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Economic valuation of climate change impacts on ecotourism in Rekawa coastal wetland in Sri Lanka: Application of stated preference techniques

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A dissertation for the degree of Philosophiae Doctor – January 2022

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List of Papers

Paper 1:

Dushani, S.N., Aanesen, M, & Vondolia, G.K. (2021). Balancing conservation goals and ecotourism development in coastal wetland management in Sri Lanka: A choice experiment. *Ocean and Coastal Management, 210, 105659*. https://doi.org/10.1016/j.ocecoaman.2021.105659

Paper 2:

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Paper 3:

Dushani, S.N. Aanesen, M. & Armstrong, C.W. Willingness to pay for the restoration of mangroves to reduce the impact of climate change on ecotourism in Rekawa coastal wetland of Southern Sri Lanka. Manuscript submitted for publication.

Summary

The research presented in this thesis has focused on the economic valuation of climate change impacts on ecotourism in a coastal wetland using three different methods of stated-preference techniques to provide answers to different research questions related to coastal tourism and climate change. Rekawa coastal wetland in Southern Sri Lanka was taken as the empirical context to examine the identified research questions.

The first issue studied in this thesis concerns the balance between conservation goals and the development of ecotourism in coastal wetland management. Our findings provide empirical evidence suggesting that ecotourism is not only an economically viable industry but also a good ecological policy instrument. This since economic benefits arising from ecotourism can be used for environmental protection and biodiversity conservation by ensuring habitat protection for a broad set of species. We have proved that well-managed sustainable tourism in and around coastal wetlands can bring important economic and ecological benefits.

The second research question attempts to provide a regional perspective on intended future visitation behavior of both domestic and foreign tourists to a coastal wetland under climate change impacts explained by a climate change induced environmental index based on IPCC scenarios. The climate change induced environmental index that we developed, was found to be a significant determinant of intended visitation behavior of tourists.

The final part of the research refers to tourists' preferences and willingness to pay for restoration of mangroves to reduce the climate change impacts on ecotourism. Our findings highlight the importance of mangrove protection as an adaptation strategy to minimize the climate change impacts. Tourists' preferences and willingness to pay for mangrove protection support the formation of an environmental protection fund and use of it in different mangrove protection measures. If increasing impacts of climate change are unattended in a timely fashion with site-specific adaptation measures, future ecotourism in coastal wetlands could be at risk.

Part 1. Introduction

1. Background and motivation

1.1. The Sri Lankan tourism industry

Sri Lanka is an island nation in the Indian Ocean and it is an attractive destination for tourism. According to the Sri Lanka tourism strategic plan 2017-2020, Sri Lanka is becoming one of the popular destinations among international travelers and expatriates returning home to visit friends and relatives. In the recent past, Sri Lanka has earned goodwill for its tourism on several occasions. For example, Sri Lanka was nominated by Lonely Planet as the number one destination in the world to visit in 2013, and Forbes magazine declared that Sri Lanka was among the "top ten coolest countries" to visit in 2015 (Abel, 2014). Also, world leading travel guidebook publishers and newspapers such as Lonely Planet, Rough Guides, The Guardian, and The New York Times have identified Sri Lanka as a top location to visit in 2016. However, currently the global Covid-19 pandemic has severely hit the tourism industry in Sri Lanka, like all other nations. However, still many agents in the Sri Lankan tourism industry share a hope from pre-Covid times; "By 2025, it is hoped that Sri Lanka will be identified as a place for memorable, authentic and diverse tourism experiences" (Kpundeh, 2017, p. 5).

Tourism is the third largest foreign exchange earning sector in the Sri Lankan economy, after workers' foreign remittance and textiles and garments, significantly contributing to the national economy (Sri Lanka Tourism Development Authority, 2019). In 2019, the number of international tourists to Sri Lanka were over 1.9 million, generating a revenue of approximately USD 3.6 billion. Tourism in Sri Lanka is multifaceted. Sri Lanka has been a tourist destination for centuries because of its strategic location in the global logistic hub[1]. In addition to its

[1] Sri Lanka has been a global hub for trade since the 8th century BCE facilitating trade between the East and the West, owing to its strategic positioning in the Indian Ocean on the major sea

uniqueness in global positioning, Sri Lanka is attractive for tourists for its favorable climate, sandy beaches, national parks and wildlife, and spectacular cultural and historical heritage (Figure 1).

Figure 1: Tourist attractions in Sri Lanka

Source: www.sltda.lk

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and air routes and maritime silk route between China and Europe (Ministry of Foreign Affairs, 2016).

The island includes 8 world heritage sites that have been inscribed in the UNESCO World Heritage. Out of these 8 sites, 6 are cultural (the ancient city of Polonnaruwa, the ancient city of Sigiriya, the Golden Temple of Dambulla, the old town of Galle and its fortifications, the sacred city of Anuradhapura, the sacred city of Kandy) and the remaining two are natural sites (Sinharaja Forest reserve and the Central Highlands of Sri Lanka). The tourists can enjoy different tourism sites located in different climatic zones in Sri Lanka within a few hour drive through the country.

1.2. Climate change impacts on Sri Lankan tourism industry

The island of Sri Lanka possesses a physically diverse geography with a tropical climate, but with large differences due to variation in topography. The country is highly vulnerable to adverse impacts of climate change. Being an island, the coastal zone of Sri Lanka encounters threats from sea-level rise as a result of climate change. The 2004 tsunami showed that low-lying plains of the coastal region will be vulnerable to sea-level rise in the future.

Twenty-five percent of the country's population resides along the 1340 km of coastal belt. They mainly depend on fisheries and tourism for their living. Along the Sri Lankan coast, Colombo city, the South-west coast, and the East coast are considered as main tourist areas. The way the Sri Lankan tourism industry has positioned itself has shifted from the traditional 3S; Sun, Sand, and Sea tourism, to more diversified tourism destinations focusing on natural, cultural, and heritage sites in the interior of the island. Nevertheless, major planned developments in tourism remain in the coastal region (Ministry of Environment and Renewable Energy, 2011).

If the impact of climate change on tourism is left unattended, the tourism industry along the coast will be severely exposed to potential risks from sea-level rise. There are some adverse effects of sea-level rise on coastal regions such as shoreline erosion, inundation, coastal flooding, sea water intrusion, increased salinity in estuaries and aquifers, changing tidal range in rivers and bays, and changing frequency and severity of storms (Nianthi & Shaw, 2015).

Although the Sri Lankan tourism industry has been labeled as a healthy industry, these climatic stressors will heavily threaten the industry's capability of being a safe and attractive destination for the tourists (USAID, 2018). Coastal erosion and flooding can be accelerated by more frequent storms causing loss of land and making tourism infrastructure more vulnerable. Many beaches decline due to accelerated erosion and inundation, resulting in a loss of beach area attractive for tourists. Rising sea temperature, ocean acidification, cyclones, and changing weather patterns could impose substantial negative effects on coastal habitats and biodiversity, diminishing the Sri Lankan positioning as a biodiversity hotspot for eco-tourists (Ministry of Environment and Renewable Energy, 2011; USAID, 2018).

1.3. Empirical case study of ecotourism at Rekawa coastal wetland in Southern Sri Lanka

Rekawa wetland is situated about 200 km south of the Capital of Sri Lanka, Colombo, along the Southern coast in the Hambantota district in the Southern Province (Figure 2). This wetland is composed of both terrestrial and aquatic habitats including beaches, mangroves, the Rekawa lagoon, corals, and the sea. The Rekawa beaches provide an ideal environment for turtle nesting (Ganewatta et al., 1995). There are five globally threatened species of sea turtles; green turtle, loggerhead turtle, leatherback turtle, hawksbill turtle, and olive ridley turtle, visiting Rekawa beach every year for nesting. In 2005, the IUCN declared Rekawa beach as one of the prime nesting habitats of turtles in Sri Lanka. There is a shallow fringing reef about 100-150 m wide and 300 m long off the northeastern side of the Rekawa. According to IUCN and CEA (2006), 35 species of stony corals and 138 species of reef fish and reef-associated fish have been recorded at this reef ecosystem.

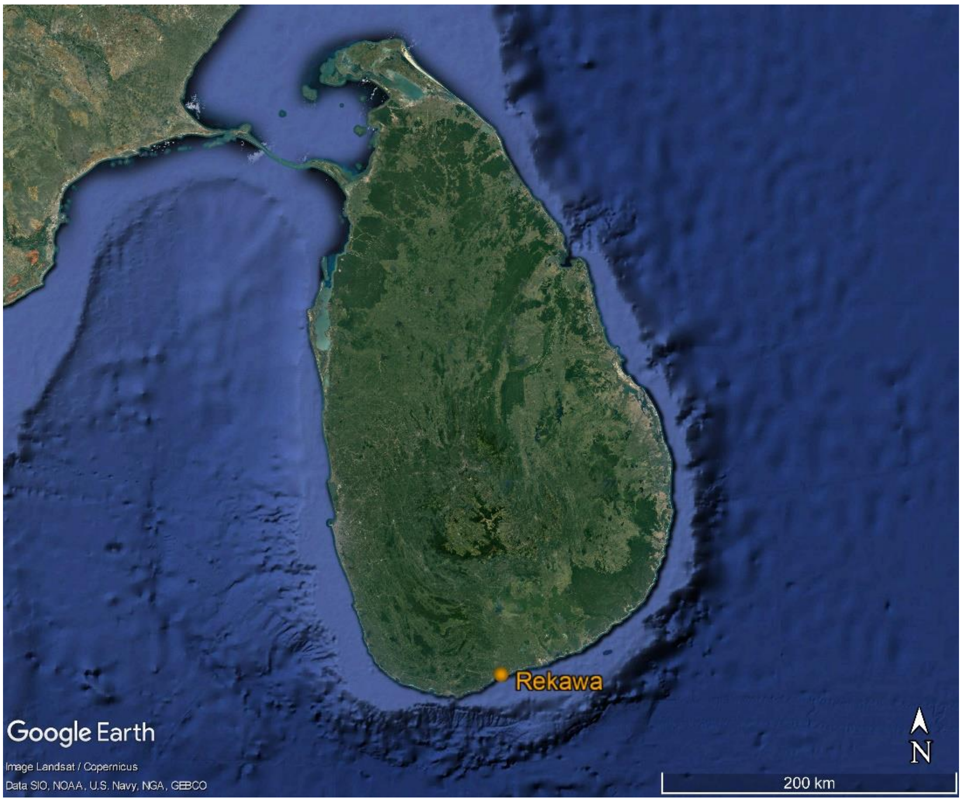

Figure 2: Location of the study area in Sri Lanka

Source: Google Earth

The Rekawa lagoon is approximately 250 ha with an average depth of 1.4 m. There is an approximate 10 km long sandy beach towards the seaside of the Rekawa lagoon-mangrove ecosystem (Gunawardena & Rowan, 2005), and landward of the Rekawa lagoon are rice fields. Most of the rice fields are, however, now abandoned due to high salinity. The lagoon and mangrove ecosystems offer shelter for many fish, shellfish, reptiles, mammals, invertebrates, and local and migratory birds (Ganewatta et al., 1995). Thirty-seven fish species and 9 crustaceans have been recorded from the lagoon environment (IUCN & CEA, 2006). *Oreochromis mossambicus*, *O. niloticus*, and *Ambasis commersoni* are dominating finfish, and *Penaeus indicus* is the commercially most important shrimp species, dominating the landings.

Lagoon fishers are involved in harvesting finfish when shrimp catches are low (Amarasinghe, 2010). In spite of being a lagoon, Rekawa is a shallow brackish water estuary that receives freshwater from *Kirama Oya* and is connected to the sea through two outlets. Approximately 11 out of 21 true mangrove species are available in the Rekawa wetland (Jayatissa et al., 2002). These mangrove ecosystems provide habitats for approximately 104 birds' species, of which 15 are migratory (IUCN & CEA, 2006). Further, the mangroves act as breeding grounds for fish and shrimps.

Rekawa coastal wetland is rich in biodiversity. However, the potential of the Rekawa wetland for ecotourism has not yet been fully achieved (IUCN & CEA, 2006). This destination is currently famous among tourists for turtle watching. Clean sandy beaches are attractive for tourists for sun-bathing and swimming, while snorkeling and diving are some of the water-sports activities which tourists can perform in Rekawa. In addition, a few inland fishers provide outrigger canoeing trips for tourists to enjoy the natural landscape around the Rekawa lagoon.

In this thesis, Rekawa coastal wetland has been selected as the study location to empirically investigate the trade-offs between tourism development and wetland conservation goals, while studying the climate change impacts on ecotourism[2], in terms of intended visitation behavior of tourists under anticipated climate change scenarios, and tourists' willingness to pay for mangrove protection to reduce the impacts of climate change on ecotourism.

[2] Ecotourism is defined as "Responsible travel to natural areas that conserves the environment, sustains the well-being of the local people and involves interpretation and education" (TIES, 2015).

1.4. Research questions

The economic literature on wetland valuation has emphasized the different roles of coastal wetlands in the provision of ecosystem services to support the human well-being (Barbier et al., 2008; Bell, 1997; Breaux et al., 1995; Costanza et al., 2008). However, a limited number of studies have estimated the value of coastal wetlands for tourism and recreational purposes (see Mehvar, et al., 2018; Pueyo-Ros et al., 2018). Some scholars have used the contingent valuation method (CVM) in estimating tourists' willingness to pay (WTP) for the development of tourist destinations (Barnes et al., 1999; Tisdell & Wilson, 2000). However, this approach has not provided information about the relative importance of different attributes describing such development, or the potential tradeoffs in management decisions such as tourism facilities and biodiversity conservation. Therefore, this thesis is designed to examine the balance between biodiversity conservation goals and sustainable development of tourism under the impacts of climate change using various stated preference techniques.

Estuaries and coastal ecosystems are decreasing at a high rate due to the pressure from anthropogenic activities, thus becoming some of the most threatened natural systems globally (Lotze et al., 2006; Valdemoro et al., 2007; Worm et al., 2006). They suffer from the stress of climate change caused by man-made activities and natural causes (Finkl & Makowski, 2017). Well-managed sustainable tourism in and around coastal wetlands can bring important economic and ecological benefits[3], while ensuring the continuation of ecosystem services (Destination Wetland, 2012). However, Baldwin (2000) argues that while tourism seems to be

[3] Sustainable tourism can directly contribute to the environmental protection and conservation by converting natural areas into national parks and wildlife parks because of their attractions for tourists.

a sustainable industry for many tropical islands, ecological impacts of tourism development in coastal regions still needs to be examined.

The tourism sector has received little attention from researchers in the field of climate change compared to sectors like agriculture and fisheries, regardless of the growing significance of this industry to the national economy (Eriyagama et al., 2010; Esham & Garforth, 2013; Harkes et al., 2015). According to Becken (2013), though the studies on climate change impacts and adaptation have been expanding with wide geographical coverage, there is still a bias in favor of winter sports tourism, with comparatively limited focus on coastal tourism. Hence, this research can be considered an early effort aiming to fill some of the research gaps in investigating climate change impacts on ecotourism in a tropical coastal region.

Climate acts as a salient feature in tourist decision-making in connection with destination choice, time of travelling, and activity planning at the destination (Scott & Lemieux, 2010). Therefore, tourism planners should take potential effects of climate change into consideration in planning the future of tourism destinations (de Freitas et al., 2008). Climate change impacts may have profound implications for visitation behavior of the tourists, because of the potential effects on human comfort level. Rosselló-Nadal, (2014) argued that a climate index can be used to capture the multidimensional nature of the climate change effects on human comfort level and thereby estimate changes in visitation behavior. However, development of such climate indices is difficult for countries when there is dearth of climate change prediction data, especially in the case of developing nations (Salpage et al., 2020). To assess the effect of climate change impacts on visitation behavior of tourists, the contingent behavior method (CBM) has been employed in a limited number of recreational studies (see Richardson & Loomis, 2004; Scott et al., 2007). In this pursuit, this research has attempted to contribute to the CBM literature providing a regional perspective on intended visitation behavior of tourists to a coastal wetland under climate change impacts explained by a climate change induced environmental index based on IPCC scenarios.

The composition and quality of the ecosystems may be impacted due to changes in climate, thereby affecting the services on which ecotourism depends. In the case of coastal wetlands, it is evident that restoration of mangrove forests can reduce the vulnerability of ecotourism due to climate change. Nevertheless, large areas of Asian mangrove are still being cut down to provide space for agriculture and aquaculture activities, as well as for urban development. This, despite knowledge about the importance of mangroves for mitigating and adapting to climate change impacts. It is estimated that in the past three decades, more half of the mangrove forests in Sri Lanka have been devastated because of prawn farming, hotel development, settlements, logging, tourism, agriculture, and pollution (Mombauer, 2019). Immense damage has already been done to these forests though it is now legally prohibited to cut down mangroves. Therefore, it is of great importance to restore and replant mangroves for the future, and studies on willingness to pay (WTP) for such activities are needed.

Studies available in the literature on WTP for mangrove restoration to deal with climate change impacts have focused on the households who interact with mangrove forests for their livelihood (Pham et al., 2018; Tuan et al., 2014). Only a few studies have focused on tourists' WTP for restoration of mangroves due to the benefits arising from the mangrove ecosystem services (Ramli, 2017; Spalding & Parrett, 2019). However, as far as we know, none of these studies have investigated the *in situ* eco-tourists' WTP for restoration of mangroves to reduce the negative impacts of climate change on ecotourism.

Therefore, from this thesis, I expect to answer the following research questions, all using the Rekawa coastal wetland in Sri Lanka as empirical context.

1. How should planners balance conservation goals and the development of ecotourism in coastal wetland management?
2. How may climate change impact on intended future visitation behavior of tourists?
3. Are eco-tourists willing to pay for restoration of mangroves to reduce the climate change impacts on ecotourism?

2. Ecosystem services

The Millennium Ecosystem Assessment (MEA) emphasizes the connections between ecosystems and the well-being of people. It defines ecosystem services as the benefits (i.e. goods and services) people receive from the ecosystems. These ecosystem services broadly categorize into four groups; *Provisioning services*, *Regulatory services*, *Cultural services*, and *Supporting services* (see Table 1).

Economic valuation has become a powerful instrument for placing wetlands on the agendas of conservation and development decision making processes (MEA, 2005). The concept of Total Economic Value (TEV) is extensively used for classifying and valuing ecosystem services provided by nature to the well-being of people. Eliciting the TEV of a wetland requires considering the full range of wetland ecosystem services and functions.

Total Economic Value components of the Rekawa coastal wetland are presented in Figure 3. The TEV framework recognizes two primary sources of value; use values and non-use values, each with their own sub-components. Use value includes three sub-components; direct, indirect, and option values. The direct use values consist of consumptive and non-consumptive uses. The utility that is derived from coastal wetland ecosystems has many direct consumptive use values such as coastal fishery and forestry goods (i.e. food, firewood, medicinal extracts, and honey). They are typically enjoyed by the inhabitants in the wetland ecosystem itself.

Table 1: Ecosystem services provided by or derived from wetlands

Services	Comments and Examples
Provisioning	
Food	Production of fish, wild game, fruits, and grains
Fresh water	Storage and retention of water for domestic, industrial, and agricultural use
Fiber and fuel	Production of logs, fuel wood, peat, fodder
Biochemical	Extraction of medicines and other materials
Genetic materials	Genes for resistance to plant pathogens, ornamental species
Regulating	
Climate regulation	Source of and sink for greenhouse gases, influence local and regional temperature, precipitation, and other climatic processes
Water regulation (hydrological flows)	Groundwater recharge/discharge
Water purification and waste treatment	Retention, recovery, and removal of excess nutrients and other pollutants
Erosion	Regulation retention of soils and sediments
Natural hazard regulation	Flood control, storm protection
Pollination	Habitat for pollinators
Cultural	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religious values to aspects of wetland ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspects of wetland ecosystems
Educational	Opportunities for formal and informal education and training
Supporting	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Recycling, processing, and acquisition of nutrients

Source: MEA, 2005, p. 2.

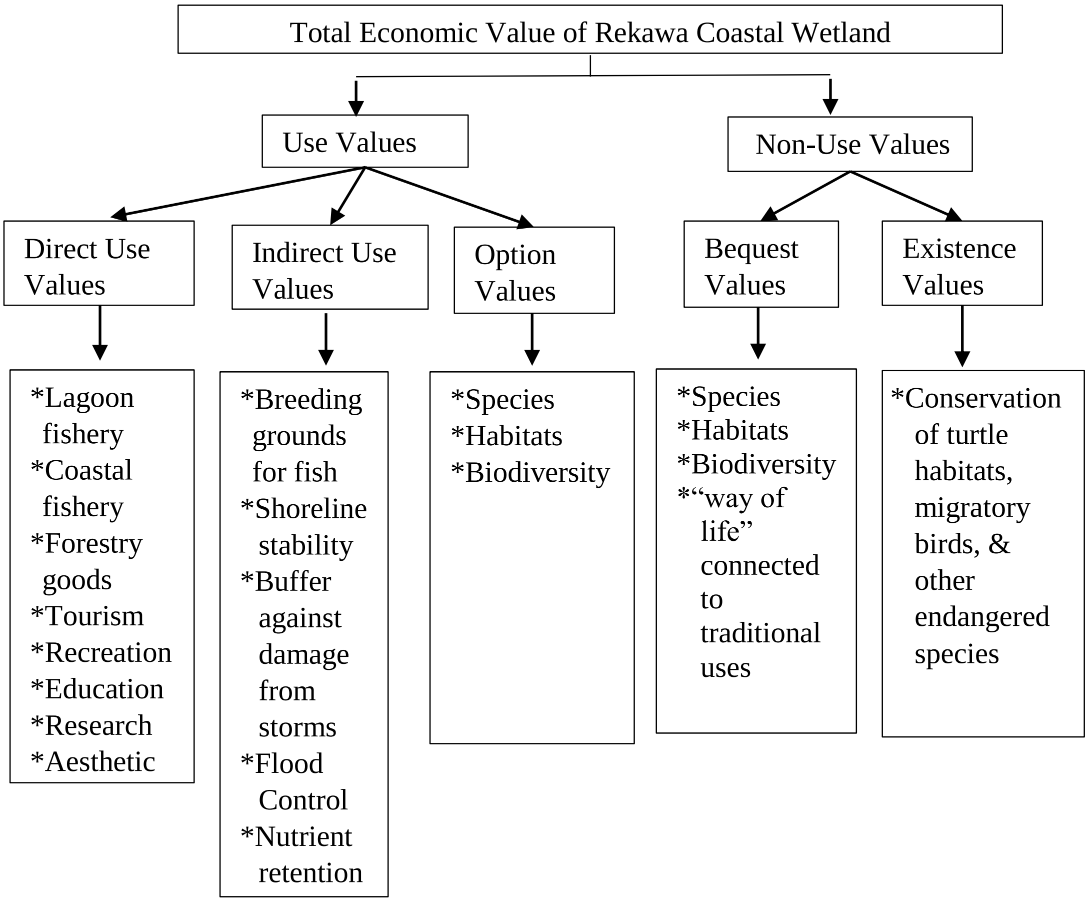

Figure 3: Total Economic Value of the Rekawa coastal wetland

Source: TEEB, 2010

Non-consumptive use values of coastal ecosystems refer to the direct uses of natural resources for recreational purposes (e.g. turtle watching, water sports, birds watching, mangrove watching, and boat trips in the lagoon), cultural amenities, spiritual experience, social services, and an increase in knowledge of coastal wetlands in terms of research activities and education programs. The benefits of the direct use category widely correspond to the provisioning and cultural services of the MEA framework (MEA, 2005).

