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Urban-rural divides in preferences for wetland conservation in Malaysia

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ABSTRACT

We examined the preferences for wetland conservation among urban and rural dwellers in Malaysia. A choice experiment using face-to-face interviews with urban and rural households was employed. Wetland conservation alternatives were described in terms of environmental protection zones, biodiversity protection, recreational services and flood. Each alternative was connected to a cost for the household, which was a reduction in subsidies for daily goods. Using a latent class model, we identified three groups with distinctly different preferences. The first group comprised mainly rural people with negative willingness to pay for conservation, while the second group included mostly urban people who favored wetland conservation and exhibited positive preference for wetland attributes. The third group was also consisted of mainly urban people who exhibited both negative and positive preferences toward different aspects of conservation. All three groups, however, asserted a strong preference for significant flood risk reduction. The results indicated potential conflicts over wetland conservation impacts and targets. Accordingly, the divide in preferences should be taken into account in policy-making, and the insights provided here may inform efforts to avoid conflict across the population.

1. Introduction

Wetlands provide many ecosystem services. However, many of these services are not traded in regular economic markets, and thus have no observable prices. This fact contributes to continued degradation of many wetlands and natural areas around the world. Moreover, competition for land uses and the societal demands for urbanization and development have exacerbated the pressures on wetlands (Koo et al., 2013; Lantz et al., 2013; Schleupner and Schneider, 2013). Quantitative information on the values of wetland conservation for all relevant stakeholders in wetland use and management is called for. It will enable resource managers and policy makers to ensure a sustainable wetland management and to account for the different interests of stakeholders. This study addresses the environmental valuation of wetland conservation through a case study in Malaysia, and specifically aim to highlight the differences in preferences and valuations across two important socio-demographic groups: urban and rural dwellers. Past studies analyzed differences in attitudes towards the environment and environmental protection between the urban and the rural populations (Badola et al., 2012; Bandara and Tisdell, 2003; Datta et al., 2012; Mbaiwa and Stronza, 2011). In general, the urban dwellers showed stronger support for nature conservation. However, in most cases, it was the rural people who had directly experienced the on-the-ground impact of a conservation project on a daily basis (Bandara and Tisdell, 2003). Residents in the rural area may depend on the access to and the use of natural resources for their livelihood, creating a risk of conflict between conservationists and the local communities (Fiallo and Jacobson, 1995; Mbaiwa and Stronza, 2011). This conflict of interest and the lack of economic compensation for losses associated with conservation and the often lower standard of living in rural areas may be causes for the negative preference and support for environmental conservation.

Several studies conducted in developed countries suggest that nature conservation tend to be favored more by people in the urban areas than by people in rural areas (Bergmann et al., 2008; Silva et al., 2017). However, there are limited accounts of similar investigations being conducted within the context of developing or emerging economies (Doherty et al., 2013). Furthermore, studies with the opposite findings also exist, e.g. Olive (2014) suggested that many urban residents are lacking in awareness on conserved and endangered species as compared to the rural people, likely due to less exposure to the issues. Crastes et al. (2014) found that urban people were willing to pay less than rural people in mitigating the risk of erosive runoff in a watershed in France, with the obvious explanation being susceptibility to

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benefits gained.

The differences in preferences between the urban and rural populations regarding the conservation of wetland areas are the focus of this study. This is of interest because the rural communities are likely the population most directly affected by any policy action, while the urban residents, because of their often larger numbers, are major stakeholders from the point of view of resource managers and policy makers. Thus, identifying any differences in urban and rural preferences for environmental protection, as well as understanding the source of these divergences, will inform decision-makers on the implications of alternative policies for wetland conservation and management. We employed a latent class choice model combined with socio-demographic information on the respondents to identify groups that share common preferences. We hypothesized that urban and rural respondents would differ significantly in their preferences to a degree where they form distinct classes in the latent class model.

In the next section, we briefly review the related studies, while in Section 3, we present the study design. We formulate the econometric specification applied for testing the hypotheses of this study in Section 4, followed by the demographic and parametric results and discussion in Section 5. Finally, we conclude our study in Section 6.

2. Literature reviews

2.1. Related environmental valuation studies in developing countries

Wetlands have frequently been viewed as unproductive areas, and converted to agriculture or industrial uses and their natural functions are often undervalued in decisions on use and conservation (Brander et al., 2013). Even though there is growing concerns about wetland conservation needs, they continue to degrade throughout the world (Chaikumbung et al., 2016; Turner et al., 2000). A better understanding of the economic value of wetlands' ecosystem services can provide a better basis for land use decisions (de Groot et al., 2012).

Also in developing countries, stated preference methods such as the contingent valuation (CV) and choice experiments (CE) are essential techniques to value the environment and ecosystem services (Whittington and Pagiola, 2012). Environmental valuation applications in many developing countries are generally still in need of methodological improvements (Bennett and Birol, 2010; Whittington and Pagiola, 2012). Some of example of studies that have applied the CV approach in the Asian region are Bann (1999); Guo et al. (2014); Jin et al. (2010); Nath et al. (2017); Rahim et al. (2012); Siew et al. (2015), Subade and Francisco (2014); Yacob et al. (2011); Aapplications of CE are less common in Malaysia and other South East Asian countries, though there are growing number of these, e.g. Barkmann et al. (2007); Do and Bennett (2009); Emang et al. (2017); Othman et al. (2004); Pek and Jamal (2011); Roessler et al. (2008); Suziana (2017) & Zhai and Suzuki (2008). Only a few of these CV and CE studies have focused wetlands, e.g. Bann (1999); Do and Bennett (2009); Othman et al. (2004); Siew et al. (2015) and Suziana (2017).

Bann (1999) focused on the value of the mangrove forest and its biodiversity in Malaysia. Using CV, the results demonstrated a lower value of willingness to pay (WTP) among Malaysian even though they showed positive attitude to preserve and conserve the wetlands. Othman et al. (2004) were the first in Southeast Asia's wetlands literature to apply the CE method to estimate the value of Matang's mangrove forest in Malaysia. The findings highlighted the flexibility of CE to evaluate both the marginal values of environmental attributes and the welfare impacts of an array of alternative management options.

Do and Bennett (2009) applied CE to estimate the value of wetland biodiversity in Cambodia. The WTP estimates in the study increased with income and education. They found local farmers were not willing to support wetland conservation because the benefits derived were not significant enough to compensate the loss of their access to the area. It illustrated the importance of accounting for local people's relationship with the different wetland ecosystem services.

This short review show, that several studies have applied the CV method and a growing number the CE method in developing countries. Incorporating socio demographic variables into stated preference studies will add more merit to the environmental valuation study and hence support benefit transfer (Chaikumbung et al., 2016).

