VALUATION OF NATURE RESERVES IN SINGAPORE

USING TRAVEL-COST METHOD

Credit: Lonely Planet

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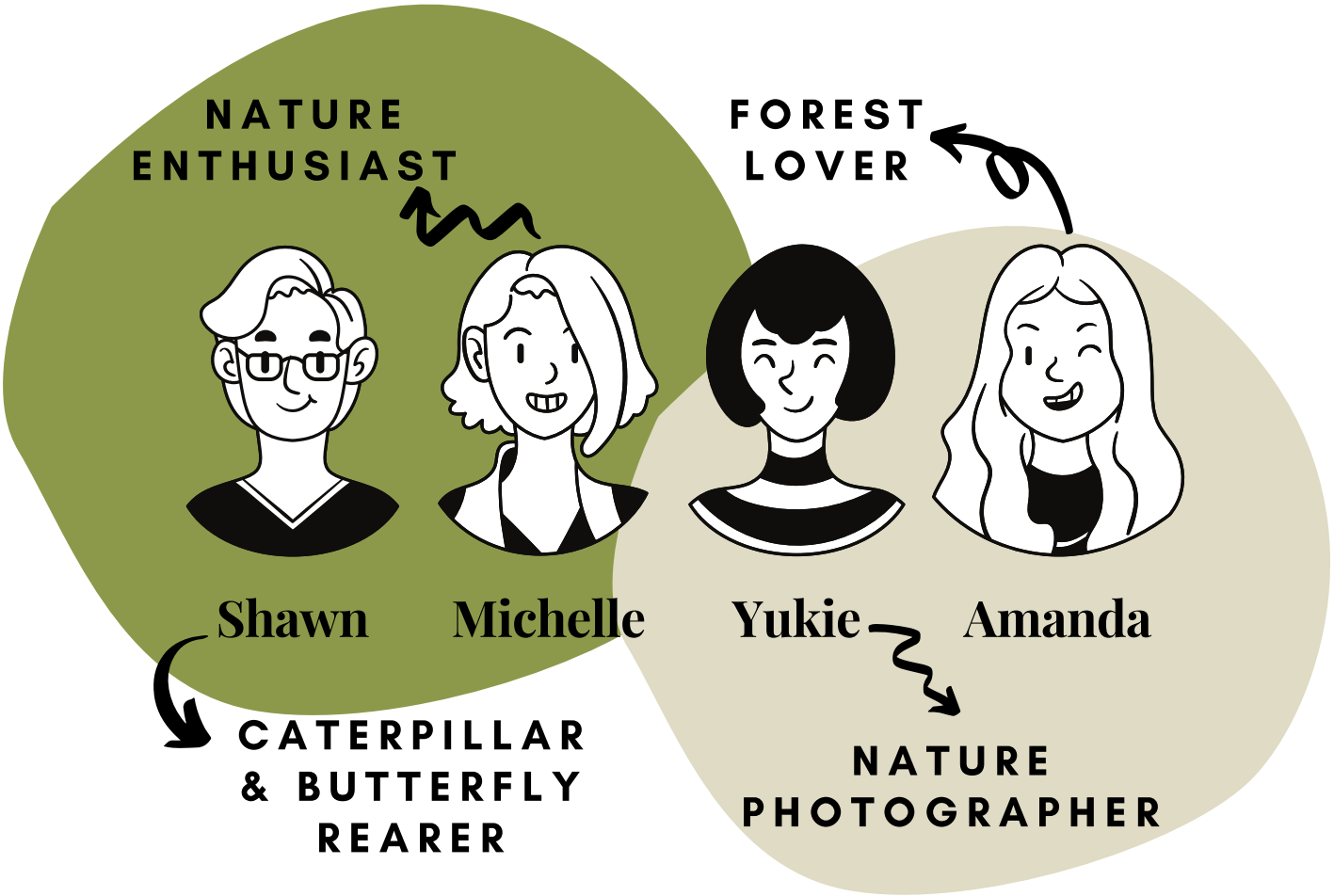
ABOUT US:



We are a group of undergraduates that are highly interested in urban ecology at the National University of Singapore (NUS). As part of our coursework for LSM4265 Urban Ecology, we were tasked to study urban ecology in relation to culture. Given our diverse backgrounds and interests, we decided to carry out a study on the perceptions and valuation of our nature reserves in Singapore, where all our interests coincide!

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INTRODUCTION:

Green spaces are increasingly being recognised as a fundamental component of any urban ecosystem (Yuen, 1996; WHO, n.d). In Singapore, green spaces designated for biodiversity conservation such as the four nature reserve, Bukit Timah Nature Reserve (BTNR), Central Catchment Nature Reserve (CCNR), Labrador Nature Reserve (LNR) and Sungei Buloh Wetland Reserve (SBWR), are critical habitats for wildlife as they remain the last remnant of a rainforest habitat that once covered the island and are an important last refuge in an increasingly urbanised environment (Lim, 1997; Chatterjea, 2012). Furthermore, as cities mature and become increasingly affluent, urbanites realise the myriad of benefits, in particular improved quality of life, related to increased nature contact through various activities, further emphasizing the role of nature in urban culture (Priego et al., 2008). This is corroborated by Yuen (1996), who mentioned that 'Nearby nature' plays an important role in the recovery from mental fatigue (Kaplan & Kaplan, 2005).

As cities are comprised of individuals from a diverse range of socio- and cultural-demographics, behavioural patterns and perception of protected biodiversity habitats such as nature reserves may vary with different urban societies (Khew et al., 2014; Priego et al., 2008).

Urban nature reserves are also different from rural nature reserves. While urban nature reserves are created to safeguard ecologically or sometimes culturally important landscapes and the flora and fauna in them, they are also designed for urbanites to seek respite from urban stresses in nature that are usually scarce in cities (Wasilewski et al., 2019).