Indirect use values include the values derived from the ecosystem through biodiversity conservation and habitat protection. Examples of such indirect use values of the Rekawa coastal wetland are the provision of breeding grounds for fish, buffer against storm surges, shoreline protection, water filtration, absorption of pollutants, and carbon sequestration. This category of benefits corresponds broadly to regulating and supporting services of the MEA (MEA, 2005). Option values encompass potential future use values of the coastal wetland which are not used at present. "Provisioning, regulating, and cultural services may all form part of option value to the extent that they are not used now but may be used in the future" (MEA, 2005, p. 61). Use of flora and fauna to extract medicinal ingredients and untapped ecotourism potential are some of the option values available in Rekawa.

The coastal wetland provides important non-use values from conserving threatened, endangered, and rare marine and coastal species, and habitats. Non-use values consist of two categories; existence value and bequest value. The existence values refer to the fact that even if the individual does not enjoy the environmental services, s/he might still benefit from the knowledge of the existence or preservation of wetland resources such as mangroves, lagoon, migratory birds, and turtles. Otherwise, a person may "derive satisfaction from the continued existence of particular species for no other reason than they find it repugnant that any species should be driven to extinction" (Perman et al., 2011, p. 413). The utility an individual derives from ensuring the availability of the ecosystem services to coming generations is called a bequest value.

The concept of ecosystem services holds that natural ecosystems provide goods and services for social and economic well-being of the human beings. Hence, all these biophysical goods and services have a value from an economic perspective (Boyd, 2011). Many ecosystem goods and services are public goods, and are not bought and sold in the marketplace. Therefore, society cannot observe their value through the lens of market transactions (Boyd, 2011).

Although a good or a service may not have a market price, it does not mean it is not valuable. This leads to the motivation for economic valuation of ecosystem goods and services as a strategy of determining the 'missing prices' of natural resources.

3. Methods and models

3.1. Non-market valuation methods

Economists value ecosystem services typically using either revealed preference or stated preference techniques. The revealed preference techniques infer preferences making use of existing market data or other observed behavior. The most common revealed preference techniques are the travel cost method and hedonic pricing. In the travel cost method, a researcher can inquire about the distance and time a visitor travels to visit a destination. Having access to transportation cost (i.e. fuel or bus tickets) and time costs, this information can be used to estimate a lower bound for the value of the recreational benefits accruing to the visitor from a particular destination. Hedonic pricing is among others, used to value preferences for property market characteristics. This technique is most often used in the housing market, wherein the price of property is determined by the characteristics of the property, such as size and appearance and its surrounding environment, like access to schools, crime rate, level of air and water pollution, and closeness to natural environments (Perman et al., 2011). Revealed preference techniques mainly capture the use values of non-market goods and services.

Stated preference techniques can be used to estimate both use and non-use values based on survey data from answers to hypothetical questions. The contingent valuation method (CVM) and choice experiments (CE) are the most frequently applied stated preference methods. The contingent behavior method (CBM) is a less used stated preference technique particularly applied in valuing environmental resources used as input in recreational activities.

The CVM involves asking for a "willingness to pay" to obtain an improvement or avoid a reduction in quality or quantity of ecosystem services. For example, we can ask from a tourist "would you be willing to pay 500 Sri Lankan Rupees as an entrance fee, which will go to the Environmental Protection Fund to protect and restore the mangroves in Rekawa coastal wetland?". It is also possible to ask the lowest necessary compensation for a specified environmental deterioration in quality or quantity. This "willingness to accept" (WTA) approach is less preferred in studies as it is often found to give too high values compared to willingness to pay, and is therefore suspected to not reflect real preferences (Reddy, 2011). In addition, asking for WTA is not regarded as incentive compatible, as respondents have incentives to claim higher compensations than they really need to be as well of as before the deterioration.

Researchers use either open-ended or closed-ended questioning formats in CVM to elicit WTP. Open-ended questions allow respondents to state their own WTP. Discrete choices or repeated bidding games are used in closed-ended questions. When the respondent is allowed to provide his or her own WTP, it reduces the starting bias but can lead to strategic biases because of the ability to avoid big or small bids (WTP) intentionally[4] (Mitchell & Carson, 1989). Closed-ended questions, especially discrete choice formats can mitigate this problem by asking the respondent whether or not they are willing to pay a randomly selected amount of money[5] (Bishop & Heberlein, 1979). Starting point bias is a key concern in closed-ended CVM formats, and it can be reduced by randomly varying the offered payment value across the respondents

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[4] Respondent can purposely avoid small bids to show that s/he would like the proposed improvements. On the other hand, respondents may bypass large bids to demonstrate unwillingness for the proposed improvements.

[5] This is also known as referendum type questions.

(Chang-San, 2019). Strategic bias can be reduced by choosing incentive-compatible payment mechanisms with plausible payment vehicles (OECD, 2018).

In a choice experiment, survey respondents receive several choice cards. Each choice card has a number of discrete alternatives. Each alternative is a scenario for future changes in a good, described with a set of attributes taking various levels. One of the attributes is normally a cost (tax), which takes a positive number for all alternatives except one. This alternative is often denoted the status quo (SQ) or business as usual (BAU) and represents no change. Sometimes the BAU-alternative can represent changes according to official public plans, while the other alternatives represent changes in the official public plans. The objective of including cost attribute is to estimate nominal (monetary) values for each of the non-cost attributes in alternatives different from the SQ. Such values are found as the marginal rate of substitution (MRS) between the non-cost attribute level and the cost (tax) level. The survey respondents are instructed to identify and select their most preferred alternative in a series of choice cards. Choice experiments have some advantages over CVM. The problem of yeah-saying and nay-saying which sometimes is present in closed-ended CVM surveys can be overcome using the CE. In addition, the tendency of refusing participation in the survey may be smaller in CEs due to the fact that monetary values here are implicit rather than explicit (Perman et al., 2011). This means that survey respondents are not asked directly how much they are willing to pay for a change in an ecosystem service. Although the values obtained from CVM studies are important in the valuation of a particular good or a service, it is important to disaggregate these values to understand the tradeoffs between different attributes which describes the good or service that is valued.

CBM has been used in valuing environmental resources for recreational purposes (Chase et al., 1998; Eiswerth et al., 2000; Richardson & Loomis, 2004; Richardson et al., 2006; Scott et al., 2007). This technique involves the construction of hypothetical changes to a destination and asking the reassessed or intended visitation behavior of the respondents' contingent on these changes. Grijalva et al., (2002) tested the validity of CBM for outdoor rock-climbing demand and recommended CBM data as a useful supplement to revealed preferences data when a future project has implications beyond current and historical range. Bertram et al., (2020) stated that CBM is an extension of the travel cost (TC) method, which is mainly used to value the recreational benefits of natural sites. While the TC method is restricted to valuing recreational benefits under current conditions, the CBM builds on reported recreational behavior in the past and future recreational behavior contingent on scenarios with varying environmental conditions.

There are two types of question formulations that have been used in CBM studies: reassessed contingent behavior (RCB) and intended contingent behavior (ICB). The former format is used to reassess respondents' visitation behavior of how they would have behaved in the past (i.e., number of visits they would have made) had hypothetical changes taken place (Simões et al., 2013). The latter format measures the intended future visitation behavior of the respondent for the proposed hypothetical changes. In this format, respondents are asked to predict how they will behave under future anticipated conditions instead of reassessing their former behavior (Christie et al., 2007).

These two question formulations vary with reference to the period considered for the contingent behavior question (Simões et al., 2013). However, the influence of the CB question format on answers has not been analyzed in the literature (Simões et al., 2013). According to Simões et al., (2013), there are some differences between these two formats. In the case of the RCB format, only one hypothetical question is required as the status quo situation is represented by the current condition of the non-market good. In contrast, the ICB format demands at least two hypothetical questions. One is assuming that the current conditions will remain also in the status quo (SQ) situation, and the second is showing a hypothetical change. Also, factors affecting the choice conditions are not identical in the two situations. For instance, respondents know about their current income but are uncertain about their future earnings. The other difference is that when respondents visit the destination for the first time, they do not have any experience from previous visits and, thus it is difficult for them to answer the RCB question. However, if the researcher opts for the ICB format, data on both current (i.e. status quo situation) and hypothetical change proposed to the future are available to the respondent. If the scenarios are prediction into the future, this demands the use of a forward-looking survey approach, i.e. ICB (see Alberini & Longo, 2006; Loomis, 2002; Salpage et al., 2020).

This thesis demonstrates the application of three stated preference methods i.e. discrete choice experiment, contingent behavior method, and contingent valuation method, all available within the tool box of stated preference techniques in economic valuation of ecosystem services.

3.2. Statistical models

3.2.1. Mixed multinomial logit model in a discrete choice experiment

The discrete choice experiment (DCE) is based on random utility theory (RUT) which postulates that the utility of a person is described by a deterministic observable component and a stochastic unobservable component (McFadden, 1974). The deterministic observable component refers to all observed characteristics of the choice situation, mainly the attributes describing the alternatives, while the unobservable stochastic component includes effects influencing choices in a non-systematic way. Following economic theory of rational behavior we assume that respondents choose the alternative which provides the highest utility from the set of available alternatives (McFadden, 1974). Different statistical models can be derived by assuming different distributions for the unobserved stochastic component of the utility (Train, 2009). The typical assumption is that this stochastic component of utility is independently and identically distributed (iid) following the extreme value type I (Gumbel) distribution which leads to the conditional logit model (McFadden, 1974), also called the multinomial logit model.

In the multinomial logit (MNL) model, the stochastic component of utility should fulfill the assumptions of iid (individually independently distributed) and IIA (independence of irrelevant alternatives). If the latter assumption is violated, the MNL is not a suitable model for discrete choice data analysis. We then need to turn to more complex models such as multinomial probit (Hausman & Wise, 1978), nested logit, or mixed logit models (Train, 1998). In the MNL model, we only estimate average attribute preferences without considering the distribution of preferences across respondents.

In a mixed logit model, we allow the preference for a particular attribute to follow a pre-specified distribution and derive the average population parameters plus their standard deviation using this distribution. In principle, any distribution can be applied. However, normal and log-normal are the most commonly used distributions while some researchers use uniform and triangular distribution (Train, 2009). It is a challenge for the researcher to decide the most appropriate distribution for the analysis of discrete choice data but sometimes economic theory can be used as a guide. For example, if we assume the same sign for all respondents' preferences for the cost attribute, then it is reasonable to use the log-normal distribution.

However, it is advisable to select the distribution for the cost attribute and non-cost attributes by testing different assumptions while testing the model fit.

The deterministic component of utility of a mixed logit model is scaled by a factor that is inversely proportional to the variance of the stochastic component of utility, and within the same dataset this scale factor is usually normalized to 1 (Train, 2009). If we combine datasets collected at different times or by different means, then it is necessary to check whether they can be assumed to have the same scale. If not, the scale of one of the datasets can be normalized to 1, while the relative scale for the other can be estimated along with the attribute parameters. Sometimes, it is also necessary to take into account potential correlations between the random parameters. Allowing the distribution of attribute parameters to be correlated will lead to estimation of the off-diagonal elements of the lower triangular Cholesky matrix. Estimation of mixed logit models, assuming the normal distribution (and other frequently applied distributions) for the attribute parameters does not yield a closed form solution and needs to be approximated using simulation averaging over a specified number of draws from the assumed distribution(s) (Hensher et al., 2005; Revelt & Train, 1998).

3.2.2. Two-stage regression using the instrumental variables technique in contingent behavior data

Data from a contingent behavior survey is used to estimate changes in consumer behavior for a non-market good, and this type of survey is especially applied in the context of outdoor nature-based recreation (Simões et al., 2013). Sometimes when using the ICB (intended contingent behavior) method to investigate the future visitation behavior of various groups of people (e.g. foreign and domestic tourists), statistical analysis can be complicated for two reasons. First, the use of two tourist types and their socio-demographic characteristics as explanatory variables may lead to a multicollinearity problem. Second, merging all respondents by excluding the variable defining which group of tourists the respondent belongs to, or the socio-demographic characteristics, may yield correlation between the remaining predictors and the error term.

Ideally, when analyzing the data from the contingent behavior (visitation) data, we would like to use tourist type, socio-demographic variables, and attitudes to climate change taking place at the destination and a climate change induced environmental index to explain variation in intention to visit Rekawa under the future climate change scenarios. However, when the characteristics of the foreign and domestic tourists (tourist type) differed greatly, there will be a significant correlation between tourist type and socio-demographic characteristics i.e. multicollinearity. This may also be the case for attitudes to climate change. Then, we are left with very few independent variables to explain the variation in intended future visitation behavior. In such situations, it is recommended to apply the instrumental variable (IV) technique. For an explanatory variable to serve as an instrument, two conditions must be fulfilled.

(i) The instrument must be correlated with the explanatory variables that are not independent.

(ii) The instrument must not be correlated with the error term in the main equation.

If these requirements are fulfilled, one computational method which can be used to calculate IV estimates is the two-stage least square. Using this method, first, we can estimate the probability of being a foreign tourist as depending on a set of socio-demographics and attitudes to climate change. Next, we can estimate the effects of tourist type, attitudes to climate change taking place at the destination, and a climate change induced environmental index on changing number of visits using estimated parameters for gender, age, education, and participation in the labor force as instruments for tourist type.

If the hypothesis of weak instruments[6] is rejected, it shows the strong instrumental nature of the socio-demographic characteristics for the tourist type variable. Further, both the Sargan-Hansen test and the Wu-Hausman test can be used to test appropriateness of the use of the instrumental variables. The former test shows that the instruments are uncorrelated with the error terms in the regression model while the latter indicates that there is no correlation between any of the predictors and the error terms. "Instrumental variables provide an estimate for a specific group - namely, people whose behavior can be manipulated by the instrument" (Angrist & Krueger, 2001, p. 77). Similarly, we could demonstrate the effect of the instruments (i.e., the socio-demographic characteristics) for tourist type, which in turn can be used as a predictor for intended future visitation behavior under the climate change scenarios together with the climate change environmental index and attitudes towards the climate change.

3.2.3. The binomial logit model applied to data from a double bounded discrete choice contingent valuation survey

Using a referendum type of question when asking for willingness to pay for a non-market good, one can distinguish between single-bounded dichotomous choice (SBDC) and double-bounded dichotomous choice (DBDC). The former was pioneered by Bishop and Heberlein (1979), in which respondents are asked only one dichotomous choice question and they are asked to

[6] "In instrumental variables (IV) regression, the instruments are called weak if their correlation with the endogenous regressors, conditional on any controls, is close to zero" (Andrews et al., 2019, p. 728).

accept or reject the suggested price in a hypothetical market situation. This methodology is similar to discrete choices in market transactions and thus mimics the decision-making process that consumers are familiar with in the market (Hanemann, 1994). Although this approach is easier for the respondents, in the CVM literature, it is noted that this format is statistically less efficient and thus requires a large sample for a given level of precision in the estimation (Hanemann et al., 1991). Another limitation of the SBDC format is that hypothetical bias can lead to the overestimation of WTP (Han & Lee, 2008; Lee & Mjelde, 2007; Mjelde et al., 2012). The SBDC is less efficient when it comes to limiting the intervals for respondents' actual valuation of the good. Especially, a yes-answer may yield a very large interval including high amounts for the actual valuation. This often leads to WTP overestimation.

To overcome the limitations of the SBDC approach, the DBDC approach was first proposed by Hanemann (1984), in which a follow-up question is asked. If the respondents choose "Yes" to the first suggested price, in the follow-up question respondent receives a higher price. Similarly, a lower price is presented in the follow-up question for the respondent who answered "No" for the first suggested price. As a result, DBDC generates four possible outcomes; Yes-Yes, Yes-No, No-Yes, and No-No. All response-pairs contribute to limiting possible values a respondent may have for the good. Asking twice yields twice the number of observations for the analysis compared to the SBDC technique, and more (relevant) data is always preferable for estimation purposes. Although the introduction of a second follow-up question is possible in the discrete choice format (Alberini et al., 1997), evidence found in the CVM literature suggests that most of the statistical efficiency gains in the estimation of mean WTP are provided by the first follow-up question (i.e. Cooper et al., 1999; Cooper & Hanemann, 1994).

The DBDC approach is statically efficient as it yields more efficient estimates of mean WTP than the SBDC because of incorporating more information about an individual's WTP than SBDC (Hanemann et al., 1991). Despite this advantage, DBDC has a few potential drawbacks. First, this method may not be incentive-compatible in a hypothetical context (Carson et al., 1999). Second, the follow-up question is not clearly independent of information which the respondent provided in answering the first question offered (Cameron & Quiggin, 1994). Third, response to the follow-up question in the DBDC depends on the bid offered in the first question thus may suffer from starting biases (Hayes & Shogren, 1995).

4. Data and data collection

4.1. Discrete choice experiment survey among foreign tourists

Our survey consisted of a choice experiment. Prior to choice experiment survey, we had focus group discussions with Rekawa tourism stakeholders to select attributes and attribute levels. The selected attributes for the survey were as follows: "Number of tourists per turtle-watching tour", "Expenditure on beach cleanup activities", "Boat trips around the Rekawa lagoon", and "Biodiversity". Levels for the cost attribute in terms of "Wetland management fund" were decided based on the information collected from foreign visitors after explaining the anticipated improvements in ecotourism facilities and biodiversity conservation in Rekawa. Table 2 shows the attributes and their levels.

The survey questionnaire has four sections. It starts with showing the study objectives and presenting the status of ecotourism in Rekawa, then explaining the attributes and the levels they take while providing the 10 choice cards to be completed (see Figure 4). The third section examines the reason for the choices they made and attitude towards Rekawa ecotourism. The questionnaire ends up with collection of socio-demographic information of the respondent.

Table 2: Attributes and levels of each attribute

Attributes	**Levels**
Number of tourists per turtle-watching tour	• 35 tourists per visit to the turtle nesting site (SQ) • 25 tourists per visit to the turtle nesting site • 15 tourists per visit to the turtle nesting site • 5 tourists per visit to the turtle nesting site
Expenditure on beach cleanup activities	• No further increase in expenditure on beach cleanup activities (SQ) • 10% increase in expenditure on beach cleanup activities • 20% increase in expenditure on beach cleanup activities
Boat trips around the Rekawa lagoon	• Boat trips without a guide (SQ) • Boat trips with a guide
Biodiversity reduction	• With no efforts the reduction in biodiversity will be 20% (SQ) • With small efforts the reduction in biodiversity will be 10% • With large efforts the reduction in biodiversity will be 5%
Rekawa wetland management fund	• LKR 0 (SQ) • LKR 250 • LKR 500 • LKR 750 • LKR 1000 • LKR 1250 • LKR 1500

Note: SQ denotes the "status quo" condition of Rekawa at the time of the survey for each attribute.

Rekawa is an unfamiliar ecosystem for many foreign tourists. Because of the unfamiliar nature of the environmental good that they are going to value, the valuation workshop format was chosen. We selected the tourists' waiting time[7] to conduct the workshops. Each workshop consisted of two activities; watching videos on ecotourism potential in Rekawa coastal wetland and choice experiment survey methodology for 10 minutes, followed by questionnaire filling for 30 minutes.

[7] Usually tourists should wait at the turtle conservation project office at Rekawa, until the arrival of a turtle for nesting at the Rekawa beach.

Attributes	**Alternative 1**	**Alternative 2**	**Alternative 3 (Same as today)**
Number of tourists per turtle-watching tour	5 tourists per visit 	15 tourists per visit 	35 tourists per visit 
Expenditure on beach clean-up activities	20% increase in expenditure on beach cleanup activities 	10% increase in expenditure on beach cleanup activities 	No regular beach cleanup 
Boat trips around the Rekawa lagoon	Boat trips with guide 	Boat trips without guide 	Boat trips without guide 
Biodiversity	With large efforts the reduction in biodiversity will be 5% 	With small efforts the reduction in biodiversity will be 10% 	With no efforts the reduction in biodiversity will be 20% 
Rekawa wetland management fund	LKR 1000 	LKR 500 	LKR 0
I would prefer			

Figure 4: An example of a choice card

We conducted 26 workshops, with 5-15 tourists, which took place between 19:00 and 23.45 from the end of August to the beginning of October 2017. Although our data collection overlapped with the off- season for turtle watching, we collected 331 completed questionnaires by the end of the data collection, resulting in 3310 observations for the data analysis as every respondent marked their choices on 10 choice cards.

4.2. Contingent behavior survey among foreign and domestic tourists

For the contingent behavior survey, we first developed two climate change scenarios, one for the short-term (2025), and the other for the long-term (2050) effects for Rekawa coastal wetland, using three climatic variables; temperature, rainfall, and sea-level rise, with three climate-induced biophysical variables; the number of turtle nesting sites, mangrove cover, and beach inundation area (see Figure 5). Complete method of development of climate change scenarios is explained in detail in my second paper. Table 3 shows how we framed the questions related to contingent visitation behavior of tourists under anticipated climate scenarios at Rekawa focusing on the number of trips and length of stay.