Turning to studies of wetland conservation studies elsewhere, it has been stressed that wetlands provide numerous types of ecosystem services for humanity and assessing the relative values of these for various stakeholders is crucial (de Groot et al., 2012). A number of studies have investigated preferences for various aspects of wetland conservation or restoration, and have recovered respondents' potential welfare gains or losses from changes in a particular wetland's attributes. Biodiversity improvement and restoration have frequently been the focus of the economic valuation of wetlands and documented positive impacts on welfare across populations (Birol et al., 2006; Ndunda and Mungatana, 2013; Westerberg et al., 2010). Moreover, the use of wetlands for flood mitigation (Lantz et al., 2013) and recreational services enhancement (Lantz et al., 2013; Westerberg et al., 2010) has also been investigated. Finally, preserving or enlarging the area of wetland as such for protecting ecosystem services has been considered (Morrison et al., 1999; Westerberg et al., 2010). Beyond the mere valuation, psychometric data such as perceptions or beliefs, attitudes or values has proven to be important in understanding the latent factors underpinning choice behavior and stated environmental values (McFadden, 1986). Understanding the individuals' interests at stake in conservation efforts may enable the regulator to enhance public participation in the conservation process. For example, Greenland-Smith et al. (2016) investigated farmers' perceptions of wetland conservation projects and found that their perceptions and preferences varied with the type of wetland in focus. A study on Kilombero Valley showed that the local population indicated a high tendency to extract trees from the wetland area for personal gains rather than to support preservation efforts (Mombo et al., 2014). However, another part of the population placed higher values on the protection of the Kilombero Valley to protect the vegetation and safeguard water quality for the population. Any effort to achieve sustainable environment management are usually perceived as challenging when preferences differ across populations, and eliciting welfare effects across crucial stakeholder groups is instrumental for sustainable conservation measures (Badola et al., 2012).

2.2. Conflicts between urban and rural population over environmental services

The rural populations in wetlands like our case area are often engaged in livelihood activities such as excessive mangrove cutting, shrimp catching along riverbanks and aquaculture farm development, which may be at odds with mangrove conservation in their area (Datta et al., 2012). Unbalanced use of wetlands to support livelihood can harm its sustainability (Yu et al., 2018). Nevertheless, in a study of mangrove conservation in India, the rural people on the east coast of India were more willing to participate in mangrove restoration efforts than the urban people by the coast. However, this willingness was conditional on the protection program, which gives them privileges to enter the mangrove area without any restriction (Badola et al., 2012). In a wetland conservation case in Tanzania, the local rural population expressed a lower WTP for the conservation than the surrounding urban communities (Mombo et al., 2014). This reflected the welfare losses expected by the rural communities from restrictions on wood extraction for their livelihood. While in the case of wetlands conservation in Malaysia, a study by Nath et al. (2017), found that the local people who live adjacent the peat swamp forest were willingly to contribute to a conservation project and join the awareness program.

People in the rural areas in developing countries tend to be highly dependent directly or indirectly on the provisioning ecosystem services delivered by nature (e.g. food production in terms of crops, livestock, hunting and drinking water). However, they are also particularly vulnerable to changes in those services. In Bandara and Tisdell (2003), a majority of both urban and rural people showed positive attitudes towards nature conservation despite revealing differing attitudes in specific cases like elephant conservation. Elephant conservation in Sri Lanka was viewed negatively among the local farmers as a result of unfortunate experiences of property damages caused by elephant raids across their farm land. On the other hand, the same conservation was strongly supported by urban respondents, who are less impacted by elephant raids.

In the context of a developed country, Bergmann et al. (2008) studied urban and rural preferences on renewable energy development to promote diversifying employment in the countryside of Scotland. Since the project were to be constructed in the rural area, the rural residents showed their support for the project and were willing to pay an additional cost for every full-time job created. However, the urban dwellers had no significant preferences for creating new job opportunities in the countryside. Meanwhile the rural dwellers showed higher WTP for air pollution reduction and improving wildlife, as compared to the urban respondents. In contrast to this, Casado-Arzuaga et al. (2013) found that the urban dwellers had a higher tendency to contribute to ecosystem conservation than the rural dwellers. This was due to the periurban forest in focus providing recreational services to the urban population.

Understanding the differences in urban and rural preferences can be crucial for successful conservation measures targeting natural resources. Molina et al. (2016) recommended that emphasis should be to rural economic development as a way to reduce the gap between urban and rural dwellers' perception on environmental protection. A starting point was therefore analyzing the degree to which such differences exist (Fiallo and Jacobson, 1995).

3. Case area and survey methodology

3.1. The Setiu Wetlands

The Setiu Wetlands (SW) is located in the state of Terengganu in Malaysia, and surrounded by fishing villages and under the authority of District and Land Office of Setiu, Terengganu. The SW is recognized as an Environmentally Sensitive Area (ESA) Rank 1 under the Malaysian National Physical Plan, which protects the area to some degree. In 2009, about 1,000 ha of the wetland area were converted into aquaculture ponds to boost the local economy, and it was claimed that the conversion would not harm the ecological functions and biodiversity of the wetland. However, Nik Fuad Kamil (2008) stated that the ecosystem services provided by SW are not sustainably managed so as to keep contributing to the local economic well-being and avoid or reduce threats for ecosystem sustainability. Despite being known for its aquaculture industry, SW has enormous potential for ecotourism development due to its high aesthetic and cultural values (traditional fishing villages, mangrove and coastal forest, coastline, lagoons, and estuary). Amin and Hasan (2003) descibred how the SW is rich in biodiversity such as birds, turtles, terrapins, fireflies, and exotic reptiles. But due to continued degradation of water quality, conversion of mangrove forest into aquaculture ponds and the growing number of fish cages in lagoon and estuary areas, such biodiversity needs reassessment and protection measures. The ecosystem has, however, several functions apart from currently being a source of fish, aquaculture, and other products. We encompass some of these in our study focusing on the functions as a potential safe-harbor for biodiversity, the potential for increased recreational services from the area, the role of the mangrove forest and surrounding natural habitats for reducing storm water floods in the vicinity and backlands of the SW.

3.2. Definition of attributes and provision levels to be conserved in Setiu Wetland

The attributes used to describe the wetland conservation alternatives were selected from literature reviews and advice from Malaysian landscape planning experts, conservationists, and researchers working with the SW. The attributes and the questionnaire as such were further improved and validated in three different focus group interviews: the general public[1], villagers from the SW area, and the professionals involved in the physical planning and development of the SW. The attributes were specified to occur in three different levels, which represented an improvement over or an equivalence to the status quo (SQ). Attribute levels varied freely across the alternative options provided. The inclusion of SQ alternatives in choice sets are dependent on the application and should be evaluated by specific study cases (Breffle and Rowe, 2002). The inclusion of the SQ was obvious here as the outcome of no further conservation actions was a realistic alternative. Furthermore, allowing for an SQ likely reduced the respondents' cognitive burden or stress. Table 1 presents a summary of attributes[2] .

