



SUMMARY REPORTS

13 September 2021

Economic Value of Ecosystem Services of the Taman Negara National Park, Royal Belum State Park and Endau-Rompin National Park

Component report of the PA Financing Projects (PIMS 3967)
on The Economics of Ecosystem and Biodiversity of
Terrestrial Protected Areas in Peninsular Malaysia (TEEB PA)



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INTRODUCTION

This report summarises the site-level economic valuation assessments of the study on **The Economics of Ecosystems and Biodiversity for Protected Areas (TEEB PA)** under the project Enhancing Effectiveness and Financial Sustainability of Protected Areas in Malaysia (PA Financing).

The project was implemented by the Department of Wildlife and National Parks (DWNP), with Perak State Parks Corporation (PSPC) and the Johor National Parks Corporation (JNPC) as key partners through the support of United Nations Development Programme (UNDP) and Global Environment Facility (GEF) grant financing.

The TEEB PA study aims to develop an evidence base for increased financing and investments for terrestrial protected area systems in Peninsular Malaysia. The study provided a demonstration the total economic value of these terrestrial protected areas through site-level economic valuation assessments of **Taman Negara National Park, Royal Belum State Park and Endau-Rompin National Park.**

1.1 Ecosystem services and economic value

Often, there are **no prices that reflect the value of the ecosystem services** of protected areas since the services that they provide such as climate regulation, downstream flood mitigation, biodiversity and so on, are not traded in markets. As a result, the value of ecosystem services is often not taken into consideration in decisions, affecting land use and protected area management.

Economic valuation tries to measure the benefits (e.g. conservation measures) and consequences (e.g. climate change, encroachment, poaching) of **environmental change**, usually in **monetary terms**, in order to communicate and fully understand the scale of impacts to human wellbeing. Such information is important to support holistic policy formulation and decision-making to ensure **wise use and management of natural resources**.

Ecosystem services refers to the flow of benefits received from “ecosystem capital”. Ecosystem capital is a component of natural capital, which can be defined as the stock of natural assets that provide society with renewable and non-renewable resources and a flow of ecosystem services.

The study applied the **Ecosystem Services (ES)** (Millennium Ecosystem Assessment, 2005; TEEB, 2010) and the **Total Economic Value (TEV) framework** (Pearce and Turner, 1990) in its economic valuation assessment.

The Millennium Ecosystem Assessment (MA) classification of ecosystem services introduced the following four categories of services.

- **Provisioning services** are the “products obtained from ecosystems”. Examples include food, timber and fuel.

- **Regulating services** are the “benefits obtained from the regulation of ecosystem processes”. Examples include water flow regulation, carbon sequestration and protection from storms.
- **Cultural services** are the “non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences”.
- **Supporting services** “are necessary for the production of all other ecosystem services”. Examples include nutrient cycling, soil formation and primary production¹.

Total Economic Value (TEV) comprises “**use values**” and “**non-use values**” (Figure 1).

Use values are the benefits that are derived from some physical use of the resource.

- **Direct use values** “stem from on-site extraction of resources or non-consumptive activities.”
- **Indirect use values** “are derived from off-site services or other processes impacted by the resource.”
- **Option value** “is the value that people place on maintaining the option to use a resource in the future.”

Non-use values are derived from the knowledge that an ecosystem is maintained without regard to any current or future personal use. “Non-use values” may be related to **altruism, bequest and existence** motivations.

“Total” in **Total Economic Value** here refers to **all components** of value rather than the sum of all values derived from a resource.

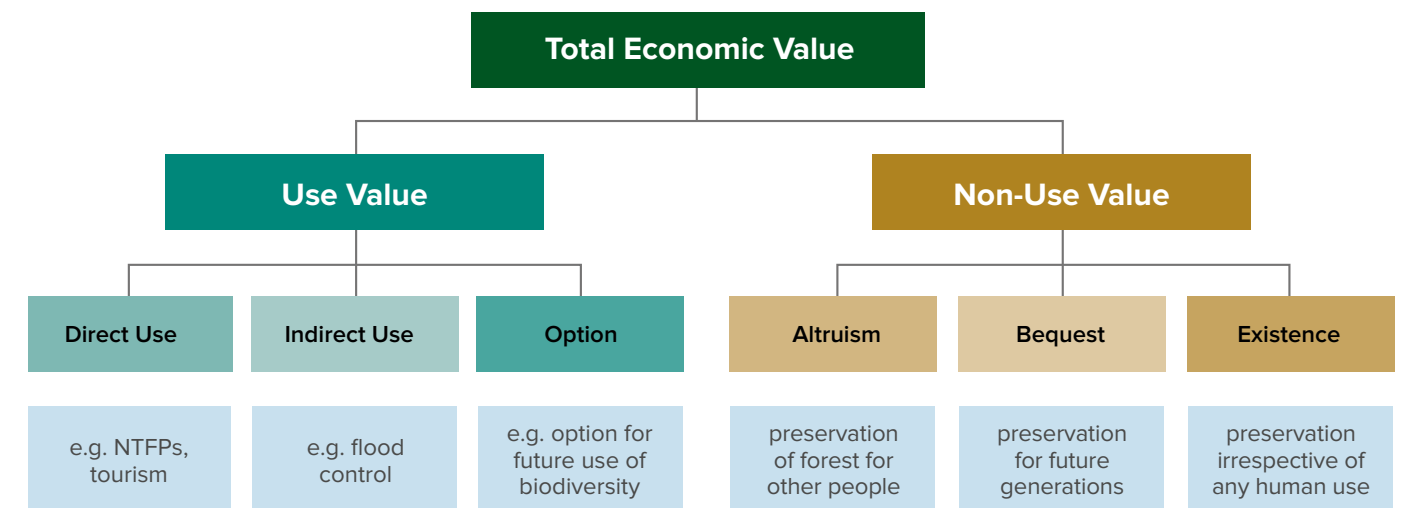


Figure 1 Components of Total Economic Value derived from forests

¹ Supporting services has been omitted in more recent classification systems due to potential double counting (e.g. The Economics of Ecosystems and Biodiversity – TEEB; Common International Classification of Ecosystem services - CICES).

2. Research Framework, Methods and Data

The study combined multiple methods to quantify and value the ecosystem services provided by the sites. The overall study framework is presented in Figure 2 below.

- **Review of existing studies, scoping and stakeholder consultations** were undertaken to understand the key ecosystem services provided by each protected area and their beneficiaries; availability of existing data and reports relevant to the study and inputs for developing future scenarios for PA management.
- **Data collection** included both primary and secondary data. Primary data collection was undertaken at the household level by PE Research Sdn Bhd to quantify the data needed for the benefit component of the study. A survey of PA

management costs was carried out to estimate the average costs of managing PAs in Peninsular Malaysia. Secondary data such as information and statistics on the profile of the sites were also obtained.

- **Spatial models of ecosystem services:** The Forest Research Institute of Malaysia (FRIM) undertook spatial modelling of ecosystem services and assessed changes to the bio-physical values under alternative scenarios (e.g. future development versus conservation scenarios).
- Both surveys on costs and benefits, including the spatial modelling, provided the data needed for the **Total Economic Value** and **Cost-benefit Analysis (CBA)** estimation.

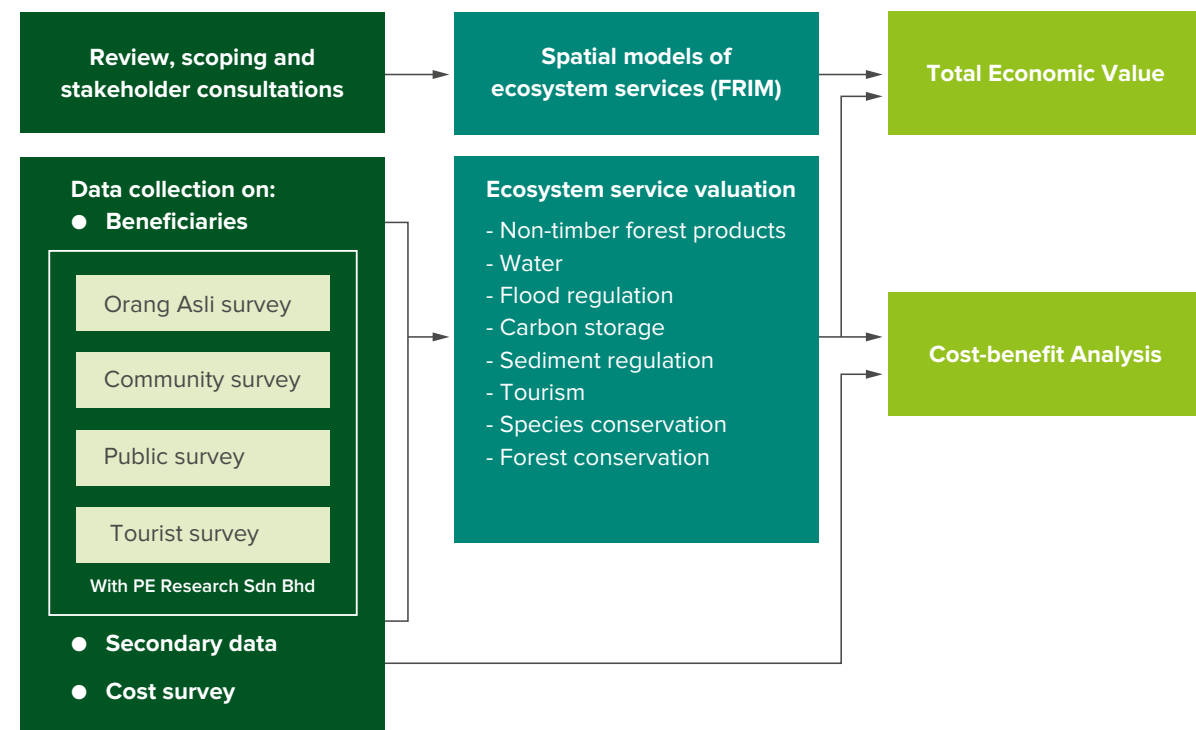


Figure 2 An overview of the key components of the study

The TEEB PA survey covered **four beneficiary groups**:

- 1) indigenous communities/orang asli (OA) within/bordering the PA
- 2) neighbouring local communities (LC) to the PA
- 3) households of the general public (GP) in Peninsular Malaysia
- 4) tourists (T)

Figure 3 provides an overview of the respective **ecosystem services that were assessed**, corresponding valuation methods applied, and data requirements for the estimations. The scope of the ecosystem services valued were based on stakeholder consultations while the valuation methods selected for each ecosystem service were determined by considering the nature of the service, beneficiary groups and data availability. In general, the valuation of provisioning services used the net factor income approach; regulating services adopted avoided cost methods, and cultural services applied stated preference methods such as contingent valuation and choice experiments.

	Ecosystem service	Valuation method	Data needs
Provisioning	Food	Net-factor income	Harvests, use, costs and prices of food, raw materials and medicinal resources.
	Raw materials		
	Medicinal resources		
Regulating	Carbon sequestration and storage	Avoided damage costs of climate change	Modelling of changes in the physical quantity of carbon stored under alternative scenarios and spatial variation of carbon sequestration rates by land use class.
	Moderation of extreme events	Avoided damage costs; Choice experiment	Flood frequencies, property damage costs and willingness to pay for changes in flood frequencies.
	Tourism		
Cultural	Spiritual experience and sense of place	Net-factor income to estimate producer surplus from providing tourism services	Tourist expenditures, activities, preferences and willingness to pay for forest and species conservation.
	Existence and bequest values	Contingent valuation Choice experiment	Preferences of Orang Asli communities towards conservation Preferences for conserving forests and wildlife in protected areas amongst general public, local communities and tourists

Figure 3 Ecosystem services of Taman Negara National Park and valuation methods



2 Research Framework, Methods and Data

The field surveys were undertaken between 31 October 2019 to 1 September 2020 (Figure 4). Due to the COVID-19 pandemic and travel restrictions in terms of the Movement Control Order (MCO) imposed by the Malaysian Government in March 2020, the survey team initiated online surveys for the General Public

and Tourist questionnaires. As the situation improved and the country transitioned to the Recovery Movement Control Order (RMCO) period, face-to-face surveys resumed in June 2020 as interstate travel was allowed and the study areas reopened.