Table 3: Visitation questions used in the survey

Question	Scenario 1	Scenario 2
1. If you know that conditions of Rekawa coastal wetland would be as described in Future Scenario 1 & 2, would you change the ***number of trips*** you take to Rekawa in the next 5 years?	• Visit ***more*** often ☐ No: of additional trips _____ • Visit ***less*** often ☐ No: of fewer trips _____ • ***No change*** in no: of trips ☐	• Visit ***more*** often ☐ No: of additional trips _____ • Visit ***less*** often ☐ No: of fewer trips _____ • ***No change*** in no: of trips ☐
2. Would the changes described in Scenario 1, affect your ***length of stay*** in Rekawa on a typical trip?	Would you stay • Longer? ☐ ___ days longer • Shorter? ☐ ___ days fewer • No change? ☐	Would you stay • Longer? ☐ ___ days longer • Shorter? ☐ ___ days fewer • No change? ☐

Source: Salpage et al., 2020

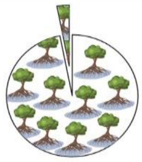
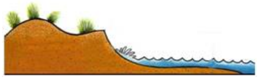
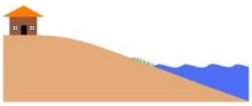
Change in environmental conditions	**Present status**	**Future scenario 1 (2025)**	**Future scenario 2 (2050)**
Number of turtle nesting sites	350 	250 	200 
Mangrove cover	No reduction 	3% reduction 	12% reduction 
Area of beach inundation	Not significant 	13% 	17% 
Rainfall	2000 mm 	1264 mm 	1330 mm 
Air temperature	27^0C 	29^0C 	29.5^0C 
Sea water intrusion into Rekawa lagoon	Not significant 	Sea level rise by 50 cm 	Sea level rise by 65 cm 

Figure 5: Climate change scenarios for Rekawa used in the survey

Source: Salpage et al., 2020

We collected data from 365 tourists (including 213 foreign and 152 domestic) from December 2016 to February 2017 which covered one of the peak seasons of tourists to this destination. The total number of observations for the data analysis was 730 as reach respondents answered two contingent visitation behavior questions under two scenarios.

4.3. Contingent valuation survey among foreign and domestic tourists

We collected the contingent valuation data for this study in the final part of the questionnaire used for the contingent visitation behavior study. The extension including the questions for this data starts with a matrix presenting a few management options to mitigate impacts on vulnerable coastal ecosystems in Rekawa and asking respondents to indicate how important they find the different options with regards to reducing the vulnerability of the study area. We presented an "Environmental Protection Fund" as the payment vehicle aiming at implementing a mangrove restoration project with the objective of reducing the effect of climate change on ecotourism. Mitchell and Carson (1989, p. 120) pointed out that *"the principal challenge facing the designer of a CV study is to make the scenario sufficiently understandable, plausible and meaningful to respondents so that they can and will give valid and reliable values despite their lack of experience with one or more of the scenario dimensions"*. We also pre-tested the prepared questionnaire with some tourists at Rekawa before the real data collection, considering the importance of adequate pilot testing of the questionnaire prior to implementation in the field. As for the visitation data, we collected a total of 365 complete questionnaires which consisted of 213 foreign and 152 domestic tourists. We used the double-bounded discrete choice format to elicit the tourists' preference and willingness to pay for restoration of mangroves.

5. Summary of the papers

Findings of this PhD research project have implications for both the environmental valuation literature and management perspectives in coastal wetlands related to tourism. Key findings of this research are presented on paper basis.

5.1. Paper 1:

Balancing conservation goals and ecotourism development in coastal wetland management in Sri Lanka: a choice experiment

We designed a discrete choice experiment, which was implemented in a valuation workshop setting out to derive foreign tourist preferences and WTP for biodiversity protection and ecotourism development in Rekawa coastal wetland in Sri Lanka. Our results provide a suggestion to reduce the current group size for turtle-watching, enabling the tourism managers at Rekawa to command higher prices for this tourism activity. This since a majority of tourists preferred to be in small groups for turtle-watching. However, our results further emphasized the importance of keeping family members in the same group, as married people prefer to be in larger groups compared to unmarried people. Our finding reveals that tourists have a willingness to pay for beach cleanup activities, indicating the importance of implementing measures to clean the beaches regularly. The tourists' preference and their willingness to pay for guided boat trips compared to non-guided boat trips can be seen as an employment opportunity for educated, young people at Rekawa to provide a quality service to the tourists as a guide during the boat trips. The conflict between tourism development and biodiversity conservation is complex due to insufficient knowledge of the effects of tourism activities on biodiversity. Therefore, making tourists aware of biodiversity facts and information about Rekawa coastal wetland, and of how appropriate tourist behavior contributes to conserving biodiversity, is important. As foreign tourists have a positive perception towards biodiversity conservation in Rekawa, our findings add to the empirical evidence suggesting that ecotourism is not only an economically viable industry but also a good ecological policy instrument as economic benefits arising from ecotourism can be used for environmental protection and biodiversity conservation by ensuring habitat protection for a broad set of species.

5.2. Paper 2

Is the Sri Lankan ecotourism industry threatened by climate change? A case study of Rekawa coastal wetland using contingent visitation approach

We designed an interview-based contingent behavior survey to examine intended visitation behavior of tourists towards Rekawa costal wetland in Sri Lanka under anticipated climate change scenarios. Our findings revealed that under short and long-term scenarios, number of trips will decline by 43 per cent and 53 per cent respectively. These relative declines are a result of the long-run, climate-induced variables being more adverse compared to the short-run. There was a significant difference in foreign and domestic tourists with regard to socio-demographic characteristics and beliefs about climate change effects at Rekawa. Controlling for such differences, we demonstrate that foreign tourists are less likely to decrease future visitation to Rekawa due to the impacts of climate change than domestic tourists. This may be due to the fact that for these foreign tourists a visit to Rekawa is a once-in-a-lifetime experience, thus they do not bother about climatic and climate-induced variables (Hamilton et al., 2005). The climate change induced environmental index was a significant determinant of the future visitation behavior of the tourists. Our findings provide important policy implications to the Rekawa community and authorities to take proactive measures to protect this coastal wetland from climate change impacts. We propose some of the adaptation strategies for Rekawa such as taking actions to minimize beach erosion, protecting mangroves, and maintaining the land next to the turtle-nesting beach without construction of any buildings to minimize the climate change impacts. If adaptation measures are not taken to meet the impacts of climate change in a timely fashion, the future of ecotourism at Rekawa wetland will be at a risk.

5.3. Paper 3:

Willingness to pay for the restoration of mangroves to reduce the impact of climate change on ecotourism in Rekawa coastal wetland of Southern Sri Lanka

We estimated tourists' preferences and willingness to pay for restoration of mangroves to reduce the effects of climate change on ecotourism at Rekawa coastal wetland, Sri Lanka, using the contingent valuation method. The results indicate that domestic and foreign tourists on average were willing to pay 2.65 USD and 11.4 USD per person, respectively, for mangrove restoration in Rekawa wetland. This result provides managerial implications to tourism managers in Rekawa about the possibility of dual pricing in terms of charging an admittance price ratio of 1:4 between domestic and foreign tourists. However, we have not assessed how this would be perceived by the foreign tourists. Our findings demonstrate that tourists' preference for mangrove restoration programs is positively influenced by education level, irrespective of the tourist type. This suggests the importance of increased knowledge of mangrove forests in climate mitigating and adapting effects through the school curriculum and general public information via media. Foreign respondents who believed the role of mangroves in mitigating the impacts of climate change on sea turtles' terrestrial reproductive phase were likely to pay more for mangrove restoration. This may be due to the fact that currently this destination is famous among the tourists for turtle watching, where the tourists can enjoy *in-situ* conservation of sea turtles. Tourists' preferences and willingness to pay for mangrove protection support the formation of an environmental protection fund and the use of it in different mangrove protection measures such planting mangroves, patrolling mangrove areas to prevent illegal activities, and promoting nature-based tourism activities.

6. Conclusion

This research project has explained the application of three different methods of stated-preference techniques in terms of a discrete choice experiment, contingent behavior method, and contingent valuation method, and their usage in economic valuation of a coastal wetland in a tropical and Indian Ocean island developing nation; Sri Lanka, providing answers to different research questions related to coastal tourism and climate change. Findings of this PhD research have revealed that foreign tourists are prefer and are willing to pay for both biodiversity protection and ecotourism development in Rekawa coastal wetland. It is observed that visitation to Rekawa wetland from both foreign and local tourists decline under the anticipated climate change scenarios. The climate change induced environmental index that we developed, was found to be a significant determinant of tourists' intended visitation behavior. Our findings highlight the importance of mangrove protection as an adaptation strategy to minimize the climate change impacts and confirm that both domestic and foreign tourists have a preference for and are willing to pay for restoration of mangroves at Rekawa coastal wetland. The results of this study support tourist entrance fees for the use of planting mangroves and coastal plants to reduce impacts of climate change, patrolling mangrove areas to prevent illegal activities, and promoting nature-based tourism activities such as bird watching in mangroves and boat trips around the Rekawa lagoon. Future ecotourism in coastal wetlands is at risk if increasing impacts of climate change are not in a timely way attended to with site-specific adaptation measures.

The impacts of climate change are looming at every level; globally, regionally, nationally, and locally, which require multi-level actions. According to IPCC (2014), risks and exposure to climate change are unevenly distributed around the world and vulnerable hotspots in the tourism sector are concentrated in Africa, the Middle East, South Asia, Small Island

Developing States (SIDA) and the Caribbean, and the Indian and Pacific Oceans (Scott & Gössling, 2018). The tourism industry must focus on integrating climate change into the business strategy, transitioning to a low carbon economy, and strengthening resilience against climate risks at the local level. In conclusion, this PhD research can be taken as an example of integrating impacts of climate change in the development of coastal ecotourism industry in a developing country, producing important managerial perspectives for ecotourism in coastal wetlands and contributing to the environmental valuation literature in stated-preference techniques.

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Balancing conservation goals and ecotourism development in coastal wetland management in Sri Lanka: A choice experiment

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ABSTRACT

Understanding the tradeoff between tourism development and environmental conservation is essential for the sustainable management of ecotourism. Accordingly, we conducted a choice experiment (CE) using valuation workshops to estimate the preferences of foreign tourists for ecotourism development and biodiversity conservation in Rekawa coastal wetland in Southern Sri Lanka. Transforming preferences into marginal willingness to pay (MWTP), shows that guided-boat trips in Rekawa lagoon is the most important development attribute, followed by increased beach cleanup activities. The MWTP for smaller turtle-watching groups is much lower, but still significant. Tourists are also willing to pay for conservation in the form of efforts to reduce losses in biodiversity. The fact that the CE asks for contributions to future management and improvement fund, and because that many tourists do not intend to return to Rekawa, this implies that elicited values can be interpreted as either non-use or option values for those who intend to return.

1. Introduction

Coastal wetlands provide a variety of ecosystem services to support human well-being. These ecosystem services include protection from storm surges and floods, water regulation and purification, habitat protection, biodiversity conservation, carbon sequestration, education and research, and recreation. A wide range of recreational activities is possible in coastal wetlands including sunbathing, swimming, diving, snorkeling, boating, recreational fishing, bird watching, and mangrove watching. Well-managed sustainable tourism in and around coastal wetlands may provide significant benefits both economically and ecologically,[1] while allowing ecosystem services to be sustained (Destination Wetland, 2012).

Estuaries and coastal ecosystems are some of the most threatened natural systems worldwide and those subjected to pressure from anthropogenic activities are decreasing at the highest rate (Lotze et al., 2006; Valdemoro et al., 2007; Worm et al., 2006). The coastal wetlands are under stress from both human-induced actions and natural causes as a result of climate change (Finkl and Makowski, 2017). It has been estimated that approximately 50% of the world's coastal wetlands have already been decimated by urbanization, industrialization, and commercial development. The remaining 50% is under extreme threat from a variety of anthropogenic activities such timber harvesting, sand mining, oil and gas exploitation, expansion of agricultural lands and aquaculture, wildlife poaching, and recreation (Finkl and Makowski, 2017). Tourism development has been recognized as a direct contributor to altering coastal wetland ecosystems due to infrastructure development, and indirectly by introducing non-native species into the ecosystem (Bacon, 1987; Baldwin, 2000; Davenport and Davenport, 2006; Mejía and Brandt, 2015).

According to the *Destination Wetland Report* (2012), which was jointly prepared by the World Tourism Organization (UNWTO) and the Ramsar Convention on Wetlands, it is estimated that 50% of all international tourists travel to all types of wetlands,[2] but especially to the coastal wetlands, spending around USD 925 billion each year (Wafa, 2012). Over the next 10 years, South Asia is expected to become the

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[1] Sustainable tourism can directly contribute to the environmental protection and conservation by converting natural areas into national parks and wildlife parks because of their attractions for tourists.

[2] "Wetlands are broadly defined under the Ramsar Convention and include rivers, lakes, ponds, mangroves, coral reefs, reservoirs, mudflats, sandy beaches, salt pans, etc. They include areas that can be coastal or inland, natural or artificial" (Destination Wetland Report, 2012).

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fastest growing region globally for tourism (WTTC, 2017). According to the WTTC (2017), South Asia experienced the second strongest growth in tourism (7.9%), while at the country level Sri Lanka was ranked ninth among the fastest growing travel and tourism destinations in 2016. Sri Lanka has become one of the most popular tourism destinations in the region due to its diverse landscape, wildlife, and cultural heritage (Lai, 2002). The tourism industry strengthens the Sri Lankan economy, contributing 5.1% of the national gross domestic product (WTTC, 2017).

To maintain its good reputation among eco-tourists, it is important to develop the ecotourism[3] industry with minimum disturbance to nature. Baldwin (2000) argues that although tourism appears to be a sustainable industry for many tropical islands, it is still necessary to examine the ecological impact of tourism development in coastal regions. To achieve the goal of sustainable tourism management, policy makers, and decision-makers in administration should be informed about tradeoffs between tourist preferences for "wilderness" and environmental protection on the one hand, and development of tourism facilities on the other. These analyses are essential for the allocation of limited financial resources in ecotourism development.

A growing body of economic valuation literature has emphasized the distinct roles of coastal wetlands in the provision of ecosystem services (Barbier et al., 2008; Bell, 1997; Breaux et al., 1995; Costanza et al., 1989, 2008; Farber, 1987). Most of the existing studies focus on commercial fisheries, coastal protection from storms, and water purification functions. A limited number of studies have been devoted to estimating the value of coastal wetlands for tourism and recreational purposes (see Bergstrom et al., 1990; Bell, 1997). Fernando et al. (2016) estimated the recreational value of Muthurajawela wetland ecosystem in Sri Lanka using the Travel Cost method. One way of estimating tourists' willingness to pay (WTP) for the development of tourist destinations is to use the contingent valuation method (CVM) (Barnes et al., 1999; Tisdell and Wilson, 2000). This approach provides an aggregate WTP (value) for tourism development. However, it does not provide the required information for decision makers about the relative importance of different attributes characterizing such development, or the potential tradeoffs in management decisions such as tourism facilities and biodiversity conservation (Louviere and Hensher, 1982).

Although the aggregate values from CVM studies are important for evaluating ecotourism development, it is important to disaggregate these values to understand their tradeoffs (i.e. tourism development vs. wetland conservation). Revealed preference methods like the travel cost method, also provides estimates for the recreational value of a tourist destination. However, given our context there are some challenges applying this specific method. The fact that almost all foreign tourists visit this area only once renders a little variation in annual visitor frequency. This, in turn, implies that the recreational demand curve cannot be reliably estimated in travel cost models. Furthermore, most foreign tourists stay in villages close to the turtle site and take this way by foot or bike. Hence, the local travel inflicts insignificant costs upon them, even when including time costs. Finally, most foreign tourists to Sri Lanka have multiple purposes for their trip, among which one may be to see the turtles at Rekawa. Applying a travel cost survey for foreign tourists to Rekawa this has to be corrected for, which in turn will make willingness to pay estimates very uncertain. The other fact is that revealed preference methods only provide estimates for use values but stated preference methods estimate both use and non-use values. Given that we are valuing nature (i.e. biodiversity) in which the non-use values may be potentially significant, we use a stated preference method of choice experiments. For these reasons, we decided to apply a stated preference method, the discrete choice experiment, for our purpose.

This study contributes to the coastal wetland valuation literature in two ways. It applies the choice experiment (CE) to estimate preferences for ecotourism development in a coastal wetland, with an emphasis on conservation of biodiversity and provision of tourism facilities. Kularatne (2017) studied tourist preferences for nature-based tourism and services in Sri Lankan national parks and nature refuges using a CE to compare before and after tourism experiences. Juutinen et al. (2011) applied a CE to estimate the value of biodiversity and recreational facilities at Oulanka National Park in northern Finland. Our study differs by considering the ecological nature for biodiversity attributes and also for attributes related to tourism development. Dussault (2016) argues that the concept of "ecological nature", enables humans to inhabit the earth's ecosystems in ecologically sustainable ways. By broadening the concept of ecological nature, this paper is better framed to investigate the interactions between the goals of conservation of biodiversity in the face of sustainable uses of tourism development.

The major objective of this study is to estimate tourist preferences, (expressed as WTP) for different ecotourism facilities and biodiversity protection. Our findings provide important policy implications for both the Sri Lankan tourism authorities and stakeholders for similar destinations (i.e. wetland and tourism managers in the region) to prepare sustainable planning of ecotourism facilities in coastal wetlands. We define the concept "sustainable planning of ecotourism" as an economically viable and socially acceptable development of ecotourism, which also preserves the natural attributes of the wetland. Furthermore, the findings from this study can be used for benefit transfer to similar sites in the region.

Our empirical case is the Rekawa coastal wetland in Southern Sri Lanka. The paper is organized as follows. Section 2 describes the study area. Section 3 explains the material and methods and Section 4 reports the results of the econometric analysis. This is followed by a discussion in Section 5 with the conclusions and managerial implications presented in Section 6.

2. Study area

Rekawa coastal wetland is located in the Hambantota district of Southern Sri Lanka (Fig. 1). The wetland is composed of an array of coastal, terrestrial, and wetland ecosystems including Rekawa beaches, corals, and Rekawa lagoon surrounded by mangroves. It is rich in biodiversity (IUCN & CEA, 2006). This region has been identified by the IUCN (2005) as one of the prime nesting habitats for turtles. As a result, the Department of Wildlife Conservation in Sri Lanka declared the Rekawa coast as Sri Lanka's first sea turtle sanctuary in 2006. This legal protection facilitates the activities carried out by Rekawa Turtle Conservation Project (TCP) which is a community-based organization established in 1996 by converting all turtle egg poachers to conservationists to protect turtle nests in-situ (Kapurusinghe, 2012). There are five species of globally threatened sea turtles in this area; green turtle, loggerhead turtle, leatherback turtle, hawksbill turtle, and olive ridley turtle. Each year they come to the Rekawa beach for nesting. The Rekawa coral reef is found off the northeastern side of the Rekawa headline. This is a shallow fringing reef about 100–150 m wide and 300 m long. In total, 35 species of stony corals and 138 species of reef and reef associated fish have been recorded at this reef ecosystem (IUCN & CEA, 2006).

The Rekawa Lagoon is approximately 250 ha with an average depth of 1.4 m and surrounded by a mangrove cover. The lagoon and mangrove habitats provide a home for many fish, shellfish, reptiles, mammals, invertebrates, and local and migratory birds (Ganewatta et al., 1995). Wild shrimp is the major resource harvested by Rekawa lagoon fishers. *Penaeus indicus* is the commercially most important shrimp species, which predominates the landings. When shrimp catches are low, lagoon fishermen are involved in harvesting finfish

[3] "Responsible travel to natural areas that conserves the environment, sustains the well-being of the local people and involves interpretation and education" (TIES, 2015).

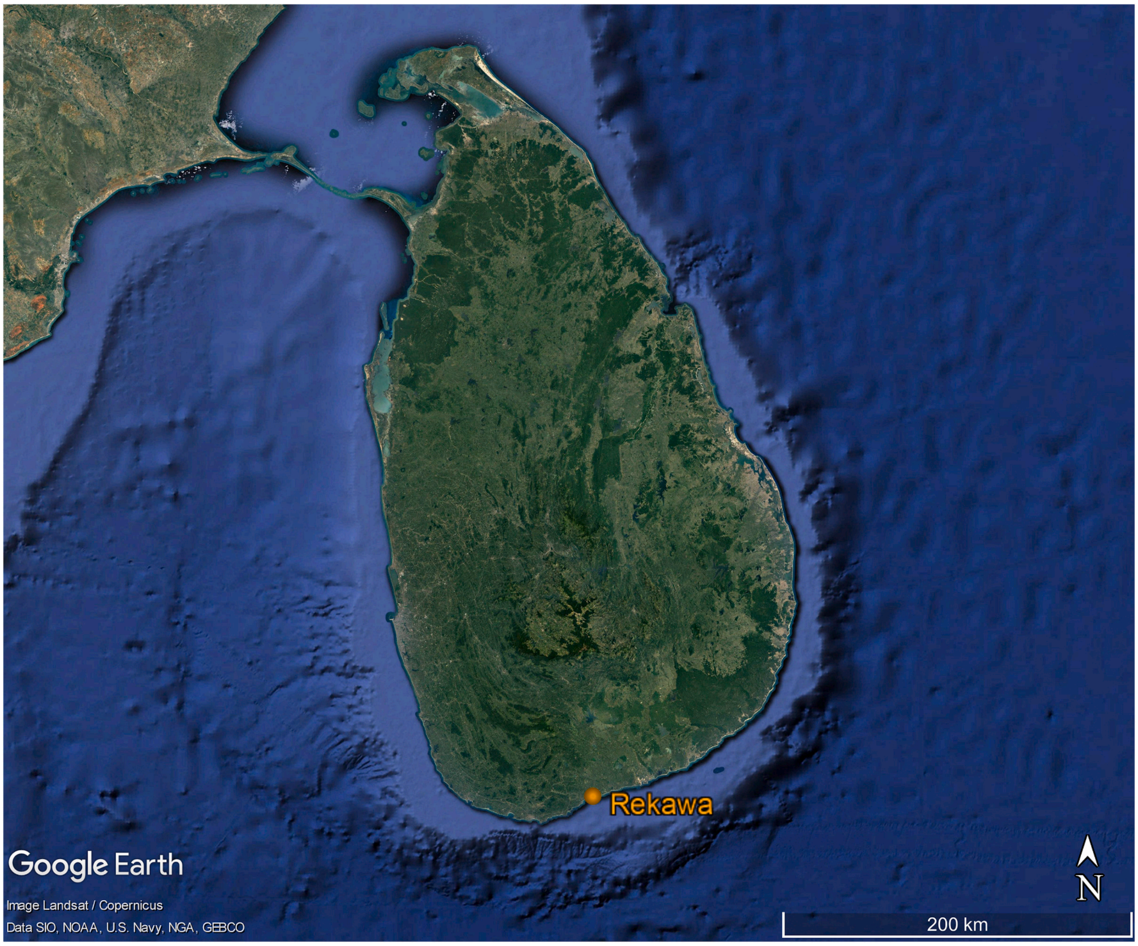

Fig. 1. Location of the study area in a map of Sri Lanka.
Source: Google Earth.