The environmental valuation literature is rich on research studying alternative payment vehicles including voluntary donations, entrance fees, utility charges, income taxes and property taxes. However, very few studies have evaluated alternative payment vehicles within the context of developing countries or emerging economies, where the tax systems and other institutions are typically much less developed, and the income tax systems may cover only a small part of the population. The payment vehicle selected for the present study was a subsidy reduction on daily consumer goods. This payment vehicle is new in the literature and was specifically developed for our case study. In a related paper on the choice of payment vehicles in Malaysia we found that subsidy reduction in consumer goods outperformed other income tax and donations (Hassan et al., 2017). Using donations as a payment vehicle is common developing county studies. However, this payment vehicle is prone to issues of biases especially free-riding. A common payment vehicle in environmental valuation is income tax, which usually has more favorable properties. However, in Malaysia and similar low to middle-income economies, large proportions of people do not pay income taxes, putting the validity of this payment vehicle into question. In Hassan et al. (2017) we showed that price sensitivity is higher and the unexplained variance smaller when using subsidy reductions as a payment vehicle compared to using donations or income taxes. We note that using subsidy reductions may improve the payment consequentiality compared to alternatives, thus enhancing the external validity of our study. For this reason, we only use the sample subjected to the subsidy payment vehicle for our study of urban and rural preferences for wetland conservation.

3.3. Experimental design

We developed the choice tasks using a D-efficient experimental design with Bayesian priors obtained from a pilot test with 68 respondents from the area around SW, who differed in their socio-economic status, were interviewed. The Ngene software was used to generate the final design (ChoiceMetrics, 2012). Each respondent evaluated 12 different choice sets, extracted from the Ngene design software, see the example in Fig. 1. Every set consisted of two

[1] A preliminary focus group held in Copenhagen. Participants in the discussion came from Malaysian families who live in Copenhagen (who left Malaysia not more than three years ago) with different background and socio-economic status. None of them from the rural areas of Malaysia. The role of this first focus group was to evaluate clarity of the instrument and to allow us to test some technical aspects.

[2] Before answering the questions, specific information about how the policies might differ regarding the levels of attributes were explained to respondents.

Table 1
Attributes and levels used in the survey (SQ indicates the current level of the attributes).

Attribute	Level	Description
Environmental Conditions (Buffer zone[a])	High	Up to 200 m buffer zone to protect the wetland habitat.
	Moderate	Up to 50 m buffer zone to protect the wetland habitat.
	Low (SQ)	No buffer zone to protect the wetland habitat and vegetation
Biodiversity	High	High population levels of several species in the area.
	Medium	A moderate population size and number of species in the area.
	Low (SQ)	A limited number of wetland species left in the area.
Recreational services	High	The recreation facilities are regularly maintained, and there are many possible recreational activities in the area.
	Medium	The recreation facilities are reasonably maintained, and there are a few different recreation activities in the area.
	Low (SQ)	The recreation facilities are not maintained, and there are only limited recreational activities in the area.
Flood Control	High (SQ)	Higher risk of a dangerous rise in water levels where evacuation of residents is needed, and property damages/ losses are large.
	Medium	Medium risk of storm flood water levels no residents evacuation is required, limited property damages and losses.
	Low	Low risk of storm flood water levels, no resident evacuation is needed and no serious property damages and losses.
Conservation cost per year and household (Ringgit Malaysia, RM[b])		0, 5, 10, 30, 90, 210, 400

[a] Buffer zone width for wetlands as suggested by Newtown (2012).
[b] At the time of data collection, the currency exchange was USD 1 = RM 3.20 (2014).

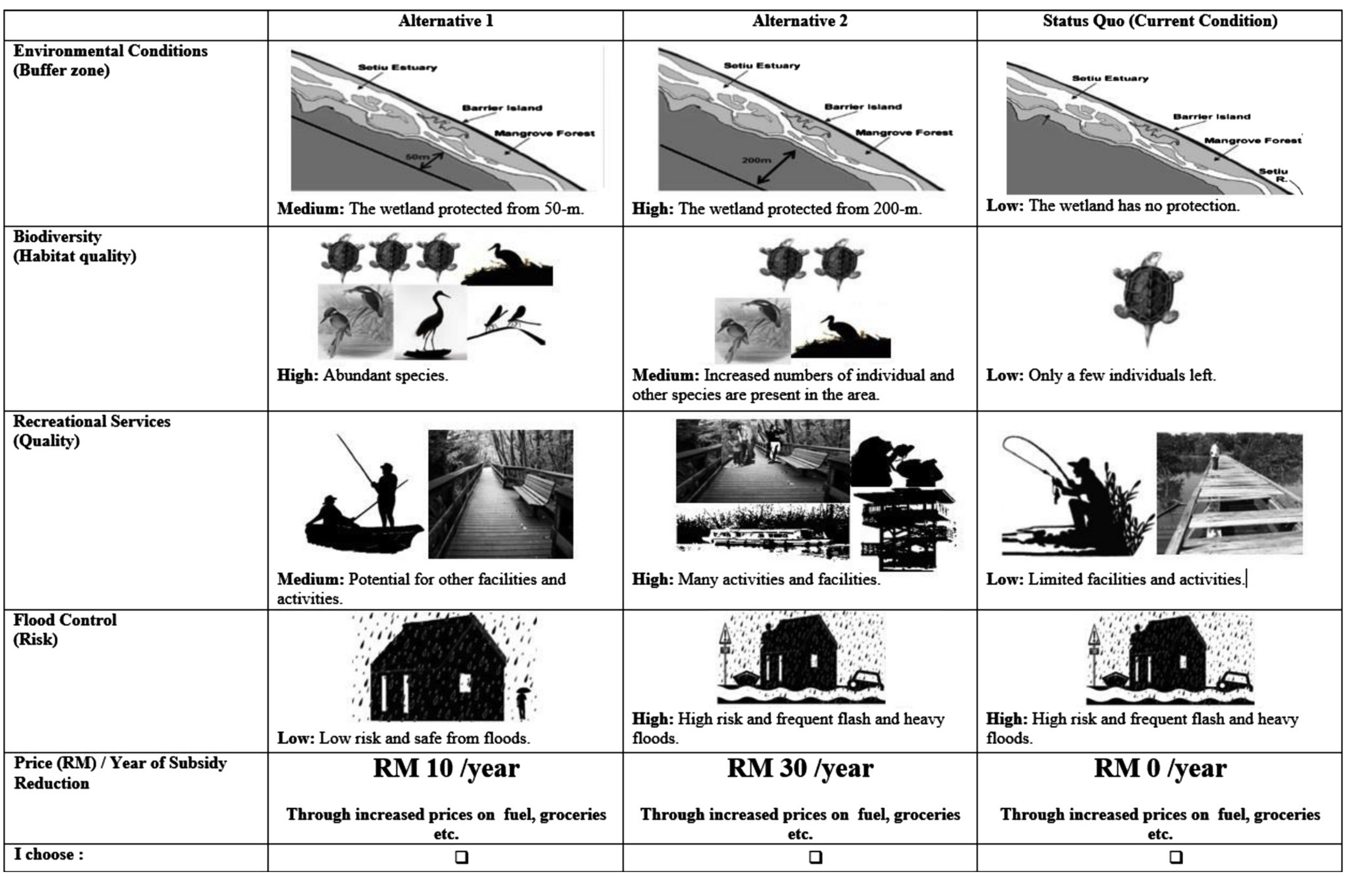

Fig. 1. An example of a choice task presented to respondent.

experimentally designed wetland management options, Alternative 1 and Alternative 2, with a SQ to represent the current management. The questionnaires also contained questions on demographic and socio-economic information, and attitudinal questions related to wetland conservation.

