

# **IMPACT OF CLIMATE CHANGE ON CHILDREN: A MALAYSIAN PERSPECTIVE**

**Sector-Based Evidence, Analysis and  
Recommendations for Policymakers  
and Stakeholders**



**September 2021**



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## LIST OF SELECTED ABBREVIATIONS

DOE	Department of Environment
EIA	Environmental Impact Assessment
EPU	Economic Planning Unit
EQA	Environmental Quality Act 1974
KASA	<i>Kementerian Alam Sekitar dan Air</i> or Ministry of Environment and Water
LMICs	low- and middle-income countries
MOH	Ministry of Health
MWFC	Ministry of Women, Family and Community Development
NADMA	National Disaster Management Agency
NDC	Nationally Determined Contribution
NPCC	National Policy on Climate Change 2009
PM <sub>2.5</sub>	Particulate Matter diameter less than 2.5µm
PPR	<i>Projek Perumahan Rakyat</i> or People's Housing Project
RCP	Representative Concentration Pathways
RM	Ringgit Malaysia
TWG	Technical Working Group
UKM	Universiti Kebangsaan Malaysia
UMS	Universiti Malaysia Sabah
UNCRC	United Nations Convention on the Rights of the Child
UNFCCC	United Nations Framework Convention on Climate Change

## EXECUTIVE SUMMARY

While everyone is vulnerable to the health impacts associated with climate change and environmental pollution, the health and well-being of children are disproportionately affected. Due to their additional risks of exposure and lower tolerance levels to climate and environmental risks than adults, children often fare worse in the short- and long-term during climate- and weather-related disasters such as floods, droughts, forest fires, and cyclones.

However, despite the many ways in which climate change impacts children, children are consistently being overlooked in the design and content of climate policies and related processes. Some of the major challenges in mobilising more effective action on climate change and environmental degradation concerns in Malaysia include:

1. Inadequate evidence to guide policies and plans on the likely impacts of climate change and environmental pollution and degradation on the healthy growth, development, and socialisation of children
2. Inadequate legislative and policy protection for children from environmental and climate risks, particularly in marginalised communities
3. Lack of clarity about the extent to which current national policies, laws, and budgets are climate change responsive and how broad climate change adaptation and mitigation measures are child-friendly
4. Low levels of community awareness of the impacts and adaptation measures required at the individual, family and societal levels.

In addressing these challenges, this exploratory study of the current situation in Malaysia intends to understand to what extent national climate policies and plans are child-sensitive and uphold the rights of the child. The study intends to address existing gaps and identify opportunities to strengthen child-sensitive national climate policies and plans. Furthermore, it contributes to national and regional availability of high-quality disaggregated data, information, and evidence that puts children as the focus for actions in climate change and environmental degradation.

Table 1 shows the objectives and the corresponding study components which address the children population in general as well as the marginalised children in Malaysia as part of the global 'Leave No One Behind' efforts to achieve the Sustainable Development Goals (SDGs).

Table 1: Study objectives and the respective study component and children population

Objectives	Study components	Target population
1. To produce an integrated analysis on the impacts of climate change and environmental degradation on children's health, nutrition, education, and poverty using existing data and case studies.	A case series review of climate change and environmental issues children face in Malaysia	All children in Malaysia
	Four desk studies using secondary data for climate projections in Malaysia and assessing the health impacts of air pollution and haze on children in Malaysia	All children in Malaysia
	Three community case studies targeting marginalised groups and children to understand the impacts of climate change and environmental degradation on specifically marginalized children. The three locations are: <ul style="list-style-type: none"> <li>– Pulau Gaya, Sabah (an island)</li> <li>– Sg. Siput, Perak (hill site indigenous group)</li> <li>– PPR Sg. Bonus, Kuala Lumpur (urban poor)</li> </ul>	Marginalised children in Malaysia
2. To assess existing climate and environment policies and plans and identify gaps and opportunities	Analysis of policy and legal documents to assess child sensitivity in the mitigation and adaptation to climate change and environmental degradation.	All children in Malaysia
3. To map key actors and interventions on climate change and environmental management and identify good practices and gaps in child-centred climate action	Engagements, interviews, and focus group discussions with relevant stakeholders to identify good practices, gaps, opportunities, and key interventions concerning climate change, environmental sustainability and children in Malaysia	All children in Malaysia
4. To identify recommendations and areas for action by various stakeholders to address or minimise the negative impacts of climate change and environmental degradation on children in Malaysia		

Overall, this study has revealed the crucial interconnections between climate and environmental challenges and children's health and well-being in Malaysia, as presented in the model in Figure 1. The model consolidates the objectives, methods, and findings from our research on the ground and our assessment of the current policy and legal framework.

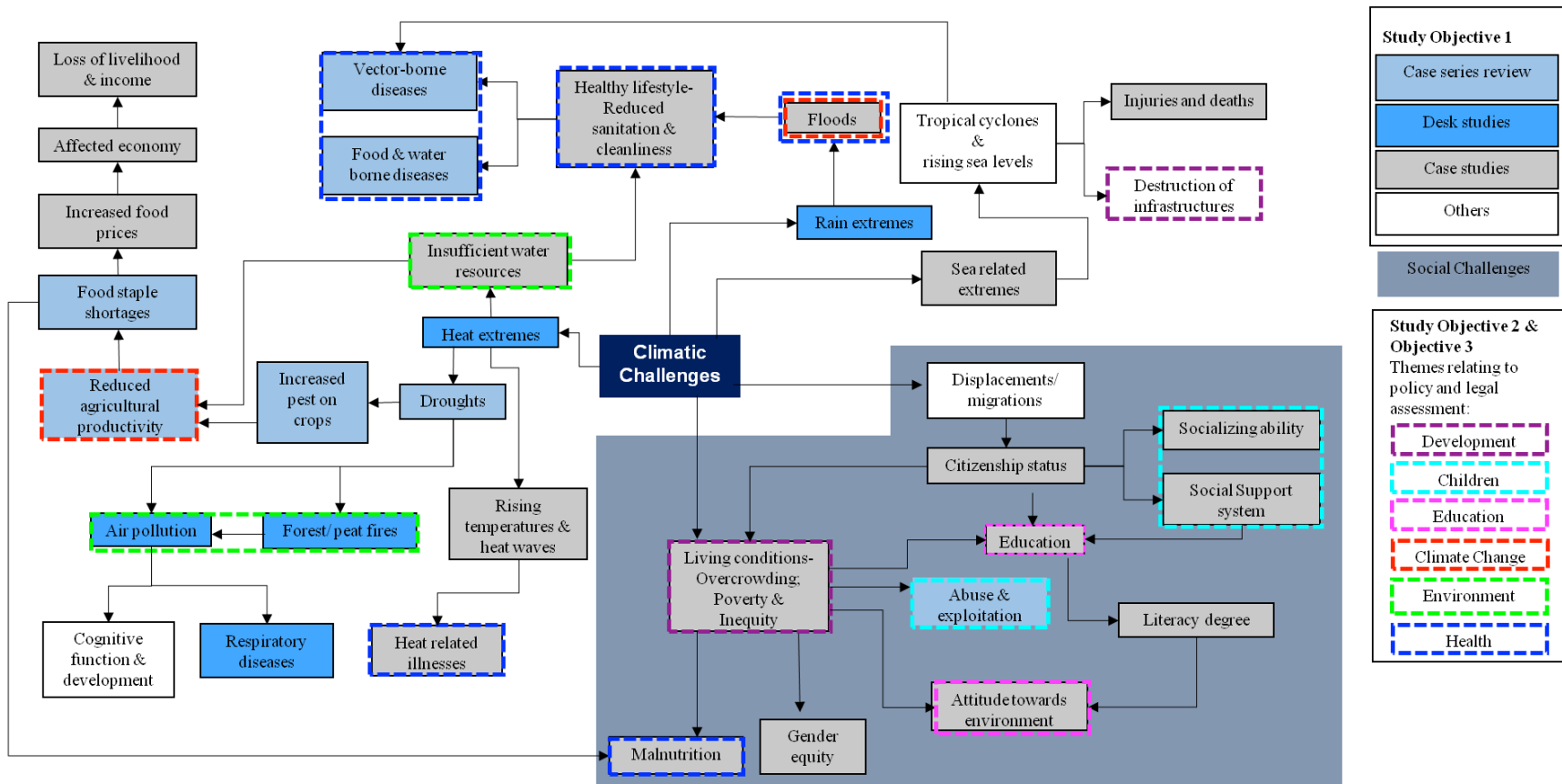


Figure 1: Model on the impacts of climate change on children in Malaysia



The overall results of this study can be summarised into six key findings:

***Climate change, environmental degradation, and pollution are intensifying in Malaysia alongside rapid development.*** The robust growth of the Malaysian economy and population has led to unaddressed negative externalities on the environment, which includes higher greenhouse gas emissions, accelerated environmental degradation, and increased waste generation. Malaysia's annual average air quality concentration has been consistently above the WHO's maximum level for safety. The country has been experiencing increasing rainfall intensity over the years, which has led to increased incidences of floods, landslides, mudslides, tropical storms, and other weather-related events. It is projected that Malaysia will experience a higher frequency, duration, and magnitude of heatwaves in the future, alongside lengthened wet spells.

***While the rights of children in Malaysia are reasonably protected, the level of protection varies with societal and geographical conditions.*** In the global context, Malaysia has a relatively low poverty headcount ratio. However, poverty rates are higher among certain vulnerable groups. Some groups also have limited access to their rights, such as refugee and stateless children. Children in Malaysia have access to free education from preschool to secondary school, translating to high school enrolment rates and basic literacy. While health literacy is included in the education syllabus, topics are not diversified across different grades, and the syllabus is not updated regularly. Malnutrition, nutritional insufficiency, and overnutrition coexist across the population, with notable deficiencies of key nutrients such as Vitamin D and Calcium.

***Accelerated climate change, environmental degradation, and pollution present serious risks for children in Malaysia in general.*** Climate change in Malaysia is increasing the frequency and intensity of flood events and the range of disease-bearing vectors. In Malaysia, increases in leptospirosis and typhoid fever have been recorded after major flood events, both of which are especially dangerous for children. Warmer conditions and increased rainfall have enhanced the breeding capacity of the mosquitoes which transmit dengue, a disease that particularly affects children and young adults. Worsening air quality in Malaysia has been linked to the increase in the risk of hospitalisation for respiratory diseases among children. Improper disposal of hazardous industrial wastes has also resulted in multiple public health emergencies of which children make up the majority of the victims.

***Children living in marginalised communities are more vulnerable to climate and environmental risks.*** In marginalised communities, climate and environment-related risks are further exacerbated by poverty, illiteracy and limited access to information. Marginalised children are more susceptible to infectious diseases. Lack of access to clean water and sanitation, which become even more restricted during extreme weather events, results in higher diarrhoeal disease, malaria, and dengue rates among children in these communities. Heavy rains and storms affect the children's access to schools and basic health services due to the lack of safe transport during these times. People who depend on climate-sensitive economic activities for their livelihood find it increasingly difficult to provide for their families, increasing the pressure on children to drop out of school to work. Low-quality housing also means that children can find themselves at risk during extreme weather events. Furthermore, extended periods of staying indoors can take a toll on children's mental health.

**While girls tend to be more vulnerable to climate and environmental risks than boys, both genders are affected differently.** Our case study with the urban poor found that girls felt especially unsafe when confined indoors in cramped quarters in a large household due to severe weather conditions. Our case study with an indigenous community in Peninsular Malaysia found that girls are more likely to drop out of school to work when sources of income become scarce. However, this was the opposite in the urban poor and island communities, where boys tended to drop out of school and work to help their families.

**While Malaysia's governance framework does address climate and environmental issues to a certain extent, all aspects of children's rights have not been adequately considered within the framework.** Most relevant policies and laws have not been updated to reflect Malaysia's current climate pledges or SDG commitments. They maintain outdated understandings of key concepts, like the non-recognition of a citizen's right to a healthful environment, a narrow understanding of child abuse that excludes climate and environmental hazards, and rigid definitions of types of pollution. In most policies and plans, children are not explicitly recognised as rights-holders and important stakeholders, ignoring their higher risks of exposure and lower tolerance levels to climate and environmental risks than adults. Health, child protection, and environmental governance frameworks were developed with different aims, even though they indirectly focus on the same target group, the vulnerable population. Matters related to the control of diseases, environmental protection, sanitation, and the prevention of injuries are under different regulatory bodies, reflecting a lack of integration across the governance framework. There is also a lack of streamlining between federal and state laws on these issues.

These findings underscore the importance of specifically addressing environmental issues from a child's perspective and not as part of the general population. Urgent action must be taken at the community and policymaking levels to ensure that children's needs are at the heart of Malaysia's climate change adaptation and mitigation strategies.

Firstly, it is recommended that Malaysia moves towards a more **child-sensitive governance framework for the climate and environment**. Children's vulnerability to climate change and environmental degradation should be explicitly addressed as part of the policies, laws, and action plans. Justice for child-related issues should be systematically and widely interpreted by the Constitution. All sectors should be aligned in addressing the impacts of climate change and environmental degradation on children, including mental health and well-being issues. There is also a need to improve coordination and synergies between federal and state levels on issues related to child environmental health.

Secondly, there is a need to **strengthen the Malaysian education sector to be climate-smart**. The inclusion of educational content on climate change and sustainable development in the curriculum should happen alongside capacity building for teachers. Specific initiatives for climate-smart schools and relevant infrastructure are crucial to ensure that school closures and learning disruptions are minimised as much as possible in the event of natural disasters, such as flooding and haze.

Thirdly, advocacy and **representation for children and vulnerable groups** should be enhanced and supported. Children should be allowed to meaningfully participate in climate change processes through direct participation and engagement or via representatives where child safeguarding and protection measures are required. Existing forums that facilitate child

participation in Malaysia can be mutually enhanced by the efforts of non-governmental organisations, academia, and private actors, in addition to government support.

Fourthly, further **research and development** remain important in ensuring that all child-sensitive climate and environmental governance initiatives are evidence-based. Research is needed into the development of child-centric guidelines and actions on health components and indicators related to climate change and environmental degradation, climate change educational materials and content for educators and students, and monitoring and evaluation mechanisms for intervention-related programmes. More fundamentally, data disaggregated to represent children and other marginalised communities will allow more accurate policy decisions to address issues unique to these vulnerable groups.

Finally, it is recommended that both the government and private sector actors explore ways to pool resources through **public-private partnerships** to address pressing issues related to children, the environment, and the climate. The public sector can partner with the government to jointly execute child-sensitive climate mitigation and adaptation plans at scale and speed by focusing on efficiency and long-term impact while remaining rooted in public oversight. Particularly in the context of climate finance, such partnerships can remove the strain on the government budget by transferring significant funding risks to the private sector.

Detailed sector-based recommendations focusing on smart partnerships with an emphasis on intersectoral and inter-ministerial synergies are available in Chapter 6, together with the proposed timeframe for prioritisation. It is recommended that stakeholders, including the Government of Malaysia, civil society organisations, the private sector, youth organisations, and the United Nations use these key findings and recommendations as input for developing specific recommendations and actions with clear roles and responsibilities, timelines, and resources.

# 1 INTRODUCTION

Climate change is a global emergency with increasing occurrences of deadly drought, flooding, heatwaves, and extreme weather events, affecting hundreds of millions of people. It has placed additional stress on the availability of clean air, clean water, and nutritious food. In addition, changes in land use and land cover, urbanisation, overpopulation, and industrialisation are causing environmental and air quality degradation.

Insufficient attention has been directed to increase community understanding of the impacts of climate change and environmental degradation on the lives of families and children and encourage environment-friendly values and practices among children and young people in Malaysia. In marginalised communities, climate and environment-related risks are further exacerbated by poverty, illiteracy, and limited access to information. Furthermore, if social protection mechanisms are not shock responsive, climate shocks and natural disasters can exacerbate poverty and illiteracy.

## 1.1 Burden of disease on children

Environmental pollution, degradation, and climate change pose significant threats to children's health because children have unique metabolism, behaviour, physiology, cognitive and development characteristics. Impacts of climate change on children are depicted in Figure 2.

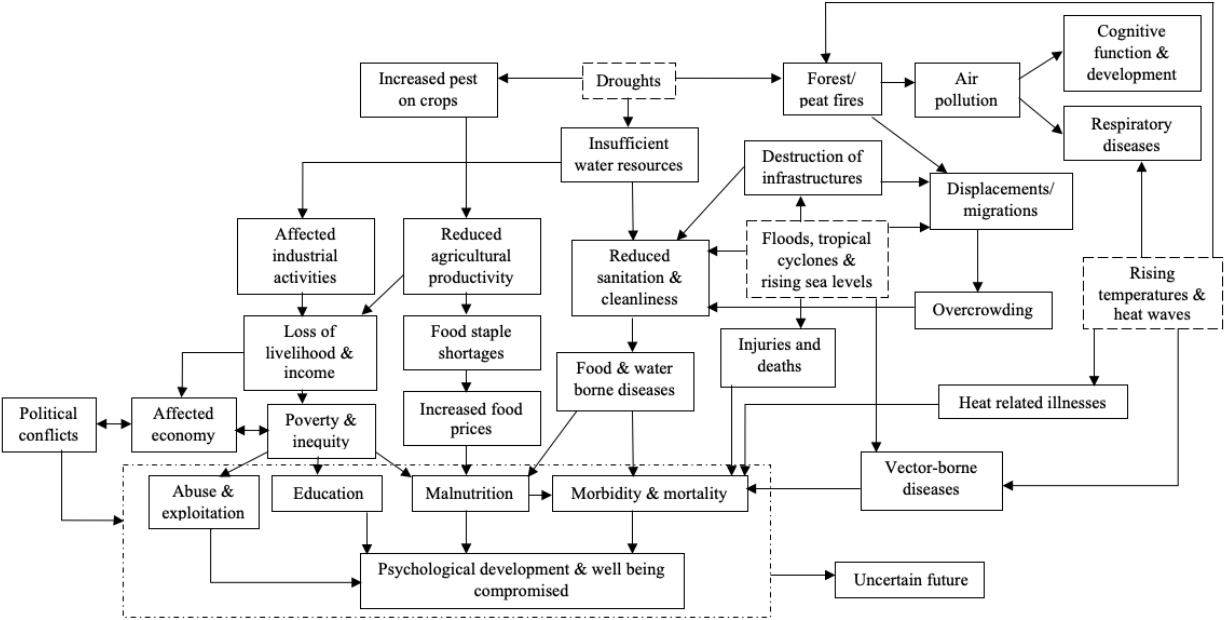


Figure 2: Impacts of climate change on children's health and well-being<sup>1</sup>

### 1.1.1 Physiological effects

Children under five years old bear 88% of the disease burden from climate change, environmental degradation, and pollution<sup>2</sup> (Figure 3). Most of the causes of mortality among children, including malaria, food- and water-borne diseases, and malnutrition, are very sensitive to climatic conditions and are expected to worsen due to climate change.

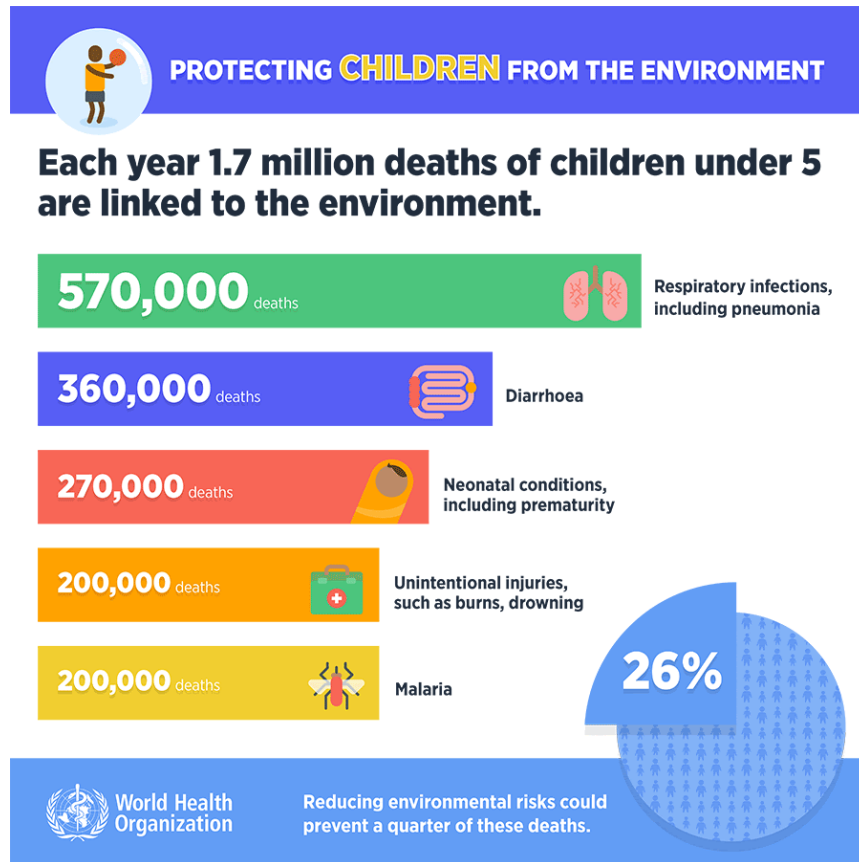


Figure 3: Number of deaths of children under five linked to the environment<sup>3</sup>

Children, especially children under five, are more sensitive to heatwaves and dry spells as they are more vulnerable to heat stress, hyperthermia, and renal disease. Children are also more vulnerable in flood situations which often come along with increased wet spells. They are at a particularly higher risk of injury and death during storms and floods and are more vulnerable to infections of vector-borne diseases during this time. Studies have also found that increased levels of air pollution can affect brain development and learning among growing children<sup>4</sup>.

### 1.1.2 Psychological effects

Exposure to traumatic events like natural disasters, motor vehicle accidents, physical injuries, and hazardous material spills can be traumatic. Even though children are generally exposed to the same spectrum of stressors as adults, they are more vulnerable because their emotional and cognitive abilities are still immature. They have limited life experience and lack coping strategies.

The distress that children suffer during these events, including losing or witnessing the death of their loved ones, being suddenly removed from familiar surroundings, and the fear of experiencing similar events again, can lead to severe psychological problems. Approximately 10% of children exposed to such events will develop post-traumatic stress disorders<sup>5</sup>. Children with post-traumatic stress disorders may experience intrusive memories, avoidance, negative changes in thinking and mood, and changes in physical and emotional reactions.