(Amarasinghe, 2010). According to Jayatissa et al. (2002), approximately 11 out of 21 true mangrove species[4] are available in the Rekawa wetland. These mangrove ecosystems support ecotourism at Rekawa by providing habitats for approximately 104 bird species, of which 15 are migratory (IUCN & CEA, 2006).

Although Rekawa has a potential for ecotourism, it has not yet been fully realized (IUCN & CEA, 2006). Currently, this destination is famous among tourists for turtle watching. A few inland fishers have provided outrigger canoeing trips for tourists to enjoy the natural landscape around the Rekawa lagoon. In addition, clean sandy beaches are attractive for tourists for sun-bathing, and swimming, while snorkeling, and diving are some of the water-sports activities which can perform there.

3. Material and methods

3.1. Survey design

The survey included a CE which is a quantitative technique for eliciting individual preferences for different attributes characterizing the goods under consideration. By varying the attribute levels, some alternatives were formulated and presented in a choice card. The respondents then chose the alternative they prefer, which was typically repeated on 6–12 choice cards. To conduct the CE, we employed four focus groups (including stakeholders from the Rekawa ecotourism industry and other stakeholders) to select attributes and attribute levels. The focus groups consisted of the following members; the Turtle Conservation Project (TCP) members; local tourist guides and drivers; lagoon and marine fishers; hotel managers; home-stay providers; government officers from the Department of Wildlife Conservation and Department of Fisheries; representatives from a local non-profit-organization; and villagers who are interested in engaging in ecotourism in Rekawa. We used various participatory rural appraisal (PRA) techniques in the focus group discussions including “resource map”, “pair-wise ranking method”, “matrix-ranking method”, and “strengths-weaknesses-opportunities-threats (SWOT) analysis” to identify the ecotourism potential in Rekawa.

After the PRA session, the groups proposed various ecotourism-related activities. Considering the scope of this study, a few attributes were selected, and cultural tourism activities (i.e. cultural shows and Sri Lankan traditional cuisine) were removed. The selected attributes for the survey were as follows: “Number of tourists per turtle-watching tour”, “Expenditure on beach cleanup activities”, “Boat trips around the Rekawa lagoon”, and “Biodiversity”. The first three attributes focus on ecotourism facilities aiming at improving tourism services, while the fourth represents a truly ecological characteristic. During our preliminary investigations in Rekawa, we collected information from foreign tourists about their willingness to pay to Rekawa wetland fund, after explaining the proposed improvements in Rekawa ecotourism facilities and biodiversity conservation. The attributes and their levels are

[4] “Mangrove species are classified as true mangroves and mangrove associates” (Wang et al., 2011). True mangroves differ physiologically and ecologically from mangrove associates, in their survival ability in the mangrove environment.

presented in Table 1.

The survey questionnaire included four parts (see Appendix 1). The first part explains the objective of the study and provides background information about the status of ecotourism in Rekawa coastal wetland. The second part starts with explaining the attributes and the levels they take, and then presents the choice cards to be completed. Each tourist was asked to complete 10 choice cards. The cards were designed to maximize expected Bayesian d-efficiency of a multinomial logit model with only main effects (Scarpa and Rose, 2008), for which Ngene software was used (Choice Metrics, 2014). An example of a choice card is given in Appendix 1. The third part investigates the reasons for the choices made and explores tourists' opinions of Rekawa wetland and the ecotourism industry operating in this area. The final part collects the socio-economic characteristics of the participants.

We tested the questionnaire in face-to-face interviews with two groups of foreign tourists who were available at the TCP center. The main feedback consisted of concerns regarding the length of the questionnaire (19 pages). However, we did not reduce the length of the questionnaire as all pages were essential to explain the survey approach. Based on this feedback, we decided to collect data through valuation workshops.[5] To reduce the reading time of the questionnaire, we applied the questionnaire text in the information videos used in the workshops. Finally, we revised photos of the biodiversity attributes in the choice cards because two of the given biodiversity pictures had to be distinguished from each other.

Table 1
Attributes and levels of each attribute.

Attributes	Levels
Number of tourists per turtle-watching tour	• 35 tourists per visit to the turtle nesting site (SQ) • 25 tourists per visit to the turtle nesting site • 15 tourists per visit to the turtle nesting site • 5 tourists per visit to the turtle nesting site
Expenditure on beach cleanup activities	• No further increase in expenditure on beach cleanup activities (SQ) • 10% increase in expenditure on beach cleanup activities • 20% increase in expenditure on beach cleanup activities
Boat trips around the Rekawa lagoon	• Boat trips without a guide (SQ) • Boat trips with a guide
Biodiversity reduction	• With no efforts the reduction in biodiversity will be 20% (SQ) • With small efforts the reduction in biodiversity will be 10% • With large efforts the reduction in biodiversity will be 5%
Rekawa wetland management fund	• LKR 0 (SQ) • LKR 250 • LKR 500 • LKR 750 • LKR 1000 • LKR 1250 • LKR 1500

Note: SQ denotes the "status quo" condition of Rekawa at the time of the survey for each attribute.

[5] Valuation workshops are different from personal interviews and postal mail or web-based surveys in that they gather a group of people in a room, and ask them to fill in the survey while being gathered. They allow the transmission of more information about the goods to be valued, and provide time to think about, and sometimes discuss the valuation task (MacMillan et al., 2002, 2006; Aanesen et al., 2015).

3.2. Sampling

According to the visitor statistics maintained by the Department of Wildlife Conservation, Sri Lanka, there were 2465 foreign and 4515 domestic tourists visiting Rekawa in 2011 (Rathnayake, 2016). However, during our data collection period, most tourists visiting Rekawa coastal wetland, were foreign with a smaller share being domestic as claimed by the turtle conservation project. For many foreign tourists, this is an unfamiliar ecosystem. Unfamiliar goods and services may lead to problems when it comes to economic valuation, because respondents are not well informed about the good that they are going to value (Aanesen et al., 2015). Setting up valuation workshops allows the researcher to inform respondents about the goods, and questions may be asked. At Rekawa, tourists are usually asked to wait at the TCP office, until the arrival of a turtle for nesting at the beach and this time was used to conduct the workshops. Each workshop involved two steps. First, the tourists watched two videos: one about the ecotourism potential in Rekawa coastal wetland and one on the CE survey methodology. Next, they were asked to fill in the questionnaire. Each workshop lasted 40 min, with 10 min allocated for watching the videos and 30 min to fill in the questionnaire. Between the end of August and the beginning of October 2017, we conducted 26 workshops, with 5–15 tourists, which took place between 19:00 and 23.45. Although the data collection was conducted in an off-season, by the end of data collection, we had 331 completed questionnaires (after discarding 19 incomplete or incorrectly answered questionnaires[6]).

The sample characteristics are presented in Table 2. Females constituted 54.7% of the sample, 57.1% were less than 30 years old, and one third were married. Further, 79.8% were graduates (implying they have at least 16 years of education), 64.7% were in paid-work, and about two third earned less than 4000 USD per month.

When explaining the Rekawa wetland management fund attribute, we informed the foreign tourists that they have to pay a mandatory additional fee to "*Rekawa wetland Management* Fund", which will be established and managed by an independent local government body.

Table 2
Overview of socio-demographic variables.

Characteristics	Frequency	Percentage (%)
Gender		
Male	150	45.3
Female	181	54.7
Age		
18–30 years	189	57.1
31–50 years	124	37.5
>50 years	18	5.4
Marital status		
Single	221	66.8
Married	110	33.2
Education		
Graduates	264	79.8
Non-graduates	67	20.2
Occupation		
Paid-work	214	64.7
No paid-work	117	35.3
Personal monthly income		
2000 USD or less	101	30.5
2001–4000 USD	110	33.2
4001–6000 USD	76	23
>6000 USD	44	13.3

[6] Data collection was interrupted on some evenings due to the arrival of turtles. Although, some tourists brought their incomplete questionnaires with them to the beach, only a few completed questionnaires were returned after the turtle watching.

Later, in the questionnaire survey, we also asked about their preferred way of paying for suggested improvements of the wetland and to finance ecotourism development at Rekawa. They preferred taxation (n = 146) to voluntary contributions (n = 124). One explanation could be that there are opportunities for some tourists to avoid payments, if the finance of the work is voluntary. In contrast, a tax is compulsory and difficult to avoid paying (Ivehammar, 2009).

3.3. Model specification

3.3.1. Mixed logit model

The econometric basis for discrete choice data analysis is the random utility model (RUM) which assumes that the utility of a person is described by an observed systematic component and an unobserved stochastic component (McFadden, 1974). The utility of tourist *n* from alternative *i* in choice task *t* (U_{njt}) can be formulated as in (1).

$$U_{nit} = \beta X_{nit} + \varepsilon_{nit} \tag{1}$$

where X_{nit} is a vector of observed attributes and their levels for alternative, β is a vector of attribute coefficients, and εnit is an unobserved stochastic component of the utility, which is assumed to be independently and identically distributed (iid) following the extreme value type I distribution (Gumbel).

In the multinomial logit (MNL) model, the random error needs to fulfill the iid (individually independently distributed) and IIA (independent of irrelevant alternatives) assumptions. If the latter assumption is violated, the MNL is not an appropriate model for choice data analysis. In this case, more complex models such as multinomial probit (Hausman and Wise, 1978), nested logit, or mixed logit models (Train, 1998) are required.

To allow preferences to be heterogeneous, we allow the attribute parameters to vary following a pre-specified distribution, which yields to a mixed logit (MXL) model. The vector of attribute coefficients, β_n, which is now individual-specific, where β is a common mean, and ˥ is the lower Cholesky matrix with standard deviations on the diagonal and η_n represents draws from a specified distribution such as normal, log-normal, triangular, or uniform. Correlation among utility coefficients is allowed by setting the off-diagonal elements of ˥ to be non-zero. (Hensher et al., 2005).

$$\beta_n = \beta_i + ˥\eta_n \tag{2}$$

Assuming utility maximizing agents they will choose alternative *i* to alternative *j*, if $U_{nit} > U_{njt}$, for all $i \neq j$, When the error terms are extreme value distributed, this implies that the difference between the two error terms is logistically distributed. The probability that alternative *i* is chosen from a set of *C* alternatives is then given by

$$P_{(i|C)} = \frac{\exp(\mu\beta_n X_{nit})}{\sum_{j\epsilon C}\exp(\mu\beta_n X_{nit})} \tag{3}$$

where *μ* is a scale parameter, which is inversely related to the variance of the error term. As μ and β are confounded and cannot be estimated separately, within one and the same dataset, it is usual to normalize μ to 1. (Train, 2009).

In the MXL model, since the probability is conditional on the heterogeneous preferences, the probability in (3) is given as

$$P(in\,|Xn) = \int \prod_{t=1}^{T} \frac{\exp(\mu\beta_n X_{nit})}{\sum_{j\epsilon C}\exp(\mu\beta_n X_{nit})} f(\beta)d\beta \tag{4}$$

where *f (β)* is a density function. The expression in (4) does not have a closed form solution and needs to be approximated using simulation averaging over D draws from the assumed distribution (Hensher et al., 2005; Revelt and Train, 1998). The simulated log-likelihood function can be represented by

$$Log\ L = \sum_{n=1}^{N} log\ \frac{1}{D}\sum_{d=1}^{D}\prod_{t=1}^{T} \frac{\exp(\mu\beta_n X_{nit})}{\sum_{j\epsilon C}\exp(\mu\beta_n X_{nit})} \tag{5}$$

Model parameters are estimated based on maximum likelihood techniques. Alternative specific constant (ASC) is assumed to be fixed across respondents. We did not observe significant correlations, thus, we applied models without correlations in this paper.

To estimate how preferences for the various attributes vary with tourist characteristics such as gender, age, education, and marital status, we ran a MXL model in which choice attributes were interacted with socio-demographic variables. We extended the MXL model further by including interactions with attitudinal perceptions of the tourists towards conservation of Rekawa wetland to examine attitudinal effects on choice attributes. Further, we interacted the ASC with the socio-economic characteristics of the respondents to analyze how the choice of the status quo option depended on characteristics of the tourists.

The estimated parameters (expressing scaled marginal utilities of the attributes) can be used to compute marginal WTPs. In turn, the WTPs can be used to derive the consumer surplus of implementing specific management alternatives, i.e. specified combinations of the attribute levels. Unconditional MWTPs are calculated as follows;

$$MWTP = \frac{\beta\breve{a}}{\beta c}\ , \forall\, a \neq c \tag{6}$$

where $\beta\breve{a} = \frac{1}{R}\sum_{r=1}^{R}\beta a$ is the average of R draws from the normal distribution and $\widehat{\beta}_c = \frac{1}{R}\sum_{r=1}^{R}\beta_c$ is the average of R draws from the underlying normal distribution of the log-normally distributed cost coefficient. The draws were taken using the mean MWTP and its standard deviation which are computed as $\frac{\beta am}{\beta c}$ and $\frac{\beta as}{\beta c}$ where *βam* and *βas* are the mean and standard deviation of coefficient respectively and are both scaled by the scale parameter (Aanesen et al., 2018). Because scale parameters cancel out, the MWTPs can be compared directly across models. R = 1000 draws were used for both non-cost and the cost parameter.

4. Results

We used both the MNL and the MXL models to estimate the preferences of foreign tourists for ecotourism development and biodiversity conservation at Rekawa wetland in Southern Sri Lanka. The MNL model was used as the first approach, and the MXL model was used to test for the heterogeneous preferences of tourists. The models were estimated in R Studio, using the cmcR package (CMC, 2017). In the MXL model we used 1000 Halton draws and assumed a normal distribution for all non-cost attributes, a negative log-normal distribution for the cost attribute, whereas the alternative specific constant was kept fixed. Table 3 shows the results of the two models.

The reported results are consistent across both models having the same signs and significance levels for the estimated parameters. The exception was the wetland management fund coefficient in the MNL model, which was significant at 95% level. Statistically significant standard deviations of all random coefficients in the MXL model indicate heterogeneous preferences among tourists for the all attributes. The model fit is given by pseudo-r^2 and equaled 0.19 and 0.27 for the MNL and MXL models respectively. This is a relatively good fit for choice models, as pseudo-r^2 is often between 0.2 and 0.4 (Louviere et al., 2000). The lower LL-value, AIC, and BIC values reveal an improvement of the MXL models over the MNL model. Hence, we report the MWTP estimates and interaction terms based on the MXL model.

The alternative-specific constant of the status quo is negative and statically significant in both models (see Table 3). This implies a preference for moving away from the status quo. The status quo of Rekawa wetland is explained by Alternative 3 in each choice card. The sign of the

Table 3
Estimate results for the MNL and MXL model (standard errors in parentheses).

Estimates	MNL model Coefficient (s.e.)	MXL model	
		Mean (s.e.)	Std. dev. (s.e.)
ASC	−1.5280 *** (0.1867)	−2.0875*** (0.2260)	
Number of tourists per turtle-watching tour	−0.0145 *** (0.0020)	−0.0252*** (0.0033)	−0.0246*** (0.0062)
Beach cleanup expenditure	0.0630 *** (0.0036)	0.1016*** (0.0074)	−0.0678*** (0.0068)
Boat trips	0.2209 *** (0.0427)	0.3117*** (0.0609)	−0.5206*** (0.1193)
Biodiversity reduction	−0.0610 *** (0.0049)	−0.0999*** (0.0097)	−0.1078*** (0.0100)
Wetland management fund	−0.0001 ** (0.0001)	−8.9936*** (0.3841)	−1.7478*** (0.1487)
N	331	331	
Number of observations	3310	3310	
Number of inter-person draws	–	1000 (halton)	
Log -Likelihood	−2106.27	−1884.89	
Adjusted Pseudo-R^2	0.19	0.27	
AIC	4224.54	3791.77	
BIC	4261.17	3858.93	

*** and ** indicate that estimates significant at 1% and 5% levels respectively.

turtle-watching group size parameter is negative, implying that the higher the number of people in the group, the less likely an alternative is chosen. Hence, tourists prefer smaller groups to larger groups. The positive sign of the boat trip attribute indicates that tourists prefer boat trips around the Rekawa lagoon with a guide compared to non-guided boat trips. The positive sign of the beach attribute indicates that tourists prefer higher expenditures on beach cleanup activities to lower. Finally, the negative sign of the biodiversity attribute indicates that tourists prefer alternatives with lower reduction in biodiversity than alternatives with higher reduction.

Table 4 presents the results of MWTP for the attributes. The MWTP estimates from the MXL model are lower and not significant. The reason is substantial heterogeneity in preferences for the various attributes, including the cost attribute, which yields large standard errors, and thus large confidence intervals. Still, the sign of the MWTPs and their relative importance are the same in the two models. Boat trips around the Rekawa lagoon have the highest MWTP. Respondents demonstrated a WTP of 1727 LKR (11.51USD[7]) extra, if boat trips are guided compared to non-guided boat trips. Beach cleanup has the second highest MWTP, with a value equal to 493 LKR (3.29 USD), implying that tourists are willing to pay 493 LKR for a 10% increase in expenditure used on cleaning up beaches at Rekawa. Tourists are willing to pay 113 LKR (0.75 USD) extra (in addition to the normal fee) for a reduction of 10 tourists in the turtle-watching group. Finally, tourists are willing to pay 477 LKR (3.18 USD) to reduce biodiversity losses from 20% to 10% or from 10% to 5%. All the estimated mean MWTP are significant at a 90% level.

Table 4
Mean unconditional MWTP generated by the MNL model and 95% confidence intervals for the mean of each attribute (LKR/person).

Attribute	MWTP based on MXL (95% CI)	MWTP based on MNL (95% CI)
Number of tourists per turtle-watching tour	19.74 (−66.36, 26.86)	−113** (−213, −13)
Beach cleanup expenditure	48.39 (−73.61, 170.40)	493** (937, 49)
Boat trips	135 (−196.01, 467.32)	1727* (3497, −43)
Biodiversity reduction	−24.16 (−108.05, 59.72)	−477** (−909, −45)

Note: ** and * indicate that estimates are significant at 5% and 10% respectively.

In the questionnaire, we asked the respondents to rank their preferences for ecotourism and conservational activities given in the choice cards. We analyzed the ranking data using Friedman test to examine whether there is a significant difference in attributes. Test results revealed that there was a statistically significant difference between these attributes ($\chi^2 = 2975.7$, df = 3, $p = 0.001$). Then we run post-hoc Friedman nemenyi test in R Studio using the PMCMR package (Pohlert, 2018) to find out which pairwise activities have a significant difference based on their rank sums or rank means. The results confirmed that each pair of activities has a significant difference in preferences (i.e. boat trips and turtle watching, boat trips and beach quality, boat trips and biodiversity conservation, beach quality and turtle watching, beach quality and biodiversity conservation, biodiversity and turtle watching).

Applying the MXL model, we interacted the ASC with each of the socio-demographic parameters. Except for the attribute parameters, this model yielded a few significant parameters. The only significant interaction was for education. The ASC only occurs in the SQ-alternative, and thus the negative sign of the interaction parameter demonstrates that higher educated (graduated) tourists are less inclined to choose the SQ-alternative compared to lower educated people. The results are shown in Appendix 2.

Furthermore, we ran a MXL model in which choice attributes were interacted with socio-demographic variables to estimate how the attribute preferences vary with tourist characteristics such as gender, age, education, and marital status. Most of the estimated parameters for the interaction variables were insignificant. Among the socio-demographic variables, only education and marital status could explain some of the variation in attribute preferences across the respondents. The results of the interaction models show that highly educated people (graduates) have higher preferences for extra expenditure being used on beach cleanup activities and are more adverse to large biodiversity reduction, and would like to enjoy boat trips around the lagoon without a guide relative to non-graduates. Married persons preferred larger turtle-watching groups and guided-boat trips around the Rekawa lagoon compared to unmarried persons. These results are displayed in Appendix 3.

The turtle-watching group size attribute is of particular interest due to its potential policy implications. Hence, we inspected the effect of this attribute on respondents' utility closer by including the square of the number of tourists per turtle-watching group in the utility functions.[8] The parameter of the squared turtle-watching group size attribute tells us whether the marginal utility of the turtle-watching group size, which is negative, is diminishing or increasing as the group size decreases. Appendix 4 shows the results of this analysis. The estimated parameter of the squared turtle-watching group size is negative, indicating that the lower the group already is, the smaller is the effect on respondents' utility of further decreases in group-size. This is as expected, as it implies that there is a limit for how small groups the tourists prefer.

In addition to personal characteristics, we also tested whether tourists' attitudes towards the conservation of coastal wetlands affected their preferences for the attributes. In the questionnaire, respondents were asked to indicate the degree to which they agreed with a set of statements. Table 5 displays how tourists responded concerning plans for the conservation of Rekawa wetland.

While about 82% of the respondents agreed that "Rekawa coastal wetland has an intrinsic value and we have no right to destroy it to develop ecotourism", about 86% agreed that "Rekawa coastal wetland has an intrinsic value and we must be careful so that our ecotourism activities to the smallest possible degree destroy them". A majority of the

[7] 1 USD = 150 LKR on average during August to October 2017.

[8] We thank an anonymous reviewer for this point.