3.4. Data collection

A full-scale survey was carried out from July 2014 until September 2014 using face-to-face interview. The target population included households in both urban and rural households of the selected areas in the state of Terengganu, Malaysia where the SW is located. We selected ten areas: four urban areas (Kuala Terengganu, Bandar Permaisuri, Jerteh, Besut) and six rural areas (Mangkuk Village, Penarik Village, Fikri Village, Gong Batu Village, Saujana Village, and Pengkalan Gelap Village). We selected the four urban areas that were closest to the SW. The distances of these urban area from SW are 80 km (Kuala Terengganu), 22 km (Bandar Permaisuri), 35 km (Jerteh), and 31 km

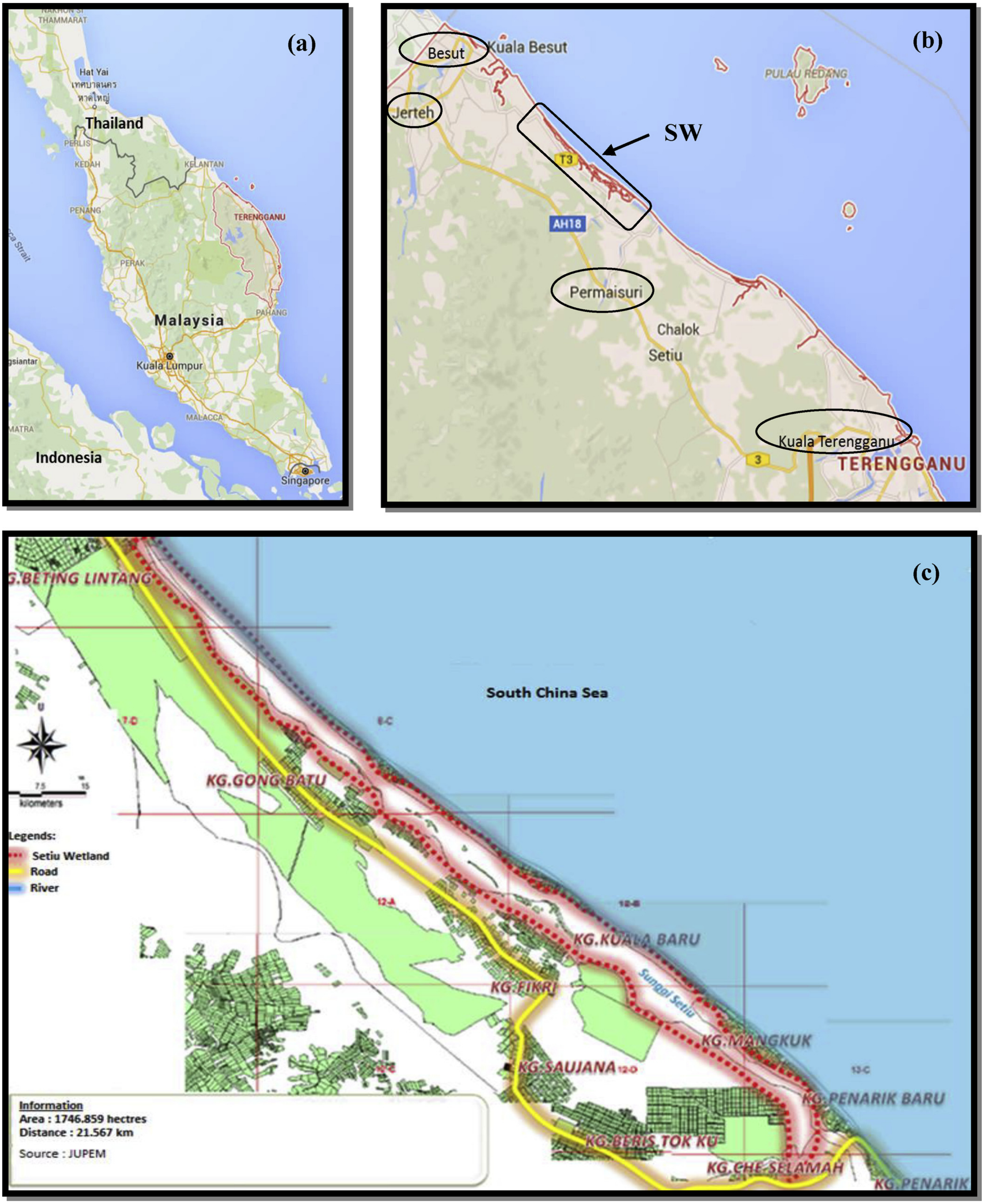

Fig. 2. Map of the case study. (a) Map of SW in Malaysia. (b) Map of the adjacent urban area to SW. (c) Map of adjacent villages to SW. (Source: Google map and the Department of Survey and Mapping Malaysia, JUPEM).

(Besut). The classification of the urban area was based on the value of the property and the availability of other modern facilities such as public schools, shopping centers, and recreational sites. Six rural areas were selected considering that all villages were adjacent with the distances about 2 km – 5 km each to the SW as mentioned in Nik Fuad Kamil (2008). Accessibility factors, time and cost constraints were also taken into account for the area selection. Fig. 2 shows the map of data collection areas. A systematic random sampling method was used to recruit respondents. In each area, a random starting point for the sampling was determined by the interviewer. A straight line was laid out across the chosen area from the starting point, and the households intersected by this line were approached for an interview.

In the rural area, a starting point typically placed at the first house closest to the main street in a rural village, and going along a line from there in the streets. In the rural villages, starting points and sample lines were often place with an interval of the 5–15 meters. While in the urban area, the sample starting points would be in e.g. a street in the housing areas, and again starting at the first house along a line following a routes or a street. If the household were unavailable or unwilling to participate, the interviewer would move on to the next house on the line assigned to them. We had no access to overall demographic statistics for the area in which the surveys were undertaken, and hence out of sample extrapolation of findings should be made with great caution. Thus, our findings first and foremost concerns preferences within the sample and across the specific spatial gradient it represented. Nevertheless, given the sampling technique and sample size of 403 respondents, we expect results also to reflect the preferences across the population in the sampled areas. The data were further analyzed using SPSS 22 for the demographic variables and Latent Class Gold 5.0 for the economic model estimate.