However, it is crucial that the "social" and "nature conservation" objectives of urban nature reserves are balanced (Wasilewski et al., 2019). If the recreational use of nature reserves is too intense and the nature reserves are not properly adapted for such a high level of recreational use, conflicts may arise and threaten to undermine the nature reserves' ability to protect its biodiversity (Thomas & Reed, 2019; Wasilewski et al., 2019). For example, Bukit Timah Nature Reserve had to be closed for maintenance works from 2014 to 2016 due to heavy usage and trampling, and required repair works and enhancements to better safeguard the reserve's biodiversity (Chatterjea, 2019). Several other studies have linked recreational activities to negative impacts on biodiversity such as a reduction in wildlife abundance or activity (Reed & Merenlender, 2008), changes in spatial or temporal use of habitats (George & Crooks, 2006), lower reproductive success (Finney et al., 2005), change in behavior (Geoffroy et al., 2015), and alteration of species richness and community composition (Kangas et al., 2010).

As such, our study aims to investigate how the various socio-demographics in Singapore could lead to differences in perception and valuation of the four nature reserves. We also aim to identify the primary purpose of visitorship for each nature reserve. With these findings, we hope to assist in the formulation of effective interventions that could address the differences in valuation of each nature reserve as well as safeguarding areas of high environmental importance while providing the nature experience that urbanites seek.

RESEARCH QUESTIONS:

1. How do visitors of different socio-demographics in Singapore value and perceive nature reserves differently?
2. *What is the purpose of visiting nature reserves?*

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METHODOLOGY:

A **survey** was created to collect responses on the socio-demographic, travel time, mode of transportation, duration spent in nature reserve, frequency and purpose of visit and willingness to pay.

A **systematic random sampling** was then conducted at each nature reserve where every third visitor was approached to administer the survey with an easily accessible QR code. Each survey was conducted at each nature reserve (Bukit Timah Nature Reserve, Central Catchment Nature Reserve, Labrador Nature Reserve and Sungei Buloh Wetland Reserve) between 0800 - 1200 on Saturdays and Sundays, spanning across two weekends.

The responses were then collated and analysed using the **travel cost method (TCM)** based on Grave (2013):

$$V = [(T \times w) + (D \times v) + Ca] \times Va$$

where:
T = travel time (h), *w* = average wage rate ($/h), D = distance (km), *v* = marginal vehicle operating costs, Ca = cost of admission to asset and Va = average number of visits per year.

The travel cost method allows us to estimate the economic value of each nature reserve by looking at full travel costs, including time, of visiting each site. While there are no admission fees to our nature reserves, we asked respondents the amount that they are willing to pay.

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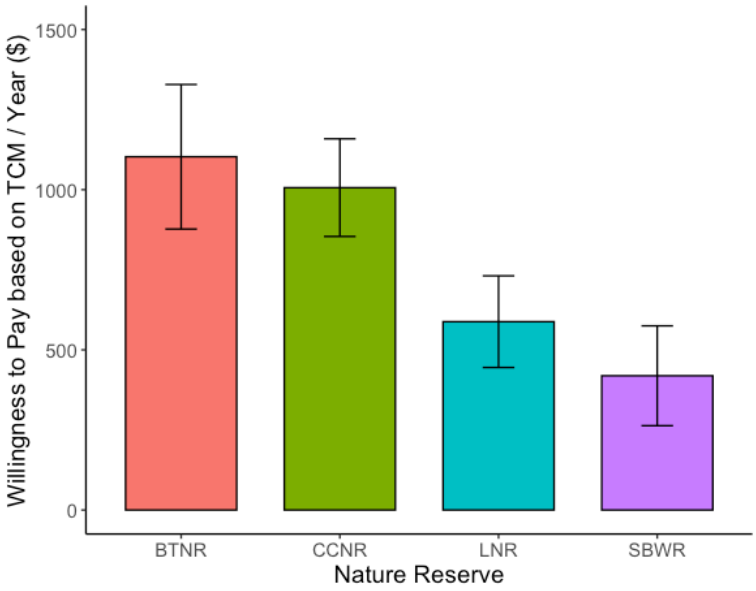
RESULTS & DISCUSSION:

OVERALL

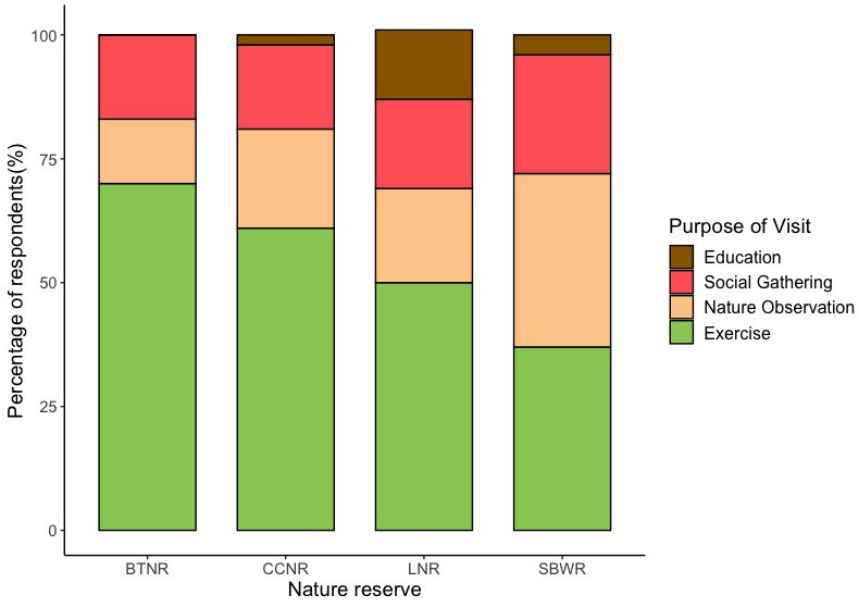


WTP based on TCM for each nature reserve:

BTNR > CCNR > LNR > SBWR

Purpose of Visit for each nature reserve:

Exercise predominates each nature reserve



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OVERALL

Based on the results, there are **two main issues** we would like to delve into:

(1) How can NParks increase the WTP of visitors at SBWR and LNR?