Table 5
Distribution of tourist attitudes towards the Rekawa wetland conservation.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Do not know
Rekawa coastal wetland has an intrinsic value and we have no right to destroy it to develop ecotourism	3%	4%	7%	22%	60%	4%
Rekawa coastal wetland has an intrinsic value and we must be careful so that our ecotourism activities to the smallest possible degree destroy them	3%	2%	5%	14%	72%	4%
We do not need to take Rekawa coastal wetland into special consideration because the ecosystem itself will manage to repair any injuries caused by tourists	65%	14%	8%	4%	5%	4%
Even if I will not visit Rekawa again, the quality of the Rekawa coastal wetland should be protected and kept in good quality	2%	2%	1.5%	9.5%	81%	4%

respondents did not agree with the statement; "We do not need to take Rekawa wetland into special consideration because the ecosystem itself will manage to repair any injuries caused by tourists". Approximately 90% of the respondents agreed that "Even if I will not visit Rekawa again, the quality of the Rekawa coastal wetland should be protected and kept in good quality".

We interacted the statement "Rekawa coastal wetland has an intrinsic value and we have no right to destroy it to develop ecotourism" with each of the attributes with those who scored 5 on the Likert-scale for this statement (see MXL model A1 in Table 6). The interaction model shows that tourists who strongly agreed with this statement have stronger preferences for guided boat trips. However, their preferences for the biodiversity attribute and extra expenditure on beach cleanup activities did not differ significantly from people who did not support this statement.

Tourists who completely agreed (i.e. those who scored 5 on the Likert-scale) with the following statement "Even if I will not visit Rekawa again, the quality of the Rekawa coastal wetland should be protected and kept in good quality", demonstrated stronger preferences for hindering reduction in biodiversity and extra expenditure to be used on beach cleanup activities (see MXL model A2 in Table 6).

Table 6
Results of the MXL model including interactions with attitudes "Rekawa coastal wetland has an intrinsic value and we have no right to destroy it to develop ecotourism (A1)" and "Even if I will not visit Rekawa again, the quality of the Rekawa coastal wetland should be protected and kept in good quality (A2)".

Estimates	MXL model (A1)		MXL model (A2)	
	Mean (s.e.)	Std. dev. (s. e.)	Mean (s.e.)	Std. dev. (s. e.)
ASC	−1.9236*** (0.2393)		−2.0662 *** (0.2295)	
Number of tourists per turtle-watching tour	−0.0305*** (0.0058)	0.0269 *** (0.0075)	−0.0290 *** (0.0070)	0.02908*** (0.0091)
Beach cleanup expenditure	0.1022*** (0.0111)	−0.0689*** (0.0072)	0.0799*** (0.0133)	−0.0690 *** (0.0076)
Boat trips	0.1805*** (0.0880)	0.4831*** (0.1257)	0.2777*** (0.1143)	0.51978*** (0.1218)
Biodiversity reduction	−0.0960 *** (0.0144)	0.1096*** (0.0116)	−0.0437*** (0.0153)	0.1069*** (0.0113)
Wetland management fund	−8.0422*** (0.4118)	−1.6940*** (0.1932)	−8.2066*** (1.1464)	1.95348*** (0.8270)
Number of tourists per turtle -watching tour x Attitude	0.0087 (0.0066)		0.0037 (0.0075)	
Beach cleanup expenditure x Attitude	0.0025 (0.0114)		0.0318*** (0.0143)	
Boat trips x Attitude	0.2276** (0.1184)		0.0468 (0.1344)	
Biodiversity reduction x Attitude	−0.0076 (0.0159)		−0.0726*** (0.0175)	
Wetland management fund x Attitude	−9.0456 (46.7889)		−1.2302 (2.4861)	
N	331		331	
Number of observations	3310		3310	
Number of inter-person draws	1000 (Halton)		1000 (Halton)	
Log -Likelihood	−1872		- 1867.66	
Adjusted Pseudo-R^2	0.28		0.28	
AIC	3776		3767.31	
BIC	3874		3864.99	

**** and ** indicate that estimates are significant at 1% and 5%.

5. Discussion

Due to the ideal conditions for turtle nesting, thousands of turtles come to Rekawa beach for egg laying every year (Ganewatta et al., 1995; Rathnayake, 2016). While this makes the beach interesting from a tourism perspective, care must be taken not to disturb the nesting activities. Therefore, habitat protection is important for turtle conservation, as large groups of tourists make the place crowded, disturb the environment, and increase littering (Juutinen et al., 2011). Further, tourists might disturb turtles when taking photographs, as they get too close to them, touching or even climbing on them (Tisdell and Wilson, 2003). Such disturbances can result in preventing the turtles from nesting on a preferred stretch of the beach, and instead laying eggs in a less-preferred stretch of the beach, which may be more exposed for predation or inundation. Sometimes, such disturbances can also result in the turtles releasing their eggs in the sea (Heng and Chark, 1989). Therefore, unregulated turtle watching can result in turtle harassment, altering the patterns of selecting beaches for nesting, which in turn may imply decreased reproductive success. Finally, it also implies degraded beach environment by littering, campfires, and trampling of vegetation (Choi and Eckert, 2009).

According to Whaling (2017), "proposals for sea turtle tourism developments and management strategies should be considered on a case-by-case basis, in order to consider possible context-specific impacts". Read et al. (2019) conducted a pilot study on turtle-watching in New Caledonia by allowing a maximum of 45 tourists per visit, dividing them into 3 groups of 15 each at night visits and with a maximum of 45 visitors per morning visit, without dividing into groups. Their findings revealed that a majority of the tourists were satisfied with the group size of 45 irrespective of the time of the turtle-watching tour. Considering both economic and environmental aspects of *in-situ* conservation of turtles, currently, turtle-watching groups in Rekawa are set up with 35 tourists per group. Our findings reveal that respondents prefer and are willing to pay for smaller groups which is consistent with the findings of Juutinen et al. (2011) whereby an increase in the number of tourists causes negative effects on respondent welfare. However, in our study the group size preference is heterogeneous and unmarried people are willing to pay more for smaller turtle-watching groups. Conversely, married people tend to prefer larger groups, although not larger than the current group size of 35. This may be due to the possibility of being in the same group with their family members.

Beach littering reduces the aesthetic value of beaches and discourages tourists from visiting (Balance et al., 2000). Cleanliness is identified as the most crucial factor in influencing beach users' choice and previous studies have shown that foreign tourists are prepared to spend more money to enjoy clean beaches (Balance et al., 2000). In line with their findings, we found that foreign tourists are willing to pay for increased beach cleanup activities. Further, our results indicate heterogeneous preferences in this respect, and those with higher education tend to have a higher preference for extra expenditure used on beach cleanup activities compared to those with a lower education. A possible explanation is that people with a higher level of education have more knowledge about the effects of beach littering on the coastal environment.

Tourists are willing to pay extra for guided boat trips compared to the current unguided boat trips. This may be due to the higher safety and security in guided tours (Wight, 2001), in addition to the possibility of receiving information about the surrounding environment. In general, it has been shown that tourists are willing to pay considerable amounts for tours that include specialized information about the flora and fauna at the destination (Kularatne, 2017). Providing wildlife information not only increases tourist satisfaction, but also strengthens their attitudes towards nature conservation (Kularatne, 2017). Roberts et al. (2014) found that guided interpretation[9] is more effective compared to non-guided interpretation in terms of tourists' satisfaction.

Kiss (2004) argues that while ecotourism is a good land use pattern for biodiversity protection, it is not as effective as pure conservation. Carlsson et al. (2003) found that biodiversity was one of the highest valued attributes in wetland management by the population living close to the studied wetland. When the ecosystem is rich in biodiversity, domestic visitors do not value further biodiversity enrichment, but are concerned if there is a decline in biodiversity (Juutinen et al., 2011). In contrast, foreign tourists place almost the same value on both increases and decreases in biodiversity (Juutinen et al., 2011). In our study, the biodiversity reduction attribute was significant and higher reduction in biodiversity negatively affected the welfare of foreign tourists, supporting Juutinen et al. (2011).

The fact that the CE asks for contributions to a fund for future management and improvements of Rekawa wetland, combined with a large share (98%) of informants stating that they do not intend to return, implies that the elicited values can be interpreted as non-use values. This is because, most of the participants do not expect to experience the improved situation in Rekawa, for which their contribution is intended. Alternatively, for those intending to return, the elicited values can be regarded as option values. Such an interpretation is supported by the attitudinal questions which revealed that a majority of tourists are highly concerned about the protection and conservation of the Rekawa coastal wetland, even if they do not intend to return. For example, approximately 90% agreed (or strongly agreed) with the statement "Even if I will not visit Rekawa again, the quality of the Rekawa coastal wetland should be protected and kept in good quality". In an earlier survey, Gunawardena and Rowan (1995) used the contingent valuation method with an open-ended approach to quantify the option and non-use (existence and bequest) values of the Rekawa mangrove ecosystems among households in Rekawa community. The existence, bequest, and option value presented in their study (2.6 USD/ha/year) is probably an underestimate of the total existence value. The reason is that they did not include broader conservation aspects such as conservation of habitats for sea turtles and biodiversity, which we have demonstrated are important non-use values, at least for tourists.

We collected data only from foreign tourists due to the unavailability of domestic tourists to Rekawa site during our data collection period, which coincided with the domestic off-season for turtle watching. However, we acknowledge that it is required to collect information from both domestic tourists and the local communities in addition to foreign tourists, to elicit preferences for development of tourisms facilities and biodiversity conservation, to have a comprehensive picture of tradeoffs in Rekawa. Future research should try to address this limitation.

Our main focus in the project, which the survey is part of, and when formulating the survey, has been to inform national and local managers in Sri Lanka and at Rekawa, regarding preferences of tourists when it comes to destination attributes. Admittedly, applying more advanced statistical models, like the hybrid MNL, may have revealed also latent preferences among the respondents concerning Rekawa ecotourism development. However, when formulating the survey, this option was not taken into consideration, and thus we lack variables to use to reveal this type of underlying preferences. In addition, this may be of larger interest if we had included both foreign and domestic tourists. For now, we have mentioned this as an idea for future research.

6. Conclusion and managerial implications

This study investigated foreign tourist preferences and WTP for biodiversity protection and ecotourism development in a coastal wetland in Southern Sri Lanka using a CE. We found that most tourists preferred to be in small groups for turtle-watching. This is an indication to managers of turtle-watching at Rekawa, to reduce the current group size as this may enable them to command higher prices for this activity. However, keeping family members and friends in the same group is required as married people prefer to be in large groups compared to unmarried people.

Marine litter has been widely recognized as one of the major environmental issues. This is an issue, caused by discarding consumer items such as plastic or glass bottles, beverage cans, cigarettes, food wrappers, straws, and fishing gear debris either at the beach or in the sea. Finding an effective solution to the causes and effects of this environmental problem is challenging. Tourist WTP for beach cleanup activities indicates the importance of taking actions to clean the beaches regularly. Initially, preventing marine litter from entering the coastal environment is the most effective way to reduce and mitigate the harmful effects of this environmental problem. There are many practical solutions, including improved waste management systems, educational and outreach programs, anti-dumping campaigns, and reducing losses of fishing gear at sea. Considering our study location, we suggest several activities such as displaying sign boards, establishing waste bins, and organizing beach cleanup activities with the local community as social events to keep the Rekawa beach clean.

Existing boat trips operated by lagoon fishers should be upgraded by providing the services of an educated guide. The results of Kularatne (2017) also demonstrate how the provision of trained interpreters who offer insights and diversity about the tour is an important factor to improve tourist experiences. Tourists indicated they are willing to pay more if there is a guide in the boat compared to the current boat service without a guide. Currently, there are no trained tour guides at Rekawa for this task. This can be seen as an opportunity for educated, young people at Rekawa to provide a quality service to tourists during boat trips, thus earning income and becoming self-sufficient.

The conflict between tourism development and biodiversity conservation is complicated due to the lack of knowledge pertaining to how tourism activities affect biodiversity. Therefore, during boat trips, we propose to make tourists aware of biodiversity facts and information about Rekawa coastal wetland, and of how appropriate tourist behavior contributes to conserving biodiversity. Tourists should also be told not to disturb wildlife while enjoying nature. In the case of Rekawa coastal

[9] "Interpretation is an educational activity which aims to reveal meaning and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simply to communicate factual information". (Tilden, 1977, p. 8). Wearing et al. (2007) split interpretation into two groups based on delivery technique: 'guided' (e.g. guided walks) and 'non-guided' (e.g. boards).

wetland, foreign tourists have a positive perception of biodiversity conservation. Thus, economic benefits arising from ecotourism should be used for conservation and programs to promote biodiversity, to ensure habitat protection for a broad set of species. In conclusion, conservation of biodiversity plays a significant role in securing long-term sustainability of the ecotourism industry in Rekawa wetland.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ocecoaman.2021.105659.

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EDE

RESEARCH ARTICLE

Is the Sri Lankan ecotourism industry threatened by climate change? A case study of Rekawa coastal wetland using contingent visitation approach

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Abstract
This study investigates intended visitation behavior of tourists toward Rekawa wetland under anticipated climate change (CC) scenarios. An interview-based contingent visitation survey was conducted with 365 foreign and domestic tourists to estimate the effects of CC on future visitation. Based on two IPCC scenarios using two direct and three indirect climatic factors, we composed a CC environmental index. The results show a decline in number of trips equal to 43 per cent and 53 per cent under scenarios 1 and 2 respectively, but the difference is not significant. Foreign and domestic tourists differ significantly with regard to socio-demographic characteristics and beliefs about CC effects at Rekawa. Controlling for such differences, we demonstrate that foreign tourists are less likely than domestic tourists to reduce future visitation to Rekawa due to CC impacts. Still, the future of ecotourism at Rekawa wetland is at risk if adaptation measures are not taken to meet CC impacts.

Keywords: climate change environmental index; climate change scenarios; coastal wetland; contingent visitation survey; intended visitation behavior

1. Introduction and background

Sri Lanka is a tropical island located in the Indian Ocean. It is an attractive destination for tourists as it offers a combination of spectacular landscapes, long beaches, rich coral covered sea-beds, high biodiversity and ancient cultural heritages. Tourism is one of the core sources of foreign exchange earnings in the national economy, and statistics reveal that the tourism industry ranked third among foreign exchange earning sectors in 2016 (Sri Lanka Tourism Development Authority, 2016). Tourism in Sri Lanka is multifaceted and ecotourism is one segment that is expected to increase in the future (Daily Mirror, 2017).

Ecotourism includes nature-based recreation and thus will be influenced by climate change (CC), both directly and indirectly (Richardson and Loomis, 2004; Richardson *et al*., 2006; Scott *et al*., 2007). Increases in temperature, changes in rainfall patterns, and sea-level rise are the direct influences of CC, inducing changes in biodiversity, mangroves, and coral cover (indirect effects). CC alters nature by changing the composition and quality of the ecosystems on which ecotourism depends. These types of climate-induced biophysical changes may in turn affect the visitation behavior of tourists (Scott *et al*., 2007). Hence, climate is a salient feature in tourist decision-making with regard to destination choice, time of travelling, and activity planning at the destination (Scott and Lemieux, 2010).

According to predictions of the Intergovernmental Panel on Climate Change (IPCC), the Sri Lankan coastal zone is highly vulnerable to changes in climatic conditions. As a result of CC induced sea-level rise (SLR), important sectors of the economy, such as tourism and fisheries, could be affected (Senaratne *et al*., 2009; Ministry of Environment and Renewable Energy, 2011). In the report '*National Adaptation Plan for Climate Change Impacts in Sri Lanka*', research studies on tourism and recreation have been identified as one of the prioritized actions to be taken while putting the major focus on nature-based tourism in the coastal zone (Ministry of Mahaweli Development and Environment of Sri Lanka, 2015). However, in spite of its current and growing significance to the national economy (Ministry of Mahaweli Development and Environment of Sri Lanka, 2015), compared to sectors like agriculture and fisheries (Eriyagama *et al*., 2010; Esham and Garforth, 2013; Harkes *et al*., 2015), tourism has received less attention from researchers in the field of CC. Hence, this study can be considered an early attempt to investigate the impacts of CC on ecotourism in Sri Lanka.

The Sri Lankan southern coastal belt is attractive to tourists due to its scenic natural and cultural landscape. Many types of ecosystems, such as beaches, coral reefs, wetlands and national parks along the Southern coast, contribute to this attraction. Rekawa coastal wetland is a tourism destination located in the Hambantota district of the Southern province, providing opportunities for ecotourism (figure 1). Due to the presence of the Rekawa Lagoon and its surrounding wetland habitat, the area is rich in biodiversity, including mangroves, coral reefs, about 104 bird species, and nesting sites for five species of globally threatened marine turtles (IUCN and CEA, 2006). Currently, the main attraction of this destination is turtle watching. To facilitate the natural egg-laying process of turtles, the Rekawa coastal belt was declared a sea turtle sanctuary by the Department of Wildlife Conservation in 2006.

There is a potential for increased ecotourism in Rekawa coastal wetland. The Ruhuna Tourism Bureau of Sri Lanka has discussed tourism-related projects with the Rekawa community to develop the ecotourism industry and thus upgrade the living standards of the community. In evaluating a future tourism destination, planners may take potential effects of CC into consideration (de Freitas *et al*., 2008). Analyzing future visitation behavior of tourists under anticipated CC scenarios for Rekawa may serve as input to tourism-related projects in Rekawa, and guide them regarding proactive actions for adapting to CC impacts.

The economic literature on CC impacts on tourism has primarily focused on winter tourism, with a geographical concentration in the European Alps and North America (Becken, 2013). Although the geographic diversity of CC impacts and adaptation studies have broadened, it still has a bias towards winter sports tourism and relatively less attention has been paid to coastal tourism (Becken, 2013). The contingent behavior method

Figure 1. Location of the study area in Sri Lanka.
Source: Google maps.

has been employed in a limited number of recreational studies to assess the effect of CC impacts on future visitation behavior of tourists (Richardson and Loomis, 2004).

The objective of this study is to investigate the future visitation behavior of both foreign and domestic tourists in light of the anticipated CC impacts on Rekawa coastal wetland in Sri Lanka. In this pursuit we, based on IPCC predictions, develop a Climate Change Induced Environmental Index (CCIEI) for the Rekawa region. The contribution of this paper to the CC literature is threefold. First, this case study provides a regional perspective on potential future visitation behavior of tourists under CC impacts in a coastal wetland in Sri Lanka. Second, it demonstrates how to develop a site-specific CCIEI including both direct and indirect climate variables, based on IPCC scenarios. This is crucial for countries and regions where there is a lack of CC prediction data, as is often the case in developing nations. Third, this study contributes to the existing literature on stated preference techniques in the form of the contingent behavior method in general, while having a special focus on CC impacts on ecotourism in a developing country.

The layout of the paper is as follows. Section 2 explains the methodology, and presents the data and the data collection procedure. Section 3 presents the results. The discussion and conclusions presented in section 4 end the paper.

2. Data and methods

2.1 Developing two IPCC future scenarios for the study site

In developing the CC scenarios, we considered both climatic variables and climate-induced biophysical variables. We chose air temperature, rainfall and sea level rise (SLR) as direct climatic variables as they are on the list of most widely applied direct climatic variables in the CC research, in addition to being relevant to our case study[1] (Maunder, 1962; McConnell, 1977; Mieczkowski, 1985; Richardson and Loomis, 2004; Whitehead *et al.*, 2009; Becken, 2013).

Rainfall and air temperature climatic variables for the Rekawa baseline scenario and future scenarios are taken from the national wetland directory of Sri Lanka and Wijesekara (undated), respectively. Future temperature and rainfall values for the Rekawa site were adopted from the Hambantota district and maximum values were taken from the HadCM3 (Hadley Centre General Circulation Model- Version 3) model. Attribute levels for SLR for Rekawa were taken from prediction values for Sri Lanka for 2025 and 2050 (UNDP, 2012).

Given the touristic attractions of our study area, we selected three climate-induced biophysical variables: the number of turtle nesting sites, mangrove cover and area of beach inundation. The Rekawa coast in southern Sri Lanka is the prime nesting habitat of turtles in Sri Lanka (IUCN, 2005). The Rekawa beaches provide an ideal environment for turtle nesting (Ganewatta *et al.*, 1995) and every year thousands of turtles reach Rekawa beach to lay eggs (Rathnayake, 2016). The Rekawa mangroves support ecotourism by providing habitats for local and migratory birds and for many species of mammals and reptiles (Ganewatta *et al.*, 1995). The Rekawa lagoon-mangrove ecosystem stretches into a sandy beach, which is approximately 10 km in length (Gunawardena and Rowan, 2005). Focus group discussions revealed that foreign tourists select Rekawa beach for relaxation due to its serene, beautiful and salubrious nature. While changes in direct climatic variables are already adopted for Rekawa based on prediction values for Sri Lanka, data do not exist for the climate-induced biophysical variables. Hence, we constructed estimates for the climate-induced biophysical variables in the two scenarios. We did this by taking into consideration the impact of SLR. First, we applied a standard survey and levelling technique to measure the present beach elevation. Next, using predicted levels of SLR for Rekawa, we predicted beach inundation for the two scenarios using Geographical Information System ArcView software. These predictions were made assuming that the current beach profile and topography would not change.

Finally, nesting site locations were marked using Global Positioning System. At the time of the preliminary investigation, we found 342 turtle nesting sites along the Rekawa coastal belt. Superimposing Google Earth satellite maps for the Rekawa coastal belt for several years, 55 nesting sites were identified as vulnerable to sea-wave actions. Based on this, a direct potential risk factor was developed, i.e., 16.08 per cent. Then, the indirect risk of losing turtle nesting sites was adopted from predictions based on beach inundation, i.e., 13 and 17 per cent for 2025 and 2050 respectively. Total potential risk of losing nesting sites for 2025 and 2050 was found to be 29 per cent and 33 per cent respectively, by summing up both direct and indirect risks. Hence, of a total of 342 nesting sites, there is a potential risk of losing approximately 100 and 113 nesting sites along Rekawa beach, leaving 242 and 229 sites for 2025 and 2050 respectively. From the pretesting of the survey, we learned that respondents preferred round numbers. Thus, we rounded these numbers in a subjective manner, with the intention of making a clear difference in changing nesting sites in two scenarios. The number of nesting sites in 2025

[1] The Rekawa coastal wetland is conducive to outdoor recreation activities such as turtle watching, sunbathing and canoe riding in the Rekawa lagoon. Thus, we used maximum temperature and rainfall as two of our direct climatic factors in our scenarios. SLR may trigger coastal erosion leading to loss of beach area for recreation and turtle nesting, which is the main tourism attraction of our case study area.

and 2050 are rounded up to 250 and rounded down to 200 respectively, considering the adverse CC effects in the long term compared to the short term.