4. Econometrics specification

The stated preference choice experiment (CE) method relies on the Random Utility Model and theory proposed by McFadden (1974). The individual indirect utility function U_{ijt} for respondent i, who selects alternative j in a choice set t can be expressed as follows:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \tag{1}$$

The observed utility, V_{ijt} is a function of all attributes of the specific alternative and choice situation for an individual, while ε_{ijt} is a stochastic error term capturing unobserved effects. The deterministic part of utility, V_{ijt}, is described as a linear additive function with estimated parameters β of each attribute x'_{ij} Assuming that the error term ε_{ijt} is Gumbel-distributed, the probability that respondent i chooses alternative j among J alternatives in t choice task can be represented as:

$$\Pr_{ij} = \prod_{t=1}^{T} \left[\frac{\exp\,(\beta\, x'_{ij})}{\sum_{j=1}^{J} \exp\,(\beta\, x'_{ij})} \right] \tag{2}$$

Heterogeneity in preferences is well captured in a random parameter logit model (RPL), which also has the advantage of not being sensitive to the independence of irrelevant alternatives (IIA) assumption (Hensher et al., 2005). In this study, we estimated an RPL model as a benchmark model, and assume a normal distribution for all the main effect parameters, except for the price parameter that was set to be fixed. The maximum likelihood was simulated using 1000 draws. However while the model allowed for preference heterogeneity, it was not well suited to explain the underlying source of such preference heterogeneity (Boxall and Adamowicz, 2002). In many cases, the sources of heterogeneity are respondents' characteristics.

In order to investigate the sources of heterogeneity in our sample, we instead applied a latent class model (LCM) which was much more suited for this purpose. The analysis of choice behavior in the latent class model is able to combine the multi-attribute structure of the choice model with information on individual's characteristics to evaluate public preferences (Kassahun and Jacobsen, 2015; Milon and Scrogin, 2006). It assigns individuals to a finite number of underlying preference groups and estimate the components of the utility function of each separate group (Beharry-Borg and Scarpa, 2010; Greene and Hensher, 2003). Preferences are assumed relatively homogeneous within the segment, but substantially different across the classes. Following this latent class approach, we investigated and tested our hypotheses regarding urban and rural preferences on wetland conservation.

The probability that respondent i would choose alternative j is conditional on being in group k $\Pr_{ij|k}$ can be expressed as the product of two probabilities:

$$\Pr_{ij|k} = \sum_{k=1}^{K} \left(\frac{\exp(\alpha_k Z_i)}{\sum_{k=1}^{K} \exp(\alpha_k Z_i)} \prod_{t=1}^{T} \frac{\exp(\beta_k x'_{ij})}{\sum_{j=1}^{J} \exp(\beta_k x'_{ij})} \right) \tag{3}$$

The first term in brackets represents the probability of observing the individual membership in class k, where α_k is a class specific vector of parameters, and Z_i denotes the individual specific characteristics. The second bracket is the probability Eq. (2) conditional to class k. The errors are assumed to be independently distributed across individuals and groups with a Type I extreme value distribution. The discrete number of groups is not known initially. There are different approaches to identifying the number of classes, and most researchers have used statistical Information Criteria (ICs) to guide the selection of group numbers (Greene and Hensher, 2003; Milon and Scrogin, 2006; Nylund et al., 2007; Schuhmann et al., 2013). However, the analyst's judgment and common sense on the interpretation of parameters in the models also is an integral part of deciding upon the number of classes (Scarpa and Thiene, 2005). Finally, we estimated the average marginal WTP for each of the attributes.

Table 2
Socio-demographic variables.

	[a]Urban (N = 299) Mean / Percentage	Rural (N = 104) Mean / Percentage	χ^2
Age	36.21 (Min:19, Max:73)	43.5 (Min:20, Max:72)	71.18**
Number of individual in household	4 (Min:1, Max:10)	6 (Min:1, Max:16)	34.23***
Number of kids in household	2 (Min:0, Max:7)	2 (Min:0, Max:8)	23.42***
Gender			1.51
Male	47.8 %	54.8 %	
Female	52.2 %	45.20 %	
Income			17.30***
< RM12,000	37.5 %	59.6 %	
RM12,000 – RM24,000	34.8 %	25.0 %	
RM24,000 – RM36,000	13.7 %	10.6 %	
> RM36,000	14.0 %	4.8 %	
Employed			46.35***
Private/gov. servant	64.5 %	26.0 %	
Self-employed	35.5 %	74.0 %	
Level of Education			13.37***
School and below	58.9 %	78.8 %	
University and above	41.1 %	21.2 %	

Note: ***, **, * denote parameter is statistically different from zero at the 1%, 5%, and 10% significance levels, respectively.

[a] The data collection was undertaken with the help of trained research assistants under the instruction of the lead author. The assistants were instructed to randomly assign respondents to payment vehicle treatments. However, in the initial phase of the data collection, a couple of assistants misunderstood this instruction, which unfortunately led them to assign the treatments randomly. Despite the fact that this mistake was quickly identified and corrected, it did cause an imbalance in the sub-samples, as is evident from Table 2.

5. Results and discussion

5.1. Respondent characteristics

We compare the socio-demographic characteristics across the urban and rural residential areas in Table 2. 25.8% of the respondent lived in rural areas while 74.2% lived in urban areas. The chi-square tests indicated that there were significant differences in socio-demographic characteristics such as age, household size, gender, education level, income level, and employment status. The minimum size of a household was one adult, while the maximum was 10 and 16 members in the urban and rural household respectively. This is prevalent in Malaysia where some families have more than five children, and the adult children would normally live in the family home until they get married. The mean ages for the urban and rural respondents were 36 years and 44 years respectively, therefore indicating that the people who lived in the rural areas were on average older than the urban respondents. The urban respondents held higher education level as compared to the rural residents. A large number of rural respondents earned below the lowest income bracket per annum, which is RM 12,000 (60%) compared to only 38% in the urban area within the same income bracket. Fourteen percent of the urban residents were in the highest income bracket, in contrast to only five percent of the rural respondents. The considerable income differences between urban and rural reflects higher wages in the urban areas (Shi and Chuliang, 2010). There was no significant differences in gender across the urban and rural populations. Most of the respondents in the urban area were employed either in the government or in the private sector. On the other hand, a majority (74 percent) of rural respondents were fishermen, or owners of small-scale farms or businesses. In the area of wetlands in Malaysia most of local people were self-employed and earned a living from the ecosystem services in their proximity (Kamil, 2008; Ling et al., 2013; Mat Alipiah, 2010; Nath et al., 2017; Siew et al., 2015). The economic status and livelihood activities are greatly influenced by the socio cultural context and a majority are depending on the goods and services of the local nature resources (Franco and Luiselli, 2014).

5.2. Results of model estimations

5.2.1. Results of a random parameter logit model

First, we present the RPL estimates in Table 3. The results showed that the wetland attributes were highly significant except for the high-level environmental condition and both biodiversity levels. We noted that significant taste heterogeneity was found in all attributes. The parameter for the price was statistically significant and negative as expected. The SQ was significant and positive, implying that several of the respondents had positive preferences for maintaining the current situation of the wetland.

Table 3
Random parameter logit model with standard error in parenthesis.

Attributes	Mean		S.D	
Medium environment zone	−0.221**	(0.100)	0.998***	(0.120)
High environment zone	−0.043	(0.095)	0.759***	(0.185)
Medium biodiversity	−0.143	(0.117)	1.340***	(0.127)
High biodiversity	0.083	(0.139)	2.290***	(0.163)
Medium recreational	0.318***	(0.111)	1.550***	(0.139)
High recreational	−0.568***	(0.124)	1.290***	(0.151)
Low flood risk	0.620***	(0.162)	1.660***	(0.134)
Medium flood risk	0.704***	(0.115)	1.300***	(0.115)
Price	−0.010***	(0.000)	–	
SQ	0.493***	(0.090)	–	
Log-likelihood	−3590.996			
Pseudo-R^2	0.321			
Number of observation	4836			

Note: ***, **, *denote parameter is statistically different from zero at the 1%, 5%, and 10% significance levels, respectively.