## 1.2 Environment and climate factors affecting the realisation of child rights

Children worldwide are increasingly aware of the dangers of climate change and are demanding more decisive action from their governments, including children in Malaysia (Figure 4). According to a survey of 1,101 young Malaysians by YouGov in 2019, 64% stated they are concerned about climate change. Many of them also said that they have either experienced or are aware of its effects. However, only 5% believe that Malaysia is prepared for it<sup>6</sup>.



*Figure 4: Education on climate change and environment at Alternative Learning Centre, Pulau Gaya*

The Government of Malaysia has ratified the United Nations Convention on the Rights of the Child (UNCRC), with four reservations. Article 24 of the Convention states the children have the right to good quality health care, to clean water, nutritious food, and a clean environment, so that they will stay healthy. Article 27 states that all children and young people have a right to primary education, which should be free.

Environmental degradation, pollution, and climate change can affect the realisation of some of these rights. For example, natural disasters may restrict a child's ability to go to school or seek medical help. Flooding and poor sanitation may cut off children's access to clean water, while rising sea levels and temperatures may reduce the availability of nutritious food for children.

The Convention states that the government is responsible for upholding the rights of the child. Therefore, it is important for the Government of Malaysia to consider and address how the environmental and climate factors affect the realisation of child rights in the country. Strong laws and policies, if implemented well, play a crucial role in ensuring children's rights and best interests are upheld and protected. This has to be supported by a good understanding of the impacts of climate change and environmental degradation on the lives of children and their families in Malaysia, now and in the foreseeable future.

## 1.3 Introduction to the study

In Malaysia, while studies on the general impacts of climate change, environmental degradation, and pollution have been done (Table 14 in Annexe 2), insufficient attention has been directed so far to assess these impacts in the context of children as an especially vulnerable group, and systematically ensuring that children's unique issues are addressed within the Malaysian legal and policy framework and national plans. This study aims to fill this gap.

The study was conducted by UKM as the main study team, in collaboration with UNICEF and UMS. Other collaborators include researchers and organisations from various local universities (Universiti Teknologi MARA (UiTM), International Islamic University Malaysia (IIUM), Institute for Medical Research, Ministry of Health (IMR)) and international universities and research institutions (Kyoto University and the National Institute of Environmental Studies (NIES), Japan). All researchers have different backgrounds and experiences in Malaysian and international policy and law related to climate change, environmental degradation and children's well-being.

This study was supported by a Technical Working Group (TWG) formed by the members of the Malaysian government, civil society and the UNICEF review committee. The TWG's role was to review and provide advice on technical issues and provide linkages with relevant stakeholders. The results of this study can be used to inform the UNICEF-Government of Malaysia Country Programme 2022-2025, the 12<sup>th</sup> Malaysian Plan, and respective government agencies in fulfilling commitments to the Paris Agreement and national aspirations for development, sustainability, and equity.

## 1.4 Report Structure

This Synthesis Report proceeds as follows. Chapter 2 provides an overview of the methodology of the four different types of study packages included in this study, including a case series review, desk studies, case studies, and document content analysis. It also spells out the ethical considerations taken in this study and the limitations faced by researchers.

Chapter 3 is the first findings chapter and provides an overview of the state of Malaysia's environment, including current and projected impacts of climate variability and environmental degradation and pollution, and key data on the status of children in Malaysia, particularly data related to poverty (SDG1), good health and well-being (SDG3), and education (SDG 4). It then outlines the priority climate and environmental issues, as identified by this study, which affect the realisation of children's rights in Malaysia: floods and water-borne diseases, air pollution and haze, vector-borne diseases, and hazardous substances and waste.

Chapter 4, the second findings chapter, addresses study Objective 1. Findings from the case series review and desk studies are distilled to detail the impact of climate change and environmental pollution and degradation on children in Malaysia, classified according to the priority issues identified above. Findings from the case studies are analysed for a section on the unique vulnerabilities of children living among marginalised communities. Data from all three of these study packages inform the following section on gender and vulnerability. The chapter concludes by identifying three main opportunity areas of improvement: safe water and sanitation, climate-smart education, and social security without discrimination.

The third findings chapter, Chapter 5, addresses study Objectives 2 and 3 and details the state of climate and environmental governance in Malaysia in the context of children, their education, and health. The chapter concludes that climate-sensitive governance frameworks should be ambitious and urgent, rights-based, holistic, and multi-sectoral, and inclusive, and identified four main opportunity areas of improvement based on these principles.

The concluding chapter, Chapter 6, addresses study Objective 4 and compiles all the findings triangulated from the two substantive chapters. The study concludes by recommending

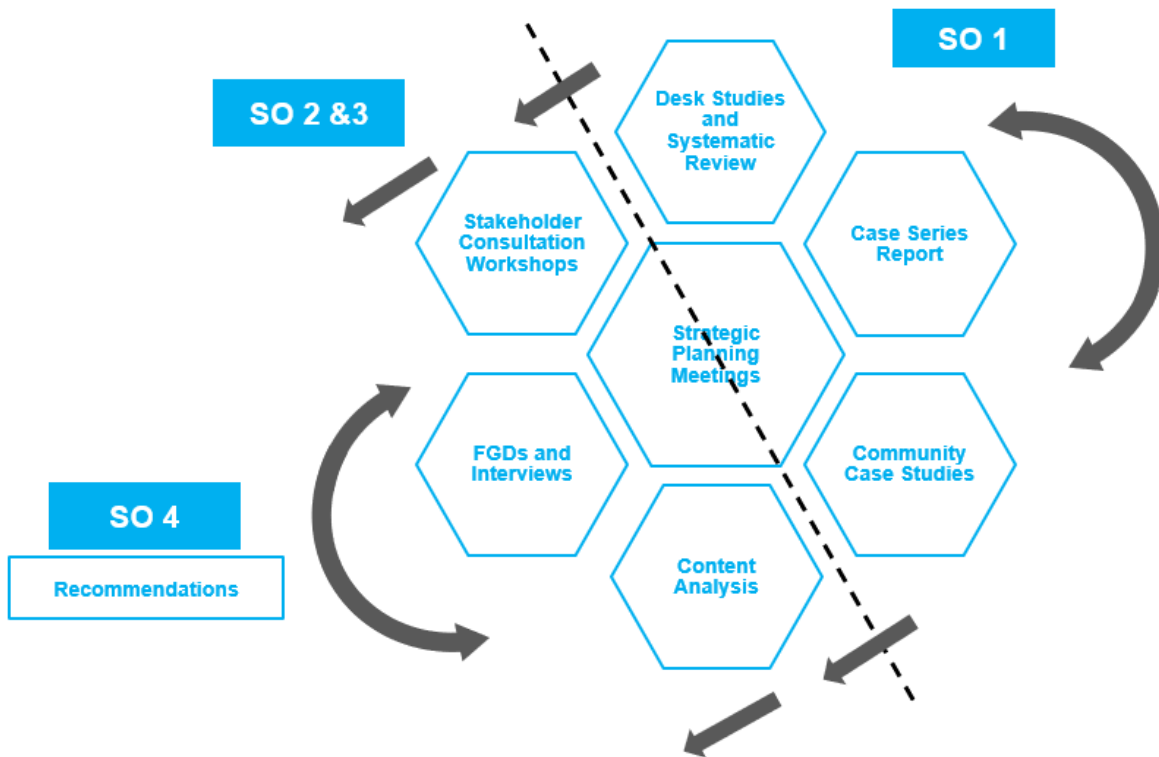
additional work to engage with key stakeholders on how these findings can be meaningfully applied to policymaking processes.

Two annexes at the end of this report offer additional information about the study team and methods (Annexe 1) and selected detailed research findings (Annexe 2). An extended Technical Report is also available, containing detailed data and evidence supporting the findings presented in this Synthesis Report.



## 2 METHODOLOGY

Figure 5 shows an overview of the study's methodology. Climate change can be driven by various anthropogenic stresses such as population growth and unsustainable consumption, which bring about extreme weather events and impacts human health and well-being. This study assesses the impacts from these drivers through a case series review, four desk studies, three case studies, and policy content analysis. The results of the case series review and desk studies were triangulated with the case studies on marginalised children, and these findings were used to cross-check the capacity and coverage of current national policies and legal frameworks in handling the impacts of climate change and environmental degradation on children in Malaysia.



*Figure 5: Overview of methodology (SO: Study Objective)*

The main activities of this study were carried out between March 2020 and May 2021. The full list of team members and collaborators are available at the beginning of this report. Please see Annex 1 for the Integrated Study Framework (Table 13) and a list of activities carried out during this study (Figure 45).

### 2.1 Study packages

Four interconnected study packages make up this study: a case series review, four desk studies, three case studies, and policy content analysis. While the case series review and Desk Study 2 and 4 covered data from all across Malaysia and from all walks of life, Desk Study 1

and 3 were bounded by location (Klang Valley region, Sabah and Sarawak). The three case studies, in turn, focused on marginalised communities.

### 2.1.1 Case series review

The case series review on children's health and well-being has been constructed to understand issues relevant to children with regards to climate change and environmental degradation in the context of the global environment and Malaysia. It consists of a literature review of related works encompassing various children's issues (Figure 6).

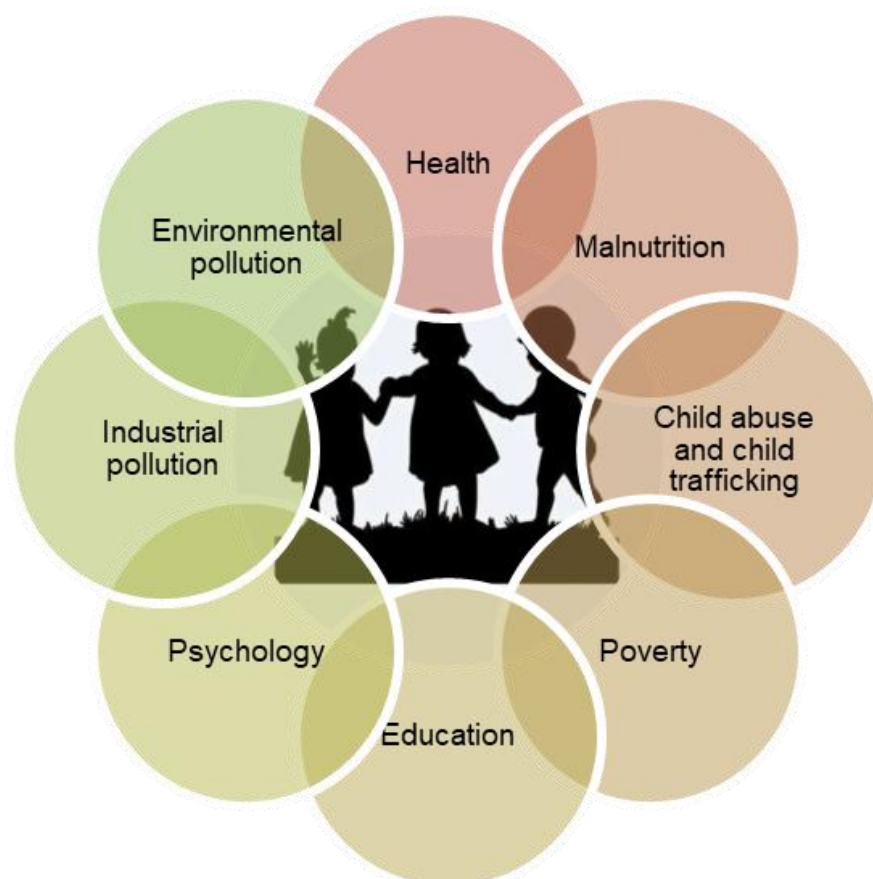


Figure 6: Issues covered in the case series review

### 2.1.2 Desk studies

Four desk studies were conducted to compile and assess the current evidence on the impacts of climate change and environmental pollution on children's health in Malaysia.

#### 2.1.2.1 Desk Study 1: Simulating the downscaling of a general climatic model to a regional climatic model for specific health sector climate indices

This desk study investigated the historical and projected changes of health-related climate indices at two study locations in Malaysia, Kota Kinabalu and Subang. The indices selected were wet and dry spells length and heatwave occurrence, duration, and magnitude. These indices can be considered proxies of the relevant hazards associated with climate extremes relevant to public health.

The observational data were obtained from the meteorological stations located close to or in the vicinity of the study areas. For the Kota Kinabalu Airport station, data on maximum and minimum temperature and precipitation were available from 1976 to 2019 (44 years), whilst data from Subang Airport station starts in 1997. The dataset used was the global surface summary of the day from the NOAA's National Climatic Data Centre<sup>7</sup>.

Future changes of key health indices were computed from the CORDEX-SEA simulated daily meteorological variables using the 'Climpact' software package<sup>8</sup>. Two Representative Concentration Pathways (RCP) scenarios representing different greenhouse gas concentration pathways throughout the 21<sup>st</sup> century were considered. RCP4.5 corresponds to a stabilisation scenario, while RCP8.5 characterises a rising pathway. The CORDEX-SEA data is available from the Earth System Grid Federation<sup>9</sup>. The changes to these indices were calculated as the differences between the future values and the historical reference values from the regional climate model's output.

### *2.1.2.2 Desk Study 2: The effect of ambient air pollution on childhood respiratory diseases in Asia's low- and middle-income countries: A systematic review*

This desk study conducted a systematic review of the literature related to the effect of ambient air pollution on childhood respiratory diseases in Asia's low- and middle-income countries (LMICs). A systematic search was conducted using PubMed, Ovid Medline and Scopus databases. Published articles were searched using search terms combined with the Boolean operator 'AND' and 'OR'. The LMICs follow World Bank's definition as countries with a Gross National Income per capita in 2018 between USD 1,025 and USD 3,995. The Asian continent was based on geographical regions used by the Statistics Division of the United Nations.

The selection criteria are summarised as per the PECOS (Population, Exposure, Comparators, Outcomes and Study Design) elements listed in Table 2. The combined results were then refined by year of publication from 2010 until 2019 and filtered by language. Studies published other than the English language were not included. Quality and risk of bias of included studies were assessed using the Appraisal tools for Cross-Sectional Studies, Newcastle-Ottawa Scale and Mustafic's quality assessment tools. Each of the included studies was appraised using the adapted risk of bias assessment tool from the Office of Health Assessment and Translation.

*Table 2: Selection criteria based on PECOS elements*

<b>PECOS ELEMENT</b>	<b>APPROACH</b>
<b>Population</b>	The age of the studied population is below 18 years
<b>Exposure</b>	Exposure to ambient PM <sub>10</sub> , PM <sub>2.5</sub> , CO, NO <sub>2</sub> , SO <sub>2</sub> , and/or O <sub>3</sub>
<b>Comparators</b>	Children exposed to lower levels of air pollutants than the more highly exposed in Asia's LMICs
<b>Outcome</b>	Morbidity and mortality of childhood respiratory diseases
<b>Study Design</b>	Cohort, case-control, case-crossover, time-series and cross-sectional studies

### 2.1.2.3 Desk Study 3: Association between air pollution and childhood respiratory admissions: A time-series analysis in Klang Valley and Sarawak, Malaysia

This desk study explored the association between air pollution and childhood respiratory admissions in two locations in Malaysia, Klang Valley in Peninsula Malaysia and Kuching in East Malaysia. Klang Valley is a Malaysian urban area centred on Kuala Lumpur and encompassing cities and towns in the states of Selangor and Putrajaya. With a population of around eight million people, Klang Valley is Malaysia's industrial and commercial heartland. In comparison, Kuching is the capital and most populous city of Sarawak, a state in East Malaysia. The city is located at the southwest tip of Borneo and has a population of approximately 325,132 people. This study included children under the age of 18 who lived in Klang Valley and Kuching. It is assumed in this study that sick children were transported from their homes to the nearest hospital.

The DOE's Continuous Ambient Air Quality Monitoring Stations provided daily ambient air pollution data. This included measurements of 24-hours PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO and O<sub>3</sub> between 1<sup>st</sup> January 2010 and 31<sup>st</sup> December 2018 (Figure 7). Daily temperature and relative humidity measurements were collected from the same database and used in the analysis as covariates.

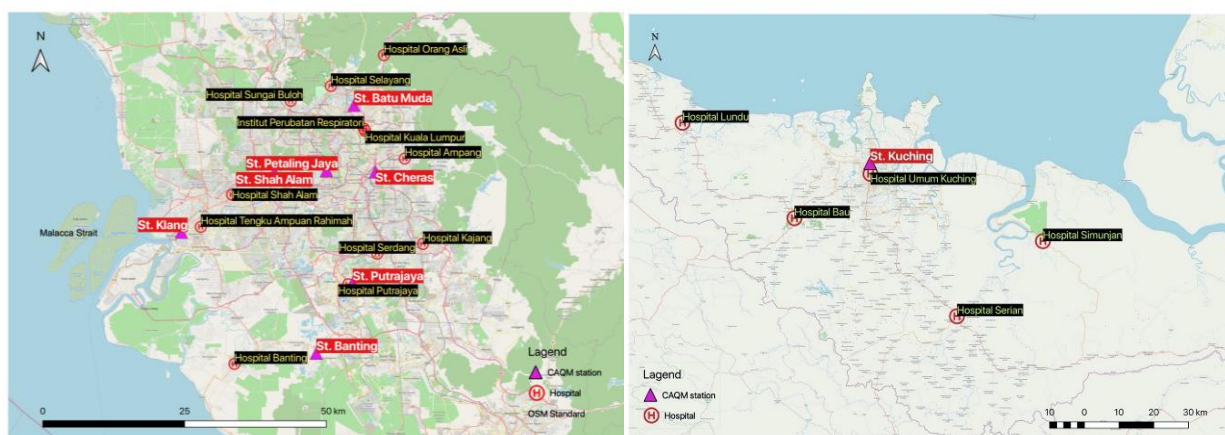


Figure 7: Locations of included monitoring stations and hospitals in Klang Valley (left) and Kuching (right)

Data on children's hospital admissions were obtained from two main sources. The first was the Malaysian Health Data Warehouse, derived from all Ministry of Health (MOH) hospitals in Malaysia. The second was an electronic database of Hospital Canselor Tuanku Mizan, a teaching hospital. A total of 17 hospitals in Klang Valley and Sarawak were included. Demographic information (including age and sex) was also obtained from the Malaysia Health Data Warehouse. Hospitalisations for respiratory diseases (WHO ICD10 J00-99) related to air pollution only were included in this study, and cases with congenital respiratory conditions were excluded.

Poisson regression in a single- and multiple-pollutant generalised linear model with a log function was used to estimate the relationship between pollutants and hospital admissions at various lag days. The covariates were the time variable (day), the daily mean temperature, humidity, a holiday indicator, and the day of the week. Relationships between air pollution and

hospital admissions were investigated for both sexes and age groups (0-4 years, 5-9 years, and 10-17 years).

#### 2.1.2.4 Desk Study 4: Assessing the health effects of wildfire haze among children in Malaysia

This desk study aimed to investigate the association between haze and mortality of children under five years old in Malaysia by accounting for three aspects: duration, intensity, and time lag. Using a generalised additive model, the desk study examined under five years mortality related to haze in Malaysia from 2014 to 2016. Considering districts with populations over 500,000 and available monitoring stations for exposure assessment, 12 districts were selected (Figure 8). Health data was obtained from the Family Health and Development Division, MOH Malaysia. All-natural deaths (International Classification of Disease, 10<sup>th</sup> Revision (ICD-10: A00-R99) were included, while deaths due to accidental, traumatic, and external causes (ICD-10: S00-Y98) were excluded.

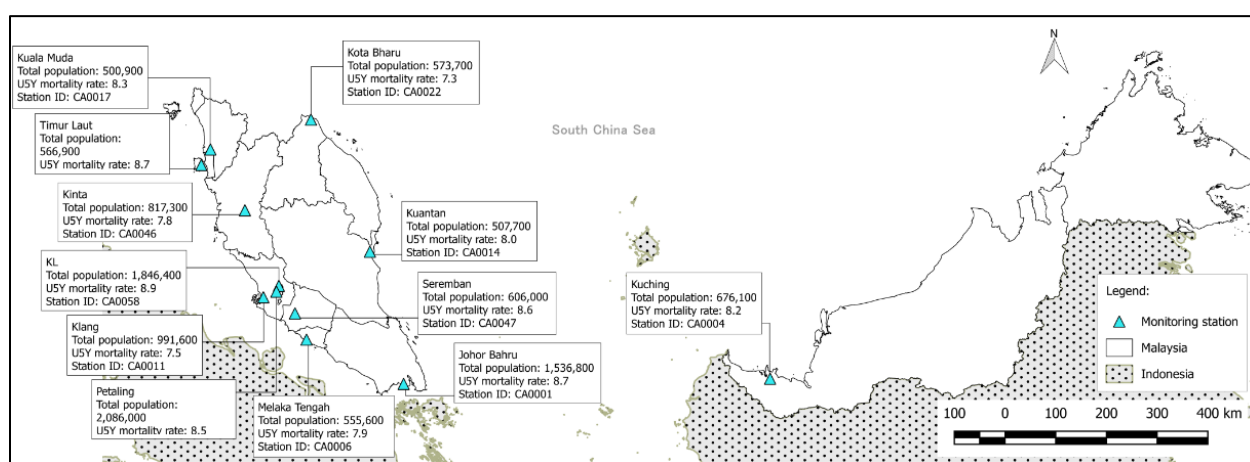


Figure 8: Map of Malaysia showing the districts included in this study

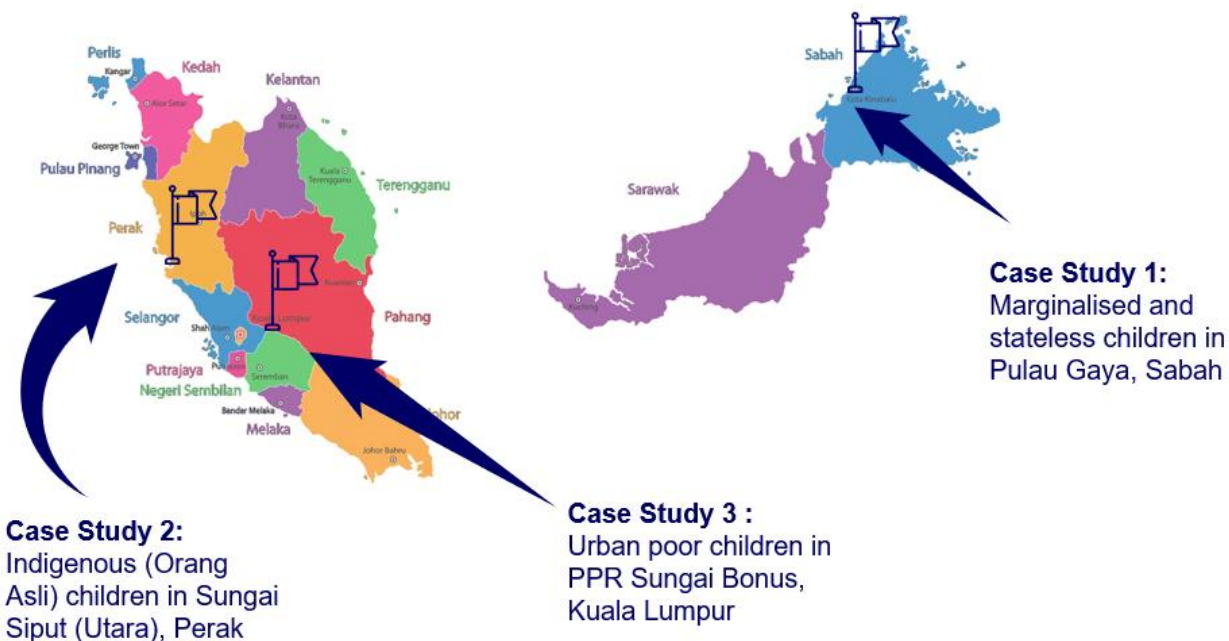
Air pollutant and weather data were obtained from the Air Quality Division, DOE Malaysia. A 'haze day' was defined by intensity and duration based on the PM<sub>10</sub> concentration. The study also examined the lag effects of the association, i.e. single lag and moving average lags up to seven days. All the statistical analyses in this study were performed using the R statistical software. Results of under five years mortality accounting for each aspect were reported as an odds ratio with a 95% confidence interval.