(2) How can NParks divert human traffic out of BTNR and CCNR to reduce anthropogenic degradation?

The TCM also revealed relatively similar results between BTNR and CCNR and between SBWR and LNR, where the latter were considerably lower than the former. We believe that inaccessibility is the main attribute for the low WTP in SBWR and LNR. This is supported by Zhang & Zhou (2019) where the number of bus stops was positively correlated with park visits, suggesting that increased accessibility through public transportation leads to more visits. Additionally, distance to the city was negatively correlated with park visits (Zhang & Zhou, 2019). This trend also follows our results as BTNR and CCNR are located more centrally compared to SBWR and LNR which are located in the south and north of Singapore. The potential recommendations to improve the WTP in SBWR and LNR will be further explored in the following sections.

Our findings show that Singaporeans use nature reserves for multiple purposes, including active and passive activities similar to most other countries (Sreetheran, 2017). However, the primary purpose of visit was for active activities despite **nature parks**, such as Hindhede Quarry Nature Park and Springleaf Nature Park, having been established as complementary habitats for nature

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OVERALL

-based recreation, such as hiking and mountain biking (NParks, 2018). Nature parks act as important buffers for our nature reserves by reducing visitorship pressure, stressors and anthropogenic disturbances by providing an alternative venue for the public to enjoy exercising in a more natural and less manicured environment than other public parks.

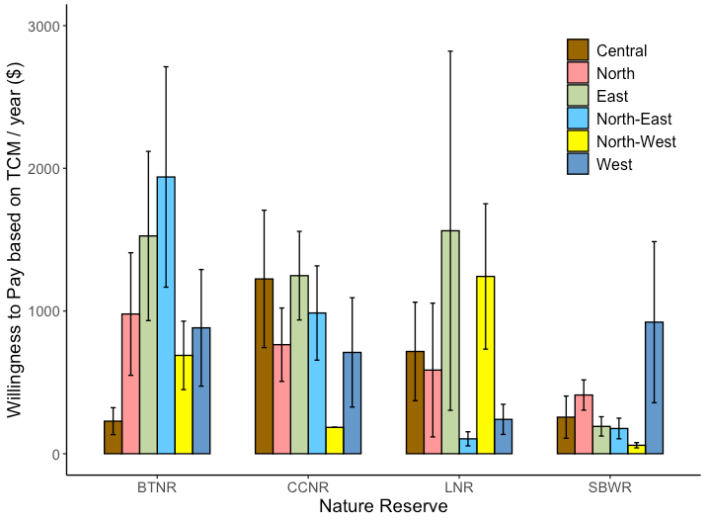
While there are existing hiking trails at the nature parks buffering CCNR and BTNR, many visitors of BTNR shared that BTNR stands out from the rest due to the presence of a steep hill and stairs which function as a great location for resistance training. As the highest point in Singapore, the steep incline in BTNR definitely gives it's visitors a certainly unique experience, but in our opinion, it should not be the primary reason for visitorship in a nature reserve.We believe that there is a need to change the primary reason for visiting BTNR and CCNR and to divert visitors who primarily visit these nature reserves for physical training to nature parks. The following recommendations could be implemented:

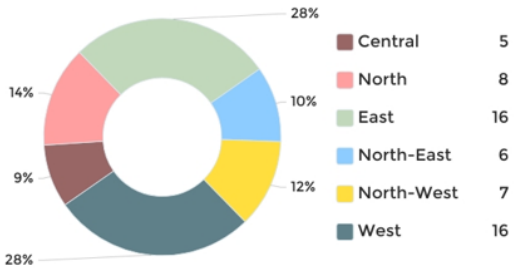
(1) Building of Slopes in Buffer Nature Parks - This provides the necessary incline that most active visitors seek for strength training. It provides alternative routes for strength training in less manicured environments and given the close proximity of nature parks to the nature reserve, it could then encourage visitorship to the nature reserve for a post-work out nature appreciation.

(2) Increase Educational Signages - Educational signages within BTNR and CCNR could educate the visitors on the purpose and proximity of nature parks to the nature reserves and the history and biodiversity of the nature reserve. This promotes nature appreciation and diversion of foot traffic to nature parks.

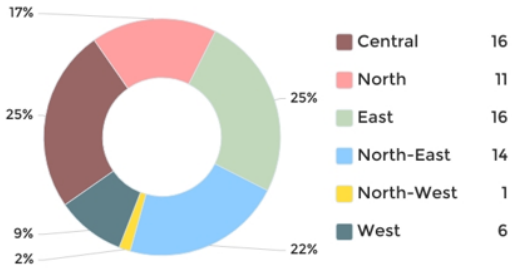
10 RESIDENCE

WTP based on TCM for the region of residence in each nature reserve

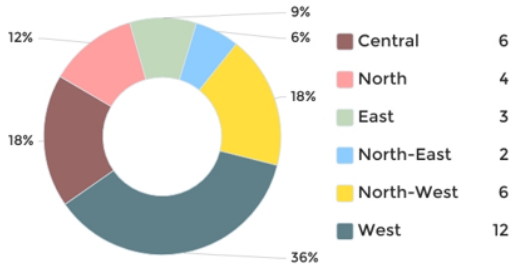




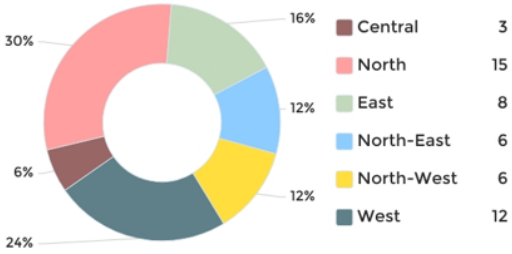
BTNR



CCNR



LNR



SBWR

Counts of respondents based on region of residence for each nature reserve

Based on the results, it is evident that most Singaporeans visit nature reserves that are closest to their residence location. The poor visitorship to nature reserves that are further away could be due to inconvenience, inaccessibility and lack of awareness of the unique features of each nature reserve. As such, a **multi-pronged approach** is required to tackle the following issue:

(1) Community Field Trips - Given that the community centres and community clubs organise field trips for each residential area regularly, the community club could expand its list of activities to include trips to each nature reserve every weekend. This not only bolsters visitorship to the nature reserves, but also fosters stronger bonds amongst the neighbourhood.