Table 4
Number of classes and goodness-of-fit measure.

Number of Classes	Number of parameters	Log-likelihood (LL)	BIC(LL)	AIC(LL)	CAIC(LL)
1-Class Choice	10	−4630.69	9321.37	9281.38	9331.37
2-Class Choice	25	−3137.86	6425.68	6325.71	6450.68
3-Class Choice	40	−2785.81	5811.58	5651.63	5851.58
4-Class Choice	55	−2705.73	5741.41	5521.47	5796.41
5-Class Choice	70	−2650.31	5720.56	5440.63	5790.56
6-Class Choice	85	−2611.89	5733.69	5393.78	5818.69

Respondents on average had negative preferences for the medium level of environmental conditions relative to a low level. This negative utility may reflect some of the respondents who live within the wetland area, being concerned about losing their lands to the conservation project. The negative preference towards high recreational services could reflect a rejection of possible overcrowding to that area. As illustrated in the choice sets, the improvement of recreational services would increase the potential activities and visitors to the area, and again preferences for recreational activities may differ between the urban and rural populations. In studies such as Arnberger et al. (2010) and Doherty et al. (2013), the urban and rural respondents revealed different utility on recreational experience in the natural areas based on various types of activities and environmental resources.

To further understand and explore the systematics of the observed heterogeneity, we used latent class models to uncover different segment of respondents with similar preferences for the cost and levels of wetland improvements.

5.2.2. Latent class model

Statistical Innovation's Latent Gold Choice 5.0 was used for our data and model estimation (Vermunt and Magidson, 2013). To assess the model fit, we investigated several models with the socio-demographic data that was available. To meet our aim of the study and to be able to interpret our results on differences between urban and rural populations, we present results from a specification of three class model, cf. Eq. (3) above, based on a model including the choice attributes and the socio-demographic variables. Both information criterions, BIC and CAIC reached the minimum value in five classes (Table 4), however considering the small size of two of those classes and given the overall structure and our focus on resident area effects, a more meaningful choice was the three-class model.

Table 5 presents the LCM results. The first part of this table reports the utility function in mean coefficients of the respondent's preferences toward wetland conservation. The lower part of the table contains the parameter estimates for the socio-demographic variables included in the class membership function, cf. Eq. (3) above. Here we included as the first variable the respondents' residential area, which was our main focus. Preference differences between the rural and urban populations may exist for a number of reasons, including the differences in socio-demographics that lead to different contexts and concerns. Nevertheless, we also included a number of the additional socio-demographic variables that differed between the urban and rural populations, such as household income, employment status, and the number of children in the household. Income and education correlate strongly and hence only one of these, income, is included in the model. Gender did not differ across the urban and rural populations, carried no explanatory power and was dropped. Age competed strongly with the urban-rural dummy. As a result, we decided to keep the dummy while stressing that it includes the effects of omitted as well as unobserved differences across the two sub-samples. In the class membership function, the parameters for Group 1 were normalized to 0 for estimation, thus, Group 2 and Group 3 parameters were estimated as relative to Group 1. See

Table 5
Latent class model with standard error in parenthesis.

Choice model	Class1		Class2		Class3	
	(Rural, Self-employed)		(Urban, employed)		(Urban, employed)	
Medium environment zone	−0.710	(0.607)	0.067	(0.090)	0.184	(0.192)
High environment zone	−1.908**	(0.866)	−0.058	(0.089)	0.700***	(0.218)
Medium biodiversity	−0.992**	(0.463)	0.378***	(0.094)	−0.776**	(0.337)
High biodiversity	−0.673	(0.733)	0.411***	(0.083)	0.385*	(0.218)
Medium recreational	−1.940**	(0.882)	0.469***	(0.084)	−0.2924	(0.192)
High recreational	−1.915***	(0.708)	0.269***	(0.084)	−0.307	(0.215)
Low flood risk	2.234***	(0.832)	0.665***	(0.088)	1.429***	(0.209)
Medium flood risk	2.695***	(0.776)	0.580***	(0.084)	1.700***	(0.186)
Price	−0.006***	(0.002)	−0.003***	(0.000)	−0.025***	(0.002)
SQ	4.017***	(0.591)	−1.127***	(0.137)	−0.576***	(0.161)
Class membership						
Constant	–		−0.477	(0.296)	0.269	(0.269)
Resident area (Rural = 1, Urban = 0)	–		−0.721**	(0.305)	−0.745**	(0.311)
Employment status (employed = 1, self-employed = 0,)	–		0.632**	(0.288)	−0.406	(0.277)
Household income (Highest income range = 1, others = 0)	–		0.254	(0.357)	−0.606	(0.500)
Number of kids	–		0.016	(0.077)	−0.062	(0.084)
Model Statistics						
Class probability	0.39		0.33		0.28	
Log-likelihood	−2785.81					
Pseudo-R^2	0.583					
Number of observation	4836					

Note: ***, **, * denote parameter is statistically different from zero at the 1%, 5%, and 10% significance levels, respectively.

Appendices for the additional models with only resident area (Appendix A) as a class membership function, and the inclusion of age (Appendix B) to the present LCM. The model predicted that 39% of the respondents belonged to Class 1, followed by 33% for Class 2 and 28% for Class 3. In Class 1, the SQ parameter was highly significant and positive, which suggests that the respondents in this class tend to choose the current situation (status quo option) regardless of the levels of the attributes in the alternatives (Meyerhoff and Liebe, 2009). This would also suggest that the people in this class were generally opposed to the conservation plan for the wetlands, but they would have opted for reduced flood risk. Concerns for land being taken for the environmental buffer zone could have lead the respondents in Class 1 to reject the environmental improvement. The respondents who did not prefer this environmental attribute may be unaware of the value of wetland services or believe they are unlikely to benefit sufficiently from that attribute. However, respondents in this group were likely to be aware of the market values and benefits they could derive from the lands around the wetland area (Lantz et al., 2013). During the interviews, the respondents living in the rural areas mentioned that they felt challenged by the potential conservation efforts in the wetlands area, because they were earning supplementary income from the wetlands. A similar study by Bergmann et al. (2008) on a wind power project in rural areas found that the rural people would only support an environmental project if it benefited and improved their job opportunities.