#### 2.1.3 Case studies

Case studies were conducted to inform understandings of children's vulnerability and resilience towards the impacts of climate change, environmental degradation, and pollution, especially in terms of their well-being.

Three locations were chosen around Malaysia: Pulau Gaya, Sabah (6°1.0798'N 116°1.7909'E), Pos Kuala Mu, Sungai Siput, Perak (4°50.2499'N 101°20.0445'E), and PPR Sungai Bonus, Setapak, Kuala Lumpur (3°11.1778'N 101°43.3215'E) (Figure 9). These three communities represent three different geographical settings. Pulau Gaya is an island, Pos Kuala Mu is located in a mountainous region, and PPR Sungai Bonus is located in an urban area. The populations in all three locations consist of marginalised communities: documented and

undocumented minority groups in Pulau Gaya; Temiar indigenous people in Pos Kuala Mu; and B40 (bottom 40% in terms of household income) families in PPR Sungai Bonus.



*Figure 9: Locations of case studies*

These areas were chosen to demonstrate the degree of risk perceptions and behavioural changes in children living in these 'extreme' areas due to climate and environmental variability. Specific objectives of the case studies were as follows:

1. To profile the children's demographic and socioeconomic backgrounds, including their mobility
2. To analyse their degree of vulnerability by correlating the climate and environment with the children's profiles
3. To recommend a strategic framework and proposed interventions to address the key issues identified in the context of children, climate change, and health

These case studies adopted a mixed-method (quantitative and qualitative) study employing a socio-ecological approach. Data collection was carried out between August and December 2020 among children, teachers, and community members. The sampling technique used for both types of studies was the purposive sampling method.

For the quantitative study, the data was collected through a piloted questionnaire, modified based on the location area and target participants, using a guided, self-administered technique. The inclusion criteria for child participants were children aged six to 18 years old who can speak and give opinions. Data obtained from the quantitative study were analysed using IBM SPSS V.26. Principal Component Analysis was used to analyse the children's opinions regarding their socio-economic background and living condition, accessibility and mobility, the impact of climate change and environmental degradation, and coping mechanisms.

The qualitative studies are exploratory and consist of in-depth interviews and focus group discussions with the children, teachers, and community representatives (Figure 10). Semi-structured interview questions were developed through several discussion sessions between the UKM and UMS teams. The inclusion criteria for these studies sessions in Pulau Gaya and Pos Kuala Mu were male and female respondents of any age who consented to the study. For the focus group session in PPR Sungai Bonus, the inclusion criteria were children aged six to 18 years old who could speak and give opinions. A brief explanation about the study was given before starting the sessions. All sessions were recorded with permission, and the audio was later transcribed into written text. These transcripts were coded, categorised, and analysed thematically, as this was used to identify patterns and themes to address the key findings of this research.

Basic structure of questions for IDIs and FGDs (children and community)	Basic structure of questions for IDIs (teachers)
<ul style="list-style-type: none"> <li><input type="checkbox"/> Knowledge about the climate and its relation to weather changes and well-being</li> <li><input type="checkbox"/> Observed changes related to the climate and environment</li> <li><input type="checkbox"/> Impact of climate change and environmental degradation</li> <li><input type="checkbox"/> Strategies to prevent and minimise the impact of climate change and environmental degradation</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Information about climate change and environmental degradation in school syllabus</li> <li><input type="checkbox"/> Impact of climate change and environmental degradation to students</li> <li><input type="checkbox"/> Attendance of seminars related to climate change and environmental degradation as part of teaching course</li> <li><input type="checkbox"/> Knowledge related to climate change and environmental degradation</li> </ul>

Figure 10: Basic structure of questions for qualitative studies

The respondents' demographic profiles for the questionnaires, interviews, and focus group discussions across the three locations are summarised in Figure 11, Table 3, and Table 4. Due to location-specific cultural factors, the team could not obtain an equal gender spread in Pulau Gaya and Pos Kuala Mu for the community interviews and focus group discussions. In Pulau Gaya, female adults generally stay at home while males tended to move around more freely. In Pos Kuala Mu, female members of the Orang Asli community are generally more wary of outsiders than males.

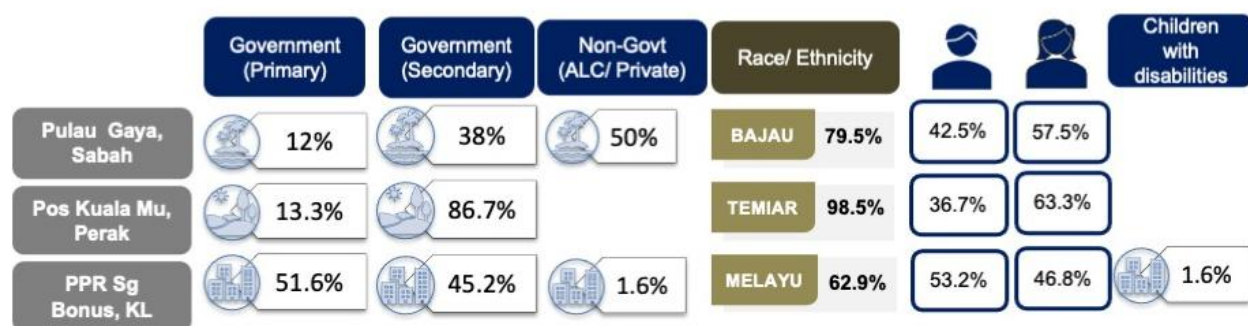


Figure 11: Demographic profile and education providers of surveyed respondents

Table 3: Demographic profile of in-depth interview respondents



		Pulau Gaya	Pos Kuala Mu	PPR Sg Bonus
<i>IDI</i>	Teachers	✓	✓	✗
	<b>Age</b>	20-60 years old		
	<b>Gender</b>	Male: 64.7% Female: 35.3%	Male: 42.9% Female: 57.1%	
	<b>Service period (years)</b>	11-15	1-5	
	Community	✗	✓	✗
	<b>Age</b>	40-70 years old		
	<b>Gender</b>	Male : 100 %		

Table 4: Demographic profile of focus group discussion respondents

		Pulau Gaya	Pos Kuala Mu	PPR Sg Bonus
<i>FGD</i>	Teachers	✓	✓	✗
	<b>Age</b>	20-60 years old		
	<b>Gender</b>	Male: 64.7% Female: 35.3%	Male: 42.9% Female: 57.1%	
	<b>Service period (years)</b>	11-15	1-5	
	Community	✗	✓	✗
	<b>Age</b>	40-70 years old		
	<b>Gender</b>	Male : 100 %		

### 2.1.3.1 Pulau Gaya, Sabah

Pulau Gaya is a 1,465-hectare island located a 15-minute boat ride from Kota Kinabalu. It is the largest island in the Tunku Abdul Rahman National Park. Pulau Gaya is one of the most sensitive areas in Malaysia in terms of climatic factors, both in terms of seasonal variability and long-term change. With its large population of undocumented children and children from low-income families, Pulau Gaya provides a classic example of a marginal and vulnerable community (Figure 12). Most children between six and 12 in Pulau Gaya are involved in economic activities in the market area, including selling candy, cigarettes, plastic goods, salted fish, lottery tickets, sewing clothes, soliciting alms, and gambling.



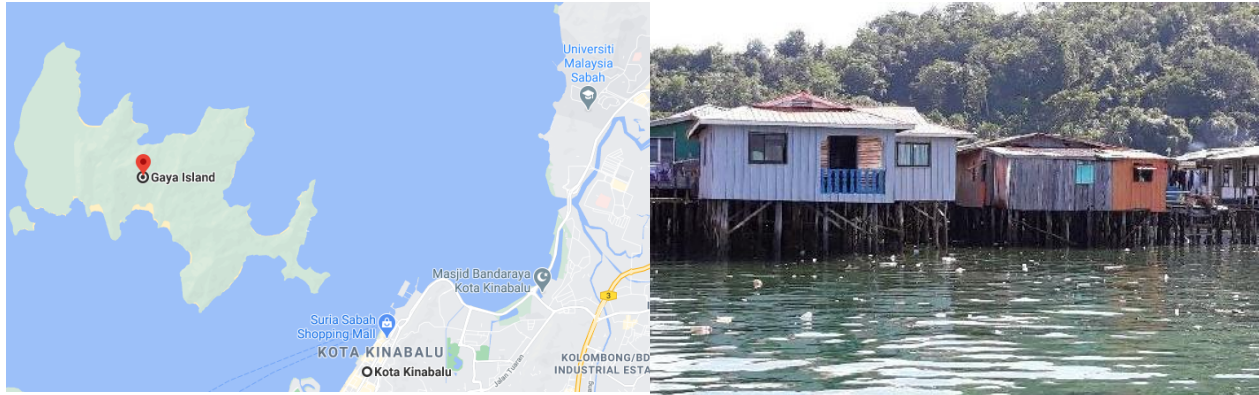


Figure 12: Location and types of houses at Pulau Gaya

### 2.1.3.2 Pos Kuala Mu, Sungai Siput, Perak

Pos Kuala Mu is an Orang Asli village located on elevated forested terrain in the Titiwangsa mountain range in the state of Perak. It is more than 60km away from Sungai Siput town. There are four different villages here (Kampung Kuala Mu, Kampung Gapeh, Kampung Toh, and Kampung Bersah), each headed by a village chief known as *Tok Batin*. Orang Asli children in Malaysia are generally considered marginalised because of low education and literacy levels, alongside low family income. Figure 13 shows the typical housing in Pos Kuala Mu.

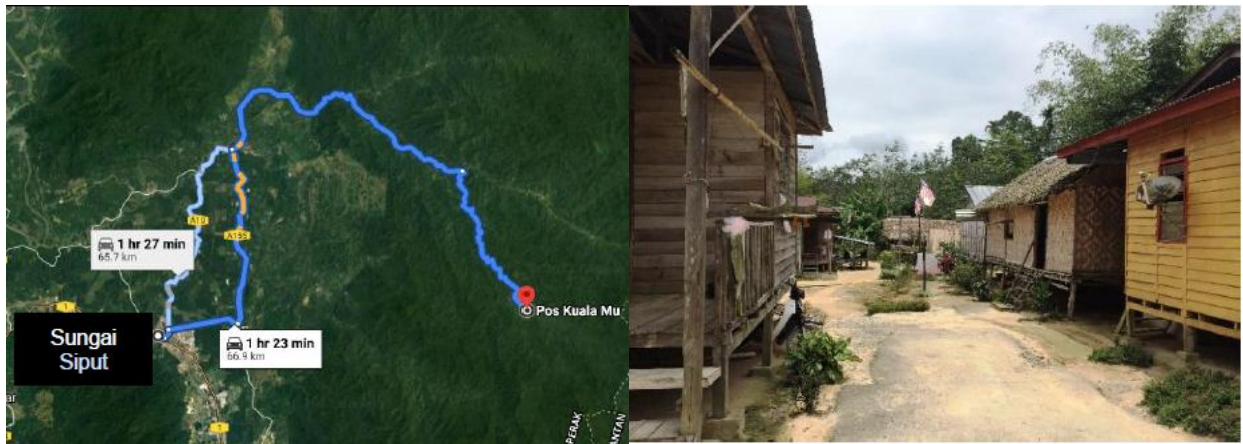


Figure 13: Location and types of houses in Pos Kuala Mu

### 2.1.3.3 PPR Sungai Bonus, Kuala Lumpur

PPR stands for *Projek Perumahan Rakyat*, which translates to the People's Housing Project. The PPR Sungai Bonus housing area is located at Setapak in urban Kuala Lumpur. It is a low-cost leasehold flat consisting of two blocks of 15 stories with 632 residential units (Figure 14). Each unit is sized not less than 700 ft<sup>2</sup> with three bedrooms, two bathrooms, a kitchen, and a hall. The PPR is part of a government programme for squatters' relocation and provides housing requirements for low-income earners. Thus, most of the tenants in PPR Sungai Bonus are from low-income group (B40) families. Eligibility requirements for PPR housing are that the applicant and spouse are Malaysian, do not own a house, are 18 years old and above, and have a gross household income of RM 3,000 per month or less.

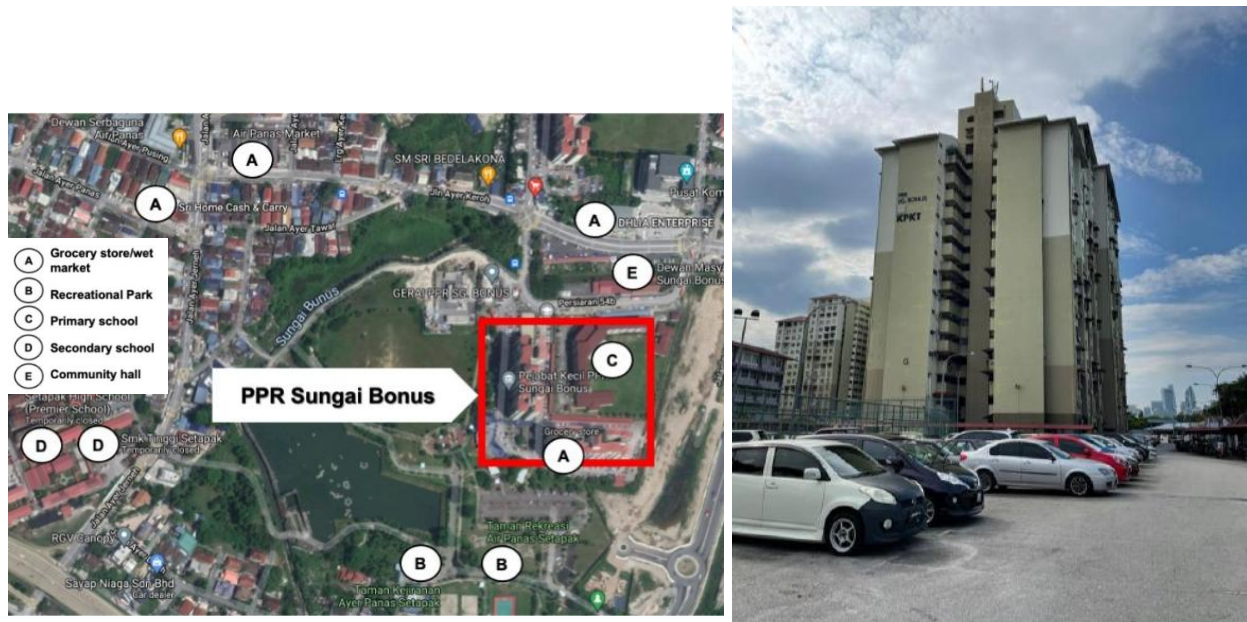


Figure 14: Location and types of houses at PPR Sungai Bonus

#### 2.1.4 Document content analysis

This exercise assessed the adequacy of climate change and environmental policies, plans, and legal frameworks to address children's health and well-being and achieve relevant SDG targets. This involved examining current policies, plans, and legal documents, identifying inadequacies, drawbacks, and loopholes, and proposing improvements.

Primary materials included statutes, case law, government policy papers, government directives, speeches and reports of government and NGOs, and other legal and non-legal literatures. Secondary materials included textbooks, journal and non-journal articles, seminar papers, media, and reports. The information and data gathered were examined using content analysis and contextual analysis followed by summarising and generating conclusions on what was available and what was lacking in resolving children's issues concerning climate change, environmental degradation and pollution in Malaysia. Further online discussions and semi-structured interviews with selected agencies, legal and judicial personnel were conducted to collect more information and viewpoints on the current positions of the laws and policies to justify the need for their revisions.

##### 2.1.4.1 Policy analysis

The inclusion criteria for the selected documents under this policy analysis study were (1) national policies, action plans, guidelines and national reports, (2) formulated or prepared by the government ministries, (3) accessible, (4) both in English and local Malay languages and (5) the most recent version. A keyword count was also carried out on these policies and plans (Figure 49 in Annexe 2). The selected documents are summarised in Figure 15.

CLIMATE CHANGE (15)	ENVIRONMENT (9)	EDUCATION (2)	HEALTH (14)	CHILDREN (7)
1. National Policy on Climate Change (2009)	1. National Policy on the Environment (2002)	1. National Education Policy (2017)	1. MOH strategic plan (2016-2020)	1. National Child Policy And Action Plan (2009)
2. National Green Technology Policy (2009)	2. National Water Resources Policy (2012)	2. Malaysia Education Blueprint (2013-2025)	2. MOH action plan (2016-2020)	2. National Child Protection Policy (2009)
3. Green Technology Master Plan Malaysia (2017-2030)	3. National Policy on Biological Diversity (2016 – 2025)		3. Malaysian Strategy for Emerging Diseases and Public Health Emergencies Workplan 2017-2021 (MySED II)	3. National Family Policy (2010)
4. National Energy Policy (1979)	4. National Forestry Policy (1978, revised 1992)		4. NEHAP (2013)	4. National Social And Reproductive Health Education Policy & Action Plan (2009)
5. National Renewable Energy Policy and Action Plan (2008)	5. National Solid Waste Management Policy (2016)		5. Disaster management plan (2015)	5. Malaysian Plan of Action for People with Disabilities (2016-2022)
6. National Biofuel Policy (2006)	6. National Cleanliness Policy (2019)		6. Flood management (2008)	6. National Strategy Plan On Addressing The Causes Of Child Marriage (2020)
7. Policy and Mechanism on National Disaster and Relief Management (1997)	7. Malaysia's Roadmap Towards Zero Single-Use Plastics (2018-2030)		7. Action Plan for Health Management from Haze (2020)	7. National Community Policy (2018)
8. National Agriculture Policy, National Agro-Food Policy (2011)	8. Environmental Impact Assessment Guidelines (2016)		8. Clinical Guidelines on Management of Heat Related Illness (2016)	
9. National Energy Efficiency Action Plan (2015)	9. Health Impact Assessment (HIA) In Environmental Impact Assessment (EIA) (2012)		9. National Strategic Plan for Dengue Prevention and Control (2016-2020)	
10. National Industry Policy 4.0 (2018)			10. Management Guidelines of Malaria in Malaysia (2014)	
11. National Transport Policy (2019-2030)			11. National Plan of Action for Nutrition of Malaysia III 2016-2025 (2016)	
12. Low Carbon City Framework (2011)			12. Typhoid case/outbreak Management Guidelines (2017)	
13. Intended Nationally Determined Contribution of The Government Of Malaysia (2015)			13. Guidelines for the Diagnosis, Management, Prevention and Control of Leptospirosis in Malaysia (2011)	
14. Third Malaysia National Communication Report & Malaysia Second Biennial Update Report to UNFCCC (2018)			14. Guidelines for Management of Scabies in Adults and Children (2015)	
15. Malaysia Biennial Update Report to UNFCCC (2020)				

DEVELOPMENT PLANS: 11<sup>th</sup> Malaysia Plan (2016-2020) & National Physical Plan 3 (2016-2020)

Figure 15: Policies and plans selected for policy analysis

#### 2.1.4.2 Legal framework analysis

The main legal documents used for this legal framework analysis include the Malaysian Constitution, Environmental Quality Act (EQA) 1974, Prevention and Control of the Infectious Diseases Act 1988, and Child Act 2001. An overview of the assessment process is detailed in Figure 16.

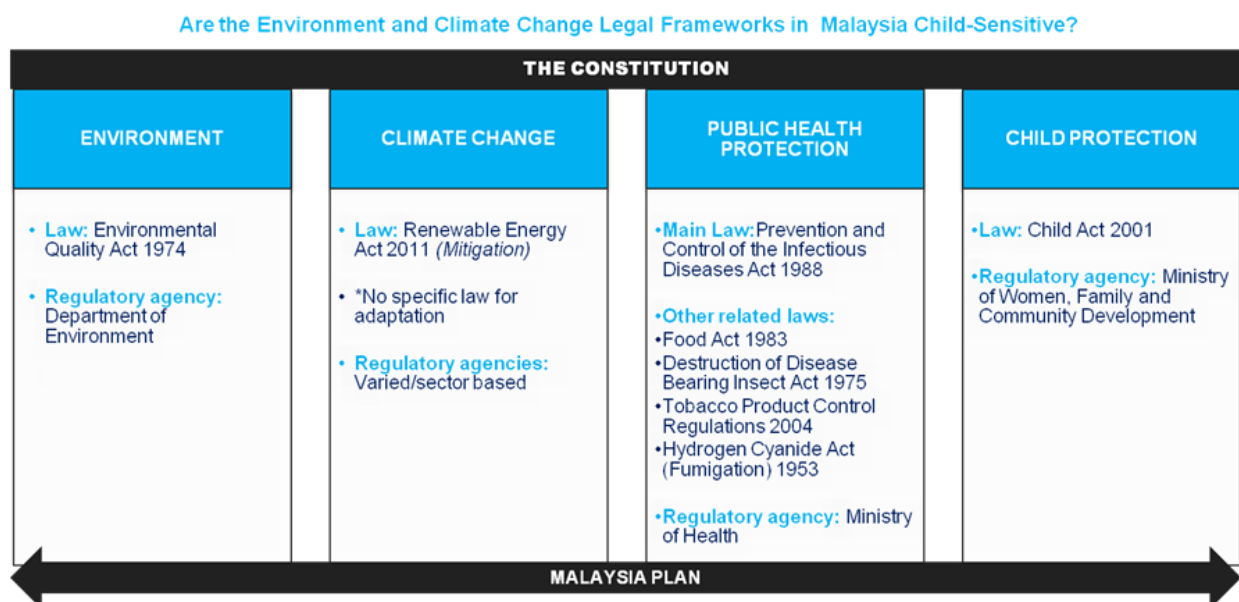


Figure 16: An overview of the assessment of the Malaysian legal frameworks

## 2.2 Ethical considerations

The key principles adopted in the implementation of this study is based on the United Nations 2030 Agenda for Sustainable Development's Universal Values (Figure 17).