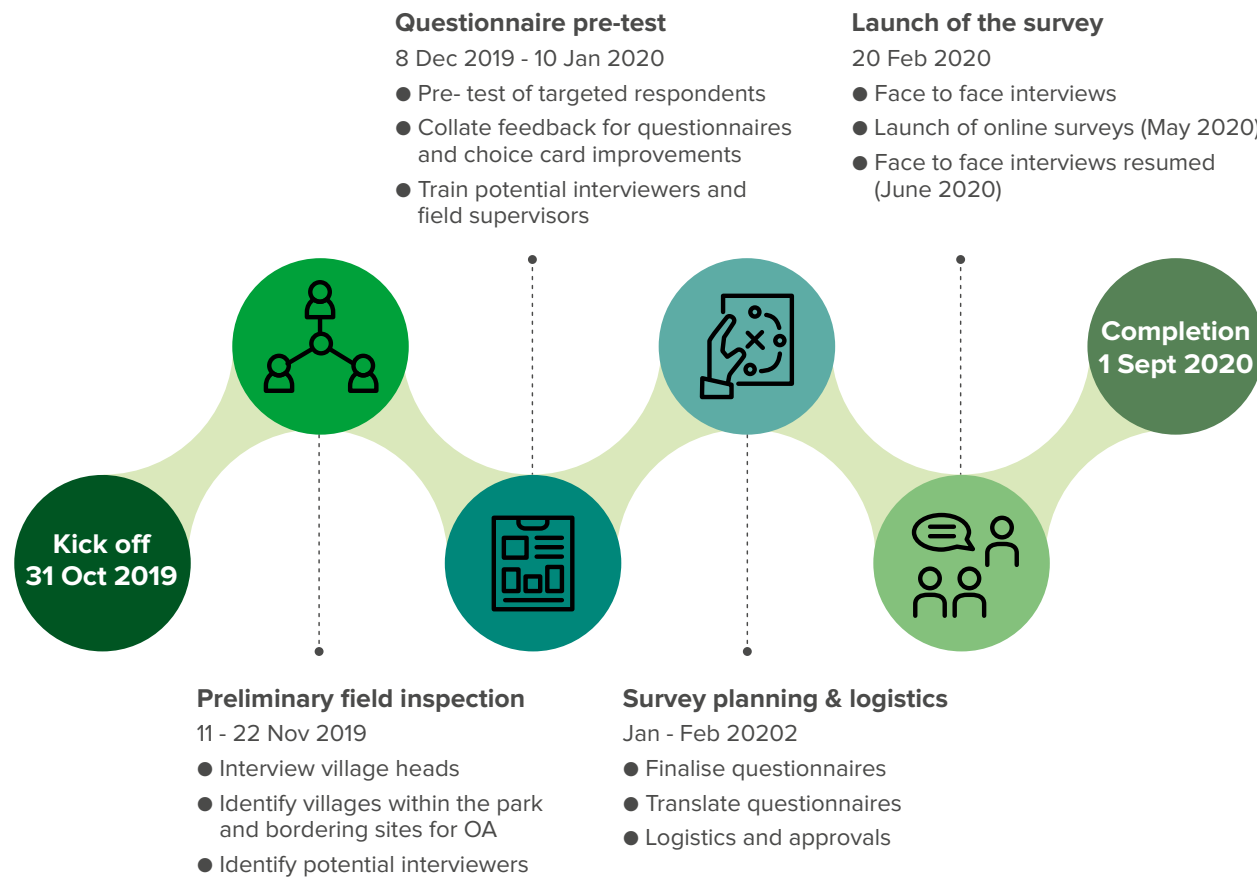


Figure 4 Survey key milestones and road map

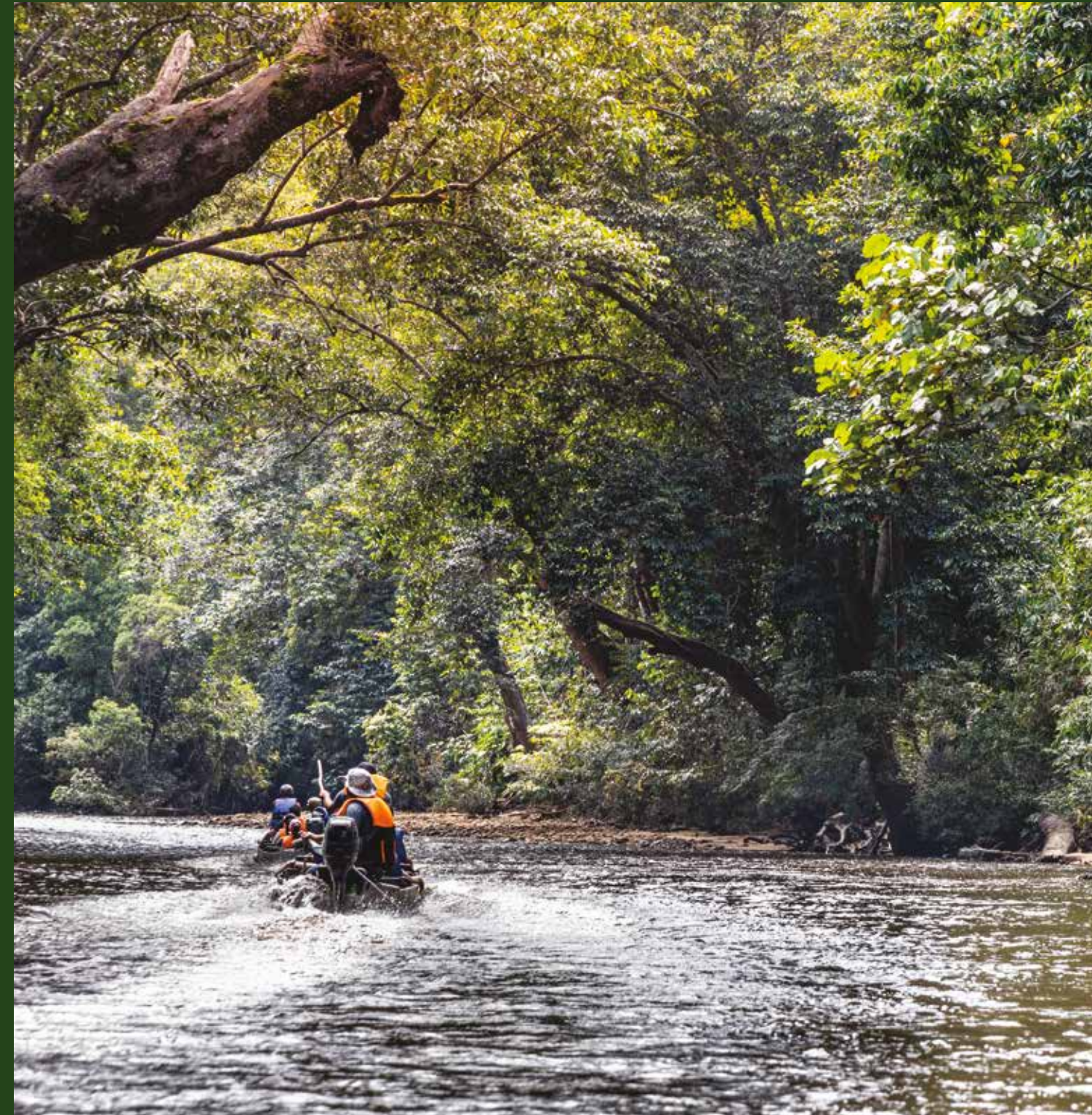
Source: PE Research Sdn Bhd, 2020

The TEEB PA study undertook a spatial analysis to model the bio-physical provision of ecosystem services by the respective PAs using the **InVEST** model. The InVEST analysis enables the evaluation of multiple ecosystem services provision under different land use and land cover (LULC) scenarios across landscapes.

Results from the **spatial modelling** are based on Adnan et al., 2020. Five ecosystem models that were assessed included water quality, water quantity, sediment retention, carbon storage and habitat quality. Due to the ecological linkages of the forest ecosystems and service provision, landscape level analysis of the watershed and sub-watersheds were undertaken for both baseline (2015) and conservation plan scenarios of the PAs.

The **discrete choice experiment (DCE) methodology** was applied to estimate the quantitative measures of local communities', general public, and tourists' preferences for environmental conservation. Four attributes comprising three environmental characteristics and one payment vehicle were used in the experimental design, including 1. The area of natural forest cut; 2. The percentage of animal species that will go locally extinct; 3. The number of floods that occur each year; and 4. The payment mechanism.

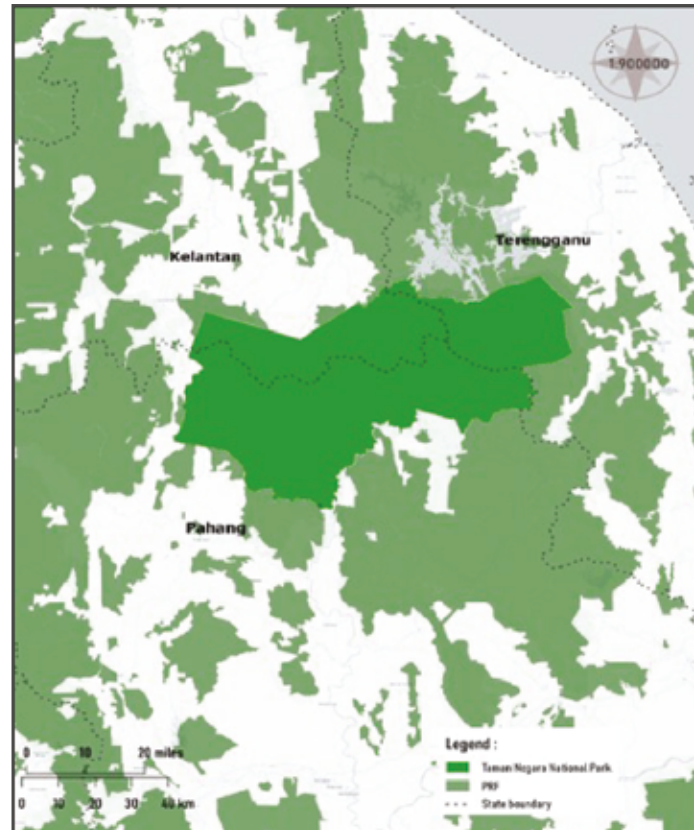
3. Taman Negara National Park



3.1 TNNP Profile

● **Ecological and physical environment:** Taman Negara National Park (TNNP) covers 4,343 km², straddling across the states of Pahang, Kelantan and Terengganu (Figure 5).

It is managed by the Department of Wildlife and National Parks (DWNP) and has four entrances which are Kuala Tahan and Merapoh (Pahang), Kuala Koh (Kelantan) and Tanjung Mentong (Terengganu).



Taman Negara National Park

Size	4,343km²
Management Body	Department of Wildlife and National Parks (DWNP)

Characteristics & recognition

- Iconic heritage site, reputed to be one of the world's oldest rainforests (130-million-year-old).
- Largest national park in Malaysia (DWNP, 2016).
- Home of approximately 1,500 indigenous Orang Asli of the Batek ancestry (Nicholas, 2000).

Biological & Physical recognition

- Vast range of unique characteristics and rich biodiversity including endemic tree species.
- West Malaysia's highest peak, Gunung Tahan (2,187 m).
- Rich charismatic animal species listed as Critically Endangered, Endangered or Vulnerable on the IUCN Red-list.
- One of the best birding destinations in Peninsular Malaysia.

Figure 5 Location and key characteristics of Taman Negara National Park²

● **Socio-economic context:** The percentage share of GDP by economic activity (2019) for the three states where Taman Negara is located shows that the services sector is the leading contributor to GDP (Kelantan – 69%, Pahang -52%, Terengganu 51%). Terengganu has the highest percentage share of manufacturing at 36%, followed by Pahang (22%). Agriculture is still somewhat important, especially for Kelantan and Pahang (Figure 6). Data on GDP contribution by sector provides insights into the sources of economic growth and dependence of the states on natural resources in relation to the understanding on the level of pressure on resource use.

Figure 7 summarises the key socioeconomic attributes of the districts surrounding Taman Negara National Park (i.e. Jerantut and Lipis in Pahang, Gua Musang in Kelantan and Dungun and Hulu Terengganu in Terengganu).

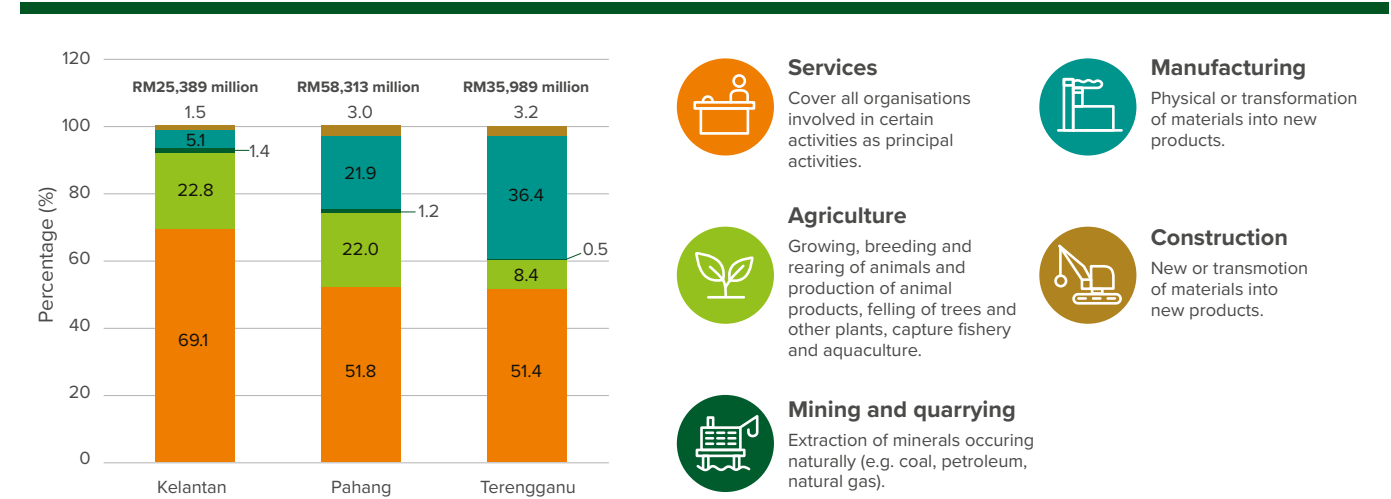


Figure 6 Percentage share to GDP by kind of economic activity and classification
Source: Department of Statistics Malaysia 2020³

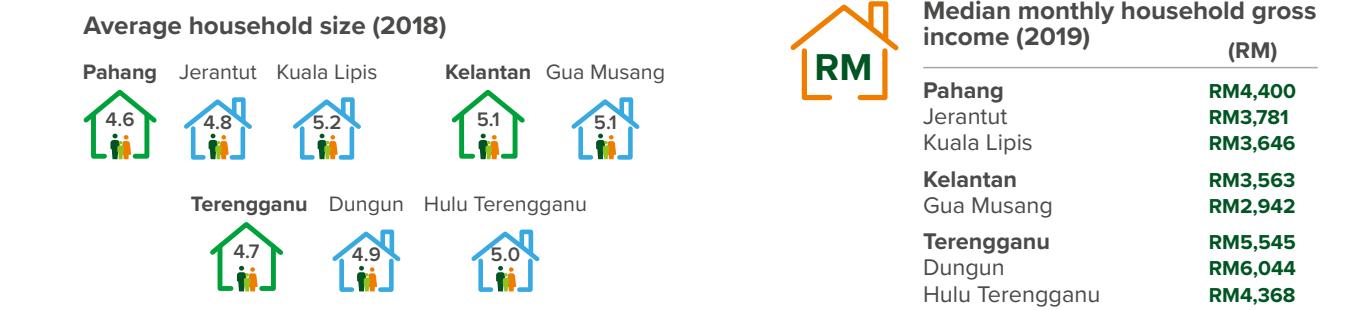
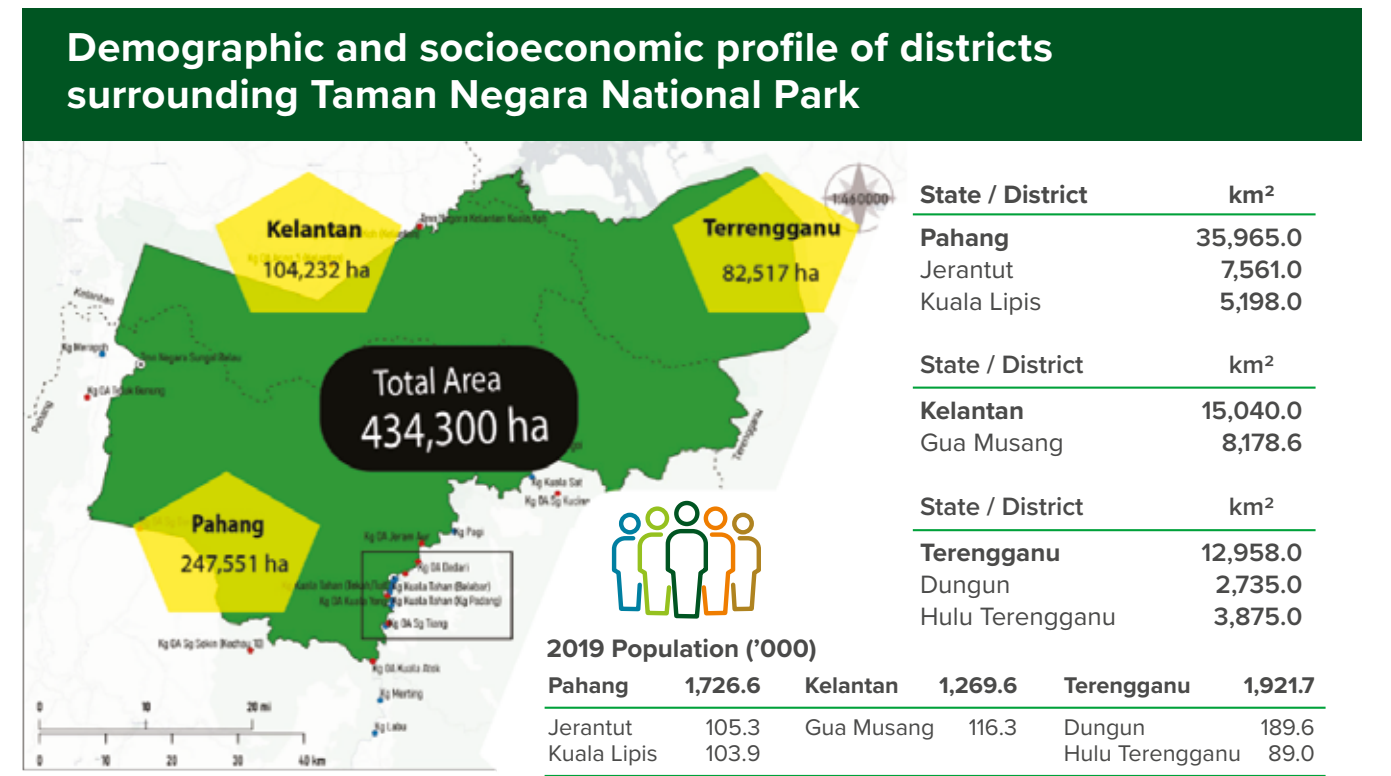


Figure 7 Demographic and socioeconomic profile of districts surrounding Taman Negara National Park
Source: Department of Statistics and Department of Survey and Mapping Malaysia

² Map: Adnana et al (2020)

³ https://www.dosm.gov.my/v1/index.php?r=column/ctthree&menu_id=Q2FvVnlnLTm9JVGmVZXRkZjY2F0ZD09

3.2 TNNP Findings

- **Surveys:** The TNNP survey completed a total of 1,454 questionnaires, beyond the target of 1,300 questionnaires⁴.
- **Orang Asli survey:** Figure 8 summarises the profile and findings of the Orang Asli (OA) household surveys. A total of 211 household surveys was completed. The average income of the OA respondents was estimated to be RM681/month.