The negative and significant SQ parameters in Class 2 and Class 3 suggest that the respondents in these classes were more likely to not select the status quo and hence preferred the wetland conservation improvements. Respondents in Class 2 showed positive and significant preferences in all the attributes and levels, except for the insignificant parameters of the environmental attribute, suggesting again that the view on the use of a buffer zone was less positive. Respondents in Class 3 held a mixture of preferences. They showed positive preference towards high level of improvement in biodiversity but negative utility on medium level of improvement. In developing countries, the lack of knowledge and awareness about the issues of protecting biodiversity can cause respondents to ignore or oppose conservation (Christie et al., 2012; Kenter et al., 2011), yet this does not explain well the counter-intuitive signs here. The group was the only one to favor a significant environmental conservation zone. Apart from this, flood avoidance is very important to this group. The bottom part of the attributes section presents the covariates of class membership. The parameters for the 'Rural' variable, suggested that the rural repondents were less likely to be in Class 2 and Class 3, and more likely in Class 1 instead. Thus, both Class 2 and Class 3 were more likely to include urban respondents. In terms of employment status, the respondents in Class 2 were most likely to be employed either in government or private sector compared to Class 1 respondents, which in contrast were more likely to be self-employed. Note that self-employment is twice as common in the rural areas, again underlining that this reflects a divide in preferences between the urban and rural populations. The household income and the number of children in the household were not significant for any classes. Based on the wetland attributes preferences and class memberships inspections, we therefore found that the Class 1 segment was more likely to contain rural people who were self-employed. They showed negative utility for all attributes improvement except for the risk of flood. Class 2 was most likely to be urban and employed people compared to Class 1. They showed significant preferences for all wetland attributes, except for the environmental protection zone attributes. Respondents in Class 3 were also most likely to be from among the urban dwellers like Class 2, yet not significantly different from Class 1 in terms of employment status, income, and the number of children in households.

Based on the LCM analysis, we found that the preferences for wetland attributes were highly heterogeneous across classes. This provided a richer understanding of the preferences for the SW conservation plans. Regardless of the variations in their preferences, the respondents showed positive and highly significant preferences for reducing the risk of flood. We also note the high increase in explanatory power of this model relative to RPL, as the adjusted pseudo-R-square increased from 0.321 to 0.583. Comparing the likelihood of LCM and RPL models with a log-likelihood (LR) test, we found that the null [-2(-3591 + 2785.81) = 1610.38] was rejected with a chi-square value 43.77 (df = 30) at 95% confidence level. Thus, the LR test showed that LCM provides a significantly better fit than the RPL model. We observed that the pattern across the three classes was significantly different. The main effect of the residential area was statistically significant across classes, therefore consistent with our main hypothesis about the differences in urban and rural dwellers' preferences. This suggests that the socio-demographic variable is an important factor to help in explaining and understanding the heterogeneity in preferences for wetland

Table 6
Marginal willingness to pay (standard errors in parenthesis).

Attributes	Class 1 (Rural, Self-employed)		Class 2 (Urban, employed)		Class 3 (Urban, employed)	
Medium environment	−119.93	(104.84)	20.58	(26.68)	7.25	(7.37)
High environment	−322.35*	(169.81)	−17.78	(28.27)	27.64***	(7.53)
Medium biodiversity	−167.61*	(98.90)	115.76***	(25.29)	−30.64**	(12.03)
High biodiversity	−113.69	(128.70)	125.88***	(27.10)	15.21	(9.31)
Medium recreational	−327.77*	(171.17)	143.41***	(28.71)	−11.54	(7.67)
High recreational	−323.47**	(133.34)	82.34***	(28.86)	−12.11	(8.93)
Low flood risk	377.47**	(160.64)	203.41***	(32.47)	56.40***	(10.02)
Medium flood risk	455.29**	(180.26)	177.55***	(38.10)	67.10***	(6.90)
SQ	678.74**	(243.28)	−344.97***	(62.64)	−22.72***	(6.20)

Note: ***, **, * denote parameter is statistically different from zero at the 1%, 5%, and 10% significance levels, respectively.

conservation. Similarly, it was examined by Sevenant and Antrop (2010) on how background characteristics of the respondents affect the probability of belonging to a latent preference class.

5.3. Willingness to pay for conserving Setiu Wetland

To evaluate the respondents' perceived value of conservation efforts in the SW, the LCM was used to compute the mean WTP for all attributes and their levels. The WTP is a measure of the respondents welfare change from the change in attribute level compared to status quo. The results are reported in Table 6. The results revealed differences in the average WTP for each class. When comparing the WTP across classes, we noted that the respondents, and especially those from the rural areas, revealed the highest WTP for reducing the risk of flood.

The respondents in Class 1, who were more to be based in rural areas and were self-employed, indicated significant and relatively large negative WTP for several changes in wetland attributes, and in particular we note a significant WTP for the status quo, i.e. to avoid changes. That said their WTP for lower risks of flooding was significant and large. Thus, the rural population’s WTP for a medium outcome would be negative -RM838 (US$ 262). This is because the respondents in this class believed that moving away from the current situation would have negative consequences on their welfare. Contrary to the welfare estimates, the respondents in Class 2, who were more likely be urban dwellers, were significantly positive towards wetland conservation improvements, and with a significantly negative WTP for the status quo, i.e. a reference for environmental change. Their WTP for a medium outcome would be RM782 (US$ 245). Several other studies in developed countries reported that urban dwellers expressed higher WTP for improvement in environmental services compared to rural dwellers (Abramson et al., 2011; Doherty et al., 2013; Mombo et al., 2014). The results suggest this may also be true in a developing and emerging economy as the on studied here. A study by Lamsal et al. (2015) showed that the community WTP for wetland conservation was lower than the general Malaysian’s WTP, which was NPR 378 (US$5.4) per annum. While in China, the WTP for especially biodiversity and mangrove area are almost similar to the urban Class 2 attribute WTP levels for this case study with the average of their study being US$ 45 to US$ 82 per annum (Tan et al., 2018). This can be compared with e.g. RM 115.76 (ca. US$ 36) for a medium biodiversity outcome in Class 2.

6. Concluding remarks

6.1. Urban and rural dwellers' perspectives on wetland conservation

The empirical analysis presented in this paper explores the preferences of urban and rural people over wetland conservation characteristics in SW, Malaysia. It was found that the urban and rural respondents differ significantly in their preferences toward various implications of enhanced wetland conservation, albeit with one exception: the reduction of risk of severe flooding.

The rural respondents exhibited negative preferences for many aspects of the wetland conservation, and preferred to maintain the current conditions rather than accepting the environmental improvement. The welfare measurement of the rural respondents suggested that they would actually need to be compensated instead of paying for wetland conservation so as not to experience a loss in welfare due to increased conservation. The important exception from this pattern was the preference for flood risk reduction, which was the most preferred choice for all classes of both urban and rural dwellers. In fact, the rural dwellers showed a higher WTP to reduce the risk of flooding than did urban dwellers. The urban respondents showed positive preference on most of the wetland attributes, and in particular those urban dwellers represented in Class 2, who are also more likely employees rather than self-employed, have a higher WTP for the conservation outcomes, bar the environmental protection zone. The third class of respondents as shown in Table 6, did not differ in terms of employment status from the likely rural dwellers in Class 1, yet were more likely comprised of urban dwellers than those in Class 1. This third class revealed a mixed set of preferences for wetland conservation outcomes. Most strikingly, they showed high sensitivity to the cost attribute compared to Class 1 and Class 2, and recorded the lowest WTP for the reduced flooding outcomes by a significant margin.