*Figure 17: Universal Values under the 2030 Agenda for Sustainable Development*

We have adopted the following ethical guidelines to operationalise these universal values within this study: (1) alignment with international norms and standards (avoidance of harm, discomfort, inconvenience, and unreasonable risk), (2) equality and non-discrimination, (3) active and meaningful participation, and (4) robust accountability mechanisms. These guidelines for ethical data collection are also in line with 'Do No Harm' principles and UNICEF's 'Every Child Counts' approach to data collection.

The study has been subjected to ethical approval at both the national and university level. It adheres to best practices in acquiring informed consent from all participants to safeguard their dignity, rights, safety, and well-being, especially the children. The study also adheres to the UNICEF Guidelines on Ethical Research. All planned consultations with children with and without disabilities have been discussed with UNICEF to ensure that they align with UNICEF's child safeguarding policies and procedures. Detailed ethics approvals obtained are listed in Table 5.

*Table 5: Ethics approvals obtained by study package*

STUDY PACKAGE	ETHICS APPROVAL
<b>Desk Study 3</b>	Medical Research and Ethics Committee, MOH Malaysia (NMRR-20-891-54456(IIR)) and the Ethics Committee of the Faculty of Medicine, UKM (UKM PPI/111/8/JEP-2020-427)
<b>Desk Study 4</b>	Medical Research and Ethics Committee, MOH Malaysia (NMRR-18-2945-42784 [IIR]) and the Ethics Committee of the Graduate School of Engineering, Kyoto University, Japan (201902)
<b>Case Studies</b>	Research Ethics Committee, UKM (UKM-NN-2020-041, UKM PPI/111/8/JEP-2020-668.)

Particular care was taken to ensure ethical data collection for the case studies, which involved direct data collection from children in marginalised communities. In alignment with international norms and standards, approval from the children's informed consent was obtained through the completion of an informed consent form by their parents, guardian, or teacher before the data collection began.

To ensure equality and non-discrimination, inclusion criteria were regardless of the children's ethnicity, religion, sex, gender, social background, legal status or disability, except as stipulated in the study design (Table 6). The reason for having only one child with disabilities is explained in the study limitations section. Strategies like 'ice-breaking' sessions were employed to increase the participants' comfort level for active and meaningful participation. In accordance with robust accountability mechanisms, the children were free to withdraw from the study at any time.

*Table 6: Gender and disability breakdown of case study participants*

	MALES	FEMALES	BOYS	GIRLS	WITH DISABILITY
Pulau Gaya	106	131	85	115	0
Pos Kuala Mu	78	138	72	124	0
PPR Sungai Bonus	38	34	33	29	1
<b>Total</b>	<b>222</b>	<b>303</b>	<b>190</b>	<b>268</b>	<b>1</b>

### 2.3 Study limitations

Different study packages within this broader study have different target audiences. The case series review and desk studies focus on children from all across Malaysia and from all walks of life, while the case studies focused on three marginalised communities. This study design has been chosen to overcome the limitations of an either too broad or too narrow focus. For example, generalised findings from the case series review were used to inform focus areas and questions for the case study instruments.

Several specific limitations were present in Desk Studies 3 and 4. Desk Study 3 focused its assessment at the city level. Hence, air pollutant concentrations could not be representative of individual exposures. In addition, the concentrations of air toxins or surrogates were not monitored. Furthermore, this study does not measure personal behaviour and socioeconomic status, such as child nutrition or time spent outdoors, which may affect the magnitude of the observed associations. Desk Study 4 focused on children under five years old, as evidence of health effects related to air pollution or haze events among this age group is scarce. However, as the immune system among children under five years may differ from older children, these findings cannot be generalised.

The mixed-methods approach adopted for the case studies was chosen particularly to complement and overcome the limitations of individual qualitative or quantitative approaches. For example, interviews and focus group discussions can gather in-depth information from a small number of participants but are not intended to broadly represent all perspectives. As such, the questionnaires filled the gap for broad representation. However, cultural issues (e.g. shyness towards strangers) and language barriers were difficult to overcome during data collection, particularly among the indigenous community in Pos Kuala Mu.

The case studies were carried out during the COVID-19 pandemic, which further presented limitations to data collection. Safety concerns among respondents resulted in the researchers' inability to obtain equal numbers and types of participants in each location. Researchers and

participants had to strictly adhere to Standard Operating Procedures and movement control orders, which may have contributed to a sense of unease among participants. To alleviate these concerns, the researchers supplied face masks and hand sanitisers and practised social distancing for all sessions. Furthermore, interviews with teachers were unable to be carried out at PPR Sungai Bonus because schools were closed at the time.

The COVID-19 situation particularly limited our ability to include more children with disabilities within the case studies. The pandemic posed heightened health risks for individuals with underlying conditions. Hence understandably, parents were especially reluctant to allow their children with disabilities to participate in our activities. Despite our best efforts, only one child with disabilities could be included in the study, from PPR Sungai Bonus.

There may be limitations in the exhaustiveness of the documents selected for the content analysis due to the sheer number of documents available and the cross-sectoral nature of climate change and environmental issues. To keep in line with the case study based in Sabah, the team decided to focus on only Sabah-specific documentation as a representative example of state-based policy and legal analysis. Furthermore, various agencies may have already addressed the gaps and opportunities identified during implementation at the ground level. However, as the study covered policies, plans, and legal frameworks, and these being the major reference points to most implementation activities on the ground, the outcomes of this study can still be considered significant.

### 3 MALAYSIA'S ENVIRONMENT AND CHILDREN

Malaysia is located in the equatorial zone within the tropical region of Southeast Asia. It is made up of two landmasses separated by the South China Sea, namely West or Peninsular Malaysia attached to mainland Southeast Asia and East Malaysia, which is part of the island of Borneo. It has a land area of approximately 330,345 km<sup>2</sup>, with 8,840 km of coastline and over 879 islands. Figure 18 shows the boundaries of 13 states and three Federal Territories (Kuala Lumpur, Putrajaya, and Labuan) of Malaysia.

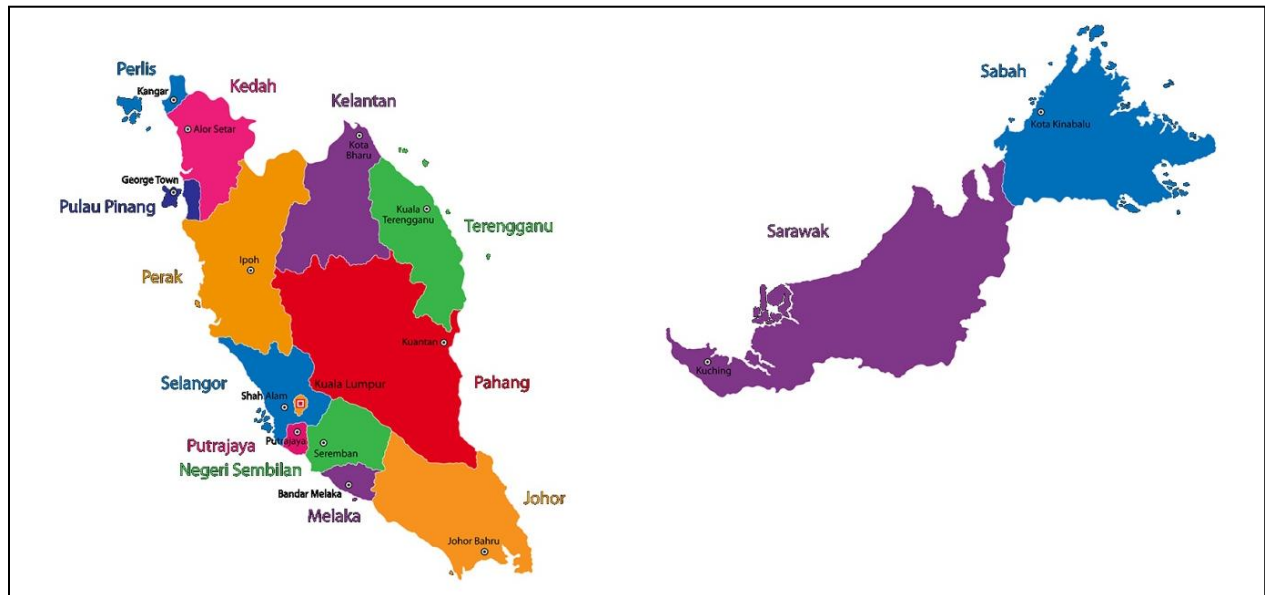


Figure 18: Map of Malaysia

As of 2019, Malaysia's population was estimated to be 32.6 million<sup>10</sup>, comprising 29.4 million (90.2%) citizens and 3.2 million (9.8%) non-citizens. Malaysia is a multi-ethnic country with 69% of its population identifying as Malay, 23% Chinese, 7% Indian and 1% other ethnicities. Malaysia's sex ratio is 51.5% male to 48.5% female. The life expectancy at birth for a person in Malaysia in 2019 has remained the same since 2013, at an average of 74.5 years. A newborn girl is expected to live longer (77.3 years) than a newborn boy (72.2 years).

In 2016, Malaysia had a population density of 95 individuals per km<sup>2</sup>. It is currently one of the most urbanised countries of East Asia, with most of its population concentrated in coastal areas. Malaysia's urban population increased from 33.5% in 1970 to 76.6% in 2019, growing at an annual average rate of 1.71%. Its capital of Kuala Lumpur is the largest city in Malaysia, with a population of 1.808 million.

The Malaysian economy is the most competitive economy among the developing countries in Asia. It was ranked 25<sup>th</sup> out of 140 economies in the World Economic Forum's Global Competitiveness Report. The economy and population growth has created an added burden on the environment, including higher greenhouse gas emissions, accelerated environmental degradation, and increased waste generation. Key environment-, children-, and population-related SDG indicators for Malaysia are listed in Figure 19 and Figure 20.

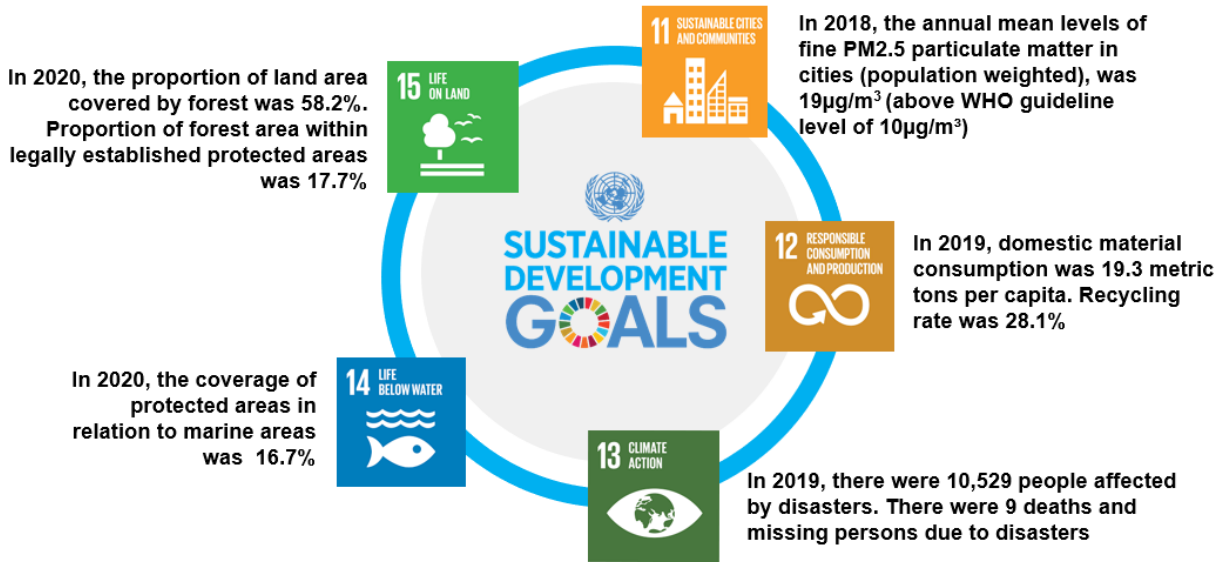


Figure 19: Summary of environment-related SDG indicators for Malaysia<sup>11</sup>

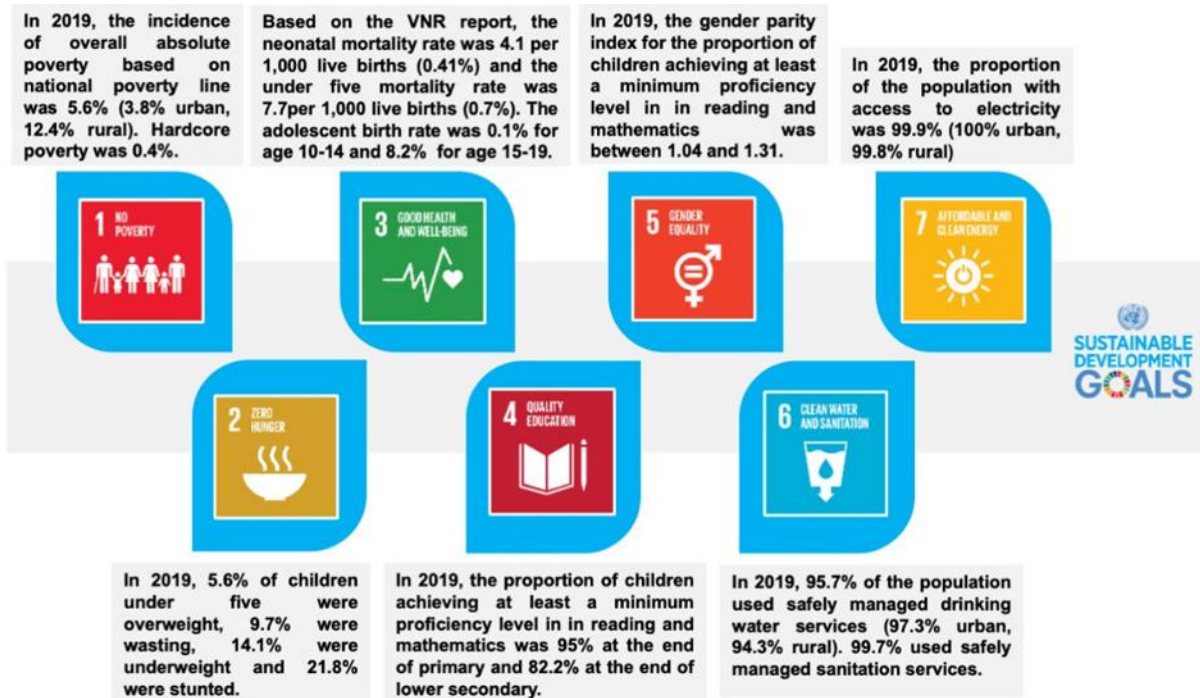


Figure 20: Summary of children- and population-related SDG indicators for Malaysia<sup>12</sup>

### 3.1 State of Malaysia's environment and climate

Malaysia's surface climate is influenced by two monsoon regimes, the southwest monsoon and the northeast monsoon. Intermittently during this period, strong pulses of wind known as cold surges penetrate the southernmost region of the South China Sea. During the inter-monsoon



periods, some areas in Malaysia experience higher than average rainfall. The region is usually wetter during the northeast monsoon when the Inter-tropical Convergence Zone is close to the equator. In turn, the southwest monsoon features drier weather accompanied by less rainfall.

Malaysia's climate is also influenced by the Pacific Ocean to the east and the Indian Ocean to the west. Inter-ocean interactions can initiate or modulate climate variations that can affect the Malaysian climate. For example, the El Niño-Southern Oscillation predominantly influences climate variability in Malaysia and the greater Southeast Asian region.

The Yale Environmental Performance Index<sup>13</sup>, which indicates which countries are best at addressing environmental challenges, ranks Malaysia as 75<sup>th</sup> among 180 countries in 2018. Malaysia ranks comparatively high for fisheries (35<sup>th</sup>), water and sanitation (55<sup>th</sup>) and water resources (58<sup>th</sup>) and comparatively low for climate and energy (102<sup>nd</sup>), air pollution (107<sup>th</sup>) and forests (136<sup>th</sup>).

### 3.1.1 Air quality

The Department of Environment (DOE) monitors the ambient air quality in Malaysia through a network of 65 automatic stations placed across the country. Malaysia reports air quality using an Air Pollution Index based on several air pollutants: sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ground-level ozone (O<sub>3</sub>), carbon monoxide (CO), PM<sub>10</sub><sup>14</sup>, and PM<sub>2.5</sub> (since 2017). The Air Pollution Index scores are classified into five categories, where a score of above 100 represents an unhealthy level of air quality. The DOE has indicated that the major emission loads of air pollutants in Malaysia come from power stations (SO<sub>2</sub>, PM, and NO<sub>2</sub>) and motor vehicles (CO and NO<sub>2</sub>)<sup>15</sup> (Figure 21).

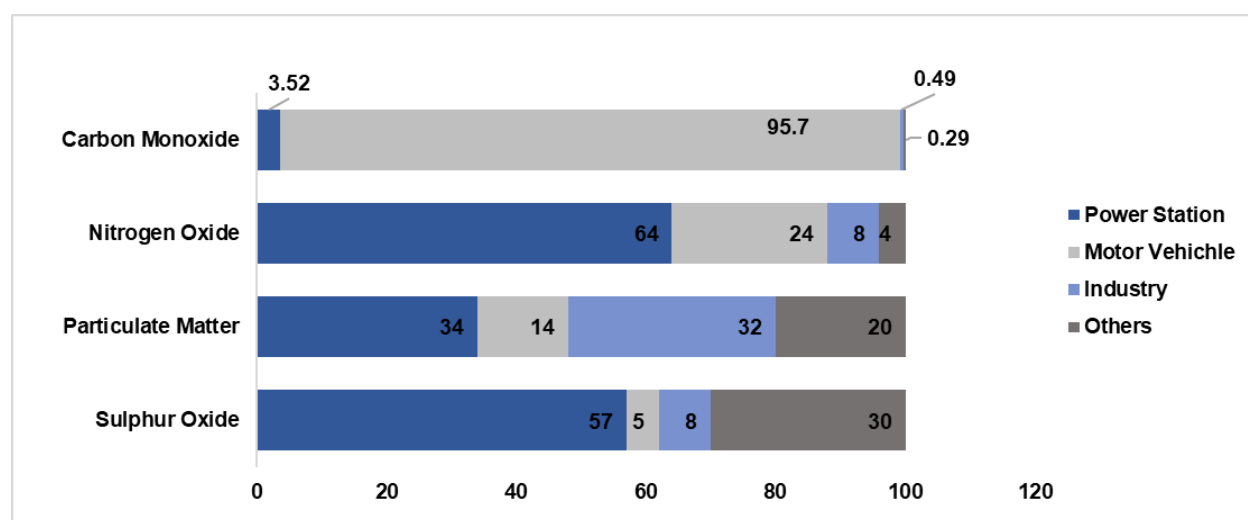


Figure 21: Breakdown of sources of key air pollutants in Malaysia<sup>16</sup>

From 2010 to 2018 (excluding 2015), Malaysia's annual average PM<sub>10</sub> concentration has been consistently below the Interim Target 2 (IT-2, 2018) Malaysian Ambient Air Quality Standard of 45 µg/m<sup>3</sup> (Figure 22). However, this is still far from the World Health Organisation's standard of 20 µg/m<sup>3</sup>. The mortality rate attributed to ambient air pollution, age-standardised (per 100,000 population) in 2016, was 41.0 in Malaysia.

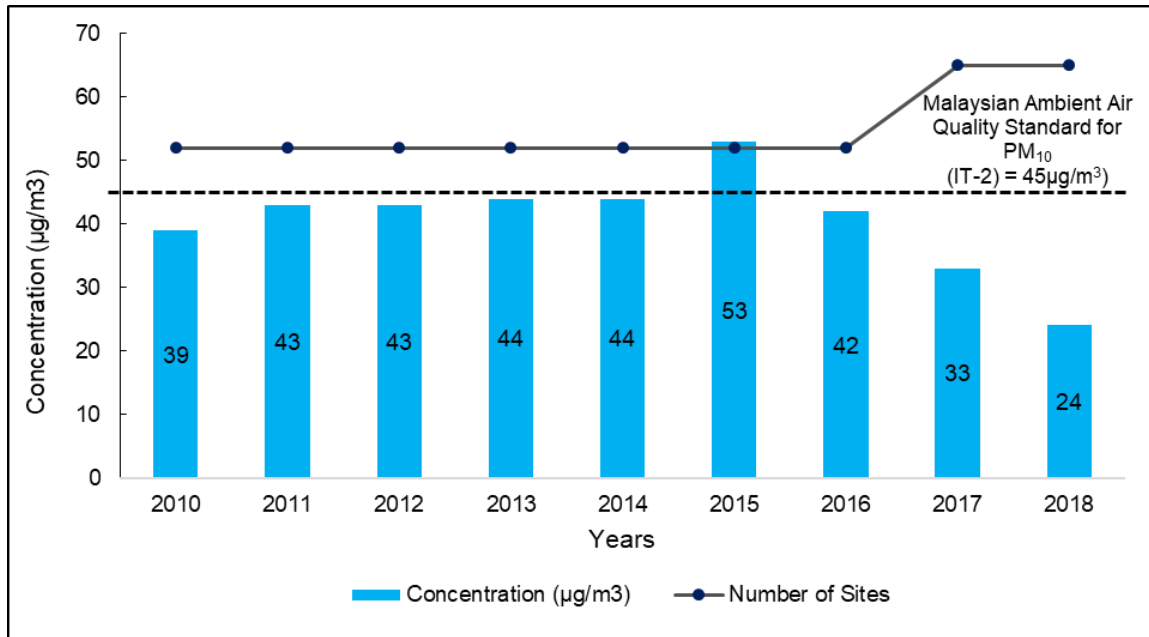


Figure 22: Annual average PM10 concentrations in Malaysia, 2010 to 2018<sup>17</sup>

### 3.1.2 Water quality and sanitation

Malaysia is blessed with an abundant water supply from high annual rainfall rates of around 973 billion cubic metres. Around 98% of Malaysia's water usage comes from rivers, and 70% of these water resources are used for agriculture<sup>18</sup>. Thus, river water quality and pollution control are especially important. In 2018, 56% of Malaysia's rivers were categorised as 'clean', increasing 10% from the previous year (Figure 23).