Changes in mangrove cover in Rekawa were predicted by adapting the mixed mangrove area reduction rate worked out by Jayatissa *et al.* (2002) for the nearby Kalametiya Lagoon. It is reasonable to assume that this mangrove reduction is merely due to CCs, as felling mangrove trees around the lagoon is prohibited.

2.2 Developing a climate change induced environmental index

Climate change may have profound implications for tourists' visitation behavior due to the potential effects on comfort level. For example, CC may increase the average air temperature to a level above what most people perceive as comfortable. In order to capture the multidimensional nature of CC effects on human comfort level, changes in visitation behavior may be derived using a climate index, which is based on existing scenarios of CC (Rosselló-Nadal, 2014). Mieczkowski (1985) was one of the pioneers in the development of a climate index for tourism.

The development of Mieczkowski's Tourism Climate Index (TCI) originally encompassed twelve climatic variables, but five variables were omitted due to lack of meteorological data for some developing countries. The remaining seven variables – maximum daily temperature, mean daily temperature, minimum daily relative humidity, daily relative humidity, precipitation, daily duration of sunshine and wind speed – were used to create sub-indices of thermal comfort, daytime comfort, and daily comfort. These variables were allocated weights assuming their relative importance for tourists' wellbeing, to formulate the TCI. A common criticism of the existing climate indices for tourism, including Mieczkowski's TCI, is that assigning weights to various climate factors within the index is based on the researcher's subjective opinion and are not tested empirically against the preferences of tourists (de Freitas, 2003; Gómez-Martin, 2006).

Mieczkowski's TCI was originally designed to evaluate the global climate with respect to tourism, but not to assess impacts on tourism from CC. However, it was later used to evaluate the attraction of tourism destinations under anticipated CC scenarios (Rosselló-Nadal, 2014). Morgan *et al.* (2000) used Mieczkowski's TCI with a slight modification, to use it in a beach environment. Studies using the TCI to evaluate the attraction of tourism destinations under anticipated CC scenarios have been made for Europe (Moreno and Amelung, 2009), North America (Scott *et al.*, 2004), and some Mediterranean countries (Amelung and Viner, 2006).

So far, climate indices applied in tourism studies have been based solely on direct climatic variables. We propose an extension to capture both direct climatic and climate-induced biophysical variables. A main reason for using such a CCIEI in our study is the presence of strong correlations between climatic and climate-induced variables in the econometric model. By converting climatic and climate-induced variables into a common CC index in a systematic way, we avoid such correlations. The climatic and climate-induced variables were converted into the CCIEI by using weights given by participants in focus groups when asked which factors were more or less important when deciding to visit Rekawa.

In composing the CCIEI, we excluded the SLR variable, as this variable was used to estimate the indirect variables 'changes in turtles' nesting sites' and 'beach inundation'. For the remaining five direct and indirect climatic variables, we estimated the percentage change from the present situation to the scenario level. As all changes were of the same sign, i.e., a deterioration, we added up these changes to give a composite CC index. In order to test for the robustness of the CCIEI as a predictor of visitation behavior, we made various assumptions about the weights of each variable when constructing the CCIEI. First, we calculated the CCIEI without using weights, and next we calculated the CCIEI allocating equal weights (0.2) to each variable. These calculations were repeated allocating various weights to the variables. The weights were based on results from focus group interviews with tourists and expert opinion, but are ultimately subjective, as was also the case in Mieczkowski (1985). As focus groups revealed that foreign tourists especially come to Rekawa mainly for turtle watching, with beach recreation as the second most important activity, we allocated the highest weight to the turtle nesting site variable. We allocated the second highest weight to the air temperature and beach inundation variables. The remaining variables were allocated equal weights. Table 1 yields information of the CCIEI number for the various weight allocations.[2]

2.3 Contingent behavior method

The contingent behavior method (CBM) is a survey-based methodology involving the construction of hypothetical changes in the environment and asking respondents about their intended behavior contingent on such changes. CBM has been used in valuing environmental resources for recreational purposes (Chase *et al.*, 1998; Eiswerth *et al.*, 2000; Richardson and Loomis, 2004; Richardson *et al.*, 2006; Scott *et al.*, 2007). Still, there is a growing demand for estimation of changes in consumer welfare from recreation due to changing environmental quality or management of natural resources (Grijalva *et al.*, 2002). The seminal paper of Loomis (1993) verified the reliability of CBM by implementing a test-retest procedure. Grijalva *et al.* (2002) also tested the validity of CBM for outdoor rock-climbing demand and suggested that when a future project has implications beyond current and historical range, CBM data may be a useful supplement to revealed preferences data.

Two types of format have been used in CBM studies: reassessed contingent behavior and intended contingent behavior. When the reassessed contingent behavior format is used, respondents are asked to reassess their visitation behavior: that is, how they would have behaved in the past (i.e., number of visits they would have made) had hypothetical changes taken place (Simões *et al.*, 2013). In the intended contingent behavior format, respondents are requested to indicate their intended future visitation behavior for proposed hypothetical changes. In this format, instead of reassessing their former behavior, respondents are asked to predict how they will behave under future proposed conditions (Christie *et al.*, 2007). According to Simões *et al.* (2013), these two formats vary in terms of reference period considered for the contingent behavior question. In this study, the intended contingent visitation behavior format is used for two reasons. First, during the preliminary investigations we found that a majority of the foreign tourists are visiting this destination for the first time in their life, and thus it is difficult for them to reassess how they would have behaved regarding previous visits. Second, CC scenarios

[2]We made these different weight allocations purposely to examine the sensitivity of assigning different weights to the variables. There was no change in magnitude and direction of the significant variables from varying the weights used to develop the CCIEI. The CCIEI was also significant each time. Hence, for our analysis, we used 20 and 27 as the value of CCIEI for 2025 and 2050, respectively. Although technically there is no difference in using the value of 1 and 2 for the CCIEI instead of 20 and 27, we use the latter two values as they represent numbers based on observed or predicted data for climatic and climate-induced variables.

Table 1. Development of CCIEI

Climatic and climate induced biophysical variables	Anticipated change in 2025 as a % (non-weighted)	Anticipated change in 2050 as a % (non-weighted)	Allocated weights	Anticipated change in 2025 as a % (with same weight)	Anticipated change in 2025 as a % (with same weight)	Allocated weights	Anticipated change in 2025 as a % (with different weights)	Anticipated change in 2025 as a % (with same weights)	Allocated weights	Anticipated change in 2025 as a % (with different weights)	Anticipated change in 2025 as a % (with different weights)
Turtle nesting sites	28.6	42.99	0.2	5.72	8.58	0.4	11.44	17.16	0.3	8.58	12.87
Mangrove cover	3	12	0.2	0.6	2.4	0.1	0.3	11.22	0.05	0.15	0.6
Beach inundation area	13	17	0.2	2.6	3.4	0.2	2.6	3.4	0.3	3.9	5.1
Rainfall	36.8	33.5	0.2	7.36	6.7	0.1	3.68	3.35	0.05	1.84	1.675
Temperature	7.4	9.3	0.2	1.48	1.86	0.2	1.48	1.86	0.2	1.48	1.86
CCIEI	**89**	**115**		**18**	**23**		**20***	**27***		**16**	**22**

*Value used for CCIEI in data analysis.

are predictions into the future, which in turn demands the use of forward-looking survey methods. We developed two climate scenarios and asked respondents whether the changes described by the scenarios would increase, decrease or not change their future visitation to Rekawa.

2.4 Data collection

Using two future climate scenarios, one based on IPCC predicted values for Sri Lanka for the year 2025 and one for the year 2050, we designed a survey asking people to answer a hypothetical question about destination visitation in the future under the two scenarios. Figure 2 shows how the scenarios were presented and the framing of the future visitation question.

The timeframe of the scenarios was not explicitly mentioned as it may extend beyond the life span of many tourists to be interviewed. In addition, the survey encompassed demographic questions and questions on their concern about CC when selecting a destination and personal view on CC and its consequences for Rekawa.

The survey was pre-tested with tourists, tour guides and Rekawa community inhabitants, including staff members of a turtle conservation project. Based on their comments, modifications were made. The final survey was translated into the local language *Sinhala,* to be used for domestic tourists, whereas an English version of the survey was used for foreign tourists. We trained a team of five Sri Lankan graduate students in data collection. The training included how to approach potential respondents, briefly explain the objectives of the study and obtain their consent to participate. Face-to-face field interviews were made during December 2016 – February 2017, covering one of the peak seasons of tourists to this site. Weekends were selected for domestic tourists, while weekdays were used to reach foreign tourists.

Every second tourist or tourist group at each chosen sampling site was randomly selected for the interview. After the introduction, the respondent received the survey, and the future climate scenarios for Rekawa coastal wetland were explained. Next, the respondents were asked to answer the contingent visitation behavior question. Preliminary investigations revealed that this destination is visited once in a lifetime or every few years by the tourists, especially foreign tourists. Therefore, the contingent visitation behavior question was asked for a period of 5 years instead of number of annual trips. The data collection resulted in 365 completed questionnaires for data analysis, including 213 foreign and 152 domestic tourists. A summary of descriptive statistics for the respondents is provided in table 2. As can be seen, there are distinct differences in socio-demographic characteristics of domestic and foreign tourists. Each respondent answered two contingent visitation behavior questions, and thus the number of observations is 730.

2.5 Two-stage regression using instrumental variables

The fact that domestic and foreign tourists differ when it comes to socio-demographic characteristics complicates the statistical analysis of relevant explanatory variables for change in visitation behavior under CC. Using both tourist type and other socio-demographic characteristics as predictors will cause problems in the form of multicollinearity, while excluding either tourist type or the socio-demographic characteristics will cause correlation between remaining predictors and the error term (Angrist and Krueger, 2001). One method to solve for these problems simultaneously is to use

Change in environmental conditions	Present status	Future scenario 1	Future scenario 2
Number of turtle nesting sites	350 	250 	200 
Mangrove cover	No reduction 	3% reduction 	12% reduction 
Area of beach inundation	Not significant 	13% 	17% 
Precipitation	2000 mm 	1264 mm 	1330 mm 
Air temperature	27°C 	29°C 	29.5°C 
Seawater intrusion into Rekawa Lagoon	Not significant 	Sea level rise by 50 cm 	Sea level rise by 65 cm 

Question	Scenario 1	Scenario 2
1. If you knew that conditions at Rekawa coastal wetland would be as described in Future Scenario 1 & 2, would you change the ***number of trips*** you take to Rekawa in the next 5 years?	• Visit ***more*** often No: of additional trips ____ ☐ • Visit ***less*** often No: of fewer trips ____ ☐ • ***No change*** in no: of trips ☐	• Visit ***more*** often No: of additional trips ____ ☐ • Visit ***less*** often No: of fewer trips ____ ☐ • ***No change*** in no: of trips ☐
2. Would the changes described in Scenario 1 & 2 affect your ***length of stay*** in Rekawa on a typical trip?	Would you stay: • Longer? ☐ ___ days longer • Shorter? ☐ ___ days fewer • No change? ☐	Would you stay: • Longer? ☐ ___ days longer • Shorter? ☐ ___ days fewer • No change? ☐

Figure 2. Choice card and contingent visitation question as used in the survey.

instrumental variable estimation, which is one type of a two-stage regression procedure (Angrist and Krueger, 2001). Applying the instrumental variable technique, the predictors possibly correlated with the error term must have at least one, but can have more, instrument. We use tourist type as a predictor, along with the CCIEI and attitudes toward climate change impacts (CCimp). The latter is strongly correlated with

Table 2. Descriptive statistics for respondents divided on domestic (Sri Lankan) and foreign tourists

Characteristics	Domestic tourists	Foreign tourists
Total	152	213
Gender		
Female	22 (15%)	105 (49%)
Male	130 (85%)	108 (51%)
Average age	32	35.5
Educational level		
Primary education	8 (5%)	0
Secondary education	92 (60.5%)	12 (5.5%)
Technical diploma	13 (8.5%)	28 (13%)
Bachelor's degree	33 (22%)	117 (55%)
Postgraduate degree	6 (4%)	56 (26.5%)
Share in labor force	67.1	88.7

tourist type because a large share of foreign tourists answer 'don't know' to the question of whether CC impacts are visible at Rekawa. Eliminating the 'don't know' answers, foreign and domestic tourists are relatively similar when it comes to attitudes toward CCimps at Rekawa. Hence, in a reduced model, eliminating the 'don't know' answers, we use CCimp as a predictor.

The model we apply is thus the following:

$$\mathrm{VisCh}_i = \mathrm{ASC}_1 + b_1\mathrm{CCIEI}_{ij} + b_2\mathrm{CCimp}_i + b_3\mathrm{TT}_i + \varepsilon \,|\, \mathrm{sex}_i + \mathrm{age}_i + \mathrm{edu}_i + \mathrm{ocu}_i, \quad (1)$$

where ASC_i, $i = 1, 2$ are alternative-specific constants, ε and $\in$ are error terms respectively, and $b_1 - b_3$ are parameters to be estimated. Subscript i is a running index for the respondent and subscript j, $j \in 1, 2$, indicates the scenario (scenario 1 or 2). The CCIEI is the CC environmental index, as explained above. The predictor CCimp is a measure of how respondents perceive CC effects in Rekawa. It takes the value 0 if the respondent indicates (s)he doesn't know, the value 1 if the respondent doesn't think CC takes place in Rekawa, the value 2 if the respondent thinks CC takes place in Rekawa but that it is not visible, and the value 3 if the respondent thinks that CC takes place in Rekawa and that it is visible. The tourist type variable (TT) takes the value 1 for foreign tourists and 0 for domestic tourists.

To determine the effects of socio-demographic characteristics on changes in visitation behavior, which works through the tourist type variable, we estimate the following model:

$$\mathrm{TT}_i = \mathrm{ASC}_2 + \beta_1\mathrm{Gender}_i + \beta_2\mathrm{Age}_i + \beta_3\mathrm{Edu}_i + \beta_4\mathrm{Ocu}_i + \in . \quad (2)$$

The gender variable takes the value 1 if the respondent is a woman and 0 if a man. Education level of the respondent is coded as 1 for no formal education, 2 for primary education, 3 for secondary education, 4 for technical diploma, 5 for bachelor's degree, and 6 for postgraduate degree. The occupation variable takes the value 1 if the respondent has paid work and 0 if not. Only age is a numeric variable indicating the actual age of the

Table 3. Current visitation and hypothetical visitation behavior of foreign and domestic tourists under climate change scenarios

Visitation to Rekawa	Foreigners ($n = 213$)	Sri Lankans ($n = 152$)	Pooled sample
• First time in life	86.8%	14%	57%
• Every few years	8.5%	30%	17%
• Several times per year	4.7%	56%	26%
% of respondents who would change/not change their visitation behavior under CC scenario 1			
• Visit more often	0.5%	6%	2.7%
• Visit less often	32%	58%	43%
• No change in number of trips	67.5%	36%	54.3%
• Length of stay is longer	5%	4%	4.7%
• Length of stay is shorter	25%	55%	37.5%
• No change in length of stay	70%	41%	57.8%
% of respondents who would change/not change their visitation behavior under CC scenario 2			
• Visit more often	3%	3%	3.3%
• Visit less often	40%	73%	53.4%
• No change in number of trips	57%	24%	43.3%
• Length of stay is longer	4%	4%	3.8%
• Length of stay is shorter	34%	70%	48.8%
• No change in length of stay	62%	26%	47.4%

respondent in number of years. The rest are categorical and binary (dummy) variables. ASC_2 is an alternative specific constant, and $\beta_1 - \beta_4$ are coefficients to be estimated.

3. Results

Just as with the socio-demographic characteristics, foreign and domestic tourists differ substantially regarding their actual and intended visitation to Rekawa. This is shown in table 3. Not surprisingly, the majority of the foreign tourists visit Rekawa for the first time, while most domestic tourists visit more regularly. Although most tourists, independent of type, selected Rekawa purposely, only 4 (2 per cent) of foreign tourists selected Rekawa as the 'sole destination' or 'primary purpose' of their trip. The corresponding number for domestic tourists was 83 (55 per cent). A majority of the tourists came to Rekawa for turtle watching (data not shown in table 3).

Regarding intended future visitation, the number of trips to Rekawa in the short-term and long-term CC scenarios is reduced by 43 and 53 per cent, respectively, for the pooled sample. The Wilcoxon signed-rank test shows no statistically significant difference between short-term and long-term visitation behavior (p-value $= 0.99$, (pseudo) median $= -0.5000644$). Hence, in the remainder of this section we do not distinguish

Table 4. Results for attitudinal questions A1: 'Do you believe that climate change is happening in Rekawa?' and A2: 'Are impacts of climate change visible in Rekawa?'

	Domestic tourists	Foreign tourists
Question A1		
I don't know	14 (9%)	68 (32%)
CC is happening in Rekawa	138 (91%)	145 (68%)
Total	152	213
Question A2		
I don't know	12 (8%)	64 (30%)
There are no CC impacts	2 (1%)	0
There are CC impacts but they are not visible	53 (35%)	47 (22%)
There are CC impacts but they are not visible	85 (56%)	102 (48%)
Total	152	213

between short- and long-term visitation behavior. Also, for intended future trips the two tourist types differ. While two-thirds of the foreign tourists will not change their visitation behavior, this is the case only for one-third of the domestic tourists. Almost 60 per cent of the domestic tourists will reduce their visitation under CC, whereas only one-third of the foreign tourists will do so.

When it comes to beliefs and attitudes regarding CC and its impacts at Rekawa, the two tourist types also differ. Table 4 shows the results for the two attitudinal questions 'Do you believe that CC is happening in Rekawa?' (A1), and 'Are impacts of CC visible in Rekawa?' (A2).

The most distinct difference between domestic and foreign tourists is that foreign tourists to a far larger degree 'do not know' whether CC takes place and/or is visible in Rekawa. While 32 per cent of foreign tourists do not know whether CC is happening in Rekawa and 30 per cent do not know whether there are (visible) CC impacts, less than 10 per cent of domestic tourists feel the same. However, if we correct for those who do not know, the number of domestic and foreign tourists who think that CC takes place in Rekawa, visibly or not, are relatively equal.

Starting out with a model including both tourist type and socio-demographics, in addition to the CC environmental index and attitudinal variable, this model demonstrated a high degree of multicollinearity. The Farrar$-\chi^2$ test, with a test statistic equal to 1,884.4, identified multicollinearity in the set of predictors, and further investigation confirmed that all socio-demographic and attitudinal predictors, but not the CC environmental index, may be non-significant in a regression model with change in the number of visits as the dependent variable due to multicollinearity problems. If we remove the 'do not know' answers from the attitudinal variable, this variable no longer causes multicollinearity and thus can be used as predictors in a model with change in number of visits as the dependent variable.

Explaining the change in intended future visitation (dependent variable) by the CC environmental index, attitudes to CC impacts at Rekawa, and tourist type, where for the latter we use socio-demographic characteristics (gender, age, education and participation in labor force) as instruments, yields the results shown in table 5. The full model applies all responses from the 365 respondents, while the reduced model

Table 5. Change in number of visits explained by tourist type, change in climatic conditions (CCIVI) and respondents' attitudes to CC visibility (CCimp-only reduced model), using gender, age, education and participation in labor force as instruments for tourist type

	Full model		Reduced model	
	Mean coefficient	Std. error	Mean coefficient	Std. error
ASC	−0.1885	0.297	−0.1883	0.45
Tourist type	0.3189*	0.14	0.498***	0.135
CCimp			0.001	0.0096
CCIVI	−0.024*	0.012	−0.287*	0.014
		p-value		*p*-value
R-adj.	0.041		0.064	
N, *k*	730, 4		578, 4	
Wald test stat	9.35***	0.000	19.76***	0.000
Weak instruments	283***	0.000	264***	
Sargan-Hansen	4.90	0.179	2.67	0.128
Wu-Hausman	2.50	0.115	4.86	0.265

* = significant at 10% level, *** = significant at 1% level.

applies responses only from those respondents who have given an answer different from 'do not know' to the attitudinal question (A2). Both models are solved by the instrumental variable maximum likelihood method, in R-Studio, specified in package AER.

Tourist type and the CCIEI explain changes in visitation behavior while beliefs about whether CC takes place and is visible in Rekawa does not. Note also that the ASC is insignificant, indicating that error terms are on average zero, and thus that there is no systematic influence on the dependent variable lacking in the model. The sign of the CCIEI indicates that higher index numbers yield lower numbers for intended change, and as the dependent variable runs from −10, indicating a reduction of 10 trips, to +5, indicating an increase of 5 trips, the negative sign means that more severe CC effects (higher CCIEI) lead to larger reductions in intended future visits. The tourist type variable takes the value 1 for a foreign tourist and 0 for a domestic tourist. Hence, the sign for tourist type indicates that tourists with characteristics more like a foreign tourist are more inclined either not to change intended future visits (dependent variable 0) or to increase them (dependent variable positive) compared to domestic tourists. Finally, the attitudinal variable takes higher positive values the more CC effects the respondent believes there are in general, and at Rekawa. Hence, the negative sign indicates that respondents who believe there are severe effects from CC are more likely to reduce their intended future visits.

Furthermore, the hypothesis of weak instruments is rejected, indicating that the instruments, i.e., gender, age, education and being in the labor force, are strong instruments for the tourist type variable. The two other tests, Sargan-Hansen and Wu-Hausman, both indicate that the null hypothesis cannot be rejected. For the Sargan-Hansen test this indicates that the instruments are uncorrelated with the error terms in the regression model. For the Wu-Hausman test it indicates that there is no correlation between any of the predictors and the error terms.

Table 6. The probability of being a foreign tourist as dependent of gender, age, education, being in the labor force and attitudes towards climate change

	Full model Mean coefficient (std. error)	Reduced Model Mean coefficient (std. error)
ASC	−0.44 (0.08)***	−0.54 (0.11)***
Gender	−0.23 (0.03)***	−0.30 (0.03)***
Age	0.005 (0.001)***	0.004 (0.0015)***
Education	0.23 (0.01)***	0.23 (0.01)***
In labor force	0.19 (0.036)***	0.18 (0.04)***
Attitude to CC	−0.06 (0.01)***	0.0035 (0.03)
N, *k*	365, 5	365, 6
Adj.R^2	0.4909	0.4967
F-test statistic	141.6***	114.9***

*** = significant at 1% level.

To fully understand the effect of the instruments, i.e., the socio-demographic characteristics, on intended future visitation under the CC scenarios, we run the model in equation (2), first on the full dataset and next on the reduced dataset. The model is estimated by the maximum likelihood method with R Studio software. Table 6 presents the results of this model.