Our analysis demonstrated that the stated choice method can provide rich and useful information for environmental issues related to wetland conservation. The significant taste heterogeneity found for all attributes in RPL model are explained in the LCM model. The residential areas and the associated variations in socio-demographic contexts and variables are parts of the source of heterogeneity in the respondents’ preferences for wetland conservation.

6.2. Caveats and future works

For this study, it is crucial to highlight the caveats that require attention. Firstly, this study is based on a sample collected under field conditions across a spatial gradient surrounding the case area of the wetland conservation valuation experiment. The full statistics of household and their distribution in the urban and rural area of the region are unknown because they are unavailable to the public. According to reports in Nik Fuad Kamil (2008), about 3000 households resided in and near the wetlands, and thus we can conclude that our sample in the rural was only a fraction of this number, though not a trivial fraction. For that reason, we carried out a systematic random sampling method (refer to Section 3.3) to cover as many households as possible, and hopefully selected a representative sample for the population. However, we have no way of verifying this. Therefore, while conclusions of this paper is of course of relevance for the conservation of the SW, we do not know how far these can be extrapolated beyond the sample and case itself. Secondly, we found that the rural respondents showed negative preference towards most of the environmental attributes as compared to the urban respondents. The finding is of importance as exactly the urban-rural divide in preferences and support can cause problems for actual conservation efforts. However, to overcome the possible opposition from rural dwellers against holistic and beneficial conservation measures, a deeper understanding is needed. Hence, the underlying divergence between the segments should be further explored, such as the reason behind respondent's negative preferences, for example the improvements in biodiversity protection and recreational options. This would require other research approaches and public involvement processes in conservation management. Finally, we acknowledge that systematic difference in perceptions of attribute levels across the urban and rural populations may also contribute to uncertainty, which may be hard to eliminate.

We have applied a novel payment vehicle of our own design, reduction in subsidies, which evidence suggest works well compared to others. We acknowledge that among rural poor households other payment vehicles are sometimes used, e.g. willingness to contribute in terms of voluntary labor days or similar, as they have few means in terms of cash (Nath et al., 2017). However, such payment vehicles may also be susceptible to free riding and other issues like e.g. donation.

6.3. Policy implications

The findings of this paper can provide useful information for decision makers and may assist in formulating conservation policies for the SW. This article contributes to the literature by uncovering considerable preference heterogeneity across the respondents and showing that heterogeneity is strongly aligned with where people live. On average, the urban dwellers derived positive and significant values from enhanced conservation of the SW, whereas the rural dwellers were opposed to several wetland conservation outcomes, with flood risks being the only exception.

Since our rural samples consisted of fishermen and villagers who generated income through the wetlands, it seemed reasonable to expect that the level of rural support for conservation would be lower than the urban sample. This variation of urban and rural preference should be taken into consideration prior to designing any conservation actions in the area so as to closely monitor the welfare effects toward different stakeholders as well as to reduce conflict between conservationists and the local people. Our analysis reveals that while enhanced conservation of the SW may overall bring larger aggregate welfare gains across urban and rural populaitons, the distribution will be highly uneven. Rural dwellers may experience higher private costs than others, and supplementary policy instruments may be needed to ameliorate this and ensure a wider support for conservation.

While our finding is specific to the SW, the study nevertheless highlights an important policy issue in emerging economics. The rise in wealth and population in urban areas may increase the demands for environmental conservation, yet the implementation of conservation actions to meet that demand may have disproportionate costs for the rural population. However, the rural population's cooperation or acceptance can be crucial, particularly in cases where such significant groups live near or in the target areas, and derive their livelihood from those areas.

Declaration of interest

None.

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Appendix A

LCM estimate with only resident area in class membershipfunction.

Attributes	Class1		Class2		Class3	
Medium environment zone	−0.704	(0.595)	0.066	(0.090)	0.182	(0.192)
High environment zone	−1.904**	(0.851)	−0.062	(0.090)	0.706***	(0.226)
Medium biodiversity	−0.995**	(0.460)	0.377***	(0.095)	−0.784**	(0.343)
High biodiversity	−0.678	(0.729)	0.406***	(0.083)	0.396*	(0.218)
Medium recreational	−1.932**	(0.871)	0.469***	(0.085)	−0.297	(0.187)
High recreational	−1.903***	(0.688)	0.270***	(0.085)	−0.288	(0.216)
Low flood risk	2.221***	(0.815)	0.665***	(0.088)	1.424***	(0.205)
Medium flood risk	2.682***	(0.755)	0.579***	(0.084)	1.696***	(0.188)
Price	−0.006***	(0.002)	−0.003***	(0.000)	−0.025***	(0.002)
ASC	4.009***	(0.584)	−1.137***	(0.138)	−0.572***	(0.159)
Class membership						
Constant	–		0.077	(0.140)	−0.152	(0.149)
Resident area (Rural = 1, Urban = 0)	–		−0.946***	(0.288)	−0.598**	(0.285)
Model Statistics						
Class probability	0.39		0.33		0.28	
Log-likelihood	−2795.10					
Pseudo-R2	0.584					
Number of observation	4836					

Note: '***', '**', '*' denote parameter is statistically different from zero at the 1%, 5%, and 10% significance levels, respectively.

Appendix B

LCM estimate with inclusion of 'age' in class membership function.

Attributes	Class1		Class2		Class3	
Medium environment zone	−0.717	(0.612)	0.068	(0.089)	0.187	(0.191)
High environment zone	−1.939**	(0.869)	−0.060	(0.089)	0.713***	(0.217)
Medium biodiversity	−0.981**	(0.461)	0.379***	(0.094)	−0.790**	(0.336)
High biodiversity	−0.676	(0.747)	0.413***	(0.083)	0.380*	(0.217)
Medium recreational	−1.966**	(0.896)	0.469***	(0.084)	−0.299	(0.194)
High recreational	−1.919***	(0.703)	0.268***	(0.084)	−0.303	(0.213)
Low flood risk	2.273***	(0.846)	0.665***	(0.088)	1.427***	(0.209)
Medium flood risk	2.734***	(0.787)	0.581***	(0.084)	1.704***	(0.187)
Price	−0.006***	(0.002)	−0.003***	(0.000)	−0.025***	(0.002)
ASC	4.055***	(0.609)	−1.125***	(0.137)	−0.571***	(0.161)
Class membership						
Constant	–		0.851*	(0.519)	1.943***	(0.538)
Resident area (Rural = 1. Urban = 0)	–		−0.567*	(0.313)	−0.542*	(0.320)
Age	–		−0.032***	(0.011)	−0.042***	(0.012)
Employment status (employed = 1. self-employed = 0.)	–		0.455	(0.297)	−0.641**	(0.293)
Household income (Highest income range = 1. others = 0)	–		0.328	(0.363)	−0.519	(0.510)
Number of kids	–		0.015	(0.078)	−0.062	(0.086)
Model Statistics						
Class probability	0.39		0.33		0.28	
Log-likelihood	−2776.93					
Pseudo-R2	0.584					
Number of observation	4836					

Note: '***'. '**'. '*' denote parameter is statistically different from zero at the 1%. 5%. and 10% significance levels. Respectively.

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