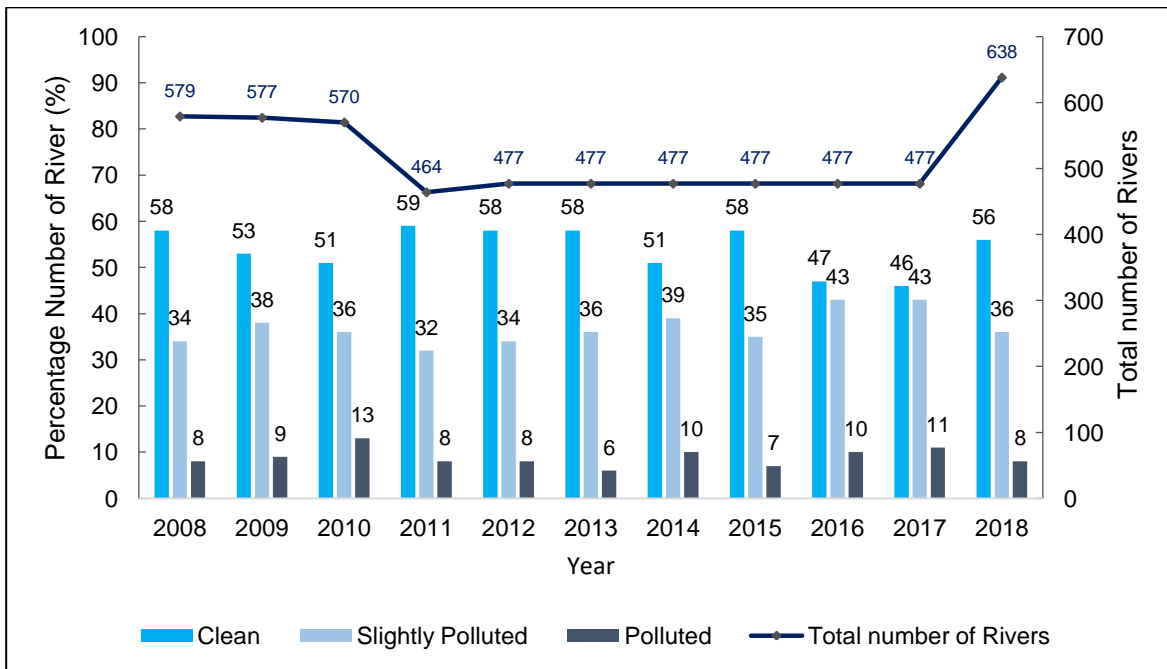


Figure 23: River water quality in Malaysia, 2008 to 2018<sup>19</sup>

Malaysia has almost universal access to safe and affordable drinking water, hygiene services, and sanitation (SDG Targets 6.1 and 6.2). 93% of the population in Malaysia used a safely managed drinking water service (SDG Indicator 6.1.1), and 87% used a safely managed sanitation service (SDG Indicator 6.1.2a) in 2017. 88% of the household water in Malaysia was safely treated in 2020 (SDG Indicator 6.3.1). However, it should be noted that some groups remain excluded from access as they are economically vulnerable, live in informal settlements, are undocumented and/or stateless. These groups are often not included in the official statistics.

63% of the water resources in Malaysia was managed under integrated water resource management (SDG Indicator 6.5.2) in 2020. While there has been an increase of 10.7% of the spatial extent of water-related ecosystems in Malaysia in 2016 compared to the baseline period of 2001-2005 (SDG Indicator 6.6.1), 3% of the renewable water resources in Malaysia are being withdrawn in 2018, after taking into account environmental flow requirements (SDG Indicator 6.4.2)<sup>20</sup>.

3.1.3 Forests and Biodiversity<sup>21</sup>

In 2014, 18.277 million ha, or approximately 55.3% of the total land area of Malaysia, was still forest areas (Figure 24). This area included permanent reserved forests, state land forests and totally protected areas. The remaining area comprises crops, rubber plantations, oil palm plantations, urban or other uses.

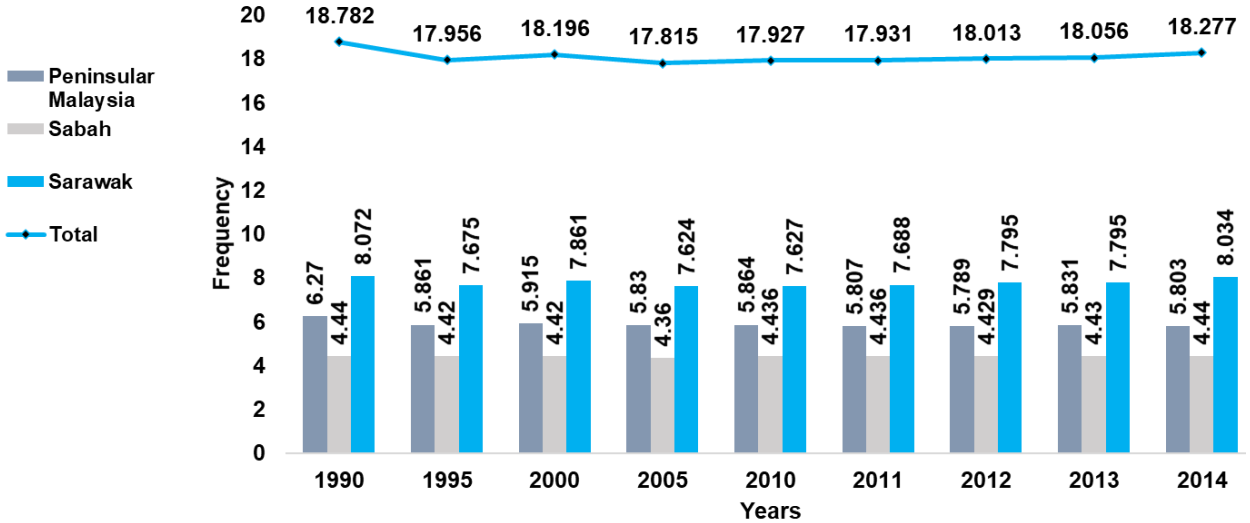


Figure 24: Total forested area in Malaysia (million hectares)

Malaysia is considered one of the world’s mega-diverse countries (Table 7). Malaysia’s terrestrial biodiversity is concentrated within its tropical rainforests that extend from coastal plains to mountain areas, including inland waters such as lakes and rivers. Marine biodiversity is found among islands and coastal ecosystems, especially in coral reefs and sea grasses. Agricultural biodiversity is supported in plantations, rice fields, fruit orchards, and farms.

Table 7: Summary of Malaysia's overall biodiversity richness

Group	Estimated Species
Mammals	306
Birds	742
Reptiles	567
Amphibians	242
Marine Fishes	1619
Freshwater Fishes	449
Invertebrates	150,000
Vascular Plants	15,000
Fungi	4,000
Mosses	552
Hard Coral	612

Forest health is affected by prolonged dry spells and associated temperature rise, especially during El Niño, where increased mortality and reduced growth rates are observed. However, there is no evidence of species composition changes to the montane areas in Peninsular Malaysia under the changing climate. Malaysia's mangrove forests may be especially susceptible to sea-level rise and salt-water intrusion.

### 3.1.4 Energy and emissions<sup>22</sup>

Primary energy supply and energy demand in Malaysia grew in tandem with population and economic growth. In 2015, natural gas contributed 44%, crude oil and petroleum products contributed 33%, coal and coke contributed 19%, hydropower contributed 4% to the primary energy supply.

The emissions for the energy sector increased at an average rate of 5.8% per year from 1990-2014. The highest emissions were from the energy industries with an average annual growth rate of 7.7%, followed by the transport sector with an average annual growth rate of 6.4%. The drop in emissions from the manufacturing industry and construction from 2008 onwards is due to the sector's shift from coal fuel consumption to electricity consumption and an increase in energy efficiency usage of the sector. Fugitive emissions from the oil and gas industries also grew at an average of 6% per year from 1990 to 2014. However, the emissions growth rate has slowed to nearly zero since 2012 (Figure 25).

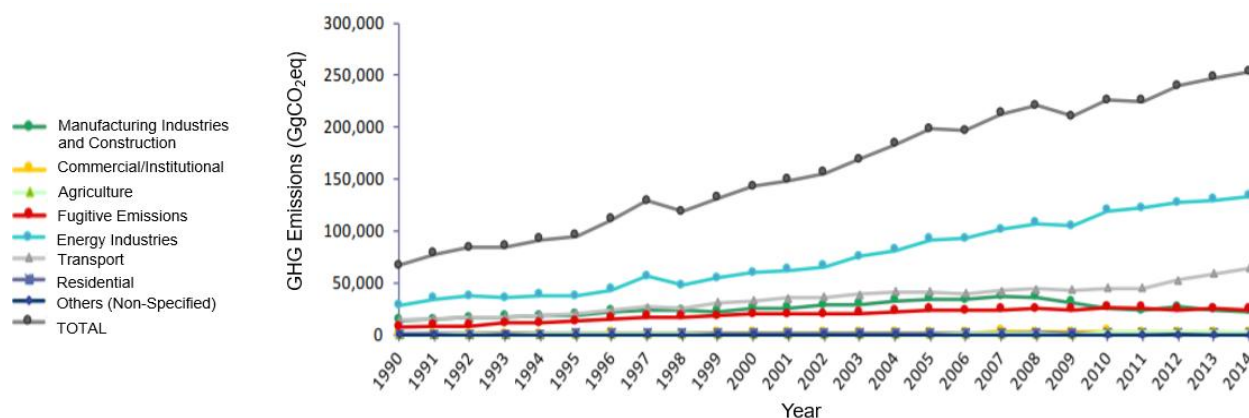


Figure 25: Emissions time series from 1990 to 2014 for the Malaysian energy sector

## 3.2 Current and projected impacts of climate change in Malaysia

Malaysia has been exposed to climate change such as altered rainfall patterns, rising temperatures and life-threatening weather conditions. As surface mean temperatures continue to rise, the country is expected to experience increasingly unpredictable weather systems. This, in addition to challenges associated with changes in land use and land cover, urbanisation, environment, and air quality degradation, is expected to increasingly impact agriculture and food security, safe water supplies, public health and the delivery of essential social services.

### 3.2.1 Natural disasters

The major types of natural disasters occurring in Malaysia include landslides, earthquakes, droughts, storms, wildfires, and floods. Extreme weather events in Malaysia include high temperature, high rainfall, dry spells, thunderstorms, and strong winds. The increased incidences of floods, landslides, mudslides, tropical storms, and other weather-related events in Malaysia can be linked to the increasing rainfall intensity.

While total rainfall varies between the monsoon seasons, the intensity and frequency of extreme rainfall events have increased for both seasons over the years. This has caused the increased frequency of flooding events over the years, among other natural disasters, as seen in Figure 26. In addition to further exacerbating floods, rising sea levels and temperatures are also causing food and water shortages in Malaysia.

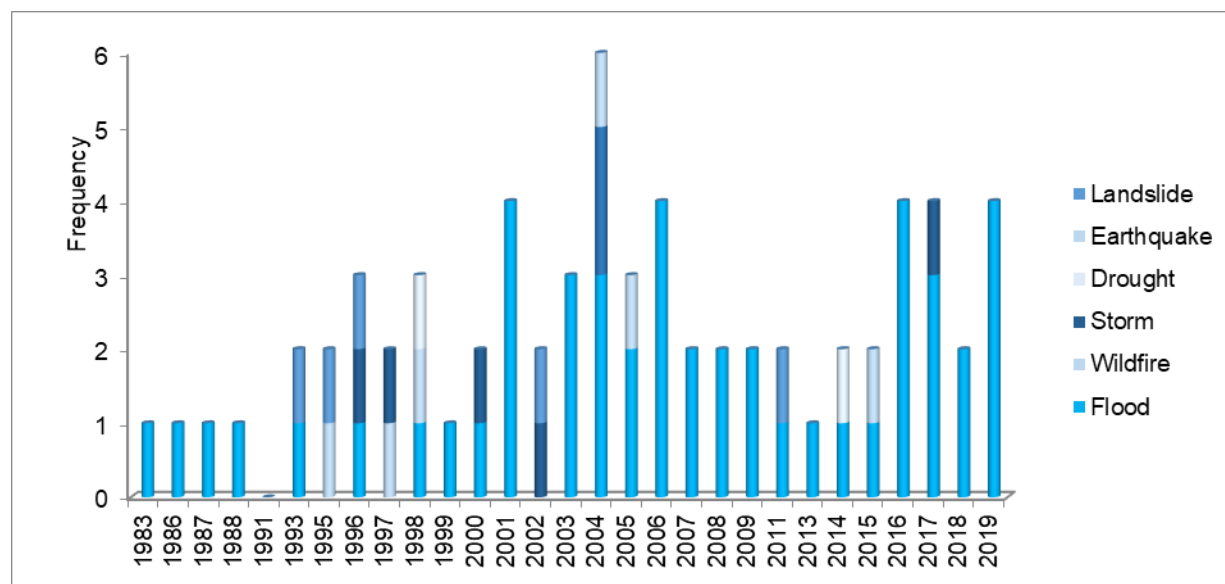


Figure 26: Natural disasters in Malaysia, 1980 to 2019<sup>23</sup>

In 2019, there were 10,529 people in Malaysia affected by disasters. This included nine deaths, 5,906 people injured or ill, 4,414 people with damaged dwellings, and 209 with disrupted or destroyed livelihoods<sup>24</sup>. Four people were missing due to disasters in 2017. As a whole, there are 32.3 people affected by disasters per 100,000 population<sup>25</sup>. However, there is no disaggregated data showing the number of children affected. Furthermore, the number of people indirectly impacted by disasters may be higher, but data on this is not available.

Several notable disaster risk reduction initiatives that the Government of Malaysia has carried out under the 10<sup>th</sup> Malaysia Plan 2011-2015 include the development of 34 flood hazard maps, the implementation of 194 flood mitigation projects that have shielded nearly one million people from floods, and the rehabilitation of 24.4 km of coastal areas in Johor, Kelantan, Pulau Pinang, Sabah, Sarawak, Selangor, and Terengganu to reduce erosion risk. Under the 11<sup>th</sup> Malaysia plan 2016-2020, Malaysia has placed green emphasis on strengthening resilience against climate change and natural disasters (SDG Indicator 13.1.2). All local governments have adopted and implemented local disaster risk reduction strategies in line with national initiatives (SDG Indicator 13.1.3).

Post-disaster and crop damage social protection and relief services are provided by the Malaysian Department of Social Welfare. Services provided include (1) the provision and management of the centre for relief or evacuation and forward supply base, (2) the supply and distribution of assistance such as food, clothing, and other essential items, (3) the registration of disaster victims for rehabilitation purposes, and (4) the provision of post-disaster counselling services. Emergency financial assistance is also provided to families or individuals, with the amount of benefit paid dependent on an assessment of the damage. The formal system of social protection is supplemented by religious-based schemes, for example, the Muslim Zakat system, which also provides for those affected by natural disasters.

### 3.2.2 Heatwaves, dry and wet spells

In Malaysia, the daily mean temperature range is between 26°C and 28°C. In the lowlands, temperatures range between 22.5°C during the night and 33°C during the daytime. Malaysia is blessed with high rainfall of between 2,000 mm to 4,000 mm annually. An increased rainfall ratio in the wet to dry seasons has been observed from 1955 to 2005.

Our Desk Study 1 on the changes of climatic indices in two study locations in Malaysia found that climate change impacts both the current scenario and future projections of the frequency of heatwaves and dry and wet spells there. There has been lengthened durations of wet spells and shortened dry spells over time in these locations. **In the future, wet spells are projected to become longer under the higher emission scenario. Dry spells are projected to become shorter under both the lower and higher projection scenarios** (Figure 46 and Figure 47 in Annexe 2).

In both locations, heatwaves have become more frequent, intense, and longer in the 2000s. Duration and magnitude, in particular, were found to be linked to greenhouse gas concentration pathways. **It is projected that there will be a continual increment of heatwaves in terms of occurrence, duration, and magnitude.** In the higher emission scenario, the duration and magnitude of heatwaves are expected to increase.

While climate change impacts are notable in the higher and lower emission scenarios examined, these impacts were generally less severe under the lower emission scenario. Therefore, it is important to maintain our pathway towards a lower greenhouse gas concentration pathway throughout the 21<sup>st</sup> century to manage these impacts better.

### 3.3 State of the children in Malaysia

The Child Act 2001 in Malaysia defines a child as a person under the age of 18. In 2019, the total number of children under 18 years old in Malaysia was about 9.3 million, with 4.8 million males and 4.5 million females. Figure 27 shows the distribution of children in Malaysia for 2019. The number of non-citizen children was 497,800, representing 1.53% of the total population and 15.53% of non-citizens in Malaysia.

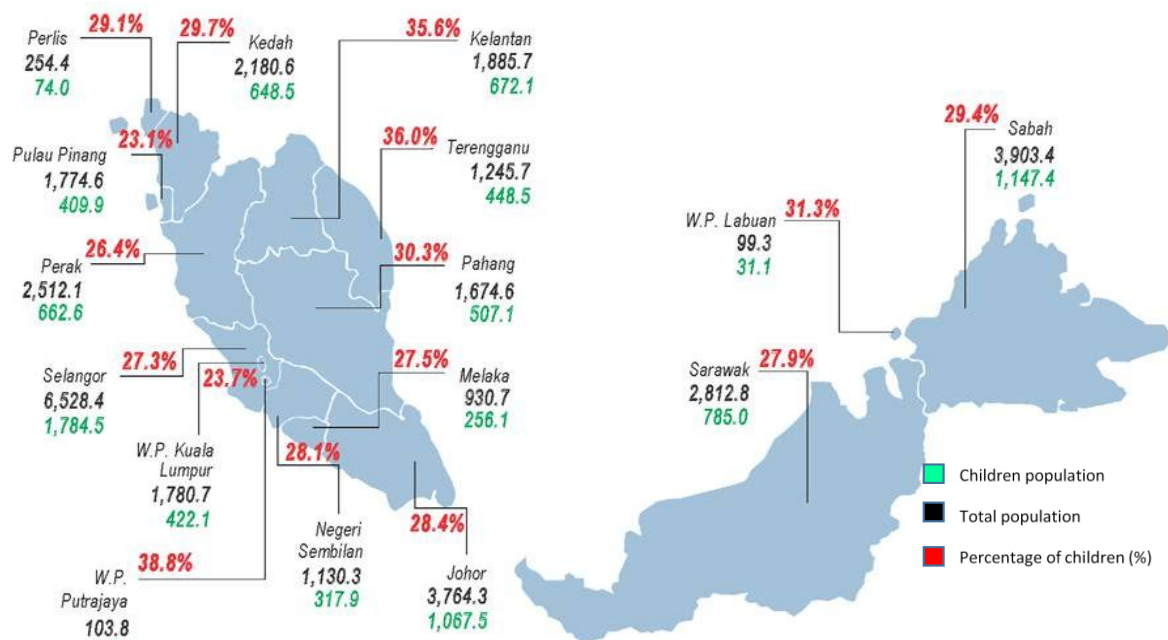


Figure 27: Distribution of children among the Malaysian population<sup>26</sup>

#### 3.3.1 SDG 1: No Poverty



Child poverty is a vital indicator of a child's well-being. Children growing up in poverty generally suffer poor health outcomes, including infant mortality, low birth weight, obesity, injuries, mental health issues, and increased communicable and non-communicable diseases. Poverty can also be linked to death due to malnutrition and acute diseases. Poverty does not only affect childhood health but persists to adulthood.

In Malaysia, poverty is measured by the Poverty Line Index, which considers minimum household expenditure related to food, clothing, footwear and other non-food items. The World Bank<sup>27</sup> ranks all countries based on poverty headcount ratio at national poverty lines. In this ranking, Malaysia is ranked in the top 10, meaning that it has among the smallest percentage of people falling below the Poverty Line Index. However, poverty rates are higher among certain vulnerable groups due to various societal and geographical conditions. In Table 8, it can be seen that there are considerable variations between states. While the states of Sabah and Sarawak have the highest poverty rates, residents in Kuala Lumpur and Putrajaya have the highest income per capita in Malaysia. Relative poverty in Malaysia, or the share of individuals

living in households with income below half of the household-size-adjusted median income, stands at 16.9%.

*Table 8: Poverty indicators for Malaysia, 2019<sup>28</sup>*

POVERTY INDICATORS	PENINSULAR MALAYSIA	SABAH/LABUAN	SARAWAK	MALAYSIA
Incidence of Poverty (%)	4.4	19.5	9	5.6
Poor Households	249,407	99,869	56,165	405,441
Mean Poverty Line Index (RM monthly)	2,226	2,537	2,131	2,208

Poverty affects children's school performance and nutritional status. These children may also be especially vulnerable to pandemics like COVID-19 (data reflected in the table above represent pre-COVID-19 conditions). Malaysia's child poverty rate for 2017 was 15%, about three times higher than the national rate<sup>29</sup>. Urban child poverty is an issue as well. For example, it was found that 20% of children living in Citizen's Housing Projects received inadequate education, healthcare, access to services, and materials<sup>30</sup>.

### 3.3.2 SDG 2: Zero Hunger



One of the critical factors for the healthy development of children is their nutritional status. Many studies have shown that poor nutritional status during childhood will increase the risk of contracting various chronic diseases when they become adults.

The FAO has defined nutritional status as the 'physiological state of an individual, which results from the relationship between nutrient intake and requirements and the body's ability to digest, absorb, and use these nutrients'. Malnutrition among children can result from an inadequate intake of nutrients for energy and cause underweight and stunting issues. In contrast, overnutrition will cause overweight and obesity.

Recent studies on children's nutritional status in Malaysia<sup>31</sup> indicate a higher prevalence of overnutrition (overweight and obesity) among children in Malaysia than thinness. A 2019 UNICEF study<sup>32</sup> found that 12.7% of Malaysian children aged between five and 19 are obese. While thinness is more prevalent among boys than girls, there is a higher prevalence of overweight among girls and obesity among boys. This distribution is similar among children living in urban and rural areas. There is a generally low prevalence of stunting and wasting among children in Malaysia. However, these issues were more prevalent among younger children (the UNICEF study found that 20.7% of children under five suffer from stunting, and 11.5% suffer from wasting). Stunting was more common in children living in rural areas.