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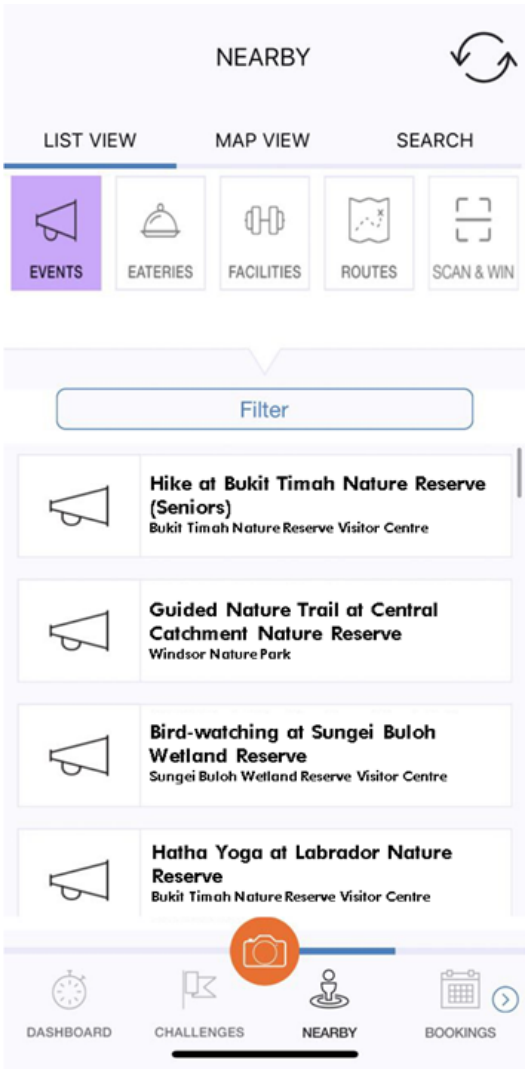
RESIDENCE

(2) Shuttle Buses - can be offered during peak periods, such as weekends, at the nearest MRT station or bus stop to increase the accessibility of nature reserves for those who commute using public transport. Presently, the Kranji Shuttle Bus Service allows commuting to SBNR at a cost of $3. NParks could work with the company to:

- Increase bus frequency and provide the service at zero cost during weekends
- Propose a route that stops at the surrounding private farms, allowing increased visitorship to both SBNR and farms



Example of events available on Healthy365

(3) Healthy365 - Presently, the Healthy365 mobile application offers events such as pilates, kickboxing, yoga and zumba for Singaporeans to attend for free. This could be extended to organised educational walks in collaboration with NParks and nature groups such as the BES Drongos that conduct regular guided walks in MacRitchie Reservoir. These nature groups would be able to reach a wider audience by tapping onto the Healthy365 mobile application. Differing intensities of physical activities could also be organised to cater to the various age groups. This could also kickstart a new challenge that promotes healthy living in nature reserves, thus promoting the visitorship of nature reserves.

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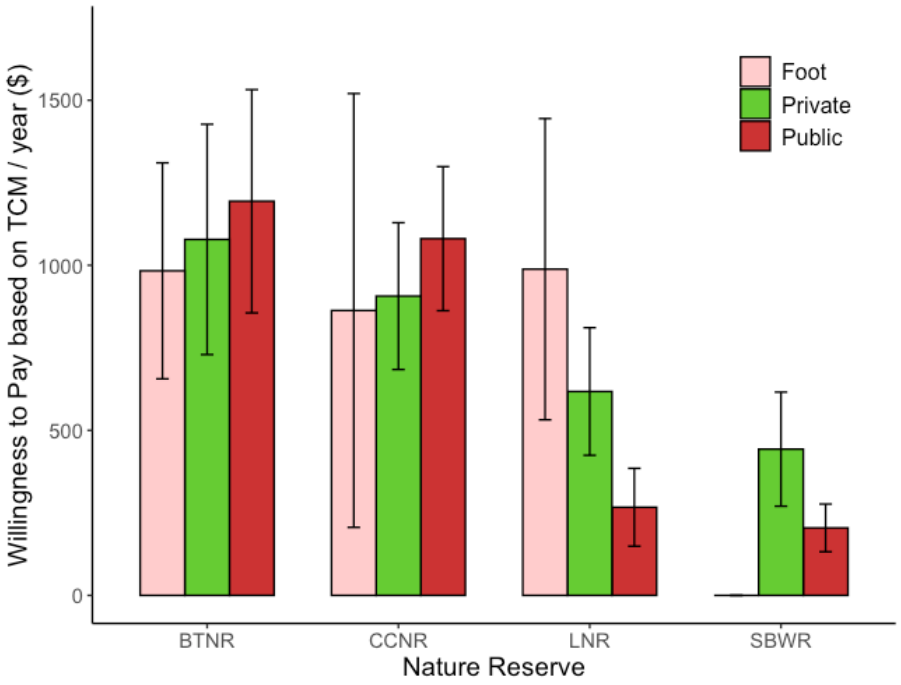
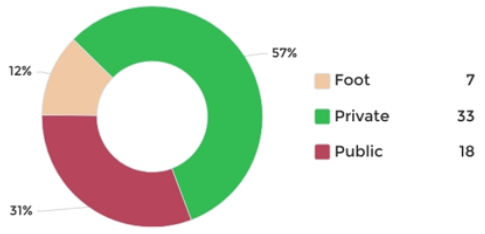
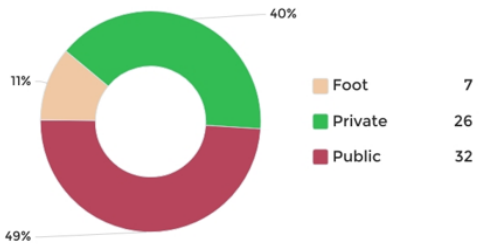
COMMUTE