About 44% of the average monthly income were sourced from natural resources. Around 63% of the respondents were willing to contribute time (WTCT) for conservation activities (average 2.2 days). The OAs were concerned about wildlife poaching, river sedimentation and deforestation.

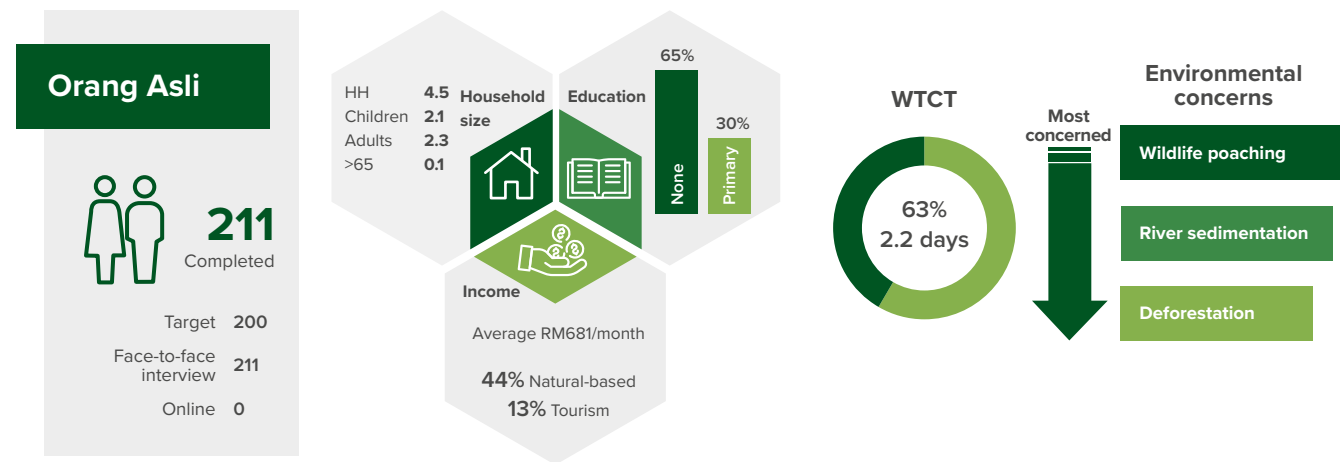


Figure 8 Orang Asli survey summary

- **Local community survey:** The survey covered five (5) neighbouring communities surrounding TNNP. A total of 309 households were interviewed. About 70% of the LC respondents' household income were below the national poverty line index (below RM2,208) (Figure 9). Almost 40% of the respondents worked in the tourism industry.

Despite the relatively low income, around 73% were willing to pay (WTP) for conservation of TNNP at an average of RM8.1. The LCs were concerned about pollution of rivers and lakes, flooding and deforestation.

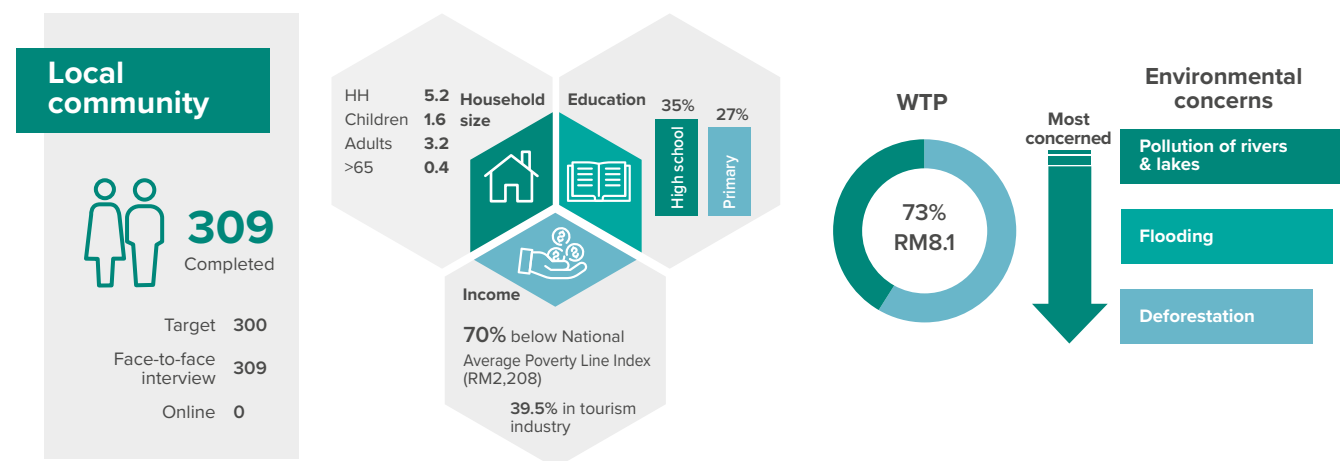


Figure 9 Local community survey summary

⁴ The survey had originally completed 1491 samples for TNNP in total prior to data cleaning.

- **Tourist survey:** A total of 471 tourists were interviewed, of which 76% of respondents were Malaysians. About 63% of the respondents thought that the current entrance fees were low. About 96% of the tourists were willing to pay for conservation in addition to the existing entry fee. The average WTP among tourists was RM21.8. Approximately 60% suggested the need for improved

operations facilities (e.g. ATM, enhancing WIFI connection, convenience store and resting areas), followed by visitor centre/information hall (56%), and more activities (40%) to be available at TNNP. The most significant environmental concern amongst tourists were deforestation, litter wastes and biodiversity loss (Figure 10).

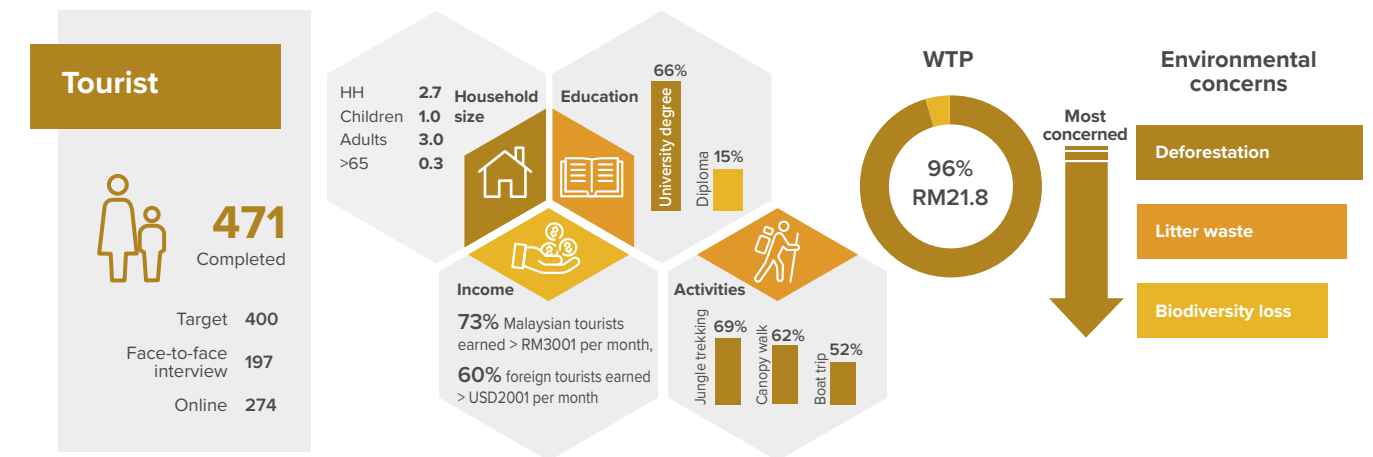


Figure 10 Tourist survey summary

- **General public survey:** A total of 463 general public (GP) questionnaires were completed. About 74% of the respondents earned more than RM3,001 per month (Figure 11). Around 83% of the respondents were willing

to pay for conservation, with an average WTP of RM15.5. Most respondents stated deforestation as their top concern, pollution of rivers and lakes and biodiversity loss.

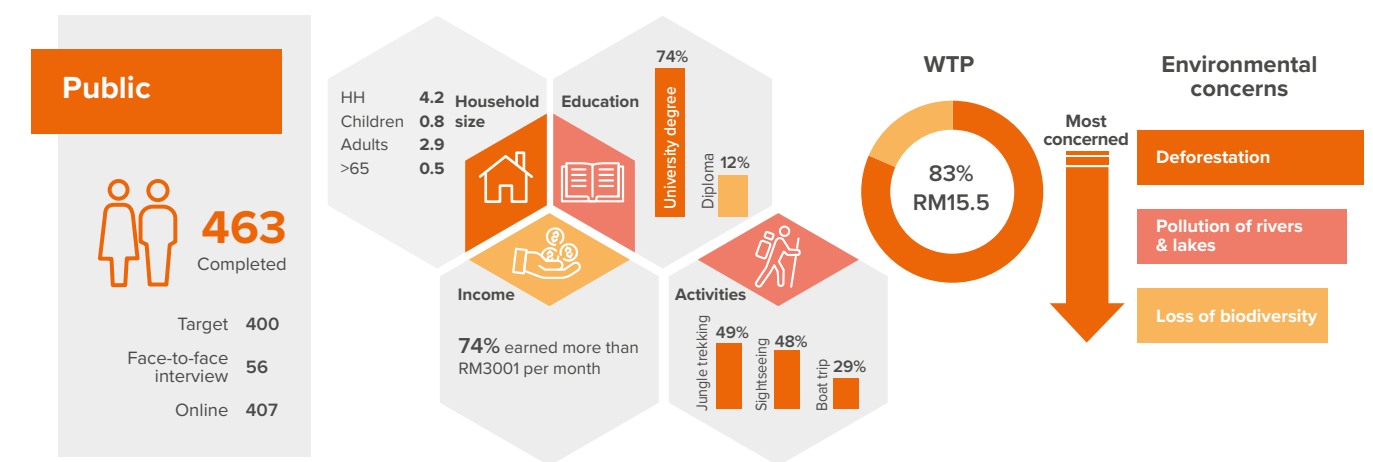


Figure 11 General public survey summary

3 Taman Negara National Park

● **Spatial modelling:** Based on stakeholder inputs, the conservation plan analysis estimated for TNNP included adopting a 1.5km buffer of the TNNP boundary. The spatial modelling Adnan et al., 2020 showed the following key improvements of adopting the conservation plan over the baseline scenario (Figure 12).

- i. Reduction in nutrient exports, particularly nitrogen (3%) and phosphorus content (1.4%)
- ii. A slight reduction in water yield up to 1,573,352.30 m³ per year or 0.004% at the watershed level
- iii. Reduction in sediment export of up to 21,955 tonnes (0.12%)

- iv. Improvement in carbon storage by 0.183% or equivalent to 988,600.75 Mg. Thus, the annual carbon sequestration is around 19,772.02 Mg yr⁻¹
- v. Improvement in habitat quality. The habitat quality had a slight increase of 0.002 (0.2%)

These changes indicate that the TNNP conservation scenario would result in significant improvement in nutrient exports, sedimentation, and carbon storage. The reduced water yield could partly result from increased evapotranspiration due to increased forested areas, providing other benefits such as flood mitigation during wet periods or improved water availability during dry periods (Nirmal B. et al., 2012)⁵.

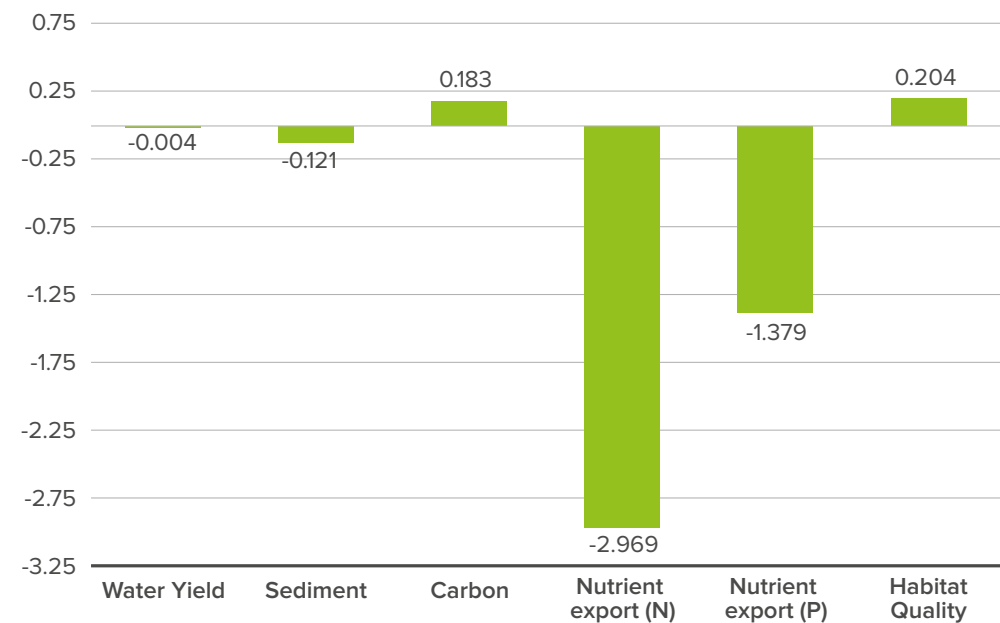


Figure 12 Percentage change of respective ecosystem service between the baseline and conservation scenarios for Taman Negara National Park

● **Choice experiment design:** Figure 13 presents the outputs of the DCE, analysed using a mixed logit (MIXL) model. Local residents and the Malaysian general public are willing to add RM 1.77 to their monthly electricity bill to prevent 1,000 hectares of deforestation; RM 1.21 to prevent one per cent of species numbers being lost; and RM 6.63 to

prevent a downstream flood event. Tourists would accept an increase to the entrance fee to Taman Negara PA of RM 10.17 per 1,000 hectares of deforestation avoided; RM7.1 to prevent one per cent of the total species going locally extinct; and RM 20.63 to reduce the frequency of downstream flooding by one flood event.