In terms of nutrient intake status, children in Malaysia did not achieve the Malaysian Recommended Nutrient Intakes for Vitamin D (of greatest concern), Calcium, and Vitamin E. There was a low level of anaemia, iron, and Vitamin A deficiency among children in Malaysia.



While malnutrition, nutritional insufficiency, and overnutrition coexist across the population, overnutrition is the most prevalent issue. However, both issues of overnutrition and undernutrition among children in Malaysia should receive urgent attention.

### 3.3.3 SDG 3: Good Health and Well-Being



The WHO defined health literacy as the cognitive and social skills that determine an individuals' motivation and ability to gain access to, understand, and use information in ways that promote and maintain good health. Health literacy is vital for achieving the internationally agreed health and development goals and facing emerging threats such as the current pandemic, climate change, and non-communicable diseases. It is crucial for healthy development and good health-related decision-making among children.

Malaysia's current health education syllabus consists of 75% on reproductive and social health, 15% on diet and nutrition, and 10% on first aid<sup>33</sup>. However, the syllabus has several issues, including repetitive topics at all levels and a lack of revision based on current health issues.

### 3.3.4 SDG 4: Quality Education



#### 3.3.4.1 Education

Education forms the basis for a child's future. There is a positive correlation between education level and lifetime earnings, better job opportunities, and community recognition. The World Economic Forum has ranked Malaysia as 19<sup>th</sup> in the world for pupil-to-teacher ratio in primary education, higher than developed countries like the United Kingdom, France, and Japan. In 2019, Malaysia invested 20% of its entire budget for education, accounting for RM 60.2 billion.

Section 15 of the Education Act 1996 (Act 550) states that the national education system covers preschool until higher education. In Malaysia, preschool begins at the age of four, followed by compulsory primary education for children turning seven years old on 1<sup>st</sup> January or later of the current school year. Then, the students proceed to lower secondary education (Forms 1 to 3) and upper secondary education (Forms 4 to 5). After that, education continues with either 18 months of post-secondary education (Form 6) leading to a certificate or a one- or two-year matriculation programme, a preparatory year for university entrance. The government provides free education to all children in Malaysia at government schools and government-aided schools.

Malaysia's enrolment levels are high and steadily increasing. The latest data from the Ministry of Education (MOE) shows an increase in the Gross Enrolment Rate across all levels of education from 2019 to 2020. However, there were some slight drops in certain categories in 2021 due to the COVID-19 pandemic. Preschool enrolment increased from 96.35% in 2018 to 96.75% in 2019 but dropped slightly to 94.55% in 2020 (SDG Indicator 4.2.1). Primary school enrolment steadily increased from 97.81% in 2018 to 98.23% in 2020. Secondary enrolment increased from 91.53% in 2018 to 92.52% in 2019 but dropped slightly to 92.37% in 2020. Student dropouts reduced from 0.12% to 0.10% for primary schools and from 1.14% to 1.13% for secondary schools between 2019 and 2020. 2018 data show an almost equal proportion of male and female enrolments at the primary level (Figure 28). In terms of the urban-rural split,

there are more schools in rural areas due to the more dispersed population. Hence, schools are built to service smaller populations in one rural area.

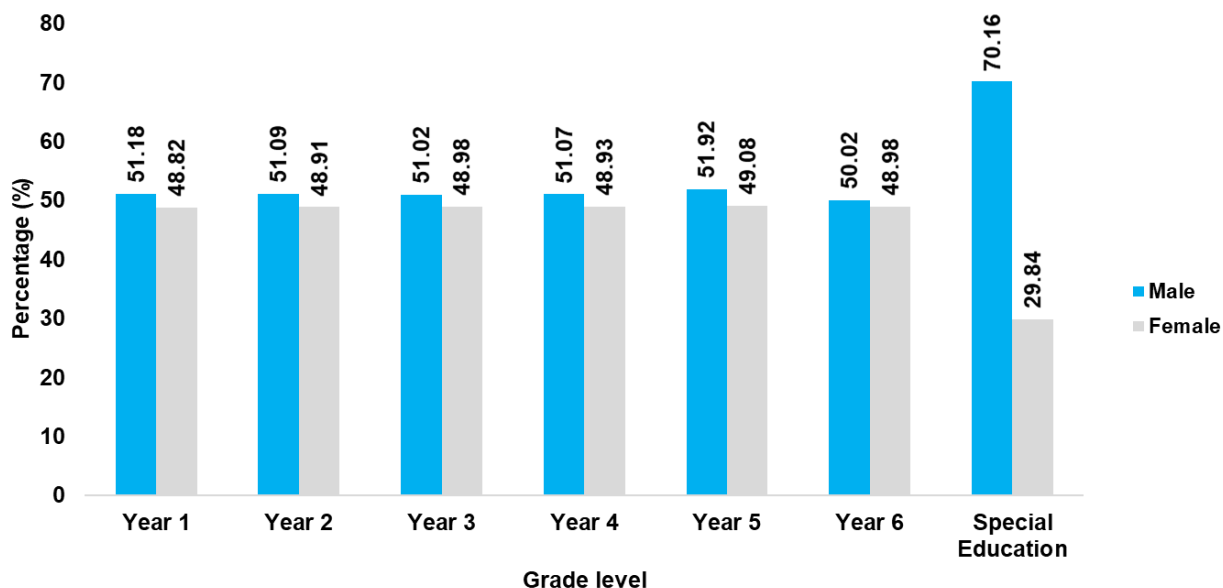


Figure 28: Percentage of enrolment by gender (2018)<sup>34</sup>

Malaysia continues to face challenges in ensuring a high quality of education for all children, including poverty, low importance placed on education, cultural and religious factors, schools far from home, lack of facilities for children with disabilities, and stigma towards the marginalised. For example, a higher proportion of male students enrolled in special education schools, which show that girls with disabilities may not receive the same opportunities as their male counterparts. There are also more special education schools in urban areas than rural areas, reflecting reduced educational opportunities for rural children with disabilities (Table 9).

Table 9: Number of schools in urban and rural areas<sup>35</sup>

Type of schools	2016			2017			2018		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
National	1,416	4,461	5,877	1,331	4,547	5,878	1,329	4,548	5,877
National Type (C)	515	782	1,297	502	769	1,298	503	795	1,298
National Type (T)	145	379	524	137	387	524	137	387	524
Special Education	20	8	28	20	8	28	20	8	28
Special Model (K9)	0	7	7	0	8	8	0	8	8
Government Aided	16	20	36	15	25	40	15	26	41
Religious School (GARS)									
<b>TOTAL</b>	<b>2,112</b>	<b>5,657</b>	<b>7,769</b>	<b>2,005</b>	<b>5,771</b>	<b>7,776</b>	<b>2,004</b>	<b>5,772</b>	<b>7,776</b>

### 3.3.4.2 Literacy

Students should master literacy skills in order to succeed. Students with poor literacy skills will struggle not only in school but also throughout life. Given the importance of literacy and its relationship to academic achievement, it is important to ensure that students master these skills during their early school years.

Malaysia enjoys high literacy rates, and this rate continues to increase, as seen in Table 10. Overall in Malaysia, UNESCO reports that youth literacy has risen from 88% in 1980 to near-universal literacy at 99% today, while adult literacy has increased even more dramatically, from less than 70% to over 92% in the same time frame. However, the proportion of children and young people at the end of lower secondary achieving at least a minimum proficiency level in reading decreased from 79.5% in 2016 to 78.3%. The minimum proficiency level in mathematics decreased from 47.1% in 2016 to 42.3% in 2018 in Malaysia (SDG Indicator 4.1.1).

*Table 10: Literacy rates in Malaysia<sup>36</sup>*

Literacy Rate(%) by Age Group	2016			2017			2018		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<b>Age 10+</b>	97.50	94.60	96.0	97.79	94.80	96.30	97.60	94.90	96.30
<b>Adult (Age 15+)</b>	97.20	94.00	95.60	97.50	94.20	95.90	97.40	94.40	95.90
<b>Youth (Age 15-24)</b>	99.20	99.40	99.30	99.00	99.20	99.10	99.00	99.30	99.10

## 4 IMPACTS OF CLIMATE CHANGE, POLLUTION AND DEGRADATION

In Malaysia, some of the most pressing climate and environmental risks to children are deteriorating air quality and seasonal haze events, the increasing frequency and intensity of floods and related water-borne diseases, the increasing range of vector-borne diseases with climate change, and the heightened risk of exposure to hazardous substances and other waste.

### 4.1 Impacts on children's health and well-being in Malaysia

The impact of climate change on health is a great concern in Malaysia, especially in light of the emergence and increase of climate-related food-, water-, and vector-borne diseases. Cholera, typhoid, hepatitis A, malaria, dengue and chikungunya are examples of climate-sensitive diseases prevalent in Malaysia. Major weather events can contribute to the outbreak of these diseases due to contamination of the water supply, inappropriate sewage disposal, and unhygienic personal and environmental conditions. The number of people requiring interventions against neglected tropical diseases<sup>37</sup> was 80,797 in 2018<sup>38</sup>.

#### 4.1.1 Water-borne diseases linked to floods

Contaminated water is a major cause of malnutrition and diarrhoeal disease among children, a leading cause of death in children under five years old worldwide. Typhoid fever, cholera, dysentery, and hepatitis A are major water-borne diseases in Malaysia. Encouragingly, Malaysia has reduced water-borne diseases by more than 8% between 1990 and 2012 through improved treated water and sanitation facilities<sup>39</sup>.

Floods are common in Malaysia as the monsoon season causes heavy and regular downpours from October to March. However, increasing sea levels<sup>40</sup>, temperatures, and precipitation are causing more floods within and outside traditional monsoon seasons. Most notably, Malaysia has seen a significant increase in the number of extreme flood events since 2000. From 1980 to 2019, 900,000 people were affected by flood events in Malaysia, including 231 deaths<sup>41</sup>. Children are at a particularly higher risk of injury and death during floods; however, exact data on children affected by floods was unavailable for Malaysia. Flooding can compromise clean water supply, decreasing water quality and quantity. The mobilisation of environmental pollutants from the soil in agricultural sites and other contaminated areas due to floods will increase the risk of contamination of persistent environmental pollutants in water bodies. In Malaysia, droughts and floods have been linked to increased water pollution and pesticides in food. Floods can also contribute to inappropriate sewage disposal, food shortages, and unhygienic personal and environmental conditions.

In developing countries, people who live in flood-prone areas are especially exposed to threats of infections. Such disruptions in human conditions, pathogen ecosystems, and the environment can facilitate the occurrence and spread of diseases. Diseases such as cholera, skin conditions, diarrhoeal disease and leptospirosis are often present after floods. In Malaysia, increases in leptospirosis and typhoid fever have been recorded after major flood events. Both the adaptation and mitigation aspects of increased flooding incidents should be prioritised to protect particularly vulnerable groups, such as children and the elderly (Figure 29).



Figure 29: Children are especially vulnerable in flood conditions<sup>42</sup>

#### 4.1.2 Vector-borne diseases like malaria and dengue

The increasing range of vectors due to climate change and the increasing number of breeding sites for disease vectors due to floods, droughts, and storms can increase the risk of health problems among children. Malaria and dengue are examples of climate-sensitive diseases. In Malaysia, malaria is a rural disease with very low incidence rates in the population but has not been completely eradicated (SDG Indicator 3.3.3). For example, our case studies in Pulau Gaya and Sungai Siput reported isolated malaria cases in the community.

Dengue, in turn, is an urban disease that particularly affects children and young adults between 10 and 30 years. Dengue has been endemic to Malaysia since the 1980s. Malaysia is on the WHO list of Southeast Asian and Western Pacific regions with many reported dengue incidences. In 2016, 328 per 100,00 population contracted dengue in Malaysia, showing a slight decline after rates doubled between 2009 and 2014<sup>43</sup>. In 2013, 450,000 children under four and another 500,000 children 15 years and below contracted dengue (Figure 30). In 2013 and 2014, children made up one in ten cases of fatal dengue in Malaysia<sup>44</sup>.

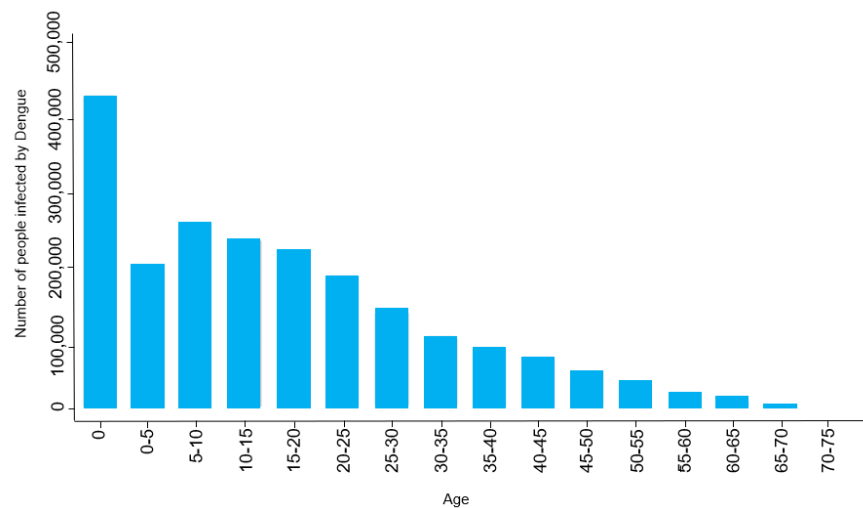


Figure 30: Number of people infected by dengue in Malaysia (2013) by age<sup>45</sup>

*Aedes aegypti* and *Aedes albopictus*, which transmit dengue, are very sensitive to environmental conditions. Climate change, such as increased temperatures, humidity, and rainfall frequency for the last four decades, has increased dengue transmission in Malaysia<sup>46</sup>. The mosquito can reach maturity rapidly in warmer conditions compared to colder conditions. While rains accumulate water for mosquitoes breeding sites, humidity influences the evaporation rates for these sites.

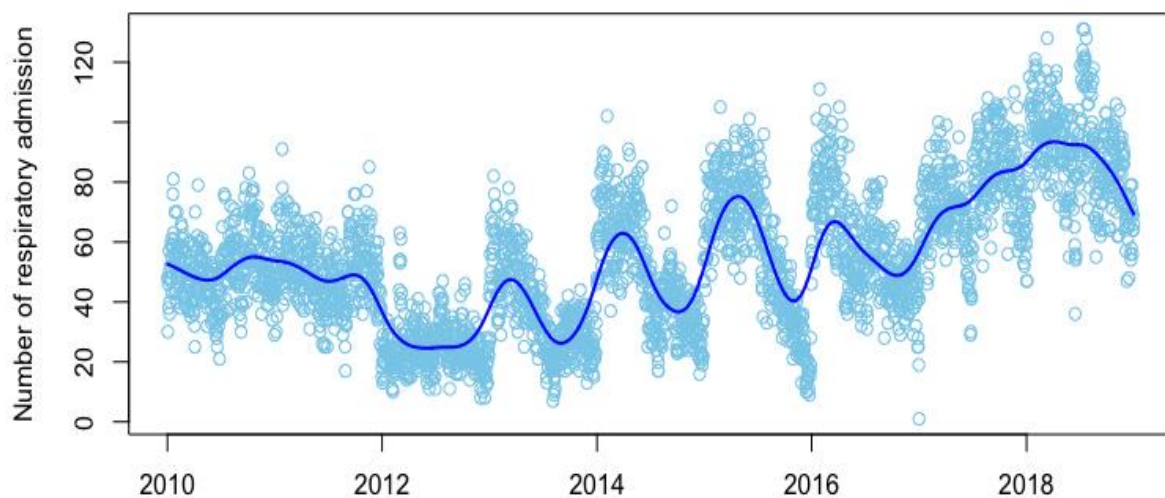
There needs to be an increased acknowledgement of the link between dengue and climate change. Climate change mitigation and adaptation can drastically slow down the transmission of vector-borne diseases, like dengue, in the long term.

#### 4.1.3 Health problems linked to air pollution

Children are highly sensitive to air pollution because they breathe more rapidly than adults. Hence, they take in a relatively higher proportion of pollutants when adjusting for body weight. Besides that, their lungs, brains, physical defences, and immune systems are not fully developed, making them more susceptible to pollutants. Health effects of air pollution among children are manifested through respiratory diseases such as asthma, bronchitis, and severe respiratory distress.

Exposure to air pollution during infancy and early childhood increases the risk of lung damage and impairs lung growth, leading to asthma, pneumonia, and chronic obstructive pulmonary disease. Among children aged zero to 14 years, 85% of global mortality related to air pollution were the younger children below five. This amounted to 5.3 million deaths<sup>47</sup>.

Our team's systematic review (Desk Study 2) also found **that short-term exposure to ambient air pollution is associated with increases in childhood respiratory morbidity and mortality in Asia's LMICs**, including Malaysia (Figure 31 below and Table 15 and Figure 48 in Annexe 2). Our Desk Study 3 provided evidence that **short-term exposure to ambient air pollution increases the risk of hospitalisation for respiratory diseases in children**, with children aged five to nine years being more vulnerable to ambient air pollution.



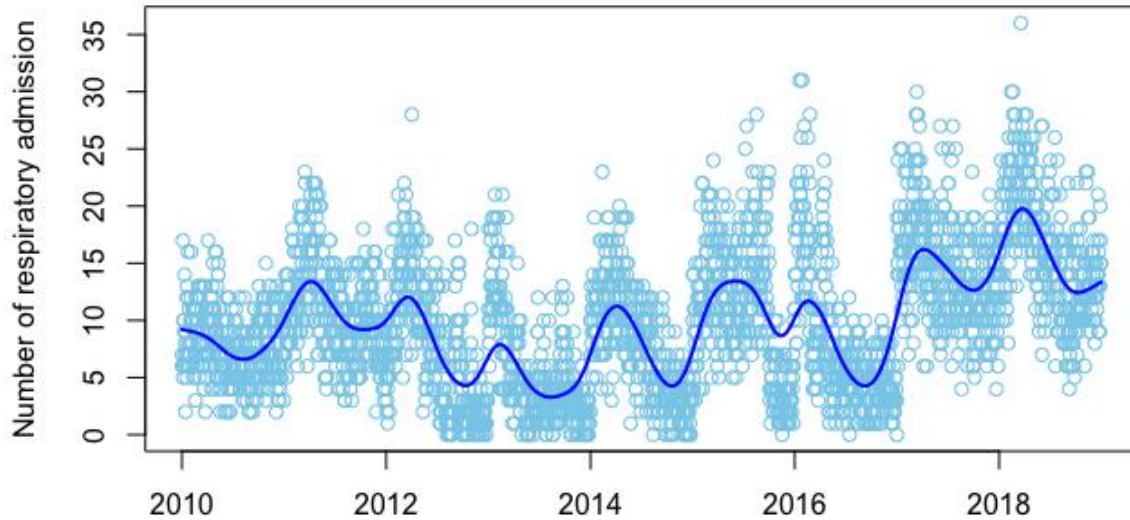


Figure 31: Daily count of hospital admissions for respiratory diseases and smoothed trend in Klang Valley (previous page) and Kuching (this page), 2010-2018

Certain components of air pollutants may indirectly reduce the availability of sunlight to children. In Malaysia, high air pollution levels contribute to the higher prevalence of Vitamin D insufficiency in children living in urban areas. High levels of air pollution and increasing temperatures may contribute to parents or children preferring to stay indoors instead of engaging in outdoor activities.

Air pollution can also have a severe impact on a child's developing brain. Ultrafine particulate matter (PM<sub>2.5</sub> and smaller) can easily enter the bloodstream and cause neuro-inflammation by damaging the blood-brain barrier. Magnetite particles, especially common in urban air pollution, are highly toxic to the brain due to their magnetic charge and ability to create oxidative stress, often the cause of neurodegenerative diseases. Polycyclic aromatic hydrocarbons, which are common in places of high automobile traffic, contribute to a loss of or damage to white matter. This can affect the ability of a developing child's neurons to communicate across different parts of the brain and impact the child's learning and development (Figure 32)<sup>48</sup>.

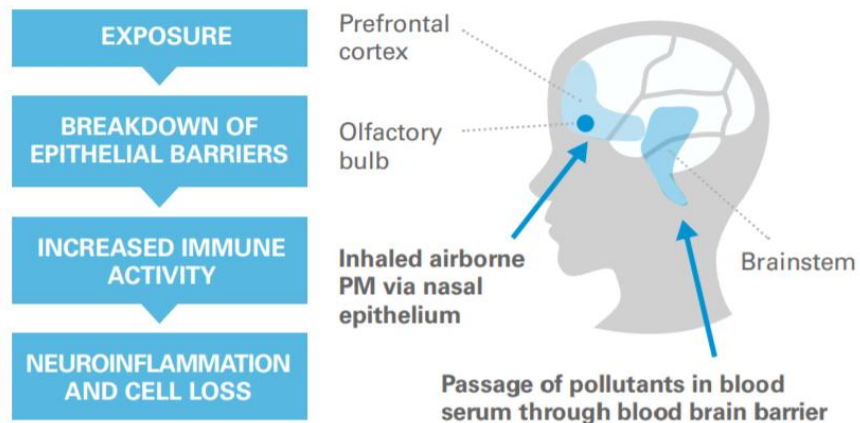


Figure 32: Possible channels through which air pollution may affect the brain<sup>49</sup>

#### 4.1.3.1 Haze pollution and children

In Malaysia, air pollution events called ‘haze’ have been common (Figure 33), especially during intensified dry weather induced by the El-Niño phenomenon. Haze events are associated with increased mortality and hospital admissions, especially for respiratory outcomes.



*Figure 33: Reduced visibility in Kuala Lumpur during 2013 haze air pollution<sup>50</sup>*

From 2005 to 2009, a 31% increase in hospital inpatient cases due to haze-related illnesses was recorded compared to normal days in Malaysia<sup>51</sup>. Haze events have also been associated with a 19% excess risk of respiratory deaths for all ages and 41% excess risk of natural deaths for children less than 14 years old in Malaysia from 2000 to 2007<sup>52</sup>. Our team’s Desk Study 4 concluded that **health effects among young children below five years old could be more acute when haze occurred for a longer duration and higher intensity.**

During severe haze episodes, schools are closed, which disrupt the children’s education and well-being. For example, in September 2019, nearly 2,500 schools were closed across Malaysia, affecting at least 1.7 million pupils as the Air Pollution Index deteriorated to ‘very unhealthy’ (201–300) levels<sup>53</sup>. While data on loss of earnings from disrupted education in the haze context is not available, other studies from disasters worldwide have shown that there can be considerable loss of earnings resulting from disaster-related education disruptions<sup>54</sup>.