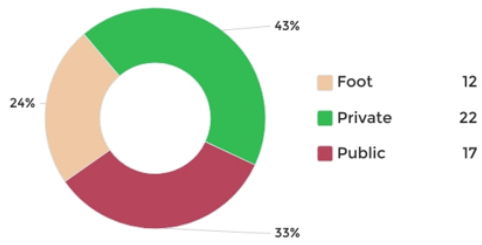
WTP based on TCM for the mode of commute in each nature reserve



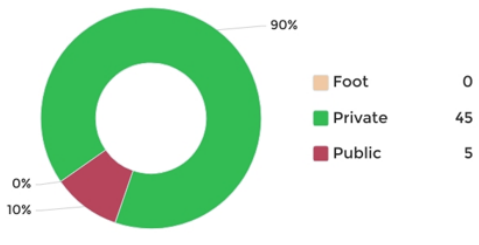
BTNR



CCNR



LNR



SBWR

Counts of respondents based on mode of commute for each nature reserve

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COMMUTE

Accessibility of each nature reserve

Nature Reserve	Number of Entrances	Number of Bus Stops within 400m from Entrance	Number of Bus Services	Number of MRT stops within 400m from Entrance	Number of Carparks	Number of Park Connector Networks (PCNs)
Bukit Timah Nature Reserve	6	19	22: 41, 52, 61, 66, 66B, 67, 67a, 75, 75a, 77, 157, 170, 171, 174, 178, 184, 852, 961, 961M, 970, 973, 985	2: • Beauty World (Downtown Line) • Hillview (Downtown Line)	4	3: • Bukit Timah PC • Dairy Farm Nature Park • Central Catchment PC
Central Catchment Nature Reserve	5	18	20: 52, 54, 74, 93, 130, 132, 156, 157, 162, 162m, 163, 165, 166, 167, 410, 851, 852, 855, 980	1: • Marymount (Circle Line)	2	0
Labrador Nature Reserve	3	5	20: 10, 30, 30e, 51, 57,61,93,97,97e,100, 120, 143, 166,175, 176, 188, 188e, 963, 963e,963r	1: • Labrador (Circle Line)	6	1: • Alexandra Garden Trail, part of the Southern Loop
Sungei Buloh Wetland Reserve	2	4	2: 925, 925M	0	2	0

Based on the results, BTNR and CCNR had the higher WTP, more even distribution of transportation means and accessibility via public transportation. However, this could be due to the fact that BTNR and CCNR being more centrally located compared to LNR and SBWR. Since LNR and SBWR are located in the north and south of Singapore respectively, they are less accessible geographically and it is worsened by the limited public transportation means. Furthermore, both BTNR and CCNR are round in shape which reduces the amount of edges and thus are more accessible with multiple entrances and bus stops.

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COMMUTE

The results suggest that highly accessible nature reserves are more valued among nature reserve users in Singapore. This is further supported by numerous studies which have shown that accessibility plays a key role in park usage (Scott & Jackson, 1996; Zhang & Zhou, 2019). A local study by Zhang & Tan (2019) also revealed that accessibility was the second most important factor influencing park usage, after availability of time.

As such, it is important that NParks collaborate with relevant authorities and stakeholders such as the Land Transport Authority, SMRT, SBS Transit to implement the following:

(1) Development of Public Transportation Routes - Increasing the number of bus services, bus stops and MRT stops surrounding the nature reserves, particularly LNR and SBWR, would increase the accessibility and thus encourage visitorship.

(2) Expansion of PCNs along LNR and SBWR - The creation of a trail system could promote foot traffic from the nearest MRT/ bus stop that is currently available. This would not only encourage physical activity of visitors, but also enhance the accessibility of nature reserves, particularly LNR and SBWR.

Estuarine crocodile (Crocodylus porosus) often spotted at Sungei Buloh Wetland Reserve

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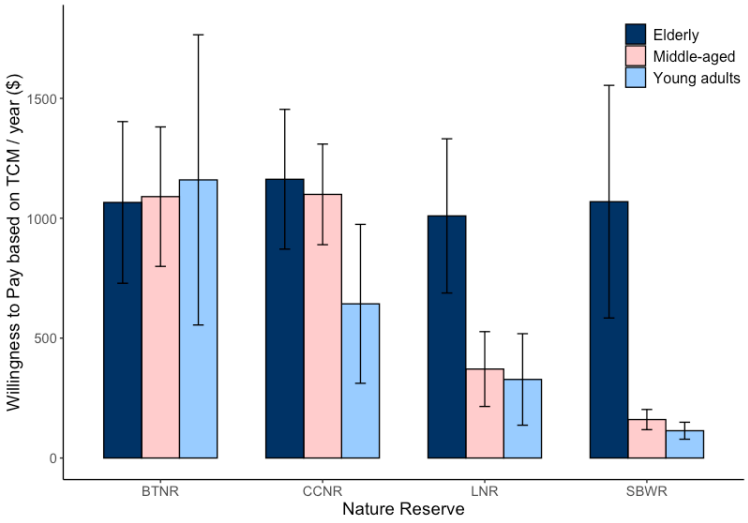
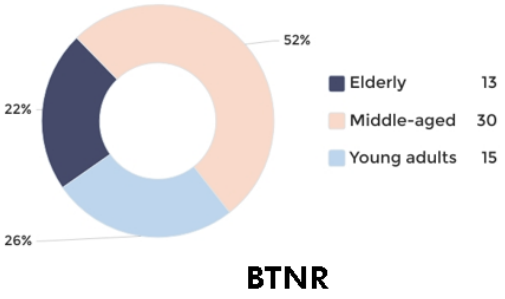
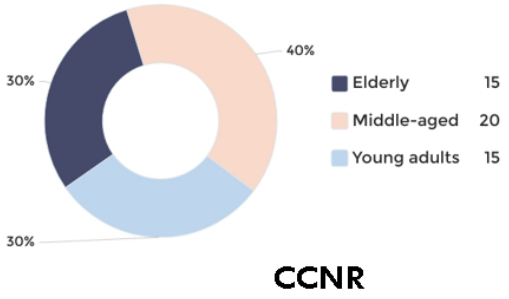
AGE