All socio-demographics are significantly correlated with tourist type, but when we remove those tourists who say 'do not know' when asked about CC and visibility in Rekawa, there is no difference between domestic and foreign tourists.

Combining the results from tables 5 and 6 shows that foreign tourists are more likely to be female and foreign tourists are less likely to change or reduce intended future visits, and female tourists are less likely to change or reduce future visitation than are male tourists as a consequence of CC impacts. Applying the same logic for the other socio-demographic characteristics shows that older people, more educated people, and people in the labor force, all increasing the likelihood of being a foreign tourist, increases the probability that the tourist will not change or increase the future number of visits. Hence, domestic tourists, who are more males than females, younger, less educated, and with lower participation in the labor force, are more likely to reduce their future visitation to Rekawa in the presence of the two CC scenarios.

4. Discussion and conclusions

This study investigates the potential impacts of CC on ecotourism at Rekawa coastal wetland in southern Sri Lanka. Two CC scenarios were developed for the short term (2025) and the long term (2050), encompassing three direct climatic variables (temperature, rainfall, and sea level rise based on IPCC predictions) and three climate-induced bio-physical variables (number of turtle nests, mangrove cover and beach inundation). Due to strong interdependencies among the climatic and climate-induced variables, we could not estimate marginal utilities for each of these variables. Instead, we constructed a CC environmental index. Richardson and Loomis (2004) probably faced a similar problem, as they used only three out of 12 climatic and climate-induced variables displayed in the contingent visitation survey as explanatory variables in their regression model. Scott *et al.* (2007) used the same type of model as Richardson and Loomis (2004) in assessing intended behavior of tourists visiting mountain regions in the western USA under CC forecasting scenarios towards the end of the 21st century, but did not differentiate between direct and indirect climatic variables.

Survey respondents were asked to state their intended change in visitation to Rekawa under the two CC scenarios. In the short-term scenario, a majority of the respondents, 54 per cent, would not change their visitation to Rekawa, whereas 43 per cent would. In the long-run scenario, these numbers were reversed: 43 per cent would not change their visitation behavior whereas 53 per cent would. This is as expected because the climate-induced variables were more adverse in the long run compared to the short run.

The model results show that the environmental index, being a proxy for the CC scenarios, significantly and negatively affects tourists' intended visitation behavior. Although this is bad news for the tourism industry in Sri Lanka, it is not unexpected. The CC scenarios predict higher maximum temperature, from 27°C today to 29°C and 29.5°C in the two scenarios. They also predict less precipitation and higher sea level, the latter leading to a lower number of turtle nests and more beach inundation. Finally, they predict less mangrove cover. The three climate-induced variables – number of turtle nests, mangrove cover and beach inundation – are all shown to contribute to tourists' welfare (Fish *et al.*, 2005; Uddin *et al.*, 2013; Sommerville, 2016), and they are all changed in a detrimental way in both CC scenarios.

At first glance, model results indicate that domestic tourists are more inclined to reduce visitation behavior under CC than are foreign tourists. However, as the two groups differ substantially with respect to socio-demographic characteristics and attitudes towards CC impacts at Rekawa, these effects are not straightforward. We applied a two-stage estimation procedure, where socio-demographic characteristics were used as instrumental variables for tourist type, which in turn was used as a predictor for change in number of visits together with the CC environmental index and attitudes towards CC at Rekawa, This showed that the socio-demographic characteristics only work through tourist type in their effect on visitation behavior. Furthermore, when corrected for those answering 'do not know', the attitudinal variable does not distinguish between domestic and foreign tourists, nor does it explain changes in visitation behavior. A separate regression of tourist type on the socio-demographic characteristics shows that foreign tourists tend to be older, better educated, more likely to be in the labor force, and more likely to be female. Indirectly, this tells us that women, older people, better educated people, and people in the labor force are less likely to reduce future visits to Rekawa, contingent on the CC scenarios presented in the survey.

These results are not unexpected. When it comes to domestic tourists, the younger may be less dedicated to one specific place than older people, for example because they have not yet developed a preference for one particular place like Rekawa, and thus are more likely to substitute Rekawa for alternative destinations (Vigolo, 2017). Foreign tourists are less likely to change their visitation behavior, which may be due to the fact that for these tourists a visit to Rekawa is a once-in-a-lifetime experience, so climatic and climate-induced variables are not so important (Hamilton *et al.*, 2005).

This paper provides some insights into the development of a CCIEI for site-specific case studies. However, we acknowledge that there is a subjective element in developing a CCIEI for Rekawa wetland. The problem of weighting the importance of the variables included in the CCIEI is stated by, for example, Maunder (1962: 5): 'Unfortunately, in deciding both what to include, and how important the elements are in relation to the total climate, one is forced to rely primarily on personal experience and observations for there is no measurable basis for deciding such issues. Nevertheless, some choice of the elements, and some weighting of the elements chosen must be decided upon, even though it is realized that there will be many who will disagree'. Still, we believe that our efforts in this paper are an early attempt to develop a site-specific CCIEI for tourism, and that further research is needed to test both the formulation of such CCIEIs and their robustness in explaining how the CC index may affect visitation behavior for tourists.

Although our results indicate that future visitation to Rekawa will decrease, the survey results should be interpreted with caution. Because of greater uncertainties in CC projections, there is a greater uncertainty in developed CC scenarios (IPCC, 2001). Also, tourists' preferences when selecting a destination evolve over time, and typically follow global trends (Nordin, 2005).

The CCIEI was found to be a significant determinant of tourists' intended visitation behavior. As Rekawa beach is famous among tourists for turtle watching, in addition to beach recreation and enjoying biodiversity in mangrove ecosystems, the findings of this study provide important insights to the Rekawa community and authorities to take proactive measures to protect this coastal wetland from CC impacts. Taking actions to minimize beach erosion, increase mangrove protection, and maintain the land next to the turtle-nesting beach without construction of any buildings are proposed as some of the adaptation strategies to minimize the CC impacts. If adaptation measures are not taken to reduce CC impacts, Rekawa coastal wetland is at risk for two reasons. First, because this will reduce the number of tourists visiting the beach and, second, because fewer tourists means less income, which in turn is used to take adaptive measures.

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Willingness to pay for the restoration of mangroves to reduce the impact of climate change on ecotourism in Rekawa coastal wetland of Southern Sri Lanka

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Abstract

This study investigates tourist preferences and willingness to pay (WTP) for restoration of mangroves to reduce the effects of climate change on ecotourism at Rekawa coastal wetland, Sri Lanka, using a double bounded discrete choice elicitation format in a contingent valuation method. The survey also included socio-economic, demographic, and attitudinal characteristics of respondents. The results reveal that domestic and foreign tourists on average were willing to pay 2.65 USD and 11.4 USD per person, respectively, for mangrove restoration in Rekawa wetland. Among socio-demographic variables, education, age, and occupation had a significant effect on WTP. Furthermore, we show that foreign respondents with greater trust in the role of mangroves in mitigating the impacts of climate change on sea turtles, and domestic tourists who believed effects of mangrove restoration in reducing the future vulnerability of urban expansion, were willing to pay more for the proposed mangrove restoration fund. Based on tourists' preferences and willingness to pay for mangrove protection, our results support the establishment of an environmental protection fund from the collection of tourists' entrance fees using a dual pricing strategy, and the use of the funds for planting mangroves, patrolling mangrove areas to prevent illegal activities, and promoting nature-based tourism activities.

Key words: contingent valuation method, double bounded discrete choice, mangrove restoration, climate change, sea turtles, dual pricing

1. Introduction

Mangrove forests are receiving growing attention in the climate change debate due to their capacity for "blue carbon" sequestration (Friesen et al., 2017). [1] In tropical climates, mangrove ecosystems act as efficient carbon sinks in terms of their capacity for carbon sequestration in both above-ground biomass, below-ground biomass and in sediments (Donato et al., 2011, Pham et al., 2018). Mangroves have an array of features that contribute to their resilience to significant environmental change such as storm damage and sea-level rise, and catastrophic events such as tsunamis, hurricanes, tidal bores and cyclones (Alongi, 2008).

Despite knowledge about the importance of mangroves for adapting and mitigating climate change impacts, large mangrove areas in Asia are still being cut down to provide space for agricultural and aquaculture activities, as well as urban spread. This development is causing substantial policy challenges in relation to mangrove conservation and management (Richards and Friess 2016). As a result, issues arising due to climate change impacts may be exacerbated in the future (Ward et al., 2016). More than 50 percent of Sri Lankan mangrove forests have been destroyed in the past 30 years due to prawn farming, hotel development, settlements, logging, tourism, agriculture, and pollution (Mombauer, 2019). Although it is now illegal to cut down mangroves, immense damage has already been done to mangrove forests. Therefore, restoring and replanting mangroves is of great importance for the future, and studies are needed for estimating willingness to pay (WTP) for such activities.

Existing literature has given considerable attention to mangrove restoration but only a few studies have focused on estimating WTP for the restoration of mangroves in the context of climate change (Pham et al., 2018, Tuan et al., 2014). Those studies have used the Contingent

[1] The carbon captured by oceans and coastal ecosystems is called blue carbon

Valuation Method (CVM) with a single-bounded discrete choice (SBDC) approach to estimate mean WTP for mangrove restoration. Answers to a SBDC question format only reveal whether the WTP value of the respondent is lower ('no' response) or higher ('yes' response) than the amount the respondent was asked to pay. In a double-bounded discrete choice (DBDC) format, a respondent receives two bids. If (s)he accepts the first bid (s)he receives a higher bid in the second round. If (s)he instead rejects the first bid (s)he is offered a lower bid. Only one study (Trung et al., 2020) is found applying the double-bounded discrete choice (DBDC) format, investigating how socio-economic, demographic and attitudinal characteristics of respondents influence their WTP for mangrove restoration in Vietnam.

The studies mentioned above have estimated WTP for mangrove restoration within households that interact with mangrove forests for their livelihood and that will have to deal with climate change impacts (Pham et al., 2018, Tuan et al., 2014). There are a few economic studies of tourists' WTP for restoration of mangroves due to the benefits from the ecosystem services provided by the mangroves (Ramli, 2017, Spalding and Parrett, 2019). However, to the best of our knowledge, none of these studies have linked the WTP for restoration of mangroves to reduction of the negative impact of climate change on ecotourism, and used *in situ* eco-tourists to assess the matter using the DBDC approach.

Only a few studies have examined the effect of respondents' perceptions towards mangroves as significant predictors of their WTP for mangrove conservation (Pham et al., 2018; Trung et al., 2020). It is evident that lack of perception indicators towards economic valuation of mangrove ecosystems could produce biased estimations of WTP, when the role of mangroves has not been included as a predictor of WTP (Trung et al; 2020). This study will contribute to the literature on economic valuation of mangrove restoration by introducing tourists' perceptions about roles of mangroves in reducing climate change impacts on ecotourism, and thereby provide a more comprehensive understanding of WTP for mangrove restoration.

As ecotourism consists of nature-based recreation, it will be influenced by climate change through the alteration of the composition and quality of the ecosystems, and thereby their services, on which ecotourism depends (Salpage et al., 2020). Restoration of mangrove forests plays an important role in reducing the vulnerability of ecotourism to climate change impacts, especially in coastal wetlands. Examples of effects of mangrove restoration include mitigating the impact of climate change on sea turtles' terrestrial reproductive phase by providing shade to beaches and preventing coastal erosion (Fuentes et al., 2012) and helping to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines (Tuan et al., 2014, Gunawardena and Rowan, 2005). Furthermore, restored and protected mangrove ecosystems prevent increased future vulnerability of mangroves due to urban expansion into low-lying coastal areas, protect buildings and infrastructure from damage caused by storms, and provide habitats for a variety of terrestrial, estuary, and marine species, while creating new livelihood options in mangrove areas such as nature-based ecotourism (Tuan et al., 2014).

Traditionally, mangrove forests are not thought of as attractive sites for tourism and recreation. However, harboring a vast range of wildlife, many such sites have been transformed into tourism destinations with the realization of fascinating and educational experiences (UNEP-WCMC, 2006). Therefore, mangrove ecosystems promote ecotourism in two ways. First, being an attractive tourism site and second, reducing the vulnerability to climate change impacts on ecotourism. Hence, the objectives of this study are to estimate tourists' WTP for restoration of mangroves to reduce the impact of climate change on ecotourism using a DBDC elicitation format, and include effects of socio-economic, demographic, and attitudinal characteristics of respondents on the WTP.

The paper is structured as follows. Section 2 presents the material and methods. Section 3 shows results, and finally, Section 4 presents the discussion and conclusions.

2. Material and methods

2.1 Survey area

The Rekawa coastal wetland is located in Hambantota district on the Southern coast of Sri Lanka (Figure 1). This ecosystem is rich in diverse coastal, terrestrial, and wetland habitats which include Rekawa lagoon surrounded by mangrove forests, beaches, coral reefs, and sea grass beds (Ganewatta et al., 1995). Irrigated freshwater is brought into the lagoon by a canal system, and it is connected to the sea via two outlets, one natural and the other human-made.

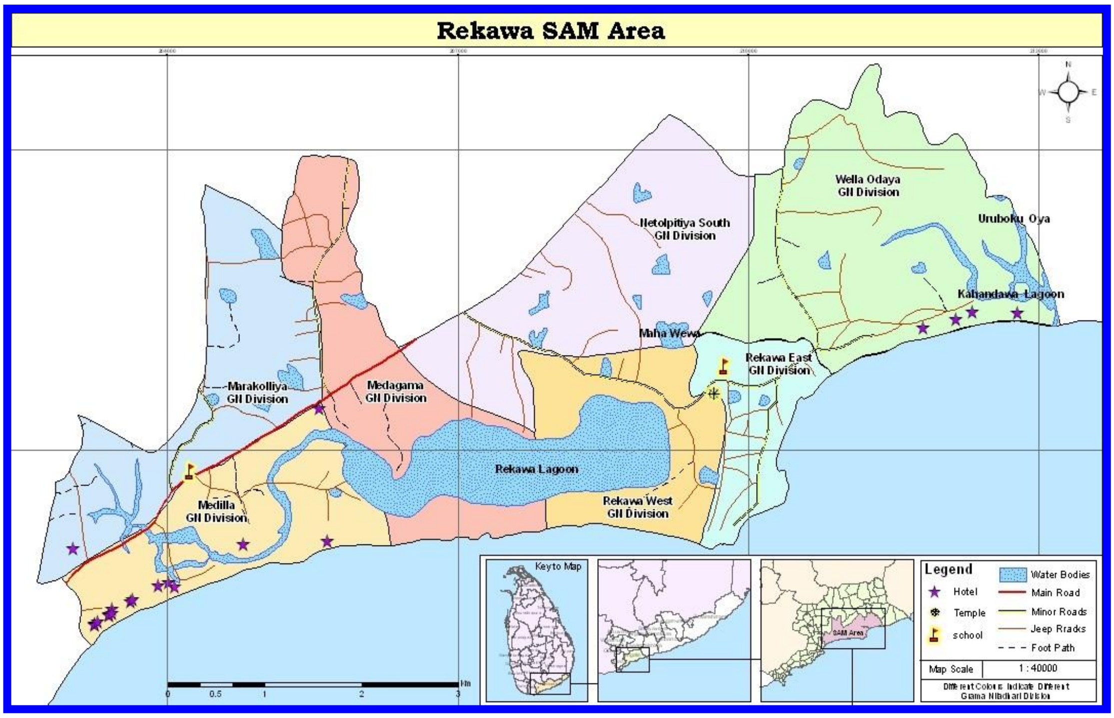

Figure 1: Location of the study area in Sri Lanka

Source: Rekawa Special Area Management Coordinating Committee, Sri Lanka (1996)

The Rekawa lagoon can be considered the most important Southern coast lagoon with respect to species diversity of the mangroves and importance of fisheries (Hettiarachchi and Jayatissa, 2004). The brackish water environment offers an ideal habitat for mangroves (Perera et al., 2005). The extent of mangrove and mixed mangrove vegetation found in the Rekawa area is over 200 ha (Ekaratne et al., 2000). Approximately 11 out of 21 true mangrove species and over 20 species of mangrove associates are recorded in Rekawa wetland (Jayatissa et al., 2002a). The Rekawa mangroves provide a home for more than one hundred bird species including 15 migratory birds that roost and nest there on seasonal movements from colder climates (IUCN and CEA, 2006). In addition to local and migratory birds, the lagoon hosts a wealth of wildlife including fish, shellfish, reptiles, mammals, and invertebrates (Ganewatta et al., 1995). The Rekawa coast has been declared a sea turtle sanctuary since 2006 as five species of globally threatened sea turtles; Green turtle, Loggerhead turtle, Leatherback turtle, Hawksbill turtle, and Olive Ridley, visit the Rekawa beach for nesting.

There is a substantial potential for ecotourism development in Rekawa coastal wetland as it has favorable conditions for outdoor recreation such as turtle watching, beach recreation, and enjoying biodiversity in mangrove forests (Salpage et al., 2020). However, the coast is vulnerable to rising sea-level and the narrow barriers protecting the lagoon could be eroded away in the future (Weerakkody, 1997).

2.2 Survey design and data collection

The survey questionnaire comprised three parts. The first part described the objective of the study, background information, and status of ecotourism at Rekawa coastal wetland. In order to underline short and long term climate effects, we developed two climate change (CC) scenarios[2] for Rekawa coastal wetland, one for 2025 and one for 2050 using three climatic variables; temperature, rainfall, and sea-level rise (SLR), with three climate-induced biophysical variables; the number of turtle nesting sites, mangrove cover, and beach inundation area. The two CC scenarios for 2025 and 2050 predict a higher maximum temperature for Rekawa, increasing from 27°C today to 29°C and 29.5°C, and a reduction of rainfall from 2000 mm today to 1264 mm and 1330 mm, respectively (Salpage et al., 2020). Prediction of sea-level rise values for Sri Lanka for 2025 and 2050 are 50 cm and 65 cm, respectively, relative to the sea level of year 2000 (UNDP, 2012). We predicted numbers of nesting sites to be reduced from 350 today to 250 and 200 in 2025 and 2050, respectively (Salpage et al., 2020). It is estimated that today mangrove cover declines in Rekawa at 3 percent and 12 percent in the future scenarios for 2025 and 2050, respectively (Salpage et al., 2020).

The second part of the questionnaire starts with a matrix presenting a few management options to mitigate impacts on vulnerable coastal ecosystems in Rekawa and asking respondents to indicate how important they find the different options with regards to reducing the vulnerability of the study area. A five-point Likert scale (very important to not important at all) with a "no opinion" alternative is used to measure the view-points of the respondents. Based on existing literature (Tuan et al., 2014) the following ecological effects of mangroves were focused on; i) "Helping to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines", ii) "Mitigating the impact of climate change on sea turtles' terrestrial reproductive phase by providing shade to beaches and preventing coastal erosion", iii) "Preventing increased future vulnerability due to urban expansion into low-lying coastal mangrove areas, by ensuring that mangrove ecosystems are restored and protected", and "iv) Providing habitats for a variety

[2] Complete method of development of climate change scenarios can be found in Salpage et al., 2020.

of terrestrial, estuary and marine species while creating new livelihood options in mangrove areas such as nature-based ecotourism".

Then, we presented a payment vehicle in the form of a payment to an "Environmental Protection Fund" aiming at implementing a project for mangrove restoration with the objective of reducing the effect of climate change on ecotourism. The project included planting mangroves and coastal plants to reduce the impact of climate change, patrolling mangrove areas to prevent illegal activities, and promoting nature-based ecotourism activities (e.g. bird watching and boat trips). Planting and restoration of mangroves could be expected to help reduce the climate change vulnerability of coastal ecosystems in Rekawa by enhancing the ecological effects of mangroves described earlier. Patrolling mangrove areas is important for protection, to prevent illegal activities such as harvesting for timber, clearance of mangroves for tourism and urban development. Rekawa lagoon and mangrove ecosystems provide a home for a variety of terrestrial, estuary, and marine species including many fish, shellfish, reptiles, mammals, invertebrates, and local and migratory birds (Ganewatta et al., 1995). Thus, mangroves can support ecotourism by creating an attractive site for tourists and reducing the vulnerability of climate change impacts on ecotourism. This currently untapped ecotourism potential in Rekawa coastal wetland could be utilized effectively by promoting nature-based ecotourism activities. Suresh et al., (2021) find that improvements in habitat quality in nature-based tourism provide more utility and foreign tourists would be willing to pay more for less-visited parks showing the substantial potential for future growth of tourism.

We used a DBDC elicitation question to query tourists' willingness to pay towards the Environmental Protection Fund, to protect and restore the mangroves in Rekawa coastal wetland. Table 1 shows the bid options proposed to the respondents. We conducted a preliminary investigation with a few domestic and foreign tourists found in Rekawa and collected their willingness to pay values for the proposed mangrove restoration project. We found that willingness to pay for domestic tourists ranged from 100 LKR to 500 LKR and it varied from 500 LKR to 1500 LKR for foreign tourists. Based on that information we fixed the initial bid levels for domestic and foreign tourists. If the initial bid was accepted, then a higher bid was proposed. If a respondent rejected the first bid (s)he would get a lower bid. Hence, there are four response categories; (Yes, Yes), (Yes, No), (No, Yes), and (No, No).

Table 1: Bid options (in LKR[3]) proposed to respondents. A-J are bundles of initial, lower and upper bids.

Options	Initial bid (Bid)	Lower Bid (BidL)	Upper Bid (BidU)
For domestic tourists			
A	100	50	150
B	200	100	300
C	300	150	450
D	400	200	600
E	500	250	750
For foreign tourists			
F	500	250	750
G	750	375	1125
H	1000	500	1500
I	1250	625	1875
J	1500	750	2250

[3] 1 USD = 150 LKR on average during December 2016 to February 2017

Subsequent to the second bid question we asked for reasons for accepting or rejecting the first bid. The following reasons were included; “I think the management plan is a good one”, “I feel this is a reasonable amount to pay”, “I am concerned about the loss of mangroves/biodiversity”, and “It is what I can afford to pay”. Reasons for declining to contribute to the “Environmental Protection Fund” included “I do not believe the system would bring the changes you describe”, “It is the government’s responsibility”, “I believe that this improvement will take place without my contribution”, “I have no spare income but would otherwise contribute”, and “I need moreinformation before I decide to pay”.