Haze-producing forest and land fires have been linked not only to climate change but also to human factors like deforestation and agricultural expansion, mainly in neighbouring countries and to a lesser extent in Malaysia<sup>55</sup>. Hence, haze mitigation should be a priority issue to combat not only from the climate front but also by modifying economy-driven human behaviours related to land-use change and fires.



#### 4.1.4 Health risks from exposure to chemicals, hazardous substances, and waste

Children are far more sensitive than adults to toxic chemicals in the environment, not only by virtue of their young age but also by their frequent exposure to outdoor activities while at play. Furthermore, during schooling hours, children spend a lot of time in crowded and closed classrooms. This increases the risk of children being exposed to more pollutants than adults. Some of these pollutants are more concentrated at ground level, which means that children, generally shorter than adults, would breathe in higher concentrations of these pollutants.

Persistent organic pollutants that are highly stable and transported over long distances are extremely hazardous to children due to their ability to accumulate in fatty tissues and become biomagnified in the food chain. Pesticides, polychlorinated biphenyls and dioxins are chemicals of special concern. Due to their bio-persistence, children remain actively exposed to dioxins and polychlorinated-biphenols when present in food and breast milk (Figure 34).

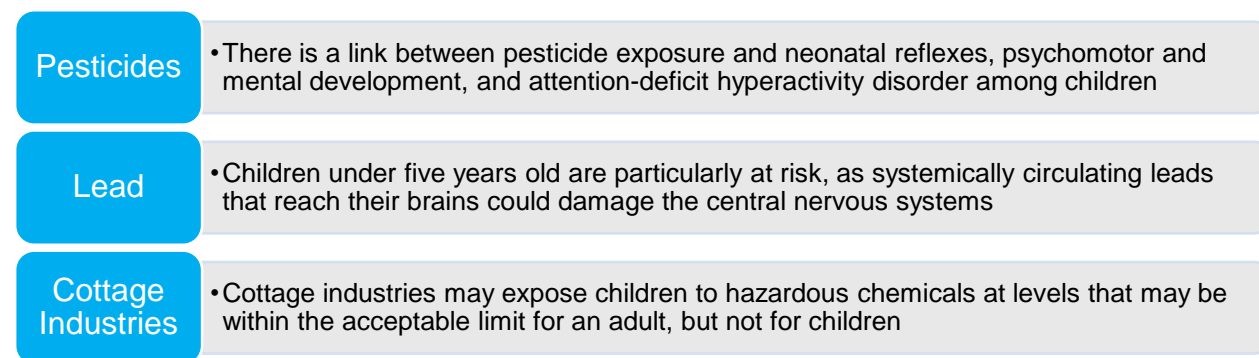


Figure 34: Persistent organic pollutants that are particularly hazardous to children

##### 4.1.4.1 Illegal dumping of hazardous wastes and children

Hazardous waste management has been a long-standing issue in Malaysia. Despite existing regulations and policies on scheduled waste management policies, illegal dumping of hazardous waste still occurs in the country. The Straits of Johor has been categorised as a hotspot for metal contamination due to anthropogenic activities, including illegal dumping, shipping, and coastal development.

In 2019, a tanker lorry from an illegal tyre recycling factory dumped some 2.43 tonnes of chemical waste containing benzene, acrolein, acrylonitrile, hydrogen chloride methane, toluene, xylene, ethylbenzene and d-limonene into the Kim Kim River under a bridge in Kota Masai, Johor. Students from nearby schools experienced difficulty breathing, coughing, nausea, eye and throat irritation, and vomiting after inhaling unpleasant odours in their school compound (Figure 35). Ultimately, more than 4,000 people (most of them children) were treated for exposure to hazardous chemicals, and all 111 schools in the area were ordered to be closed<sup>56</sup>. The victims were found to have been exposed to various chemicals, which can cause a range of short- and long-term effects, ranging from mild to severe, including cancer risks (Table 16 in Annexe 2).



Figure 35: Location and effects of the Kim Kim River pollution incident in Johor<sup>57</sup>

Poor industry compliance in abiding with health- and environmental-related legislation and poor enforcement by related agencies have exposed children to hazardous industrial waste multiple times in Malaysia. Hence, illegal dumping of hazardous wastes should be a priority issue for Malaysia to address in ensuring the safety of children in Malaysia.

#### 4.2 Climate and environmental risks among marginalised children

Marginalised children are defined as children outside and peripheralised from the mainstream group or centre of society. They have little control of their lives, little available resources, and are subject to stigmatisation with negative public attitudes.

Marginalised children in Malaysia include street children, children living near waste disposal areas, and children with single parents or no parents. In Malaysia, the estimate for marginalised children under 18 years old stands at approximately 290,000 in 2016<sup>58</sup>. These include children unregistered at birth, adopted or abandoned, have parents who did not register their marriage or are part of marginalised communities like indigenous people, refugees, stateless people, or undocumented migrants. The issues surrounding marginalised children are unique due to proxy decision making, ethical dilemmas on consent, confidentiality and right of autonomy. Besides being denied access to education, being marginalised can affect a child's development and well-being, healthcare, and other services.

Marginalised children have limited adaptive capacity and are more likely to be affected by climate change. For example, flood and drought zones often overlap with areas experiencing high poverty and poor access to important services such as water and sanitation. The low quality and availability of drinking water, lack of access to adequate sanitary facilities, poor hygiene practices, outdoor and indoor air pollution, vector-borne diseases, and chemical hazards are the primary environmental hazards related to climate change that can affect these children's health.

In marginalised communities, children's exposure to climate and environment-related risks are further exacerbated by poverty, illiteracy, and limited access to information. The likelihood of such underprivileged communities being most affected is high due to their social and economic

conditions (e.g. having a high dependence on ecosystem goods), lack of access to health services, and geographical locations (such as islands, disaster-prone areas, slums, or informal settlements).

For example, marginalised children from refugee, migrant, and asylum-seeker families in Malaysia do not have access to basic services, including free healthcare. Their limited health literacy and the language barrier often mean that they may not seek healthcare as they are unaware of their healthcare options and fear getting caught by the authorities. Marginalised children raised in these conditions may suffer huge impacts on their physical, emotional, and social well-being. They are also more likely to suffer from health problems caused by environmental issues such as access to water and sanitation.

#### 4.2.1 Vulnerability of marginalised children around Malaysia

UNICEF's social policy defines multidimensional poverty as 'measures of poverty and deprivation that go beyond income, including things like the lack of necessities as basic as nutrition or clean water'<sup>59</sup>. Vulnerability is defined as 'characteristics and circumstances of a person, community, system, or asset that make it susceptible to the effects of climate change and other hazards'<sup>60</sup>. Our team conducted case studies in three areas in Malaysia with a high population of children that can be considered marginalised and suffering from multidimensional poverty to identify how these children are particularly vulnerable to the impacts of climate change. The vulnerability of these children towards climate change and environmental degradation are different for each region or area.

The environment and climate in the mountainous, forested terrain of Pos Kuala Mu, Sungai Siput have experienced significant changes over time. The community mainly associates these changes with increased logging and tourism in the area. Fewer trees were linked to an increase in landslides and floods. Furthermore, the extraction of logs via rivers is linked to increased river pollution and clean water availability. Furthermore, the community has also noticed broader changes in climate patterns, for example, changes in the regularity, timing, and duration of hot and rainy seasons.

In Pulau Gaya, Sabah, residents are feeling the effects of climate change through the increased frequency and intensity of destructive hurricanes. There is also the risk of slow-onset changes like seawater rise. Environmental pollution is also intensifying due to improper disposal of garbage, most of which are found floating around in the waters surrounding Pulau Gaya (Figure 36). Improper garbage disposal is contributing to environmental pollution in PPR Sungai Bonus too. Children here are also exposed to flash floods and urban microclimates, particularly the heat island phenomenon.



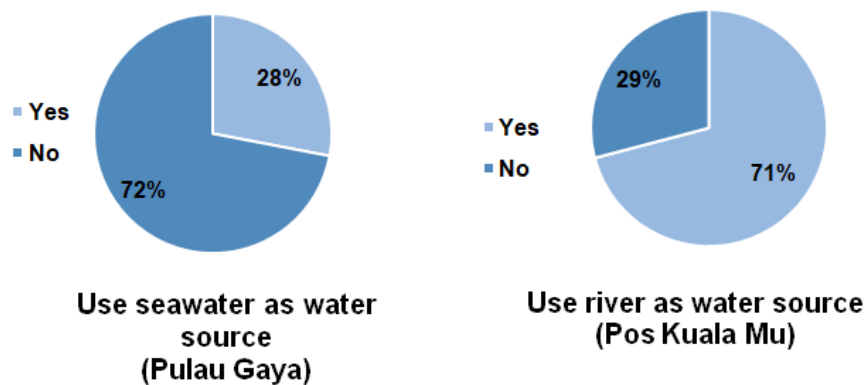
*Figure 36: Rubbish floating in the waters around Pulau Gaya*

The following discussion distils the findings of the three case studies into five major areas of concern for marginalised children in the face of climate and environmental risks in Malaysia.

#### *4.2.1.1 Susceptibility to infectious diseases*

While climate change, environmental pollution, and degradation increase the risk of infectious diseases, studies have shown that primary measures for infectious disease prevention include improving water, sanitation, and hygiene. However, our case studies have shown that personal hygiene awareness among the three marginalised communities is generally low.

The lack of clean water in Pulau Gaya and Pos Kuala Mu (Figure 37) has been linked to the increase of water-borne diseases. In Pulau Gaya and PPR Sungai Bonus, improper garbage disposal habits also increase the breeding sites for vector-borne diseases. All these factors have resulted in the increased vulnerability of these children to water-, food-, and vector-borne diseases in the face of a changing climate and environment.



*Figure 37: Source of water for the surveyed children in Pulau Gaya and Pos Kuala Mu*

In Pulau Gaya, less than half of the population surveyed had access to clean, running water. Hence, children there were especially susceptible to water-borne diseases such as diarrhoeal disease and vector-borne diseases like malaria. In Pos Kuala Mu, cases of malaria have been linked to stagnant water in wells. For PPR Sungai Bonus, dengue is a major concern linked to stagnant water collecting in improperly disposed of garbage, providing breeding sites for mosquitoes.

#### 4.2.1.2 Access to schools and education

Children's education can be considered a part of the children's adaptive capacity against the impacts of climate change and environmental degradation. Education can provide children with adequate knowledge and skills to cope with climate change and environmental degradation.

Our case studies have revealed that climate variability can affect children's education in terms of transportation and access. In Pulau Gaya and Pos Kuala Mu, teachers observed a decline in school attendance during the rainy season. In Pulau Gaya, parents were concerned about the safety of boat transport to school in the rough seas. In Pos Kuala Mu, most parents only had motorcycles (Figure 38), making it more difficult to send their children to school safely, often many kilometres away, using dangerous mountain roads in the rainy season. Children in Pos Kuala Mu also associated heavy rain with unsafe conditions due to possible landslides and raised river water levels, making crossing unsafe. The increasing intensity and frequency of severe rain and storm events will further aggravate this situation.

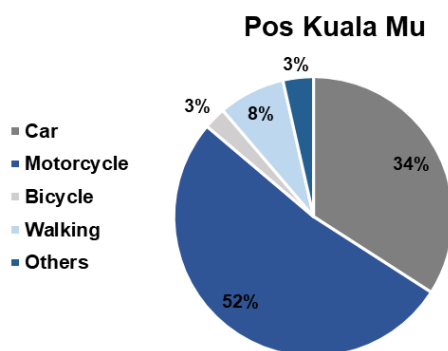


Figure 38: Mode of transportation to school among children surveyed in Pos Kuala Mu

Increasing drought events are also a concern to the quality of children's education. In Pulau Gaya, teachers reported that students were noticeably less attentive during the hot weather due to increased levels of discomfort.

#### 4.2.1.3 Access to basic services and supplies

The availability and accessibility of basic amenities are key for children's development. Sufficient access to these basic services and supplies are necessary to protect the children against climate change and environmental degradation impacts. Our case studies found that access to basic services and supplies are better the closer to the city. We found that families in PPR Sungai Bonus faced only minor issues with access to such facilities, even during hazardous climatic conditions.

Pulau Gaya and Pos Kuala Mu communities are far from basic services like health clinics and clean water supplies. Like access to schools, extreme climate events may hinder these communities' access to such services (Figure 39). Hurricanes and rainstorms in Pulau Gaya have prevented families from seeking medical aid on the mainland. Safety concerns also prevent Pos Kuala Mu residents from seeking medical attention at the closest health clinic 40 kilometres away during the rainy season. Landslides may even completely cut off the main road access to these facilities. Most notably, extreme weather prevents children who have health conditions that require regular treatment or checkups from continuing their appointments.

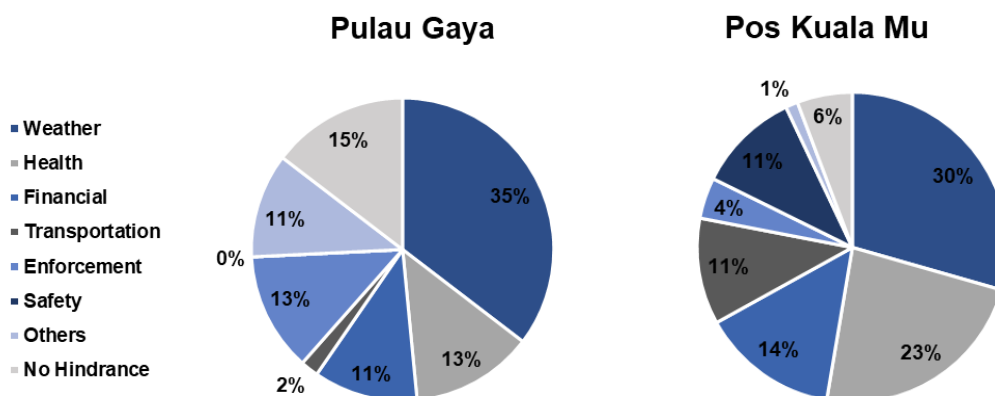


Figure 39: Factors preventing access to the nearest town in Pulau Gaya and Pos Kuala Mu

Climate variability can also affect water quality and accessibility for communities in Pulau Gaya and Pos Kuala Mu. In both communities, access to clean water is already limited under normal circumstances. In Pulau Gaya, extreme weather (either storm or drought) affects boat services selling freshwater from the mainland. During a drought, water scarcity increases its price leading to higher reliance on rainwater by residents. In Pos Kuala Mu, heavy rains affect the water quality and murkiness of the river, which is the primary source of water supply for residents. This reliance on non-tapped water in both locations increases the risk of water-borne diseases.

For communities in Pulau Gaya, the rainy season affect their food supply as they cannot go to the mainland regularly to purchase food, and they cannot go to the sea to fish.

#### 4.2.1.4 Family income instability

Income insecurity may have a snowball effect on the basic resources of the family, including access to basic amenities, especially residents with large household numbers. This, in turn, can affect the well-being of the children in the family. In general, our case studies found that families with a higher and more stable family income were less vulnerable to climate variations and environmental degradation.

Communities in Pulau Gaya and Pos Kuala Mu depend largely on climate-sensitive economic activities and economic activities that involve reliance on natural resources for their livelihood. In Pulau Gaya, the rainy season not only prevents fishermen from going out to sea. It also prevents residents who work on the mainland to make the trip to work. As communities on Pulau Gaya are land-poor, the option of shifting to subsistence farming is limited. In Pos Kuala

Mu, activities like rubber tapping and collecting forest produce become more difficult and dangerous during the rainy season. Even in PPR Sungai Bonus, residents working as Grab drivers saw decreased income during the rainy season as fewer people ventured outdoors.

Children’s perceptions towards education and their school performance can be influenced by their families’ socio-economic background and parents’ involvement and attitude towards education. Education will become less important for families with economic and social difficulties (Figure 40). Thus, a family’s lack of income due to climate variability may affect the children’s education. This, in turn, may affect the children’s adaptive capability against climate change and environmental degradation.

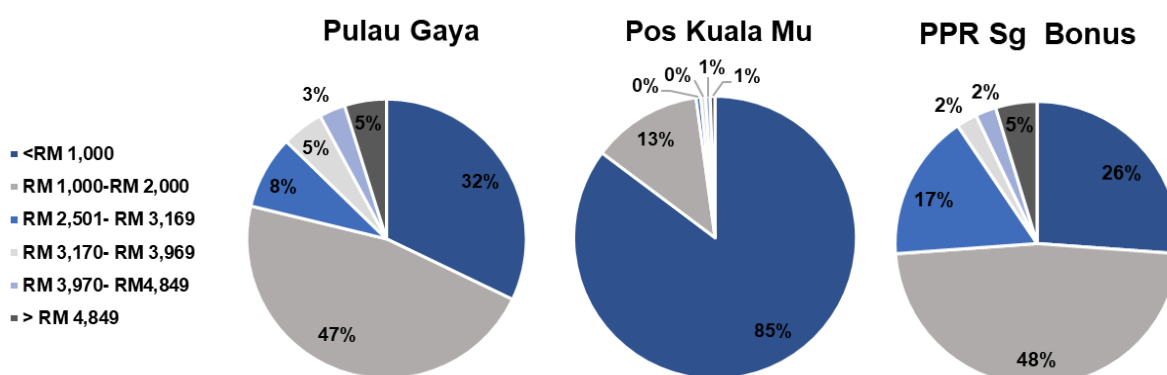


Figure 40: Family income bands for surveyed children in all three locations

Such income instability will also affect children’s access to basic necessities (e.g. food) and social services (e.g. healthcare). It may also lead to social issues among youth like drugs and petty theft, which were particularly prevalent in PPR Sungai Bonus.

#### 4.2.1.5 Health hazards and general well-being

Extreme climate events put these marginalised communities in higher levels of mortal danger. In Pulau Gaya, hurricanes often cause house roofs to be blown away, houses to collapse, and bridges that connect one house to another to break. Storm damage to school buildings here has also prevented children from attending school for an extended time. In Pos Kuala Mu, residents fear landslides that may damage their houses and threaten their safety. In such disasters, children are usually the most vulnerable.

In PPR Sungai Bonus, cramped conditions due to a combination of small residential unit size and many family members (Figure 41) lead children to report feeling ‘choked’ and ‘stressed’ when confined indoors for long periods during extreme weather events. Such conditions can take a toll on the children’s mental health. This study found that, in general, children were more vulnerable to climate change when their household size was larger than five.

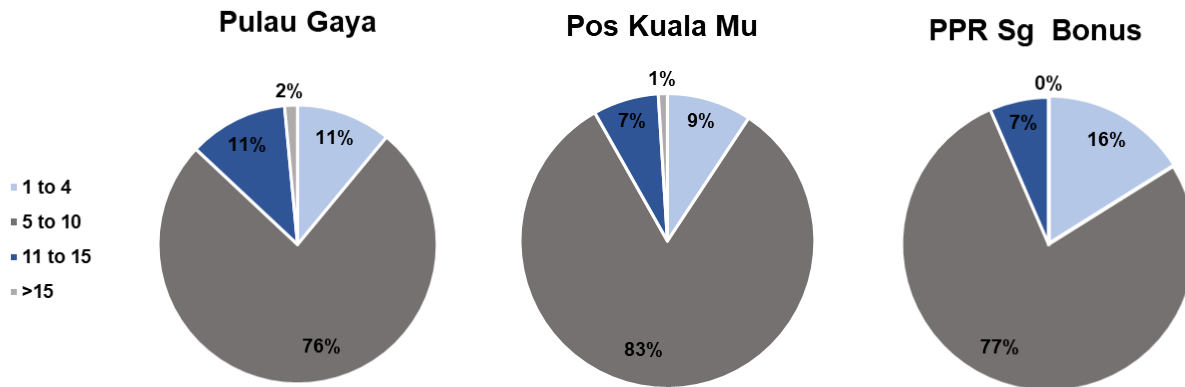


Figure 41: Household size for surveyed children in all three locations

The lack of environmental education and awareness among marginalised communities can also lead to serious safety issues. In PPR Sungai Bonus, despite scheduled waste services provided by the municipal council, children have been hurt by ‘flying dumps’, which are plastic bags of rubbish indiscriminately flung out of higher floors.

### 4.3 Gender and vulnerability

Reducing inequality strengthens economies and builds stable, resilient societies that give all individuals the opportunity to fulfil their potential. Different countries and communities have different issues related to gender, be it due to religious, cultural, or other factors, which may affect how children of a particular gender respond to climate variability and environmental degradation.

In terms of physiology, girls may be more susceptible to climate variability and environmental degradation. A study in Istanbul, Turkey, found that females seem to be at a higher risk of suffering from respiratory diseases attributed to PM<sub>10</sub>, PM<sub>2.5</sub>, and NO<sub>2</sub><sup>61</sup>. A similar trend was observed in our Pulau Gaya case study, where girls were perceived to be more vulnerable to climate change (particularly in the face of sea-related extremes, a major climate risk on the island) than boys. However, girls were perceived to be better protected and have access to better support systems in the face of climate and environmental risks. Cultural factors may have played a role in these perceptions: because girls are perceived as more vulnerable, they tend to be better protected by their families and community.

While the gap in enrolment rates between girls and boys in Malaysia is low<sup>62</sup>, girls generally have slightly higher literacy rates than males. However, in Malaysian society, there is a dominance of resources and decision-making power among males in the family and society. This means that, despite the higher levels of health literacy among females, females may not have the freedom to make key decisions based on their best knowledge for their families, increasing their children's vulnerability towards climate change and environmental degradation.

Gender plays a significant role in the access to education among children in Malaysia, especially among marginalised communities. For example, there are much higher male



enrolments in special education schools across Malaysia, indicating that boys with disabilities have better access to education than girls with disabilities.

Patterns of access based on gender differ across the communities examined in this study. In Pulau Gaya, male children are perceived to be responsible for the family's economy. This, coupled with higher wages generally offered to males, has resulted in the 'Lost Boys phenomenon'<sup>63</sup>, where boys tend to drop out of school in favour of low-paying jobs on the mainland. These boys also seemed to prefer working and showed little interest in school. In PPR Sungai Bonus, it was found that boys, especially among the lower-income families, felt that they needed to leave school to help make ends meet. However, the situation was reversed in the Orang Asli community examined. Here, girls preferred to earn a living instead of going to school. Cultural issues may come into play for this variation.