WTP based on TCM for the age group in each nature reserve

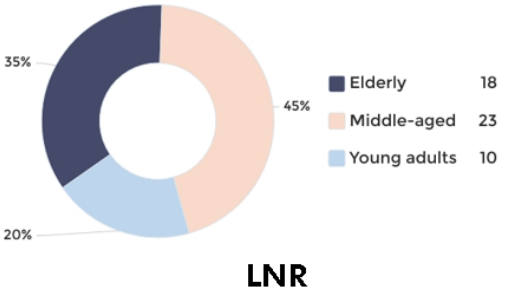




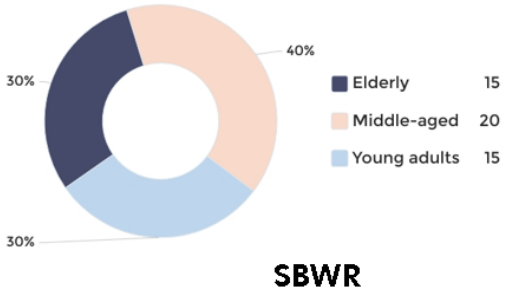
BTNR



CCNR



LNR



SBWR

Counts of respondents based on age group for each nature reserve

Based on the results, the majority of visitors are middle-aged, followed by the elderly and young adults. The WTP of elderly remained relatively constant across all nature reserves, while that of the young and middle-aged adults were higher for BTNR and CCNR and declined drastically for LNR and SBWR. This could be due to the fact that the elderly have a higher frequency of visits to SBWR and LNR compared to the young and middle-aged adults as factors such as income and travel time were similar amongst the three age groups. Noting that the majority of young and middle-aged adults visited LNR for nature appreciation and education and SBWR for nature appreciation and social gathering, the following could be implemented to engage and increase young and middle-aged adults' WTP:

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AGE

LNR:

(1) Nature and Historical Guided Walks - Adapting from guided walks seen in the other three nature reserves, it could be implemented and extended to include the historical significance of LNR. This could be further enhanced with NParks' efforts to better upkeep the historical artefacts, reopen some bunkers and tunnels with wartime replicas.

(2) Increase Educational Signages - This allows visitors to appreciate the history of LNR at the convenience of their time and it can tell a more cohesive, interactive and engaging story of the history of LNR as seen in Fort Canning Park or the Bicentennial event. The rocky shore of LNR could also be highlighted given the rarity of rocky shores in Singapore and the biodiversity it houses.

(3) Increase Number of Look-out Points - Look-out points that face the sea view on the top of the ridge could be constructed to allow visitors to better appreciate the surrounding nature.

SBWR:

(1)Increase Educational Signages - This seeks to improve the current nature trails present in SBWR with engaging information boards that could enhance the visitors' knowledge of local biodiversity, both flora and fauna, and habitat.

(2) Installation of Spotting Scopes - Given that SBWR is a birding haven, the installation of spotting scopes would greatly enhance inexperienced birders' willingness to look out for biodiversity and increase ease of birding for experienced birders.

Birders at Sungei Buloh Wetland Reserve

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AGE

To further engage and increase visitorship of young adults and elderly, the following could be implemented:

Young Adults:

(1) Social Media Campaigns and Challenges - Given young adults' high usage of social media platforms, social media campaigns could reach out to them directly and hashtag challenges could be implemented where they post their visit to the nature reserve on various social media platforms. This not only engages young adults during their visit, but also promotes the nature reserve to their social circle and thus encouraging others to visit.

Elderly:

(1) Community Field Trips - As mentioned under 'Commute', community field trips could be organised specifically for the elderly where it is conducted at a suitable pace and level of strenuosity. This increases convenience for elderly as they would not need to worry about directions and also ensures the safety of the elderly while they interact with others and appreciate nature.