	Deforestation prevention (RM/1,000 ha)	Extinction prevention (RM/percentage point)	Flood prevention (RM/flood)
Local communities (household/month)	RM 1.77	RM 1.21	RM 6.63
General public (household/month)	RM 1.77	RM 1.21	RM 6.64
Tourist (person/visit)	RM 10.17	RM 7.1	RM 20.63

Figure 13 Median willingness to pay (RM; 2020 price level)

● **Estimation of Total Economic Value:** The total economic value of ecosystem services assessed is computed as the sum of annual values (RM 1.7 billion per year). The values of each service are summarised in Table 1. The estimated value of ecosystem services from TNNP is dominated by the value of carbon sequestration,

which accounts for almost two-thirds of the TEV. This ecosystem service is globally important, but TNNP also provides services that are locally and nationally important to beneficiaries in Peninsular Malaysia. In particular, the value that households place on forest conservation reaches almost RM 400 million per year.

Table 1 Total economic value of ecosystem services provided by Taman Negara National Park

Ecosystem Service	Annual value of (RM millions/year)
NTFPs	5
Water purification	28
Tourism	43
Flood regulation	73
Biodiversity conservation	92
Forest conservation	397
Carbon	1,066
Total	1,705

* Rounded to the nearest figure

⁵ Source based on Adnan et al., 2020

3 Taman Negara National Park

- **Cost-benefit analysis of the TNNP conservation scenario:**

The conservation scenario describes the adoption of a 1.5 km buffer from the current boundary (Table 2). The aim of the forest buffer zone is to minimise the impacts from the development of other land uses such as agriculture and logging, reduce land-use conflicts and

human-wildlife conflicts. With the buffer area expansion of TNNP, 58,980 ha of protected area is increased. With this conservation scenario, forest area will increase by 4,531 ha while agriculture/crops land area will decrease by 3,835 ha relative to the baseline.

Table 2 Land use of baseline and conservation plan of Taman Negara National Park

Land Use	Scenario		
	Current	Conservation Plan	Changes (ha)
Forest	1,783,591	1,788,121	4,531
Agriculture/Crops	168,918	165,083	- 3,835
Built-Up Area	12,939	12,487	- 451
Husbandry and Aquaculture	733	733	-
Mining Area	11,922	11,922	-
Water Bodies	48,836	48,836	-
Others (grass, orchard, swamp & unused land)	19,235	18,991	- 244
TOTAL	2,045,174	2,045,174	-

- **The present values of the costs and benefits** of the conservation scenario were computed over a 30-year time horizon using a discount rate of 5%. Figure 14 demonstrate the cost and benefit computation of the expansion of TNNP.

A positive Net Present Value (NPV) of RM583 million and Benefit-Cost Ratio (BCR) of 2.9 were estimated, indicating that the benefits of the conservation scenario for TNNP outweighed the costs.

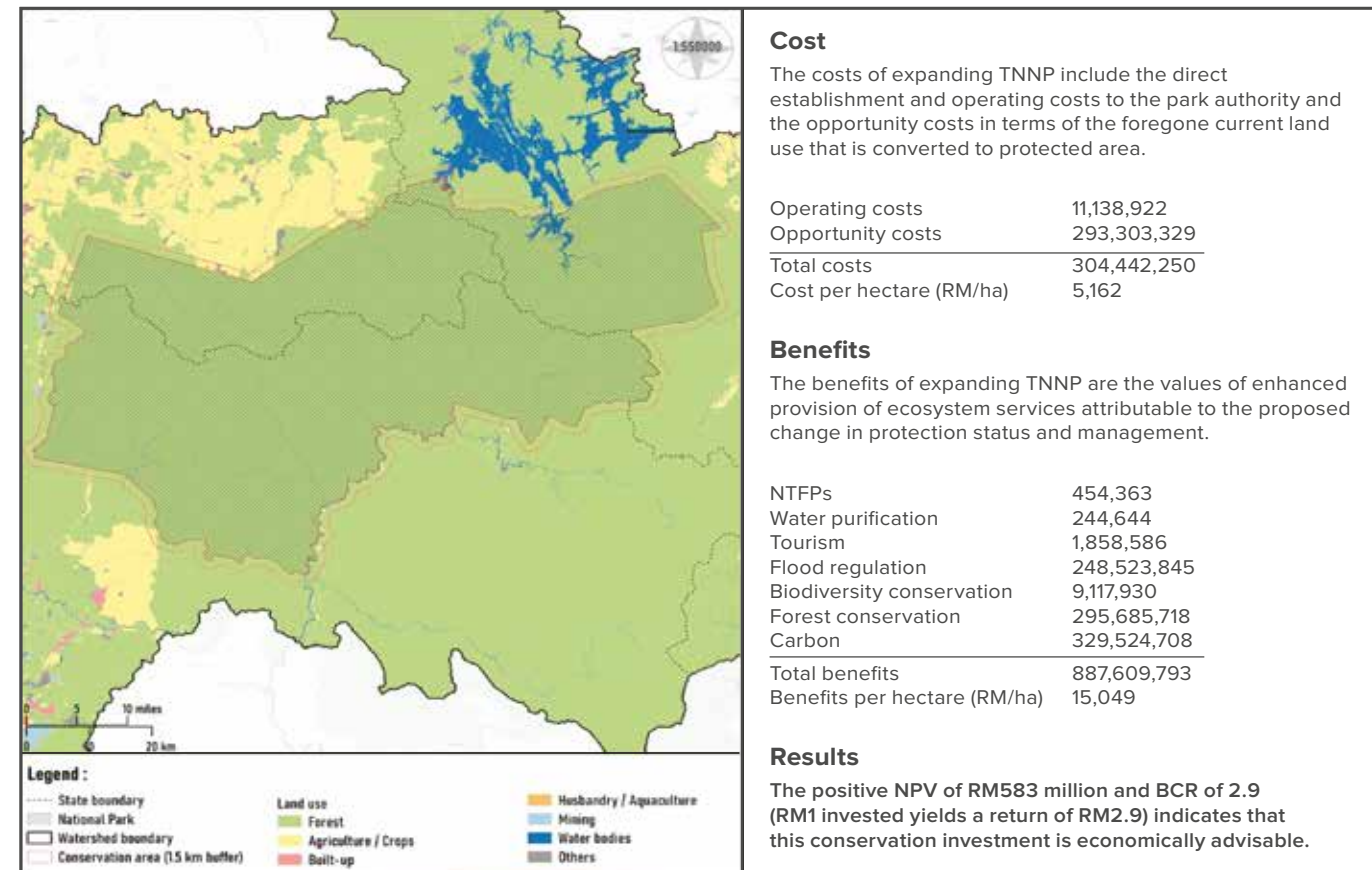


Figure 14 The cost and benefit of the expansion of TNNP

3.3 TNNP Policy Implications and Recommendations

Taman Negara National Park delivers a wide range of ecosystem services that have a high economic value. The following key findings highlight the significance of TNNP and contribute to policy implications.

- **Significant economic contribution:** annually, the total economic value of ecosystem services from Taman Negara is over RM 1.7 billion, implying a capital asset value of almost RM 32.8 billion over a 50-year time horizon and a discount rate of 5%. At the state level, this is comparable to approximately 55% of the combined projected revenue of the three states in 2020 (RM3.1 billion: RM 1.6 billion-Terengganu⁶, RM744 million - Kelantan⁷, RM 748 million - Pahang⁸). In addition, the illustrative Cost-Benefit Analysis of the conservation scenario for the adoption of the TNNP buffer zone found that the benefits outweighed the costs.
- **Ecosystem services provide benefits at the local, state, national and global levels.** The ecosystem services assessed in the study include provisioning services (RM 5 million/year), tourism (RM 43 million/year), carbon sequestration (RM 1,066 million/year), water purification (RM 28 million/year), flood regulation (RM 73 million/year), and conservation value attached to the preservation of animal species (RM 92 million/year) and forests (RM 397 million/year). These values demonstrate the contribution of TNNP at the local level in terms of food and livelihood options and national level through flood regulation and water purification. At the same time, it also supports the nation's progress towards its international obligations on biodiversity and climate change. Hence, investing in the effective management of the TNNP would ensure that these services continue to benefit the nation.
- **TNNP ecosystem services are critical to OA communities' basic needs and livelihoods.** Although the number of OA households making direct use of the forest resources is relatively small, their usage of **forest services constitutes a substantial proportion** of their real income. Forest management and rural development policies serve as vital platforms for addressing the welfare of indigenous communities who are also B40 income groups⁹. Careful considerations are essential to ensure that these communities could continue to supplement their livelihood and source of food while sustaining their cultural practices connected to the forests.

- Protected areas provide the **opportunity to support green jobs and catalyse sustainable rural economies.** The TEEB PA study found that a high percentage (70%) of the LC respondents' household income was below the national poverty line index. Integrating environmental considerations into poverty reduction strategies and policies is critical. The interventions will support sustainable rural economies and build the necessary impetus and innovation to create green jobs in areas that lack employment opportunities. Moving forward, equipping the civil service at the local, state and national levels with appropriate capacity to incorporate natural resource management into social support and pro-poor programmes of relevant Ministries and agencies are critical to bringing about the transformation.
- **Integrating baseline data to support future management of TNNP.** At the park level, the TNNP Management Plan, Business Plan and human resources enhances the effective management of TNNP. The study contributed baseline data that could be integrated into TNNP's management practices to monitor and guide its management services (such as entrance fee setting, tourism management and local community connections and involvement) and subsequently enhance its ecosystem values.

⁶ <https://www.nst.com.my/news/nation/2019/11/541675/terengganu-presents-deficit-budget-2020>

⁷ <https://www.kelantan.gov.my/images/Penerbitan/Belanjawan2020.pdf>

⁸ <https://www.klscreeener.com/v2/news/view/602958/pahang-tables-2020-budget-with-rm4-13-mil-in-surplus>

⁹ Household group with the lowest income range

4. Royal Belum State Park

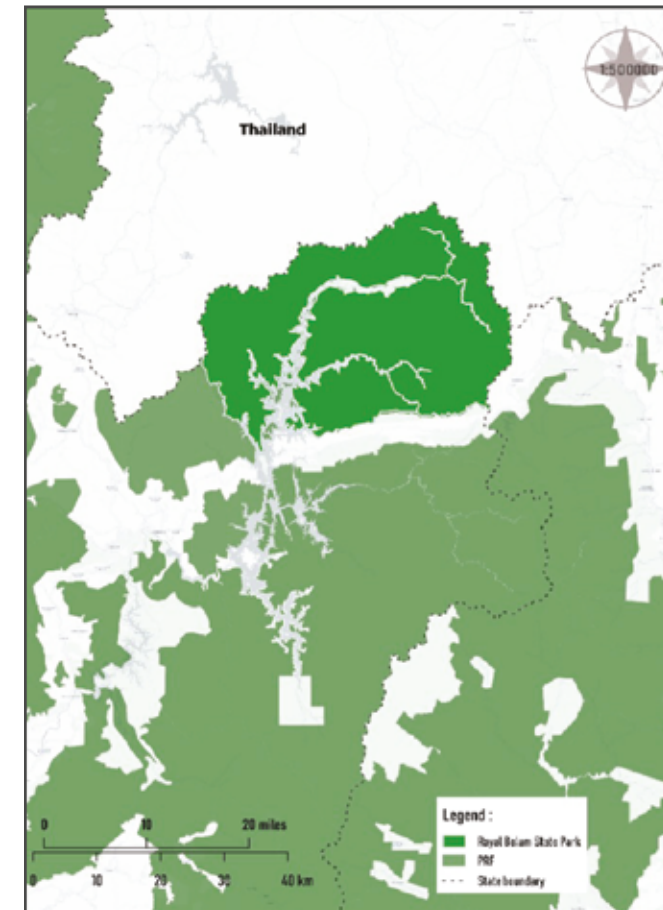


4.1 RBSP Profile

- **Ecological and physical environment:** The Royal Belum State Park is the second-largest protected area in Peninsular Malaysia, covering 117,500 ha. It was gazetted in 2007 under the Perak State Parks Corporation Enactment. Prior to that, it was gazetted as the Belum Forest Reserve in 1971.

Together with the Temengor Forest Reserve and Gerik Forest Reserve, the RBSP forms an important 300,000 ha

forested landscape known as the Belum-Temengor forest complex. It serves as one of the largest remaining forest complexes in Peninsular Malaysia and a core component of the Central Forest Spine (CFS) while connected to mainland Asia through the Bang Lang National Park and Hala-Bala Wildlife Sanctuary in the southern Thai province of Yala (Perak State Park Corporation 2016a).



Royal Belum State Park

Size **300,000 ha**
 Management Body **Perak State Parks Corporation**

Characteristics & recognition

- One of the largest remaining forest complexes in Peninsular Malaysia and a core component of the Central Forest Spine (CFS) while connected to mainland Asia through the Bang Lang National Park and Hala-Bala Wildlife Sanctuary in the southern Thai province of Yala (Perak State Parks Corporation, 2016a).

Biological & Physical recognition

(Perak State Parks Corporation, 2016b)

- Contains over 100 species of mammals, 18 of which are globally threatened.
- Supports populations of three of Malaysia's nine Rafflesia species.
- One of three landscapes in Peninsular Malaysia crucial for the survival of the nation's tiger population.
- One of the largest Important Bird Area (IBA) in Peninsular Malaysia, supporting all ten of Peninsular Malaysia's hornbill species, including the Plain pouched and Helmeted Hornbills.
- The only place in Peninsular Malaysia where all of its three gibbon species occur in the same area.

Figure 15 Royal Belum State Park location and key characteristics

- **Socio-economic context:** Figure 16 highlights that the services sector is the leading contributor to the state's GDP (63%), followed by manufacturing (18%), agriculture (15%), construction (3%) and mining and quarrying (1%). The figures indicate that Perak has moved towards services and industrialisation with a higher GDP share from services and manufacturing. Agriculture is still somewhat important,

positioned as the third-highest contributor to the state's GDP. Data on GDP contribution by sector provides insights into the sources of economic growth and dependence of the states on natural resources in relation to understanding the level of pressure on resource use.

4 Royal Belum State Park



Figure 16 Percentage share to GDP by kind of economic activity and classification

Figure 17 summarises the key socioeconomic attributes of Ulu Perak, the district surrounding Royal Belum State Park. The land area of the Ulu Perak is around 31% of the Perak State. The population of the district is relatively small despite the land area. Based on 2019 figures, the population in

Ulu Perak was 104,000, representing around 4% of the people in Perak. The average household size in Perak was 3.5 in 2019, while Ulu Perak recorded a larger average household size at 4.0. The median monthly gross household income for Ulu Perak was RM3,532 compared to Perak's RM4,273.

