5*, 13–21.

Manandhar, S., Pratoomchai, W., Ono, K., Kazama, S., & Komori, D. (2015). Local people's perceptions of climate change and related hazards in mountainous areas of northern Thailand. *International Journal of Disaster Risk Reduction, 11*, 47–59. https://doi.org/10.1016/j.ijdrr.2014.11.002.

Mei, Y., Hite, D., & Sohngen, B. (2017). Demand for urban tree cover: A two-state hedonic price analysis in California. *Forest Policy and Economics, 83*, 29–35.

Membrebre, Z. O., Jr., Santos, A. J. G., Valeroso, J. C. C., & Ancheta, A. A. (2017). Urban forest park as eco-space for liveable city: Arroceros Forest Park, Manila, Philippines. *International Journal of Real Estate Studies, 11*(4), 23–34. http://www.utm.my/intrest/files/2017/09/03-URBAN-FOREST-PARK-AS-ECO-SPACE-FOR-LIVEABLE-CITY-ARROCEROS-FOREST-PARK-MANILA-PHILIPPINES.pdf.

Mendoza, L. A., Lagbas, A. J., & Buot, I. E., Jr. (2016). Conservation status of the plant species in selected areas with frequent human activities in Roosevelt Protected Landscape, Bataan, Luzon Island, Philippines. *The Thailand Natural History Museum Journal, 10*(2), 79–115. ⟨http://www.thnhmjournal.com/attachments/view/?attach_id=34789⟩.

Morley, I. (2018). Manila. Cities, 72, 17-33. ⟨http://dx.doi.org/10.1016/j.cities.2017.07.022⟩.

Munarriz, M. L. T., Perez, P. J. A., & Caguimbal, R. S. (2015). Urban renewal of the city of manila and its impact to environment and physical design: Where can we go from here? *Journal of Philippine Architecture and Allied Arts*. ⟨https://ovpaa.up.edu.ph/wp-content/uploads/2015/09/ESPASYO-6-full-download.pdf⟩.

Na, H. R., Heisler, G. M., Nowak, D. J., & Grant, R. H. (2014). Modeling of urban trees' effects on reducing human exposure to UV radiation in Seoul, Korea. *Urban Forestry Urban Greening, 13*, 785–792. https://doi.org/10.1016/j.ufug.2014.05.009.

Nowak, D. J., Hirabayashi, S., Doyle, M., McGovern, M., & Pasher, J. (2018). Air pollution removal by urban forests in Canada and its effect on air quality and human health. *Urban forestry Urban Greening, 29*, 40–48. https://doi.org/10.1016/j.ufug.2017.10.019.

Nowak, D. J., Hirabayashi, S., Bodine, A., & Greenfield, E. (2014). Tree and forest effects on air quality and human health in the United States. *Environmental Pollution, 193*, 119–129.

Parilla, R. B., Laude, R. P., de Guia, A. P., Espaldon, M. V. O., & Florece, L. M. (2016). Local communities' knowledge, attitude and perception toward Cebu black shama (Copsychus cebuensis Steere) and its habitat characteristics: Implications for conservation in Cebu island, Philippines. *Journal of Environmental Science and Management, 19*(2), 76–83.

Pereira, R. A., & Lopez, E. D. (2004). Characterizing the spatial pattern changes of urban heat islands in metro manila using remote sensing techniques. *Philippine Engineering Journal, 25*(1), 15–34.

Philippine Daily Inquirer (PDI) (2017). Manila's 'last lung'. Retrieved 24 May 2018 from ⟨http://opinion.inquirer.net/106588/manilas-last-lung⟩.

Philippine Native Plants Conservation Society, Inc., (PNPCSI) (2018). ⟨https://www.facebook.com/search/top/?Q=philippine%20native%20plants%20conservation%20society%2C%20inc⟩.

Pornasdoro, K. P., Silva, L. C., Munarriz, M. L. T., Estepa, B. A., & Capaque, C. A. (2014). Flood risk of metro manila barangays: A GIS based assessment using multi-criteria techniques. *Journal of Urban and Regional Planning, 1*(1), 51–72. (Retrieved on 18 April 2018 from) ⟨http://journals.upd.edu.ph/index.php/19May2014_ surp/article/view/4207/3817〉.

Reyes, D. D., & Lu, J. L. (2017). Gender dimensions and women's vulnerability in disaster situations: A case study of flood prone areas impacting women in Malabon City, Metro Manila. *Journal of International Women'States Studies, 18*(4), 69–88. (Retrieved 19 June 2018 from) 〈http://vc.bridgew.edu/cgi/viewcontent.cgi?article=1964&context=jiws〉.

Roces, A.J. (2005). Arroceros Forest Park should be preserved. Retrieved 24 May 2018 from 〈https://www.philstar.com/opinion/2005/04/21/274716/arroceros-forest-park-should-be-preserved〉.

Roces, A.J. (2007). The Arroceros Forest Park: Manila's last lung. Retrieved 14 June 2018 from 〈https://www.philstar.com/opinion/2007/11/08/26232/arroceros-forest-park-manilarsquos-last-lung〉.