A Long-tailed Macaque hanging on a tree at MacRitchie Reservoir

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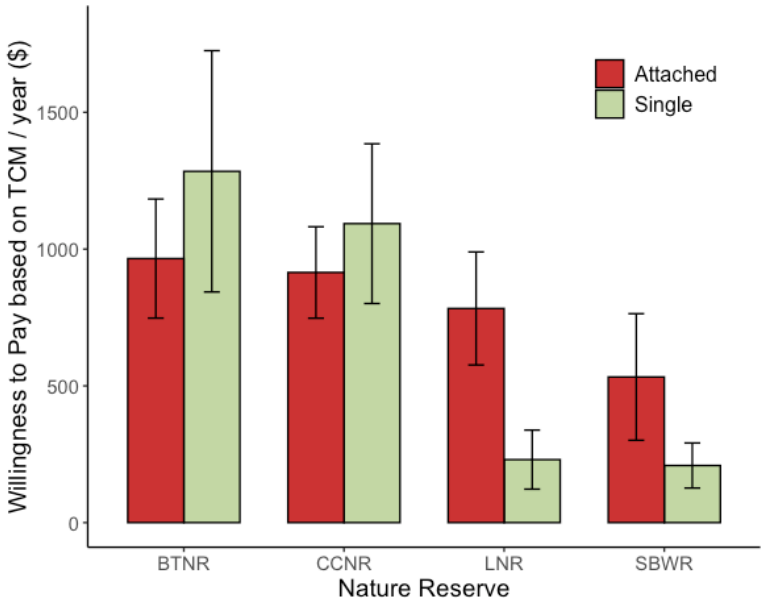
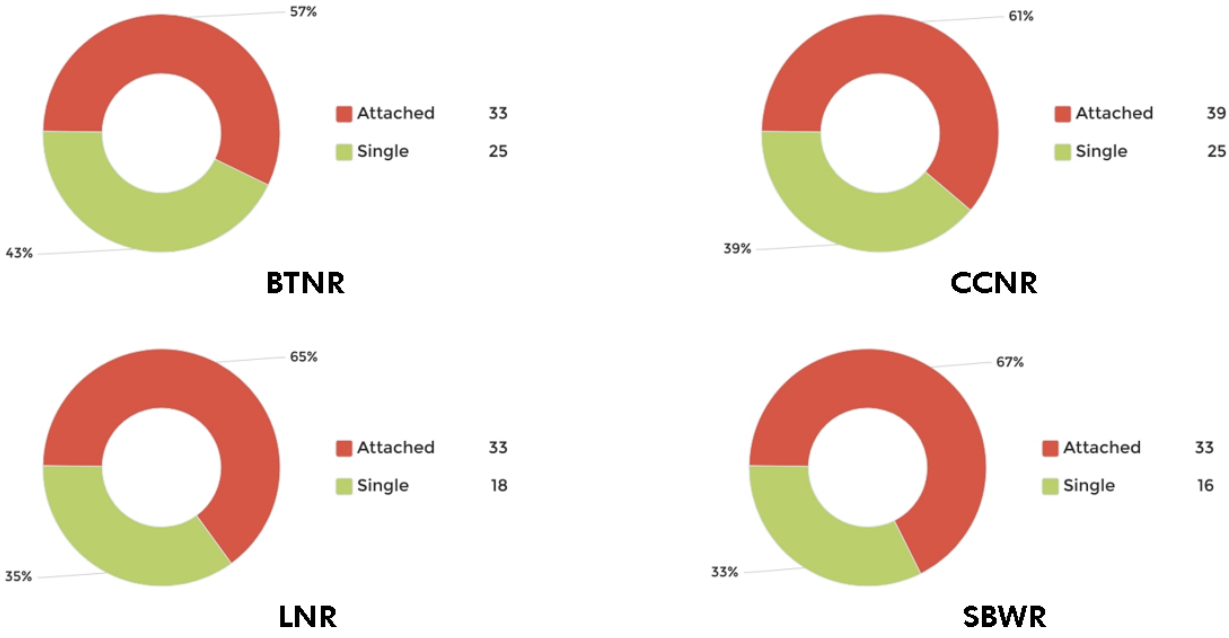
RELATIONSHIP STATUS

WTP based on TCM for the relationship status in each nature reserve





Counts of respondents based on relationship status for each nature reserve

Based on the results, it is evident that a higher proportion of surveyees who frequented the nature reserves are **attached**, either married or in a relationship, compared to singles. It was also interesting to note that in SBNR, singles engage in physical activities whereas attached individuals were engaged in social activities such as gathering and picnic. Conversely, the opposite trend is observed in LNR.

Moving forward, a myriad of activities could be organised to encourage singles to frequent the nature reserves:

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RELATIONSHIP STATUS

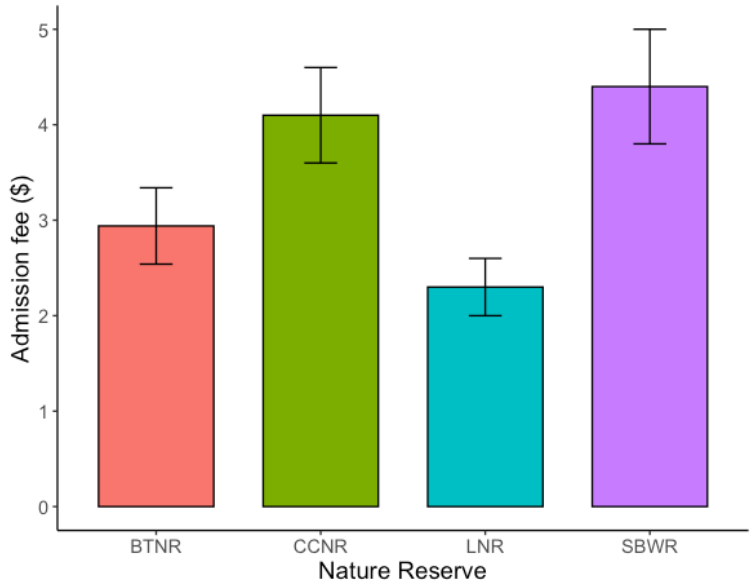
(1) Dating Events - Given the day and age of our society, there have been rising numbers of dating platforms locally such as Tinder, CoffeeMeetsBagel, Bumble and many others. However, as swiping profiles online becomes mundane, dating agencies are switching up the dating scene in Singapore by organising singles' dating events.

A pair of Pink-Necked Green Pigeon lovebirds spotted in Labrador Nature Reserve

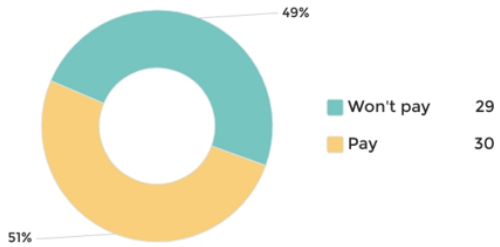
For example, Fabrique organised a singles' glamping event at East Coast Park which included food and games with dating experts (Fabrique, 2020). Similarly, the same concept could be applied to attract singles to nature reserves where singles are not only able to mingle with other singles, they can engage in games such as treasure hunts that would indirectly promote their knowledge of the nature reserve. Based on the different types of games organised, it could also appeal to different groups of singles. For example, activities that are based on strength training would attract physically active singles to participate.