Demographic and socioeconomic profile of districts surrounding Royal Belum State Park

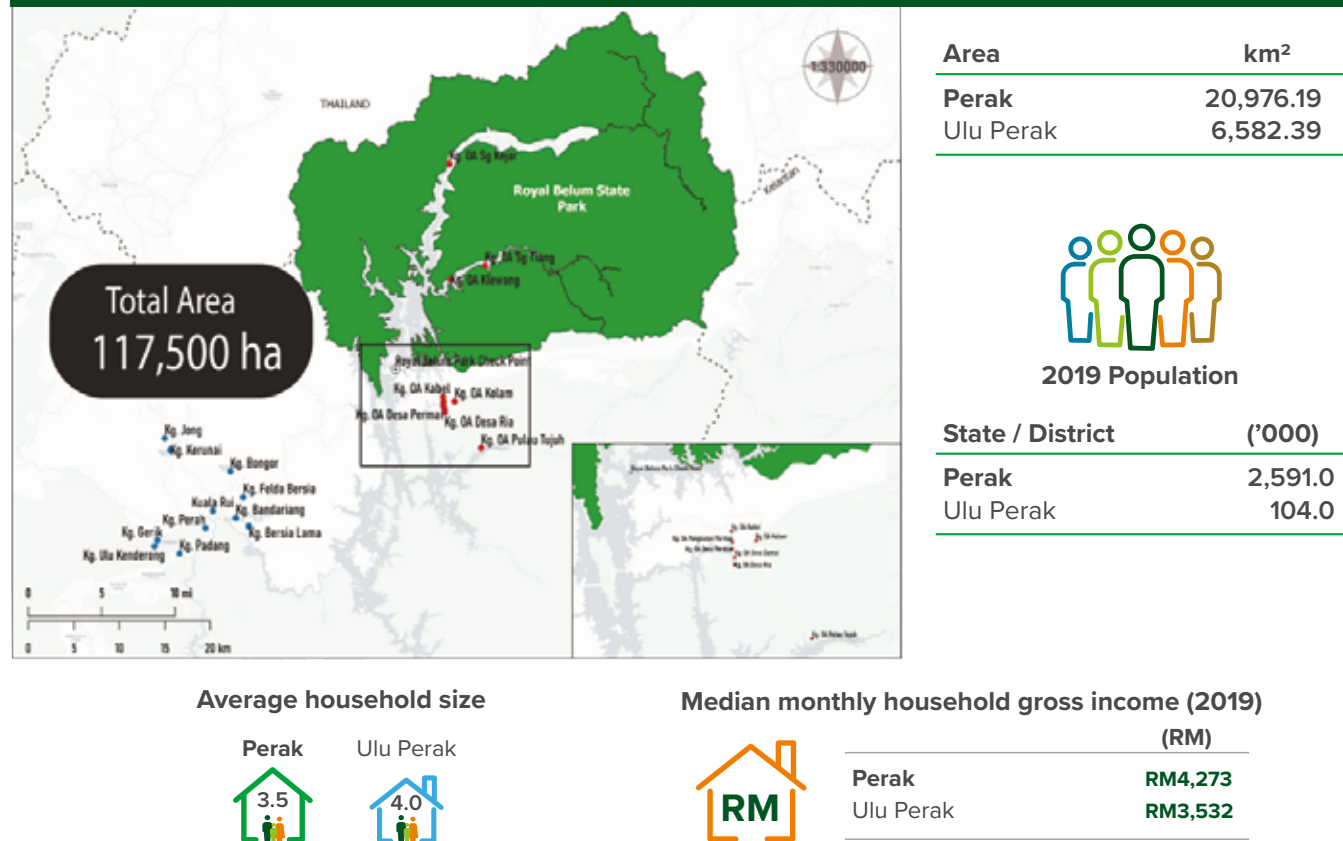


Figure 17 Demographic and socioeconomic profile of districts surrounding Royal Belum State Park

4.2 RBSP Findings

- **Surveys:** The RBSP survey completed 1,457 questionnaires in total, beyond the target of 1,300 questionnaires.
- **Orang Asli survey:** A total of 253 questionnaires were completed (Figure 18). Most of the respondents received government benefits (87%) with an average contribution of RM103/month for those who were part of the programme. Though employment provided the highest average income at RM893, only 33% of the respondents were employed.

Tourism was the second-highest average monthly income contributor at RM218/month, with only 21% of the respondents involved in the activity. Furthermore, around 62% of OA were willing to contribute time (WTCT) on an average of 2.0 days. The respondents were concerned about human-wildlife conflict, wildlife poaching and overfishing.

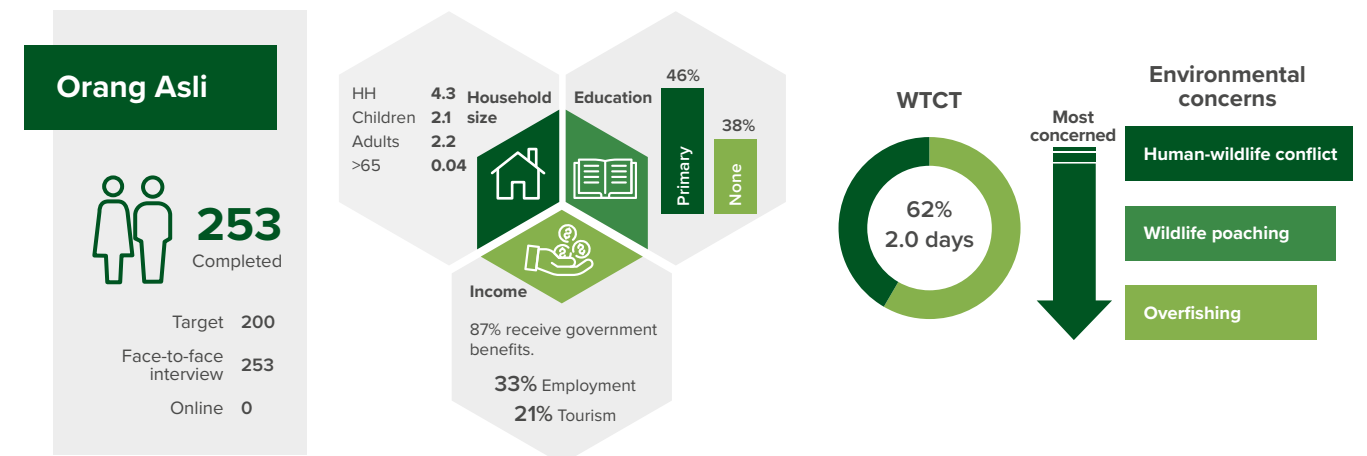


Figure 18 Orang Asli survey summary

- **Local community survey:** The survey covered eleven (11) neighbouring communities to the protected areas. A total of 300 households were interviewed. About 94% of the LCs interviewed earned below RM3,001/month (Figure 19). Moreover, most of the respondents were self-employed (36%)

and only 9% of the respondents interviewed worked in the tourism industry. Around 62% were willing to pay (WTP) for conservation at an average of RM3.0. The respondents were concerned about forest fires, pollution to rivers and lakes and flooding.

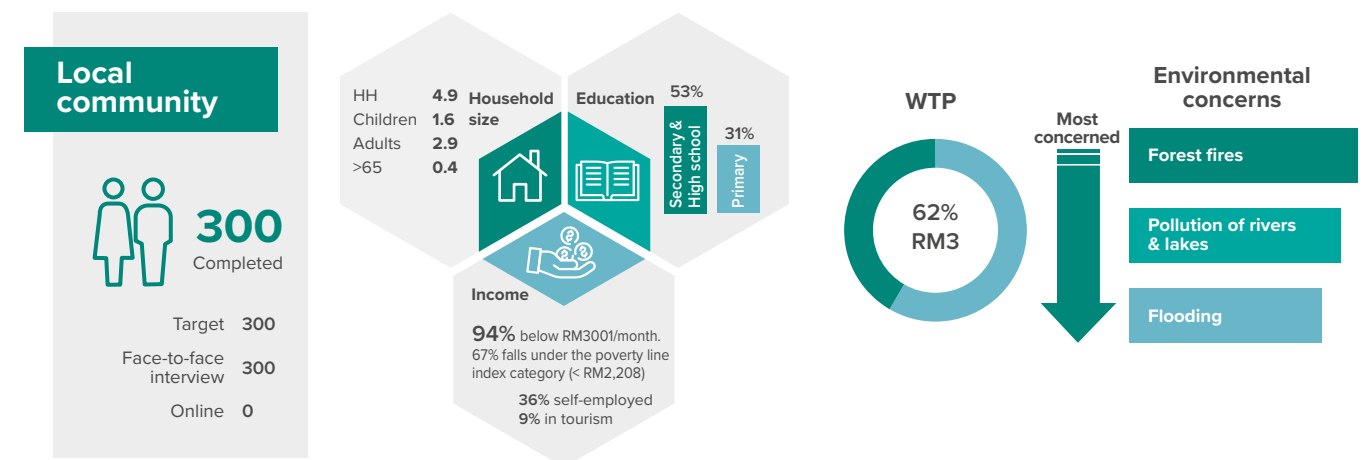


Figure 19 Local community survey summary

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● **Tourist survey:** A total of 459 tourists were interviewed, of which 97% were Malaysians. About 82% of the tourists were willing to pay for conservation in addition to the existing entry fee. The average maximum WTP among tourists was RM171. Approximately 38% of respondents

suggested the need for visitor centre/information hall, and 34% highlighted the need for improvements to facilities such as ATM machine and WIFI connection. The tourists were concerned about pollution of rivers and lakes, litter waste and deforestation (Figure 20).

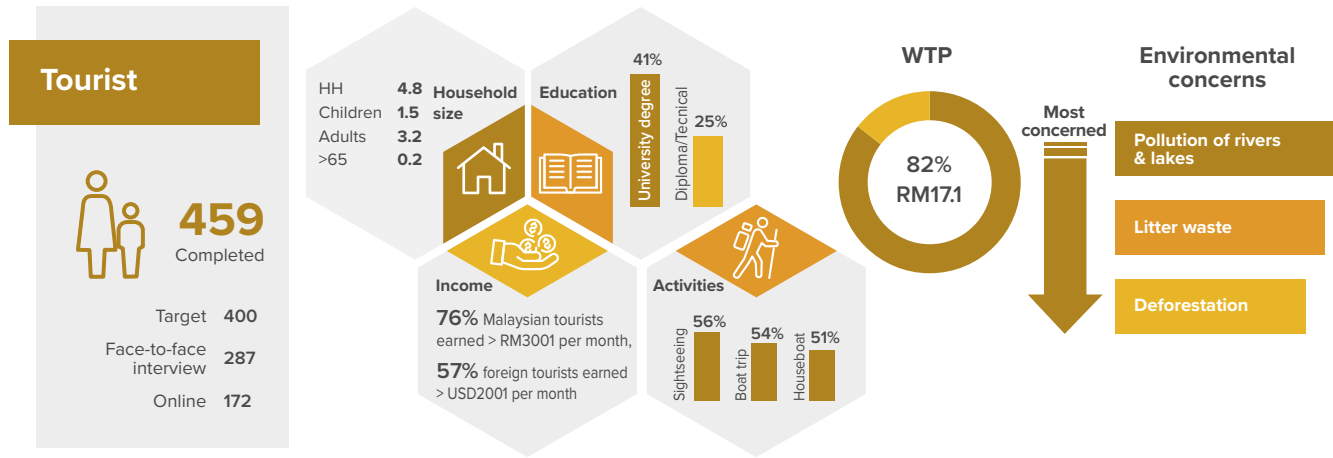


Figure 20 Tourist survey summary

● **General public survey:** A total of 445 GP questionnaires were completed. About 73% of general public respondents earned more than RM3,001 per month (Figure 21). Around 87% of the respondents were willing to pay for

conservation with an average WTP of RM13.4. Most of the respondents were concerned about pollution to rivers and lakes as their top concern, followed by litter waste and lakes and deforestation.

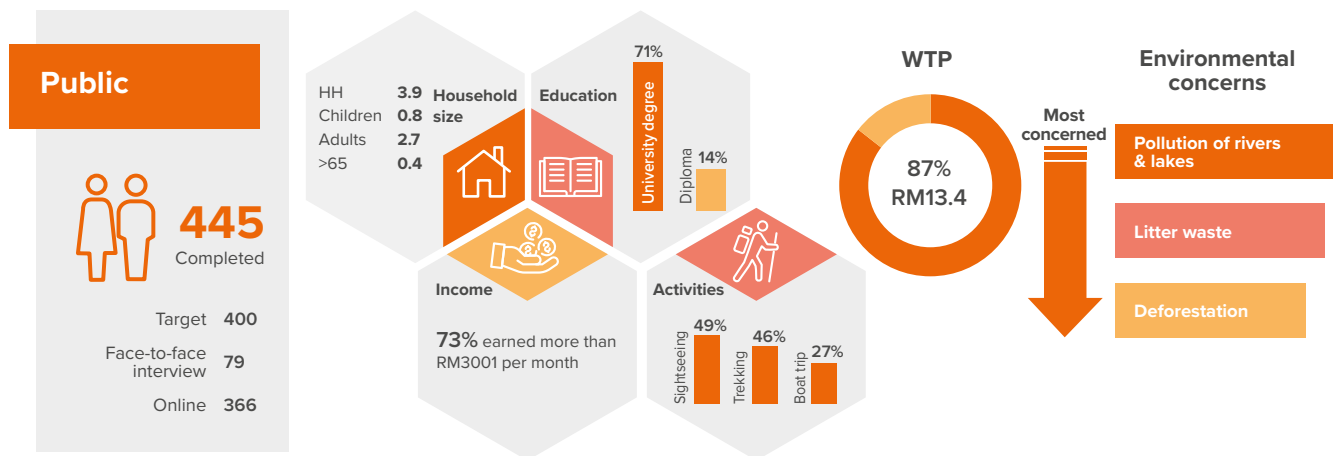


Figure 21 General public survey outcomes.

Note: WTP refer as "willingness to pay".

● **Spatial modelling of ecosystem services:** The spatial modelling demonstrated the following key improvements for RBSP of adopting the conservation plan over the baseline scenario (Adnan et al., 2020) (Figure 22).

- Reduction in nutrient exports particularly nitrogen (0.96%) and phosphorus content (0.38%) at the watershed level.
- Slight reduction in water yield to 48,991 m³ per year or 0.004% at the watershed level¹⁰.

iii. Reduction in sediment export of 263.74 tonnes per year (0.0032%).

iv. Improvement in carbon storage by 0.0094% or equivalent to 13,903.50 Mg. Thus, the annual carbon sequestration is around 2287.07 Mg yr⁻¹.

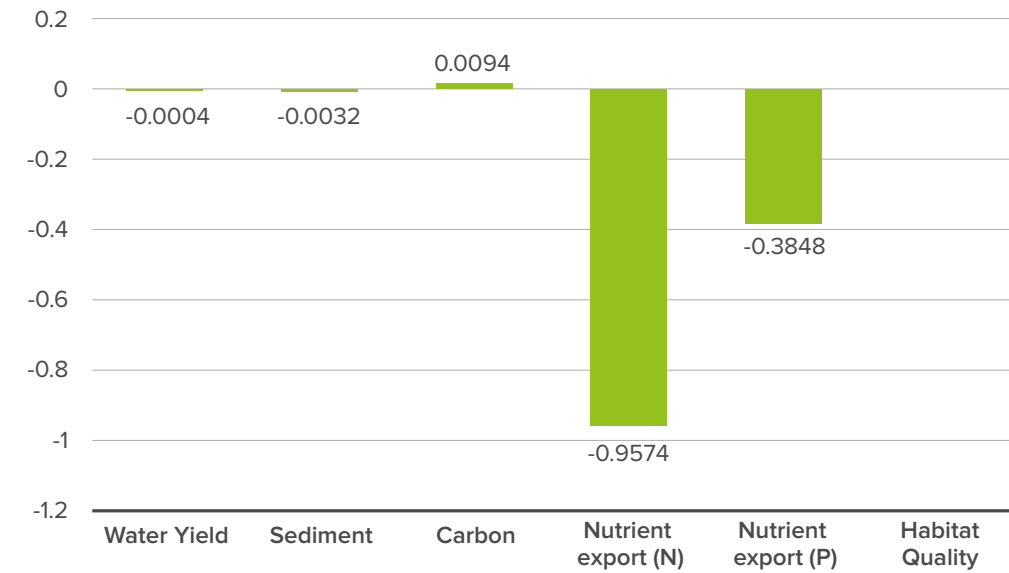


Figure 22 Percentage change in each ecosystem service between the baseline and conservation scenario

● **Choice experiment design:** Figure 23 summarises the DCE's outputs analysed using a mixed logit (MIXL) model. Local communities and the Malaysian general public are willing to add RM 1.58 to their monthly electricity bill to prevent 1,000 hectares of deforestation; RM 1.18 to prevent one percent of species numbers being lost;

and RM 7.27 to prevent a downstream flood event. Tourists would accept an increase to the entrance fee to RBSP of RM 35.80 per 1,000 hectares of deforestation avoided; RM13.83 to prevent one percent of the total species going locally extinct; and RM 32.91 to reduce the frequency of downstream flooding by one flood event.