Rutishauser, E., Noor'an, F., Laumonier, Y., Halperin, J., R., Hergoualc'h, K., & Verchot, L. (2013). Generic allometric models including height best estimate forest biomass and carbon stocks in Indonesia. *Forest Ecology and Management, 307*, 219–225. https://doi.org/10.1016/j.foreco.2013.07.013.

Samara, T., & Tsitson, T. (2011). The effects of vegetation on reducing traffic noise from a city ring road. *Noise Control Engineering Journal, 59*(1), 68–74 (Retrieved on 3 April 2018 from).

Sampaio, M. B., de la Fuente, M. F., Albuquerque, U. P., da Silva Souto, A., & Schiel, N. (2018). Contact with urban forests greatly enhances children's knowledge of faunal diversity. *Urban Forestry Urban Greening, 30*, 56–61. https://doi.org/10.1016/j.ufug.2018.01.006.

Santamouris, M. (2015). Analyzing the heat island magnitude and characteristics in one hundred Asian and Australian cities and regions. *Science of the Total Environment, 582-598*, 512–513.

Sirina, N., Hua, A., & Gobert, J. (2017). What factors influence the value of an urban park within a medium-sized French conurbation? *Urban Forestry & Urban Greening, 24*, 45–54. https://doi.org/10.1016/j.ufug.2017.03.021.

Song, X., Lv, X., & Li, C. (2015). Willingess and motivation of residents to pay for conservation of urban green spaces in Jinan, China. *Acta Ecologica Sinica, 35*, 89–94. https://doi.org/10.1016/j.chnaes.2015.06.003.

Subade, R. F., & Francisco, H. A. (2014). Do non-users value coral reefs? Economic valuation of conserving Tubbataha Reefs, Philippines. *Ecological Economics, 102*, 24–32.

The Economics of Ecosystems and Biodiversity (TEEB) (2010). Retrieved on 11 April 2018 from 〈http://doc.teebweb.org/wp-content/uploads/2013/04/D0-Chapter-5-The-economics-of-valuing-ecosystem-services-and-biodiversity.pdf〉.

Millennium Ecosystem Assessment (MEA) (2005). *Ecosystems and human well-being: Synthesis.* Washington, DC: Island Press. (Retrieved from) 〈https://www.millenniumassessment.org/documents/document.356.aspx.pdf〉.

Uni, D., & Katra, I. (2017). Airborne dust absorption by semi-arid forests reduces PM pollution in nearby urban environments. *Science of the Total Environment, 598*, 984–992. https://doi.org/10.1016/j.scitotenv.2017.04.162.

United States Environmental Protection Agency (USEPA) (2017). Heat island impacts. Retrieved 19 June 2018 from 〈https://www.epa.gov/heat-islands/heat-island-impacts〉.

Ureta, J. C. P., Lasco, R. D., Sajise, A. J. U., & Calderon, M. M. (2016). A ridge-to-reef ecosystem-based valuation approach to biodiversity conservation in Layawan Watershed, Misamis Occidental, Philippines. *Journal of Environmental Science and Management, 19*(2), 64–75.

Vallejo, B. M., Jr., Aloy, A. B., & Ong, P. S. (2009). The distribution, abundance and diversity of birds in Manila's last greenspaces. *Landscape and Urban Planning, 89*, 75–85. https://doi.org/10.1016/j.landurbplan.2008.10.013.

Votsis, A. (2017). Planning for green infrastructure: The spatial effects of parks, forests, and fields on Helsinki's apartment prices. *Ecological Economics, 132*, 279–289. https://doi.org/10.1016/j.ecolecon.2016.09.029.

Yang, J., McBride, J., Zhou, J., & Sun, Z. (2005). The urban forest in Beijing and its role in air pollution reduction. *Urban Forestry and Urban Greening, 3*, 65–78. https://doi.org/10.1016/j.ufug.2004.09.001.

Yli-Pelkonen, V., Scott, A. A., Viippola, V., & Setala, H. (2017a). Trees in urban parks and forests reduce O_3, but not NO_2 concentrations in Baltimore, MD, USA. *Atmospheric Environment, 167*, 73–80. https://doi.org/10.1016/j.atmosenv.2017.08.020.

Yli-Pelkonen, V., Setala, H., & Viippola, V. (2017b). Urban forests near roads do not reduce gaseous pollutant concentrations but have an impact on particle levels. *Landscape and Urban Planning, 158*(39), 47. https://doi.org/10.1016/j.landurbplan.2016.09.014.

Zoleta-Nantes, D. B. (2002). Differential impacts of flood hazards among the street children, the urban poor and residents of wealthy neighbourhoods in Metro Manila, Philippines. *Mitigation and Adaptation Strategies for Global Change, 7*, 239–266. (Retrieved 19 June 2018 from) 〈https://crawford.anu.edu.au/pdf/staff/rmap/dzoletanantes/2002_climate_change_and_mitigation.pdf〉.