(2) Charity Events - Based on a 2014 Millennial Impact Report, it revealed that millennials have exhibited a higher probability of giving back to society than other generations where 84% of working millennials engaged in donating to charity (Wheeler, 2018). Presently, the most predominant event is the 'Walk for Rice' which took place in HortPark in 2019. For every 400 m walked, a bowl of oatmeal will be donated and for every 200 m walked, two bowls of rice will be donated to provide assistance to lower-income families (ISACA, 2019). Similarly, this event has been implemented on a small scale in Prince George's Park Residences in NUS. As such, such events could also be implemented in the nature reserves where single millennials could appreciate the nature reserves while engaging in a charitable cause.

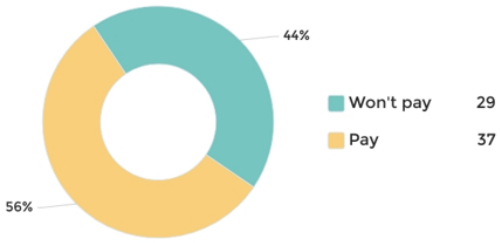
20 ADMISSION FEE



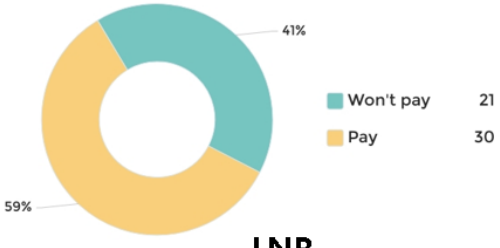
Price of admission fee that respondents are willing to pay in each nature reserve



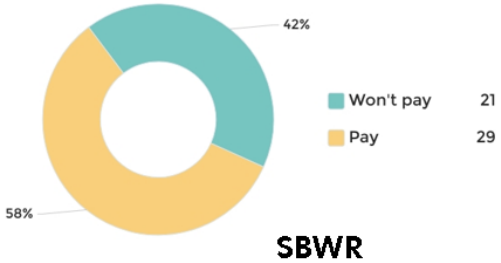
BTNR



CCNR



LNR



SBWR

WTP for admission fee in each nature reserve

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ADMISSION FEE

The results have revealed that the WTP for an admission fee decreases in the following order: SBWR > CCNR > BTNR > LNR. Even so, the range at which people are willing to pay are relatively low with < $5 as shown. SBWR could have the highest WTP for admission fee due to it being a birding haven where birders could have inflated the result. Similarly, CCNR and BTNR's WTP for admission fees are relatively high and comparable to SBWR as they are located more centrally and offer a myriad of activities that are popular amongst the people. It is saddening to note that the WTP for admission fee in LNR is evidently low and it reveals the lack of appreciation to Singapore's history.

Furthermore, at each nature reserve, an average of 44% respondents are unwilling to pay for any admission fee. It is a disheartening result as admission fees are commonly used to generate revenue for the maintenance and operation of the nature reserves (Witt, 2019). A study conducted by Witt (2019) also revealed that an estimated 26% rise in admission fees would only result in a 5% fall in visitorship where there is a relatively inelastic visitor demand. While lower income countries tend to implement admission fees that are below the cost of maintenance, it is shocking to note that people do not possess a higher monetary value of our nature reserves even in a well-developed and affluent country.

Oriental Pied Hornbill (Anthracoceros albirostris)

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LIMITATIONS:

(1) TCM Limitations

The TCM is a simple model that assumes individuals take a trip for a single purpose. This means that if they made the trip for more than one purpose, the value of the site may be overestimated (Bhuyan, 2011). Additionally, measuring opportunity cost based on their wage rate may not be the best way to measure opportunity cost (Tisdell, 1991).

(2) WTP may vary with seasons

We acknowledge that WTP may vary with seasons for the different nature reserves. For instance, CCNR may have a higher WTP during less hectic periods of work or school such as summer breaks or december holidays when people have a greater availability of time as it takes more time to complete the Tree-top walk trail. SBWR may have a higher WTP during the bird migratory season during October to January which may attract more birders.

(3) Covid-19 Situation

The current Covid-19 situation may have affected visitorship to nature reserves as those who live further away might be less likely to commute further for non-essential trips, especially for those taking public transportation.

(4) Small Sample Size

Due to the short time constraints, we only managed to interview 50 to 60 people per nature reserve, which may not be representative due to the uncoverage and voluntary response bias.

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CONCLUSION:

All in all, there are **differences in preference and valuation** of each nature reserve based on the varying WTP where LNR and SBWR are less 'valued' than BTNR and CCNR. This could be mainly attributed to the relative inaccessibility of LNR and SBWR. Furthermore, while it is heartening to see **biophilia** exhibited by Singaporeans, the results also revealed a pressing issue where nature reserve visitors predominantly utilise these spaces for exercise. We believe that there is a **greater need** to promote **education** in terms of **conservation** and **greater appreciation of local biodiversity**. As such, we proposed a variety of solutions that accounts for the varying socio-demographics, in particular - region of residence, form of commute, age and relationship status, observed in Singapore. Furthermore, in comparison with other studies, it was also interesting to note the **relatively elastic visitor demand** if an admission fee were to be imposed in our nature reserves. Thus, this revealed that any interventions implemented needs to be f**ree of charge** to promote visitorship and must be **economically viable** in the long run.

Collared Kingfisher at Sungei Bulooh Nature Reserve

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THANK YOU!

Moving forward, we hope that NParks would find this report beneficial for future planning of nature reserves and understanding the perceptions and valuation of nature reserves in Singapore.

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- Shawn, Michelle, Yukie and Amanda

Saturday morning at the entrance of Bukit Timah Nature Reserve