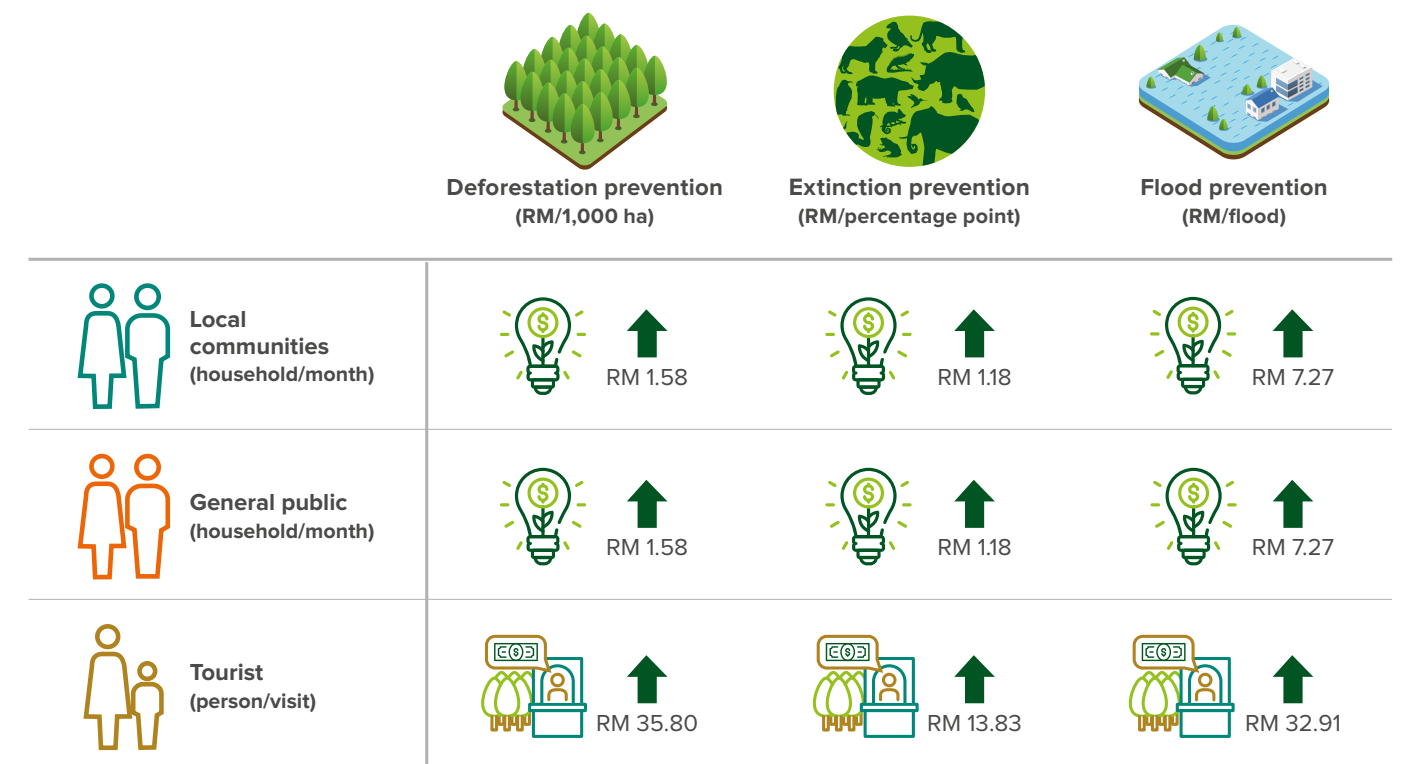


Figure 23 Median willingness to pay (RM; 2020 price level)

¹⁰ The reduced water yield could partly result from increased evapotranspiration due to increased forested areas, providing other benefits such as flood mitigation during wet periods or improved water availability during dry periods (Nirmal B. et al., 2012)

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● **Estimation of Total Economic Value:** The total economic value of ecosystem services assessed in this study is computed as the sum of annual values of RM531 million per year. The values of each service are summarised in Table 3. The estimated value of ecosystem services from RBSP is dominated by the value of carbon sequestration,

which accounts for over half of the TEV. This ecosystem service is globally important but the protected area also provides services that are locally and nationally important to beneficiaries in Peninsular Malaysia. In particular, the value that households place on biodiversity (RM 86 million) and forest conservation (RM 121 million) is substantial.

Table 3 Total economic value of ecosystem services provided by Royal Belum State Park.

Ecosystem Service	Annual value of (RM millions/year)
NTFPs	9
Water purification	8
Tourism	17
Flood regulation	72
Biodiversity conservation	86
Forest conservation	121
Carbon	219
Total	531

* Rounded to the nearest figure

● **Cost-benefit analysis of the expansion of RBSP:**

The conservation scenario considers the expansion of RBSP through the southern section of Aman Jaya Forest Reserve, including the East-West highway, within the Central Forest Spine plan. This is to ensure sustainability of the RBSP in providing ecosystem services. With the expansion of Royal Belum State Park to include Aman Jaya and Temengor forest reserves, there is an

increase of additional 167,736 ha of protected area. With this conservation plan, forest area will increase by 61 ha and approximately 9,000 ha will be preserved from harvesting annually. Agriculture/crops land area will decrease by 46 ha relative to the baseline. The extent of land uses under the baseline, conservation plan and associated changes are provided in Table 4.

Table 4 Land use of baseline and conservation plan of Royal Belum State Park

Land Use	Scenario		
	Current	Conservation Plan	Changes (ha)
Forest	482,230	482,291	61
Agriculture/Crops	55,449	55,403	-41
Built-Up Area	3,715	3,715	-
Husbandry and Aquaculture	253	253	-
Mining Area	1,333	1,333	-
Water Bodies	19,318	19,318	-
Others (grass, orchard, swamp and unused land)	2,728	2,712	-16
TOTAL	565,026	565,026	-

● **Present values of costs and benefits of conservation scenario:** The present values of the costs and benefits of the conservation scenario were computed over a 30-year time horizon using a discount rate of 5%. Figure 24 demonstrate the cost and benefit computation

of the expansion of RBSP. A positive Net Present Value (NPV) of RM380 million and Benefit-Cost Ratio (BCR) of 3.33 were estimated, indicating that the benefits of the conservation scenario for RBSP outweighed the costs.

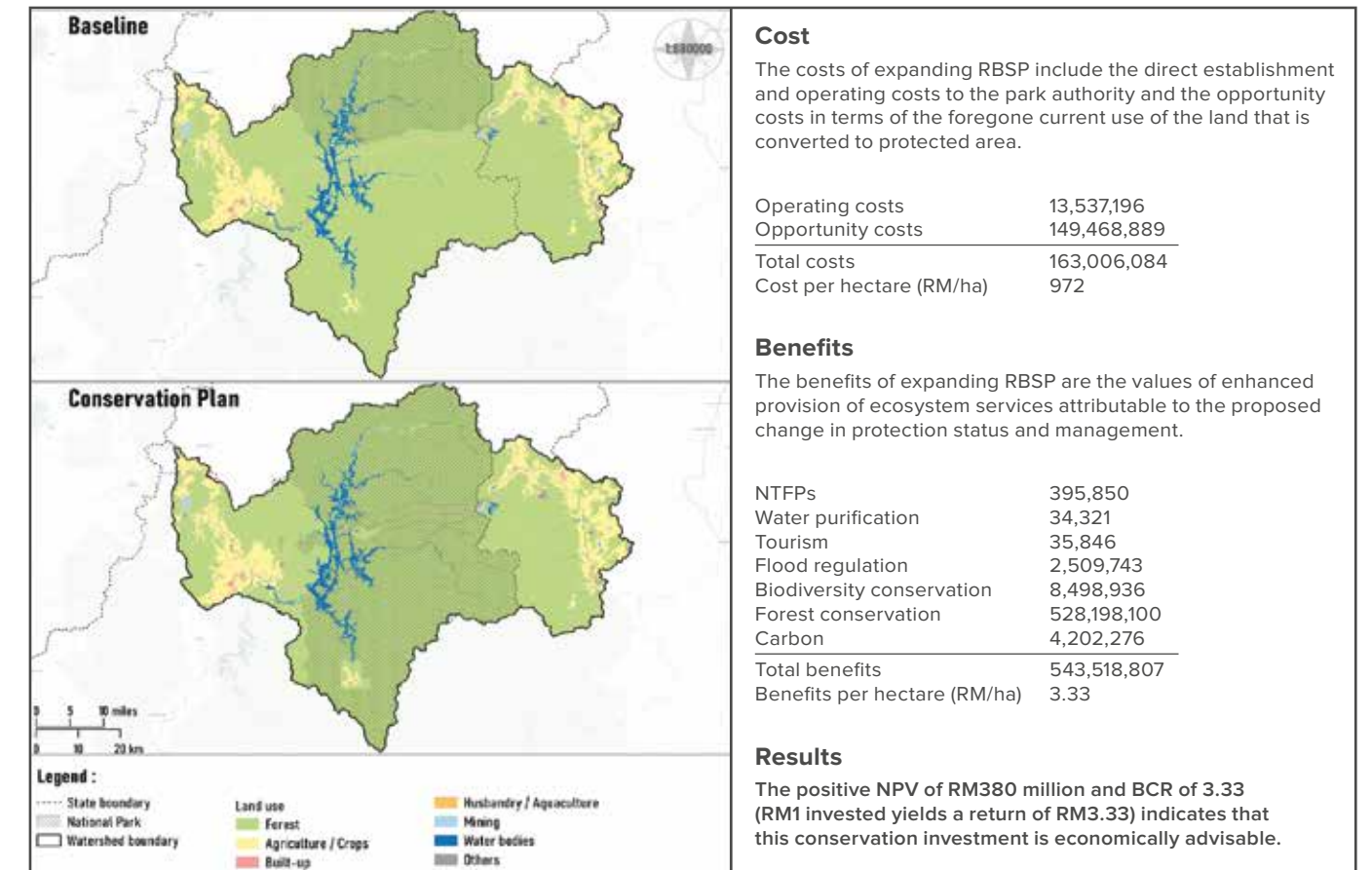


Figure 24 The cost and benefit of the expansion of RBSP

4.3 RBSP Policy Implications and Recommendations

The natural capital of Royal Belum State Park delivers a wide range of ecosystem services that have a high economic value. The following key findings highlight the significance of RBSP and provide insights into policy implications.

- **Significant economic contribution:** Annually, the total economic value of ecosystem services from Royal Belum is approximately RM 531 million. This implies a capital asset value of over RM 10.2 billion over a 50-year time horizon and a discount rate of 5%. At the state level, this is comparable to approximately 49% of the projected state revenue of RM1.1 billion¹¹ in 2020. The Cost-Benefit Analysis of the conservation scenario for the expansion of RBSP found that the benefits of enhanced ecosystem services, particularly in terms of public willingness to pay for forest conservation, outweighed the increased operating costs and opportunity costs of expanding the protected area.
- **Ecosystem services provide benefits at the local, state, national and global levels.** The ecosystem services assessed in the study include provisioning services (RM 9 million/year), tourism, (RM 17 million/year), carbon sequestration (RM 219 million/year), water purification (RM 8 million/year), flood regulation (RM 72 million/year), and conservation value attached to the preservation of animal species (RM 86 million/year) and forests (RM 121 million/year). These values demonstrate the contribution of RBSP at the local level in terms of food and livelihood options, national level through flood regulation and water purification; as well as national level initiatives such as connecting the Central Forest Spine. At the same time, it also supports the nation's progress towards its international obligations on biodiversity and climate change. Hence, investing in the effective management of the RBSP would ensure that these services continue to benefit the nation.
- **RBSP ecosystem services are critical to OA communities' basic needs and livelihoods.** Although the number of OA households making direct use of the forest resources is relatively small, their usage of **forest services constitutes a substantial proportion** of their real income. Forest management and rural development policies serve as vital platforms for addressing the welfare of indigenous communities who are also B40 income groups¹². Careful considerations are essential to ensure that these communities could continue to supplement their livelihood and source of food while sustaining their cultural practices connected to the forests.

- RBSP provides the **opportunity to support green jobs and catalyse sustainable rural economies.** The TEEB PA study found that a high percentage (63%) of the LC respondents' household income was below the national poverty line index. Integrating environmental considerations into poverty reduction strategies and policies is critical. The interventions will support sustainable rural economies and build the necessary impetus and innovation to create green jobs in areas that lack employment opportunities. Moving forward, equipping the civil service at the local, state and national levels with appropriate capacity to incorporate natural resource management into social support and pro-poor programmes of relevant Ministries and agencies are critical to bringing about the transformation. Though most LC reside a distance away from the PA, around 9% of the respondents were involved in the tourism industry.
- **Integrating baseline data to support future management of RBSP.** At the park level, the RBSP Management Plan, Business Plan and human resources enhances the effective management of RBSP. The study contributed baseline data that could be integrated into RBSP's management practices to monitor and guide its management services (such as entrance fee setting, tourism management and local community connections and involvement) and subsequently enhance its ecosystem values.

¹¹ <https://www.perak.gov.my/images/pdf/textucapanmb/UcapanBelanjawan2021.pdf> (Perak State Government 2021)

¹² Household group with the lowest income range

5. Endau-Rompin National Park



5.1 ERNP Profile

- **Ecological and physical environment:** ERNP, located in Johor, is a mega-diverse area in southern of Peninsular Malaysia. The PA is accessed through the Peta entrance, situated in the district of Mersing and Selai entrance,

located in the district of Segamat (Figure 25). It covers 48,905 ha and is recognised as an area holding unique, diverse ecosystems, plants and animals and unique landforms.