Finally, we collected respondents’ socio-demographic factors which included respondents’ age, gender, level of education, income, and being a member of an environmental non-governmental organization (ENGO). In addition, we collected data on respondents’ concerns regarding the climate when selecting a tourist destination, and attitudes regarding climate change in Rekawa. The perception of climate change and its consequences for Rekawa is divided into four categories: “I do not have any idea about climate change in Rekawa”, “Climate change is happening and its consequences are visible”, “Climate change is happening but its consequences are not yet visible”, and “Climate change is not happening”.

We pre-tested the questionnaire on-site at Rekawa and revised it based on feedback received from tourists, tour guides, and Rekawa community inhabitants, including staff members of a turtle conservation project. We used two versions of the survey; English and Sinhala (a local language) for foreign and domestic tourists respectively. A team of five trained Sri Lankan graduate students were employed to conduct face-to-face interviews from December 2016 to February 2017. This data collection period coincided with one of the peak seasons for tourists to this site. For the interviews, we randomly selected every second tourist or tourist group at pre-defined sampling sites, such as a turtle watching site and a lagoon site. We interviewed all adult members in each randomly selected group as the groups consisted of only 4-5 members. Each respondent received the survey after giving their consent to take part. Then data collectors explained future climate scenarios for Rekawa coastal wetland, in order to facilitate the respondents' understanding of the two scenarios. A total of 365 complete questionnaires were collected, consisting of 213 foreign and 152 domestic tourists.

2.3 Econometric model

In the CVM literature, it has been shown that the DBDC elicitation technique increases the efficiency of the parameter estimates relative to the SBDC technique (Hanemann et al., 1991; Haab and McConnell 2002, Nayga et al., 2006). It enables clear boundaries on the WTP for the response-pairs "Yes, No" and "No, Yes". For the response-pairs "No, No" and "Yes, Yes" the second question contributes to further restrict the distribution of the WTP compared to the SBDC. Asking twice yields twice the number of observations for the analysis compared to the SBDC technique, and more (relevant) data is always preferable for estimation purposes.

Formally, when WTP is the actual, but unobservable, willingness to pay of a respondent, and Bid, BidL, and BidU are the first bid, the lower bid if the respondent answers "no" to the first bid, and the higher bid if the respondent answers "yes" to the first bid, respectively, then we have the following interpretation of the four possible responses:

$$\begin{aligned}
&(\text{Yes, Yes}) \rightarrow \text{WTP} \geq \text{BidU} \\
&(\text{Yes, No}) \rightarrow \text{Bid} \leq \text{WTP} < \text{BidU} \\
&(\text{No, Yes}) \rightarrow \text{BidL} \leq \text{WTP} < \text{Bid} \\
&(\text{No, No}) \rightarrow \text{WTP} < \text{BidL}
\end{aligned} \tag{1}$$

With these known bid values and answers from respondents, probabilities for each response can be presented as follows;

P^{YY} = Prob[(Yes, Yes)] = Prob[WTP ≥ BidU] = 1 − G(BidU)

P^{YN} = Prob[(Yes, No)] = Prob[Bid ≤ WTP , BidU] = G(BidU) − G(Bid)

P^{NY} = Prob[(No, Yes)] = Prob[BidL ≤ WTP , Bid] = G(Bid) − G(BidL)

P^{NN} = Prob[(No, No)] = Prob[WTP ≤ BidL] = G(BidL) (2)

where G(·) is the cumulative distribution function of a known statistical distribution such as logistic and normal (Trung et al., 2020).

When the distribution function is logistic, the log-likelihood function can be represented by

$$lnL = \sum_{j=1}^{J}[d_j^{yy}\ln(\exp(a - bt_j^U)) + d_j^{nn}\ln(1 - \exp(a - bt_j)) + d_j^{yn}\ln(\exp(a - bt_j) - \exp(a - bt_j^U)) + d_j^{ny}\ln(\exp(a - bt_j^L) - \exp(a - bt_j))] \quad (3)$$

where d_j^{yy} is an index taking the value 1 if respondent *j* has answered *yes* to both bids,

d_j^{nn} is an index taking the value 1 if respondent *j* has answered *no* to both bids,

d_j^{yn} is an index taking the value 1 if respondent *j* has answered *yes* to the first bid and *no* to the second bid,

d_j^{ny} is an index taking the value 1 if respondent *j* has answered *no* to the first bid and *yes* to the second bid,

a is a constant, *b* is the parameter of the bid and t_j is the bid respondent *j* receives. U and L denote upper and lower (Aizaki et al., 2014).

Individual characteristics are included in the constant *a* as follows:

$$a = \gamma + \sum_{k=1}^{K} \gamma_k X_k \quad (4)$$

The γ is a constant term and γ_k is the parameter of individual characteristic k (Aizaki et al., 2014). X_k is a vector of socio-economic characteristics of the respondent.

Model parameters are estimated applying the maximum likelihood techniques on Equation (3).

3. Results

3.1 Socio-demographic characteristics of the respondents

A summary of socio-demographic and attitudinal characteristics of the respondents are shown in Table 2. Male tourists dominated among domestic tourists while for foreign tourists the proportion of males and females was about the same. Average age of domestic tourists and foreign tourists were 32 and 35 years respectively. We collected data covering several categories of occupations, such as civil servant, private sector employee, self-employed or own business, student, housewife/homemaker (unpaid), and retired. However, in the data analysis we divided them into two groups; those who belonged to the labor force and those who did not. The latter group includes pensioners, home working persons not receiving any salary, and students. A majority of the tourists we interviewed belonged to the labor force. Secondary education was the most frequent level of education among domestic tourists, while over 80 percent of foreign tourists had higher education with bachelor or postgraduate degrees.

Table 2: Socio-demographic characteristics of respondents and their perceptions towards climate change

Characteristics	Domestic tourists	Foreign tourists
Total number of tourists	152	213
Gender		
Male	130 (85%)	108 (51%)
Female	22 (15%)	105 (49%)
Average age	32	35.5

Occupation		
Contribute to labor force	102 (67%)	189 (89%)
Unpaid work	50 (33%)	24 (11%)
Level of education		
Primary education	8 (5%)	0
Secondary education	92 (60.5%)	12 (5.5%)
Technical diploma	13 (8.5%)	28 (13%)
Bachelor's degree	33 (%)	117 (55%)
Postgraduate degree	6 (%)	56 (26.5%)
Being a member of environmental society		
Yes	21(13.8%)	53 (24.9%)
No	131 (86.2%)	160 (75.1%)
Concern about climate when selecting a tourist destination		
Yes	90 (76%)	178 (94.7%)
No	30 (24%)	10 (5.3%)
Perception on climate change and its consequences for Rekawa		
I have no idea	14 (9%)	64 (30%)
Consequences are not yet visible	53 (35%)	47 (22%)
Consequences are visible	85 (56%)	102 (48%)

About 76 percent and 95 percent of the domestic and foreign tourists, respectively, were concerned about the climate when selecting a tourist destination. Data on perception of climate change and its consequences for Rekawa revealed that nobody believes that climate change is not happening. We observed a difference between domestic and foreign tourists where the latter more frequently 'do not know' whether climate change takes place and/or is visible in Rekawa. Approximately 56 percent and 48 percent domestic and foreign tourists respectively believed that consequences of climate change are visible.

3.2 Stated perception of effects of mangrove restoration

Results revealed that a majority of the respondents either strongly agreed or agreed with the proposed effects of mangroves as a measure to reduce the climate vulnerability of the coastal ecosystems in Rekawa (see Table 3).

Table 3: Stated perception of the effects of mangrove restoration by foreign (F) and domestic (D) tourists (in %)

Statement		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Do not know
Helping to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines	F	65.7	28.6	2.35	1.4	0.5	1.4
	D	24.3	47.4	9.9	15.8	2.6	0
Mitigating the impact of climate change on sea turtles' terrestrial reproductive phase by providing shade to beaches and preventing coastal erosion	F	65.3	31.4	1.4	0.5	0	1.4
	D	42.1	46	4.6	3.3	0	3.9
Preventing increased future vulnerability due to urban expansion into low-lying coastal mangrove areas, by ensuring that mangrove ecosystems are restored and protected	F	69.5	27.2	1.4	0.5	0	1.4
	D	59.9	29.6	3.3	7.2	0	0
Providing habitats for a variety of terrestrial, estuaries and marine species while creating new livelihood options in mangrove areas such as nature-based ecotourism	F	68.5	28.6	2.8	0.5	0.5	0
	D	38.2	50.7	3.9	7.2	0	0

In Table 3 we observe that the majority of tourists, both foreign and domestic, agree with the four statements. An interesting result is that almost 20 percent of domestic tourists disagree with the statement that restoration of mangrove forests help to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines. Relatively few respondents state that they do not know their perceptions regarding these statements.

3.3 Bid responses

Reasons for being willing to pay or not are shown in Table 4. The most important reason for WTP for mangrove restoration was concern about the loss of mangroves and associated biodiversity, formulated as "I am concerned about the loss of mangroves/biodiversity", in the survey. About 18 percent of the respondents felt that the proposed entrance fee which ultimately contributed to the Environment Protection Fund was reasonable and 14.8 percent believed that the proposed management plan was a good one to implement to protect mangrove forests in Rekawa.

Table 4: Reasons for being willing to pay and for not being willing to pay subsequent to the first bid option.

Reasons	No: of responses (365)
Respondents' reasons for being willing to pay (244)	
I think the management plan is a good one	14.8 % (54)
I feel this is a reasonable amount to pay	18.6% (68)
I am concerned about the loss of mangroves/biodiversity	31.8% (116)
It is what I can afford to pay	1.1% (4)
Other	0.5% (2)
Respondents' reasons for NOT being willing to pay (121)	
I don't believe the system would bring the changes you describe	3.3% (12)
It is the government's responsibility	6.6% (24)

I believe that this improvement will take place without my contribution	4.9% (18)
I have no spare income but would otherwise contribute	8.2% (30)
I need more information before I decide to pay	8.8% (32)
Other	1.4% (5)

On the other hand, 6.6 percent believed that mangrove restoration is the responsibility of the government while 3.3 percent did not believe the proposed restoration project would bring the changes we describe in the questionnaire. About 8 percent of the respondents were not willing to pay for the mangrove restoration project for one of the following two reasons; insufficient information and lack of money to spend on such a project. The latter group would contribute to the project had they sufficient money.

The distribution of the respondents' answers for each option in (Yes, Yes), (Yes, No), (No, Yes), and (No, No), is displayed in Table 5. While a majority of the foreign tourists accepted both bids presented to them, very few foreign tourists refused both bids. This was different for domestic respondents, where a little more than 1/3 accepted both bids and 17 percent refused both bids.

Table 5: Distribution of respondents by bid options.

Options	Domestic Tourists	Foreign Tourists
Yes, Yes	37% (57)	54.4% (116)
Yes, No	31% (47)	40% (85)
No, Yes	15% (23)	2.3% (5)
No, No	17% (26)	3.3% (7)

3.4 Parametric estimation of WTP for mangrove restoration at Rekawa

We assumed that WTP is a function of gender, age, education, occupation, and perceptions[4]. The statistical model assumes a linear combination of the perceptions, socio-demographics and the bid as explanatory variables for the likelihood of a bid being accepted. First, we tested whether it is statistically meaningful to introduce the respondents' socio-economic and demographic characteristics and perceptions in addition to the initial bid. We ran a likelihood ratio test comparing the estimated model with a model only including the bid variables. Results of the likelihood ratio test rejected the null hypothesis that all the latter parameters are equal to zero. This is true for both models involving foreign and domestic tourists. We tested for correlations of the variables in the model and found no statistically significant correlated variables. Although the marginal monetary effect of the variables on WTP cannot be directly measured from the estimated coefficient of an explanatory variable, the sign of the estimated coefficient indicates the direction of the effect. Table 6 shows the signs and significance of the parameters for domestic and foreign tourists.

[4] The perceptions included: Concern about climate when selecting a tourist destination, mangroves help to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines, mangroves mitigate the impacts of climate change on sea turtles' terrestrial reproductive phase by providing shade to beaches and preventing coastal erosion, mangroves prevent increased future vulnerability due to urban expansion into low-lying coastal mangrove areas, by ensuring that mangrove ecosystems are restored and protected, and mangroves provide habitats for a variety of terrestrial, estuaries and marine species while creating new livelihood options in mangrove areas such as nature-based ecotourism.

Table 6: Estimated parameters for the determinants of the WTP for mangrove restoration in Rekawa wetland.

Variables	Domestic tourists	Foreign tourists
Constant	2.288 ** (1.0728)	4.774 ** (1.9693)
Bid	-0.005**** (0.0005)	-0.003 **** (0.0002)
Gender (male = 0, female=1)	-0.399 (0.5109)	0.163 (0.3281)
Age	-0.035 ** (0.0178)	0.006 (0.0143)
Education	0.796 ** (0.4003)	0.644 * (0.3731)
Occupation (outside labour force =0, in labour force =1)	0.169 (0.4036)	0.941 ** (0.4052)
Concern about climate when selecting a tourist destination	0.079 (0.3482)	-0.984 (0.6617)
Mangroves help to protect against sea-level rise by accumulating sediments and stabilizing weak shorelines	-0.076 (0.3737)	-0.915 (0.7462)
Mangroves help to mitigate the climate change impacts on sea turtles' terrestrial reproductive phase	-0.351 (0.5233)	2.188 *** (0.8381)
Mangroves reduce increased future vulnerability due to urban expansion into low-lying coastal mangrove areas, by ensuring that mangrove ecosystems are restored and protected	0.927 * (0.5008)	-1.3494 (1.2997)
Mangroves provide habitats for a variety of terrestrial, estuaries and marine species creating nature-based ecotourism livelihoods	0.404 (0.4826)	-0.703 (0.9357)
Number of observations	152	213
Log-likelihood	-230.73	-214.20
p-value	0.04	0.01
AIC	483.45	450.40
BIC	516.71	487.37

Note: Standard errors are in parenthesis

Significant at p < 0. 1 (*), 0.05 (**), 0.01 (***), and 0.001 (****)

The bid variable was statistically significant at 1 percent with a negative coefficient in both models. It implies that a higher bid value reduces the probability of respondents accepting the bid. Education had a strong positive impact on the probability of accepting the bid in both models. For the domestic tourists, the probability of accepting the bid declined for the elderly. Occupation showed a strong and positive effect on the probability of accepting the bid for foreign tourists. This indicates that foreign respondents who have paid work are more willing to accept the bid, compared to foreign respondents who do not have paid work. In this study, gender did not show any significant impact on the probability of accepting a bid irrespective of type of tourist (domestic or foreign). Concern about the climatic condition of the touristic sites did not reveal any significant impact on the probability of tourists accepting a bid. However, belief that mangroves support mitigation of climate change impacts on sea turtles' terrestrial reproductive phase, did significantly affect the probability of foreign tourists accepting the bid. Also, findings revealed that domestic tourists with higher trust in the role of mangroves in preventing future vulnerability of urban expansion into low-lying coastal mangrove areas were more willing to accept the bid. The results revealed that domestic and foreign tourists are willing to pay 398 LKR and 1710 LKR, respectively, for mangrove restoration in Rekawa wetland.

4. Discussion and conclusion

The presented study investigated domestic and foreign tourists' preferences and WTP for mangrove restoration to ensure adaptation to the impacts of climate change on ecotourism at Rekawa coastal wetland, using the contingent valuation method. We developed two climate change scenarios for Rekawa coastal wetland for the short-term (2025) and the long-term (2050). All climatic and climate-induced biophysical variables are changed in a detrimental way in both CC scenarios. We suggested protection and restoration of Rekawa mangroves as an adaptation measure to reduce the climate change impacts and asked the tourists about their willingness to pay for the proposed conservation activity. Further, we examined the effect of respondents' socio-demographic characteristics and climate concern, and their willingness to pay for mangrove restoration as an ecotourism adaptation to climate change.

Similar to previous studies related to mangrove restoration (Pham, et al., 2018; Trung et al., 2020; Tuan et al., 2014), we found that the probability of accepting a bid declined with increasing bid amount. The results showed that education has significant influence on the probability of respondents accepting the bid, as highly educated people had a higher probability of accepting the bid. A possible explanation is that tourists with a higher level of education have more knowledge about the role of mangroves in coastal protection and mitigation of climate change impacts. This finding is in line with most empirical results in recent studies conducted on households in relation to WTP for mangrove restoration (Pham et al., 2018; Susilo et al., 2017). The results of our study demonstrate that education plays a key role in contributing to tourists' preferences for mangrove restoration programs, irrespective of tourist type. This suggests the importance of increased knowledge of mangrove forests' climate mitigating and adapting effects for buy-in to mangrove forest management efforts, for instance in the school curriculum and general public information.

Our results revealed that occupation of the foreign respondents appears to have a positive and significant impact on the probability of accepting the bid. Foreign respondents belonging to the labor force were likely to pay more compared to those outside the labor force, although the latter is a very small group (24 respondents). This can be explained as a fact of earning capacity which empowers the respondent to contribute towards mangrove conservation programs. Pham et al. (2018) also indicated that occupation was found to be a significant determinant of respondents' WTP for mangrove restoration.

Gunawardena and Rowan (2005) estimated the option and non-use (existence and bequest) values of the Rekawa mangrove ecosystems among households in Rekawa community using the contingent valuation method with an open-ended approach. The estimated existence, bequest, and option value of Rekawa mangroves in their study was 2.6 USD/ha/year. Probably this is an underestimate of the total existence value, due to the fact that their study did not include the broader aspects of conservation such as habitat protection for sea turtles and migratory birds and biodiversity conservation as important non-use values, considering these non-use values were far beyond community boundaries (Gunawardena and Rowan, 2005). In our study, we found that foreign tourists who believed that mangroves play a role in mitigating the climate change impacts on sea turtles' terrestrial reproductive phase were willing to pay more for mangrove restoration in Rekawa. This may be due to the fact that foreign tourists found the potential of enjoying the *in-situ* conservation of sea turtles as this destination is famous among the tourists for turtle watching though this wetland has several other potential for ecotourism (IUCN and CEA, 2006, Salpage et al., 2020).

Although it is illegal to destroy mangroves, these important ecological ecosystems are still being impacted as a result of anthropogenic activities such as urbanization, illegal construction, shrimp farming, agriculture, and tourism in coastal areas of Sri Lanka where nearly one fourth of the population is concentrated (Masakorala, 2020). Knowledge of such anthropogenic activities might influence domestic tourists to accept the offered bid, due to their belief in preventing increased future vulnerability of urban expansion into low-lying coastal mangrove areas, by ensuring that mangrove ecosystems are restored and protected.

The study of Perera et al., (2005) emphasized the importance of the presence of wide mangrove areas in Rekawa, as no structural damage was observed in the mangroves there after the tsunami in 2004, thereby securing that turtle nesting was not severely affected. They further stated that strict measures should be taken to protect the intact mangrove stands and restore mangrove patches in certain extended areas of Rekawa proposed coastal sanctuary that were severely affected by the Tsunami. Our findings support their suggestions, and indicate tourism willingness to pay for protection and restoration of Rekawa mangroves to reduce the effect of climate change on this coastal wetland. Our study further confirmed that over 96 percent of the foreign tourists have placed option and existence value on the role of mangroves in providing habitats to complete the life cycle of turtles in the coastal terrestrials.

According to our findings, there is a substantial difference in willingness to pay for mangrove restoration in Rekawa between domestic and foreign tourists. On average, the foreign tourists were willing to pay an entrance fee of more than four times that of the domestic tourists. This is however based on nominal terms, and given the purchasing power corrected values of the two tourist groups' WTP, i.e. expecting a higher purchasing power of 1 USD of Sri Lankans versus most foreign tourists, in real terms the difference in WTP is presumably somewhat smaller. Estimating exact purchasing power parity is however hampered by our sample which includes foreign tourists from 22 countries. Nonetheless, the difference does open the avenue for dual pricing in Rekawa.

Dual pricing is a kind of price discrimination by charging higher prices from foreign tourists than domestic ones (Apollo, 2014; Dallen and Boyd, 2003). This is a very common practice in Asia, parts of Africa, and Latin America (Dallen and Boyd, 2003). Existing literature on dual pricing showcases both pros and cons of this price discrimination strategy. Some scholars have emphasized the importance of implementing dual pricing in tourism. According to Laarman and Gregersen (1996), the domestic population have already paid for creation and management of tourist facilities in their host countries through taxes. Hence, an alternative could be to have a zero price for locals, and only charge foreign tourists for access to recreational areas. This kind of differentiation is not uncommon. Samdin (2007) argued that it is appropriate to impose a high entrance fee for foreign tourists as most of them have a higher level of income compared to domestic people and tend to have a higher willingness to pay. If a higher willingness to pay among foreign tourists can be demonstrated, charging higher entrance fee to recreational areas from foreign tourists can be regarded as a third degree price discrimination aiming at seizing a share of the foreign tourists' consumer surplus.

However, there are some counter arguments that dual pricing in tourism is harmful, as the reputation of a destination can be tarnished by pervasive overcharging of foreign tourists (Chiaravutthi, 2019). Currently no entrance fee is required from anyone to enter Rekawa coastal wetland, but the Turtle Conservation Project office at Rekawa charges 1000 LKR per foreign tourist while no charge is taken from domestic tourists for turtle watching. Based on our study, an admittance price ratio of 1:4 between domestic and foreign tourists can be recommended to Rekawa tourism managers. How this will be perceived by the foreign tourists remains to be assessed.

According to the findings of Salpage et al. (2020), Rekawa coastal wetland is at risk, if adaptation measures are not taken. Their study has highlighted the importance of mangrove protection as an adaptation strategy to minimize the climate change impacts at Rekawa. The current study confirms that both domestic and foreign tourists have a preference and are willing to pay for restoration of mangroves at Rekawa coastal wetland. In conclusion, our results support tourist entrance fees for the use of planting mangroves and coastal plants to reduce impacts of climate change, patrolling mangrove areas to prevent illegal activities, and promoting nature-based tourism activities such as bird watching in mangroves and boat trips around the Rekawa lagoon surrounded by mangroves.

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