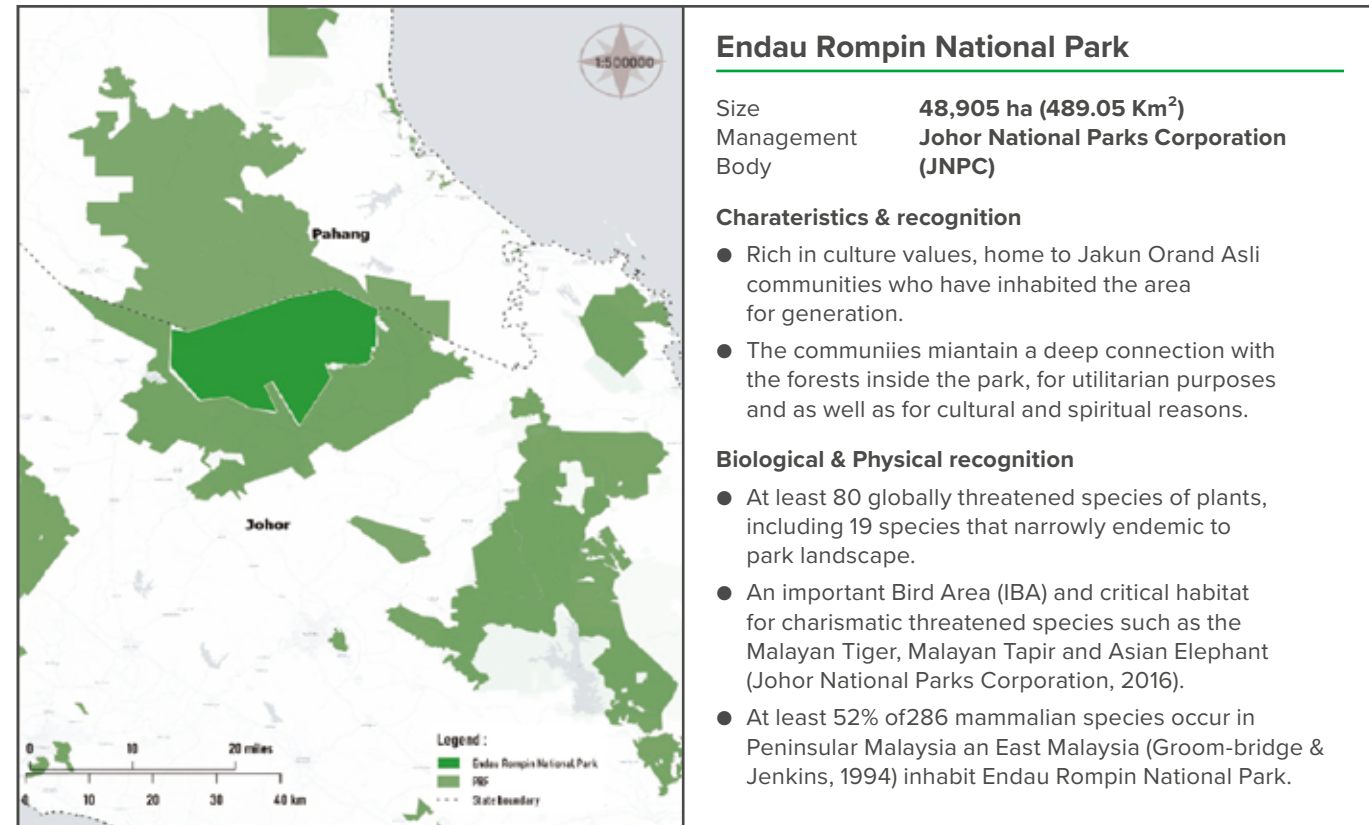


Figure 25 Location and key characteristics of Endau Rompin National Park ¹³

- **Socio-economic context:** Figure 26 highlights the percentage share to GDP by kind of economic activity for Johor in 2019. The services sector is the leading contributor to the state's GDP (52%), followed by

manufacturing (30%), agriculture (12%), construction (5%) and mining and quarrying (1%). The figures indicate that Johor has moved towards services and industrialisation with a higher GDP share from services and manufacturing.



Figure 26 Percentage share to GDP by kind of economic activity and classification

Figure 27 summarises the key socioeconomic attributes of the districts surrounding Endau Rompin National Park. The land area of Segamat and Mersing makes up around 30% of the state. The population of the districts are relatively small

despite their land areas. Based on 2019 figures, the population in Segamat and Mersing districts represented 7.8% of the people in Johor, with 219,000 and 84,000 residents.

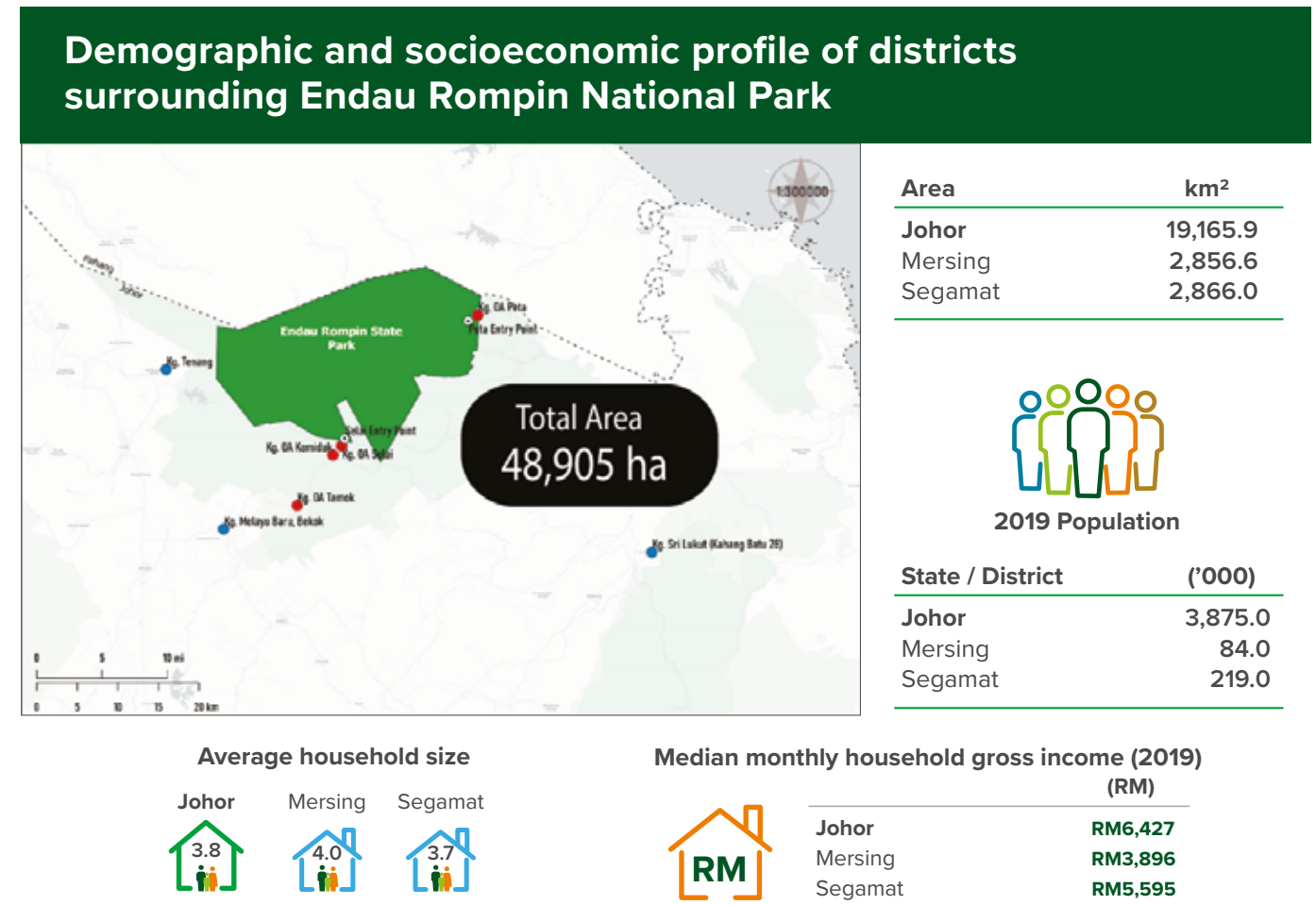


Figure 27 Demographic and socioeconomic profile of districts surrounding Endau Rompin National Park

¹³ Map: Adnan et al (2020)

5.2 ERNP Findings

- **Surveys:** The ERNP survey completed 1,362 questionnaires in total, beyond the target 1,300 questionnaires.
- **Orang Asli survey:** Figure 28 summarises the profile and findings of the Orang Asli (OA) household surveys. A total of 206 questionnaires were completed. The average household income for the OA community was estimated

at RM1,489/month, with about 39% of respondents involved in oil palm plantation and 17% in the tourism industry. Furthermore, around 54% of respondents were willing to contribute time (WTCT) on an average of 0.8 days. The respondents were concerned about wildlife poaching, human-wildlife conflict and litter waste.

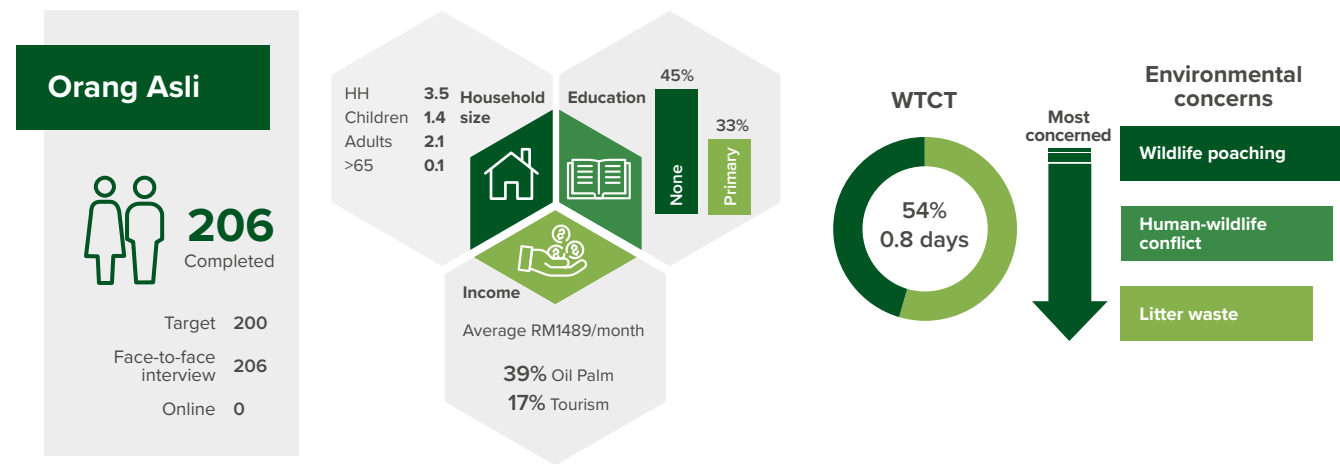


Figure 28 Orang Asli survey summary

- **Local community survey:** The survey covered five (4) neighbouring communities surrounding the ERNP. A total of 320 households were interviewed. About 77% of the LC respondents interviewed earned below RM3,001/month. Moreover, 40% of the respondents

interviewed work in the tourism industry. Around 61% are willing to pay (WTP) for conservation of ERNP at an average of RM6.3. The respondents' key environmental concerns were air pollution, pollution to rivers and lakes and flooding (Figure 29).

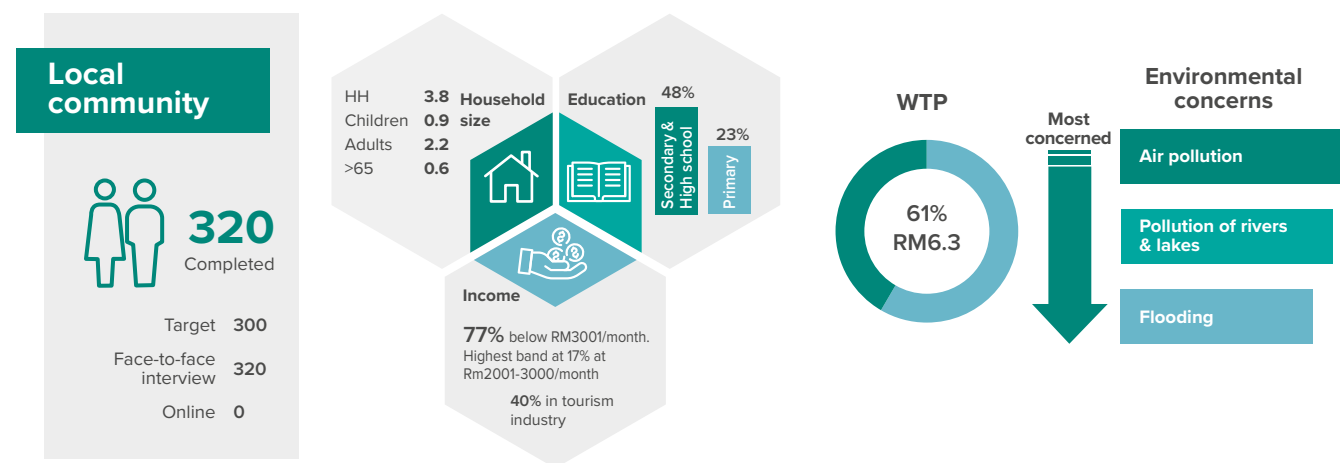


Figure 29 Local community survey summary

- **Tourist survey:** A total of 400 tourists were interviewed, of which 85% were Malaysians. About 58% of the respondents had no opinion on the current entrance fee while 20% thought it is low and 16% thought it is too low. About 80% of the tourists were willing to pay for conservation in addition to the existing entry fee.

The average maximum WTP among tourists was RM19.5. Approximately 60% suggested the need for a visitor centre/information hall, and 44% thought that more activities at the ERNP would enhance their visit. The most significant environmental concern amongst tourists were deforestation, litter/waste and biodiversity loss (Figure 30).

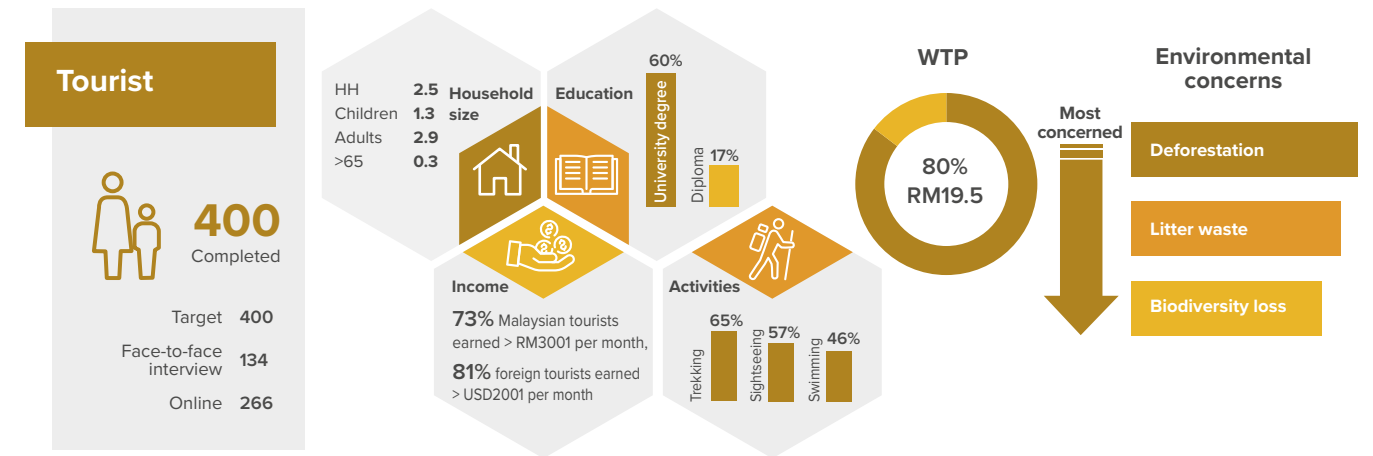


Figure 30 Tourist survey outcomes

- **General public survey:** A total of 436 General Public (GP) questionnaires were completed. About 73% of the respondents earned more than RM3001 per month (Figure 11). Around 85% of the respondents were willing

to pay for conservation with an average WTP of RM14.9. Most of the respondents were concerned about forest fires, followed by pollution to rivers and lakes and litter/waste (Figure 31).

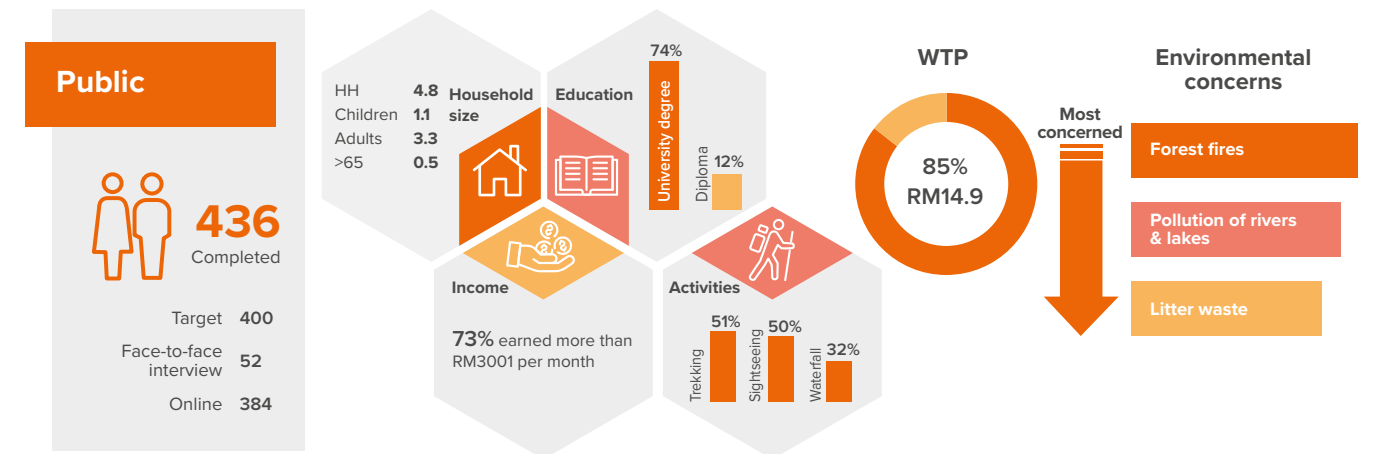


Figure 31 General public survey summary

5 Endau-Rompin National Park

- **Spatial modelling:** The ERNP spatial modelling demonstrated the following key improvements of adopting the conservation plan over the baseline scenario (Adnan et al., 2020) (Figure 32).
 - Reduction in nutrient exports particularly nitrogen (5%) and phosphorus content (3.5%) at the watershed level.
 - Reduction in water yield up to 5,393,227 m³ per year or 0.050% at the watershed level¹⁴.

- Reduction in sediment export of up to 6,413 tonnes per year (0.33%). 6,413.76 tonnes per year or 0.336
- Improvement in carbon storage by 1.98% or equivalent to 2,055,909.40 Mg. Thus, the annual carbon sequestration is around 2,055,909.40 Mg yr⁻¹.
- Improvement in the habitat quality index by 0.01 to 1% within the watershed.

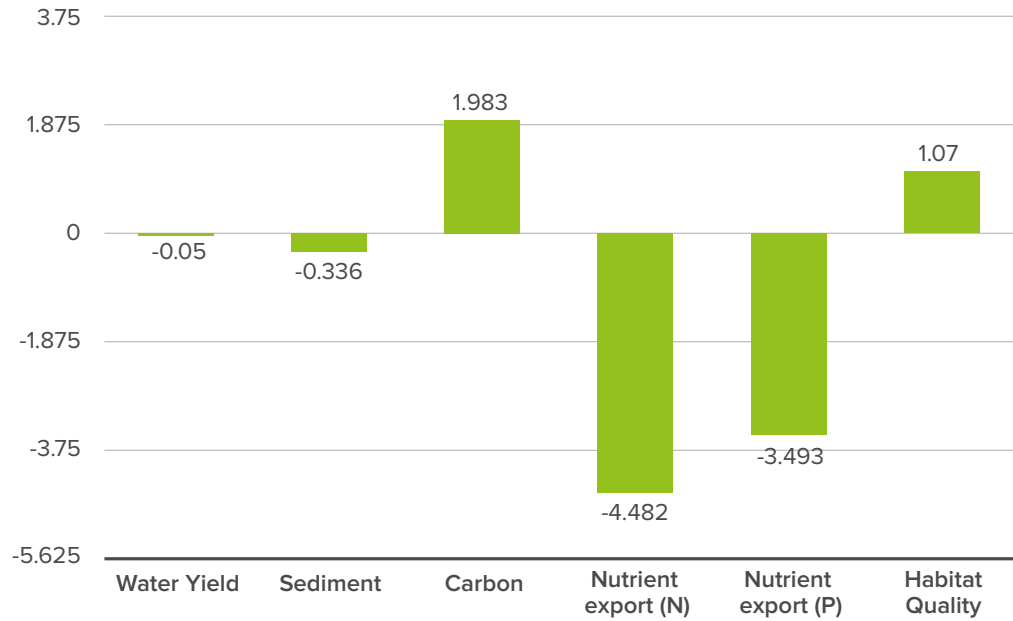


Figure 32 Percentage change in each ecosystem service between the baseline and conservation scenario

- **Choice experiment design:** Figure 33 summarises the DCE's outputs analysed using a mixed logit (MIXL) model. Local communities are willing to add RM 0.51 to their monthly electricity bill to prevent 1,000 hectares of deforestation; RM 0.46 to prevent one percent of species numbers being lost; and RM 4.54 to prevent a downstream flood event. The general public are willing to add RM 1.17 to their monthly electricity bill to prevent 1,000 hectares of deforestation; RM 1.04 to prevent

one percent of species numbers being lost; and RM 10.39 to prevent a downstream flood event. Tourists would accept an increase to the entrance fee to ERNP of RM 6.04 per 1,000 hectares of deforestation avoided; RM4.44 to prevent one percent of the total species going locally extinct; and RM 14.75 to reduce the frequency of downstream flooding by one flood event.



Figure 33 Median willingness to pay (RM; 2020 price level)

- **Estimation of Total Economic Value:** The total economic value of ecosystem services assessed in this study is computed as the sum of annual values of RM427 million per year. The values of each service are summarised in Table 5. The estimated value of ecosystem services from ERNP is dominated by the value of carbon sequestration,

which accounts for over half of the TEV. This ecosystem service is globally important but ERNP also provides services that are locally and nationally important to beneficiaries in Peninsular Malaysia. In particular, the annual value that households place on biodiversity (RM 71 million) and forest conservation (RM 91 million) is substantial.

Table 5 Total economic value of ecosystem services provided by Endau Rompin National Park.

Ecosystem Service	Annual value of (RM millions/year)
NTFPs	1
Water purification	3
Tourism	2
Flood regulation	26
Biodiversity conservation	71
Forest conservation	91
Carbon	232
Total	427

* Rounded to the nearest figure

¹⁴ The reduced water yield could partly result from increased evapotranspiration due to increased forested areas, providing other benefits such as flood mitigation during wet periods or improved water availability during dry periods (Nirmal B. et al., 2012)

5 Endau-Rompin National Park

- **Cost-benefit analysis of expansion:** ERNP is habitat for more than half (52%) of the 286 mammalian species in Peninsular Malaysia including threatened and rare species. The investment scenario is targeted at increasing the quality of wildlife habitat through the creation of wildlife corridors to ensure ecosystem connectivity. This plan will involve

creating an additional 14,423 ha of protected area. Under the conservation plan, forest areas will increase by 5,586 ha to 286,513 ha while agriculture/crops land area will be reduced by 4,688 ha to 226,581 ha from the baseline. The extent of land uses under the baseline, conservation plan and associated changes are provided in Table 6.

Table 6 Land use of baseline and conservation plan of Endau Rompin National Park

Land Use	Scenario		
	Current	Conservation Plan	Changes (ha)
Forest	280,927	286,513	5,586
Agriculture/Crops	231,268	226,581	4,688
Built-Up Area	9,235	9,235	-
Husbandry and Aquaculture	1,983	1,974	9
Mining Area	1,245	996	249
Water Bodies	5,891	5,891	-
Others (grass, orchard, swamp and unused land)	6,554	5,913	640
TOTAL	537,104	537,104	-

The present values of the costs and benefits of the conservation scenario were computed over a 30-year time horizon using a discount rate of 5%. Figure 34 demonstrate the cost and benefit computation of the expansion of ERNP.

A positive Net Present Value (NPV) of RM200 million and Benefit-Cost Ratio (BCR) of 1.2 were estimated, indicating that the benefits of the conservation scenario for ERNP outweighed the costs.

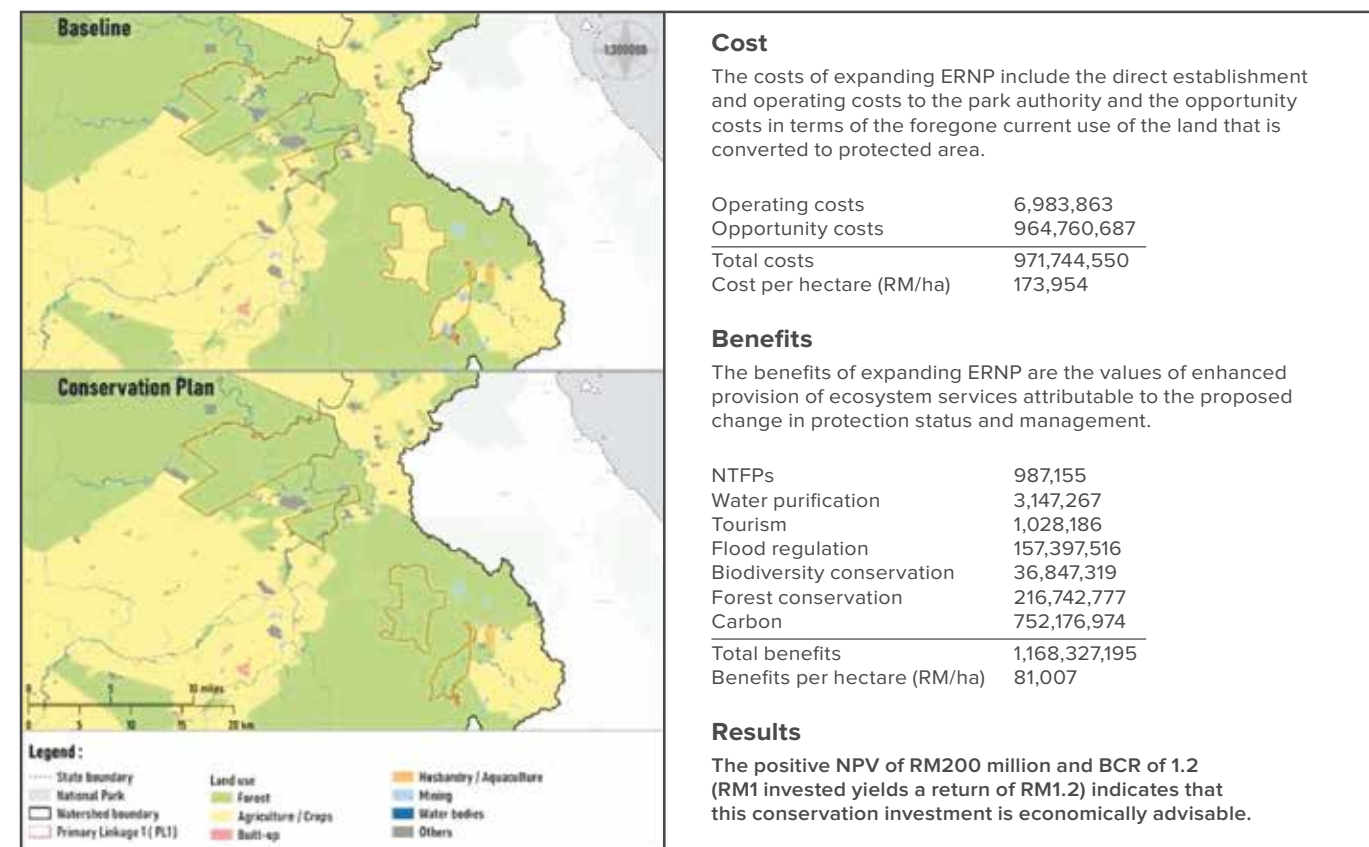


Figure 34 The cost and benefit of the expansion of ERNP

5.3 ERNP Policy Implications and Recommendations

The natural capital of ERNP delivers a wide range of ecosystem services that have high economic value. The following key findings highlight the significance of ERNP and provide insights into policy implications.

- **Significant economic contribution:** Annually, the total economic value of ecosystem services from Endau Rompin is approximately RM 427 million, making up about 28% of the projected state revenue of RM1.5 billion¹⁵ in 2019. This implies a capital asset value of almost RM 8.2 billion over a 50-year time horizon and a discount rate of 5%. The Cost-Benefit Analysis of the conservation scenario through the creation of wildlife corridors found that the benefits outweighed the costs of expanding the protected area. The conservation scenario analysis of the three major PAs in Peninsular Malaysia found that the degree of changes in ERNP watershed was the highest due to the pressure of land use changes for economic impacts within the watershed area surrounding the PA.
- **Ecosystem services provide benefits at the local, state, national and global levels.** The ecosystem services assessed in the study include provisioning services (RM 1 million/year), tourism, (RM 2 million/year), carbon sequestration (RM 232 million/year), water purification (RM 3 million/year), flood regulation (RM 26 million/year), and conservation value attached to the preservation of animal species (RM 71 million/year) and forests (RM 91 million/year). These values demonstrate the contribution of ERNP at the local level in terms of food and livelihood options and national level through flood regulation and water purification. At the same time, it also supports the nation's progress towards its international obligations on biodiversity and climate change. Hence, investing in the effective management of the ERNP would ensure that these services continue to benefit the nation.

- **ERNP ecosystem services are critical to OA communities' basic needs and livelihoods.** The study demonstrated that the natural resources of ERNP are important at different levels (local, state, national and global). At the local level, ERNP contributes to the well-being of OA communities particularly through non-monetary benefits such as non-timber forest products for food, flood protection, opportunities for tourism and maintaining their cultural practices. The importance of ERNP to the OA communities are reflected in their willingness to volunteer days for conservation to ensure that the resources continue to provide benefits to the community. In addition, the study also found that the forests of ERNP provide important support to the OA communities' food and livelihood sources.
- ERNP provides the **opportunity to support green jobs and catalyse sustainable rural economies.** At the local community level, around 40% of the respondents who live around ERNP work in the tourism industry contributing to their livelihoods. Malaysian public (85%) and tourists (80%) are also willing to pay for the conservation of ERNP. While the study has indicated the benefits of ERNP at various levels, strategic interventions could be put in place to enhance the revenue streams from ERNP.
- **Integrating baseline data to support future management of ERNP.** At the park level, the ERNP Management Plan, Business Plan and equipped human resource team enhances the effective management of ERNP. The study contributed baseline data that could be integrated into ERNP's management practices to monitor and guide its management services (such as entrance fee setting, tourism management and local community connections and involvement) and subsequently enhance its ecosystem values.

¹⁵ <https://bpen.johor.gov.my/wp-content/uploads/2019/12/FINAL-UCAPAN-BELANJAWAN-JOHOR-2020-1.pdf>

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PA Financing Project