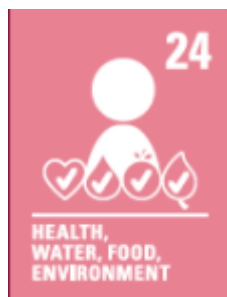
Our case studies also revealed how climate change vulnerability could increase concerns and the risk of sexual abuse among children, especially girls. Worldwide, about 18% of girls and nearly 8% of boys experience sexual abuse, including sexual assault or rape during childhood<sup>64</sup>. Factors leading to sexual abuse included the absence of another adult at home, family unemployment, and a history of drug abuse in the family. Unemployed male adults with a history of drug abuse living in unprotected housing conditions pose a danger, especially for female children<sup>65</sup>. These factors become especially pronounced in communities like PPR Sungai Bonus during bad weather. Girls reported that being confined indoors with many family members in a small housing unit made them feel unsafe due to a lack of privacy and a proper place to study and sleep. The risk of gender-based violence can also be heightened in the aftermath of natural disasters as overcrowded and unsafe conditions in disaster shelters can expose women and girls to gender-based violence. At the same time, medical and legal services are overwhelmed, making it harder to get help<sup>66</sup>.

#### 4.4 Gaps and opportunities

The Government of Malaysia has ratified the UNCRC but has expressed reservations concerning Articles 2 (no discrimination), 7 (name and nationality), 14 (freedom of thought and religion), and 37 (children in detention) of the Convention and has declared that said provisions shall be applicable only if they are in conformity with the Constitution, national laws, and policies of the nation.

As explained above, while the rights of children in Malaysia are reasonably protected, the level of protection varies with societal and geographical conditions. Our analysis has identified several gaps, based on the UNCRC framework, where there exist opportunities for the Government of Malaysia to improve further to ensure that all children in Malaysia are better protected from the impacts of climate variability and environmental degradation and pollution. These gaps map onto Articles 24, 26, and 28 of the UNCRC.

##### 4.4.1 UNCRC Article 24: The right to safe water and sanitation



While the mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene in Malaysia was a low 0.4 deaths per 1,000 population in 2016 (SDG Indicator 3.9.2)<sup>67</sup>, our analysis above shows that many of the effects of climate change and environmental degradation and pollution in the Malaysian context are closely related to issues of safe water and sanitation.

Firstly, even though people living in Malaysia enjoy almost universal access to safe and affordable drinking water, hygiene services, and sanitation during regular times, this is not the case during times of natural or human-made disasters. As detailed above, normally rare water-borne diseases and diseases related to sanitation and hygiene tend to occur among the affected population after floods in Malaysia. With the increasing frequency and intensity of floods due to climate change, there is a need to improve emergency and water sanitation services during emergencies.

Secondly, water and sanitation services are also closely linked to vector-borne diseases. Mosquitoes, which are vectors of diseases like dengue and malaria, need stagnant water to breed. Such occurrences are especially pertinent in marginalised communities with the added problem of improper waste management. Hence, it is very important for the Government of Malaysia to guarantee clean and running water and good and regular sanitation services to reduce the breeding ground of these vectors.

Thirdly, the regular incidences of river contamination with hazardous wastes draw attention to the concern of the quality of the waters in Malaysia's rivers. Even though Malaysia saw a rise in the percentage of rivers categorised as 'clean', this is still low considering that almost all Malaysia's water usage comes from rivers. There is an urgent need to accelerate the cleaning up and maintenance of Malaysia's rivers, especially in areas where children live close to rivers, like riverside cities or indigenous villages. There is also a need to consider penalties and/or compensation regarding the upstream uses of the rivers and watershed where such communities reside.

Finally, despite almost universal access, a significant number of 12% of wastewater in Malaysia is still unsafely treated in 2020. Communities without access to safe and affordable drinking water, hygiene services, and sanitation usually comprise marginalised groups. The growing frequency and intensity of rainfall events and droughts will further increase water pressures for the marginalised communities as issues surrounding water scarcity and affordability exacerbate. Water and sanitation issues are some of the leading causes of diseases among children in these marginalised communities. Hence, the priority should be to ensure that the last few remaining communities around Malaysia receive access to clean water, hygiene services, and sanitation.

#### 4.4.2 UNCR Article 26: The right to social and economic help (without discrimination)



Socio-demographic vulnerabilities can be strengthened with sufficient knowledge, resources, and support to enhance children's adaptive capacity to climate change. A robust adaptation plan with sufficient implementation may help them prepare against the impending impact. Under Article 26 of the UNCR, every child has the right to benefit from social security. Governments must provide social security, including financial support and other benefits, to families in need of assistance.

The PPR is an example of a social welfare programme run by the Government of Malaysia to ensure that low-income earners in Malaysia have a place to stay. However, the relatively small sizes of the units and the tendency for residents to have relatively large-sized families have resulted in uncomfortable living conditions for the children there. The findings of our case study evidenced possible mental health issues among children having to stay indoors in such a small unit for extended periods during severe weather. This was

particularly heightened among girls, who reported feeling unsafe. As the frequency and intensity of such severe weather will translate to longer periods indoors, there is a need to revisit the living conditions of PPRs, unit sizes, and other facilities there.

As more people have their lives and livelihoods disrupted by climate and environmental events like floods, haze, and related diseases, they may not be able to maintain their regular sources of income, either temporarily or permanently. Furthermore, our case studies revealed that people from marginalised communities tended to hold climate-sensitive jobs, which not only increases their precariousness but also increases the pressure on their children to work instead of going to school. Hence, there is room for more climate and environmental considerations in the current social, economic, and financial assistance programmes made available by the government, both during normal times and in the face of climate and environmental shocks.

Refugees make up a significant part of the marginalised communities in Malaysia<sup>68</sup>. Because of their status, these communities often do not have access to basic services or government assistance. They are often excluded from official statistics and datasets due to their status, making it difficult to determine their actual conditions. While Malaysia has not declared reservations for Article 22 under the UNCRC on refugee children, Malaysia is not a party to the 1951 Refugee Convention nor its Protocol. It does not have an asylum system regulating the status and rights of refugees. Hence, there is a risk that refugee children in Malaysia cannot access their rights, including receiving social and economic help from the government where they are seeking refuge.



#### 4.4.3 UNCR Article 28: The right to (climate-smart) education

The United Nations Framework Convention on Climate Change (UNFCCC) Article 6 on education, training and public awareness states that countries shall develop and implement educational and public awareness programmes on climate change and its effects. The Paris Climate Agreement Article 12 also reiterates the importance of education in enhancing climate actions<sup>69</sup>. In this vein, UNICEF has identified four areas for urgent action towards a 'climate-smart' education sector:

**The leadership of the education sector in relevant climate change policy-making processes.** The Malaysian education sector has played an important role in incorporating climate change issues into education planning and including education system priorities and climate action needs into climate change policy and financing. For example, Malaysia has integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula through its Digital Educational Learning Initiative Malaysia (DELIMa) for Global Citizenship Education (SDG Target 13.3), however more needs to be done.

**Enhancing data and improving the evidence base to inform climate and education policies.** Studies like this are part of the effort to collect evidence on how climate change affects education. This knowledge will enable education stakeholders to actively participate in climate change discussions, monitor progress, and identify solutions. However, this is a preliminary study, and there is room for more studies looking into different aspects of how climate change affects education all around Malaysia.

**Ensure continued climate-sensitive and resilient education under different climate change scenarios.** Floods often cause disruptions to the schooling of students in affected areas. In addition, schools often are instructed to close if air pollution (haze) gets especially severe. In marginalised communities, heavy rains and storms are especially disruptive to school attendance, as conditions become too dangerous for children to travel to school. Schools are sometimes also damaged in such severe climatic conditions, sometimes disrupting children's education for weeks. Schools should be built and retrofitted to withstand climate shocks so that school closures can be reduced as much as possible.

**Improve learning and skills in schools to address climate crisis challenges.** While teacher training in such subjects has been included in key ministries' strategies, teachers interviewed in our case studies felt they needed more formal training to improve their skills to teach issues on the climate crisis and its challenges. In addition, a disaster risk reduction approach must be instituted at all schools that are at risk of natural disasters. This can be done through integration within the school curricula, by preparing students through disaster drills, emergency response and early warning systems, and making sure that school buildings are built to withstand natural hazards.

## 5 CLIMATE AND ENVIRONMENTAL GOVERNANCE IN MALAYSIA

Despite the many ways climate change impacts children, children are consistently being overlooked in the design and content of climate policies and related processes. Legislative, enforcement and other measures to prevent children from being exposed to environmental health risks are often inadequate or missing in national policy frameworks. While the child's best interests should be at the heart of all decisions affecting the child, large gaps in laws and policies worldwide essentially permit children to be exposed to hazardous substances.

UNICEF's guidance document for child-sensitive climate policies state that governance frameworks should be structured around four key principles:

1. **Ambitious and urgent:** Ambitious mitigation and adaptation measures that protect the rights and best interests of the child from harm caused by climate change
2. **Rights-based:** Explicit and meaningful references to children and youth, considering them as rights-holders and important stakeholders
3. **Holistic and multi-sectoral:** Address children's unique risks and vulnerabilities through specific sector interventions.
4. **Inclusive:** Informed by, and provide for, the systematic consultation and meaningful participation of all children, including children of different ages, gender and social backgrounds, at every step of the climate policy-making process and at all levels<sup>70</sup>

### 5.1 State of climate and environmental governance in Malaysia

At the international level, Malaysia's direct involvement in the climate change process began when it ratified the UNFCCC, followed by the Kyoto Protocol. Under the Kyoto Protocol, Malaysia is categorised as a developing country (non-Annex 1 party) that does not have a mandatory greenhouse gas emissions target. While the Kyoto Protocol is not legally binding for Malaysia, Malaysia nevertheless pledged a voluntary reduction of up to 40% in terms of emissions intensity per unit of GDP by 2020 compared to emission levels in 2005, conditional on its receiving technology transfer and adequate financing from developed countries.

Article 3 of the Paris Climate Agreement addresses climate change in a bottom-up approach through Nationally Determined Contributions (NDCs), which endorses flexibility for states to decide their climate actions based on their respective capabilities. In 2016 during the Paris Climate Agreement, Malaysia renewed its pledge to reduce its greenhouse gas emissions intensity per unit of GDP by 45% by 2030 relative to the emissions intensity in 2005, of which 35% was implemented unconditionally while the remaining 10% was conditional upon support by developed countries. On 30 July 2021, Malaysia submitted an update to its NDC to the UNFCCC, which states that the target will be revised to 45% by 2030 (unconditional), meaning that the NDC will be financed domestically.

Malaysia is a federation with administrative jurisdictions made up of federal, state, and local governments. Environmental protection, climate mitigation, children's welfare and public health management patterns have been shaped by this system, the government, and the Constitution, which is the supreme law. The complex setting of legal frameworks on the environment, climate change, and children's protection stems from the Constitution's distribution of powers as

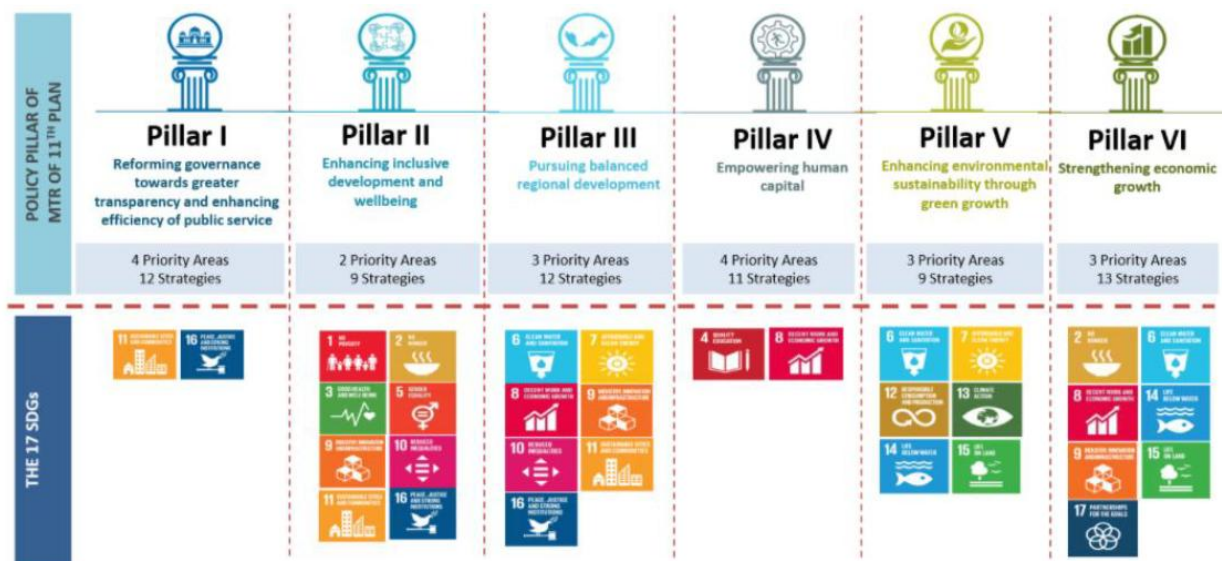
provided in the legislative lists under the Ninth Schedule through List I (Federal List), List II (State List) and List III (Concurrent List).

Specifically, matters relating to health, including sanitation and child welfare, come under Item 14 of List I, where the federal government (Parliament) has the jurisdiction to enact laws on the matter. However, matters relating to public health, social welfare, sanitation (excluding sanitation in the federal capital) and the prevention of diseases are provided in Item 7 of List III, where both federal and state governments have the power to enact laws. The subject matters of environment and climate change do not exist within any of the legislative lists. However, aspects incidental to both matters could be found within the three Lists, as provided in Table 11.

*Table 11: Ninth Schedule of the Malaysian Constitution*

LIST	JURISDICTION	SCOPE
I	Federal government	Treaties with other countries; trade, commerce, and industry; factories; water supplies; welfare of the aborigines; and control of agricultural pests
II	State government	Land, rivers, obnoxious trades, and public nuisances in local authority areas
III	Federal and state governments	Town and country planning; public health, sanitation, and the prevention of diseases. Drainage and irrigation; protection of wild animals and wild birds; and national parks. Social welfare.

The Economic Planning Unit (EPU) under the Prime Minister’s Office is the coordinating agency for all government ministries in planning and budgeting for the SDGs. The five-year 11<sup>th</sup> Malaysia Plan (2016-2020) formulated by the EPU aims to operationalise the SDGs across six pillars (Figure 42) to improve the national economy and people’s quality of life. Disadvantaged communities are a major focus; the plan prioritises improving access to quality education and healthcare services for these communities. It also aims to reduce school dropout rates among the poor and people in remote areas such as indigenous communities.



*Figure 42: Mapping of the 11<sup>th</sup> Malaysia Plan and the SDGs*

Under the 11<sup>th</sup> Malaysia Plan, children are mentioned especially in relation to education and equity. In the strategic thrust for green growth and sustainability, one initiative is to incorporate education on sustainable consumption and production into the school curriculum. Themes like energy, water, waste, food consumption and production, transport, and sustainable buildings have been integrated within the existing preschool to secondary curriculum, particularly in subjects such as science and geography. Climate change adaptation is also included for flood mitigation and inculcating public awareness on health impacts from vector-, food-, and water-borne diseases.

### 5.1.1 Climate change and the environment

Malaysia's environmental policy and laws are highly influenced by the United Nations conventions, starting from the United Nations Conference on the Human Environment 1972, the 26 Principals of the Stockholm Declaration (of which Malaysia is a signatory), and the 126 recommendations of its Action Plan.

In general, climate change mitigating actions are embedded in the laws, policies and actions plans across sectors in Malaysia. Apart from the National Policy on Climate Change (NPCC) 2009 and the EQA 1974 discussed below, other policies addressing climate change and the environment include the National Green Technology Policy 2009, the Policy and Mechanism on National Disaster and Relief Management (n.d.), the National Policy on the Environment 2002, and the National Water Resources Policy 2012. In these policies and action plans, and awareness are a strategic thrust. For example, waste and cleanliness policies emphasise the challenge of behavioural change in the community.

#### 5.1.1.1 Key document: National Policy on Climate Change 2009

Malaysia's key policy document concerning climate change is the NPCC 2009. This policy identifies three main principles in Malaysia's approach to climate change, which are climate change mitigation, climate change adaptation, and capacity building.

Under this policy, a general reference is made to children as included within the term 'Major Groups', including 'farmers, women, the scientific and technological community, indigenous people and their communities, workers and trade unions, business and industry, non-governmental organisations and local authorities'. Children are sometimes also addressed as one specific target group, especially related to educational activities.

Upon the policy's identification of renewable energy generation as one of the main measures to reduce greenhouse gas emissions, the Renewable Energy Act 2011 was passed to provide a more comprehensive law on renewable energy. The Renewable Energy Act 2011 also formed a vital instrument to achieve the National Renewable Energy Policy (n.d.) and National Green Technology Policy 2009 objectives, which were introduced to boost the development of green technology and are expected to assist in mitigating climate issues. As a result, Malaysia's most relevant sectoral laws and policies pertinent to climate change are within the renewable energy sector. The energy policies in Malaysia are inclined towards sustainable energy use, focusing on energy security through diversification of fuel sources and green energy.

Renewable energy for electricity generation has been identified as a key sector supporting climate change regime and sustainable development. In 2018, renewables only contributed 1.3% of Malaysia's electricity generation mix<sup>71</sup>. The increase of the renewable energy share in

the total power generation is a predominant agenda in developing a climate change policy. Specifically, Malaysia aims to achieve a 20% renewable energy capacity mix by 2025<sup>72</sup>.

#### *5.1.1.2 Key document: Environmental Quality Act 1974*

The EQA 1974 is considered the most important environmental legislation in Malaysia concerned with the 'prevention, abatement, control of pollution and enhancement, and for the purposes connected therewith'. The Act addresses environmental and human health protection with different strategies (limits of emission, discharge license, fines, environmental standards) targeting anthropogenic inputs and receiving environmental compartments.

The Act is primarily a pollution control law and forms the basic legislation for achieving national environmental objectives and policies. This Act is a federal law and applies to the whole of Malaysia. It also establishes powers to be exercised exclusively by the federal government, and it does not depend on parallel state enactments for its effectiveness within state boundaries. It is a framework law, so for its provisions to take effect, the minister needs to make rules and regulations on that provision.

Such regulations that have been developed include emission limits on industrial discharges to air (e.g. Environmental Quality (Clean Air) Regulations 2014), effluent limits on discharges to water (e.g. Environmental Quality (Industrial Effluent) Regulations 2009, Environmental Quality (Sewage) Regulations 2009), and scheduled wastes (Environmental Quality (Scheduled Wastes) Regulations 2005). These standards are generally set to either control emissions to rivers, soil, and other environmental media and/or protect a vulnerable receptor, such as human beings and the environment. The standards are usually a combination of science and policy (e.g. society's attitude to risk, achievability, costs), international agreement, the UN mandate, or WHO standards.

An important component of the EQA 1974 is the Environmental Impact Assessment (EIA) requirement. An EIA assesses the short-term and long-term effects of any proposed action (or absence of action), including policies, legislative proposals, programmes, projects, and operational practices, on the population and the physical, biological, and socio-economic environment. It is required for all prescribed activities before project approvals can be obtained, without which the project proponent will not be able to commence. Possible measures to prevent or control the impact of the various associated forms of environmental pollution are also included for consideration during the decision-making process. This allows decision-makers to select the option that results in the least pollution or stop the project entirely.

The assessment includes a Health Impact Assessment, with a guidance document established in 2012. Children have been mentioned briefly as an example of a vulnerable population in the Health Impact Assessment.

The principle of public participation is a required process in the EIA. It holds that people affected by a decision have the right to be involved in the decision-making process. Strong public participation in environmental governance could increase the commitment among stakeholders, strengthening the compliance and enforcement of environmental laws. Activities specified in the Second Schedule of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 require public display and public comment.



### 5.1.2 Child protection and education

As a member of the United Nations, Malaysia has subscribed to the philosophy, concepts, and norms provided by the Universal Declaration of Human Rights 1948, which sets out the common standard of human rights and nations. Even though the Malaysian Constitution does not refer to 'human rights', the Constitution guarantees 'fundamental liberties'.

As a state party to the UNCRC, Malaysia observes the principles in this Convention to uphold its commitment to the protection and welfare of children, subject to four articles that are at variance with national and Syariah laws. The pursuit of Malaysia's child's protection is guided by the UNCRC as stated in the Preamble, that 'the child, by reason of his physical and mental immaturity, needs special safeguards and care, including appropriate legal protection, before as well as after birth'.

As education is the key channel for transmitting information on climate change and environmental health, especially to marginalised groups, many educational programmes (including formal and informal channels, experiential learning, awareness programmes, and teacher training) have been organised by the related ministries such as the Ministry of Energy and Natural Resources, Ministry of Science and Technology, Ministry of Environment and Water (*Kementerian Alam Sekitar dan Air* or KASA), civil society organisations and private companies as reported in the Third National Communication Report 2018.

Furthermore, the MOE's Inclusive Education Programme ensures that students with disabilities receive equal education opportunities. Although disaster mitigation and adaptation strategies for children with disabilities in schools are not mentioned directly, it is understood that the Ministry includes children with disabilities in implementing all programmes.

#### 5.1.2.1 Key document: Child Act 2001

To fulfil the UNCRC, Malaysia enacted the Child Act in 2001. The Act is regarded as the most powerful Act introduced to consolidate and amend the laws relating to children's care, protection, and rehabilitation. The preamble of the Act recognises that every child is entitled to protection and assistance in all circumstances.

The Act's scope in Section 31 provides an offence that carries a maximum fine of RM20,000 or a maximum imprisonment term of 10 years or both if the guardian cares for the child in a manner likely to cause him or her physical or emotional injury. Specifically, Section 31 states that any person who, being a person having the care of a child: abuses, neglects, abandons, or exposes the child in a manner likely to cause him physical or emotional injury; or causes or permits him to be so abused, neglected, abandoned, or exposed; or sexually abuses the child or causes or permits him to be so abused, commits an offence.

#### 5.1.2.2 Key document: Malaysian Education Blueprint 2013-2025

The MOE developed the Malaysia Education Blueprint 2013-2025 to transform the education landscape in Malaysia and prepare children in Malaysia for the needs of the 21<sup>st</sup> century. It affirms the critical role of education in turning Malaysia into a knowledge-based economy to compete in an increasingly globalised world. The Blueprint puts five system aspirations at the forefront, namely Access, Quality, Equity, Unity and Efficiency

In line with this vision, facilities provided in schools have been improved since 2018. Throughout 2018, 394 dilapidated schools have been upgraded compared to 120 schools in the previous year. In the same year, 1,260 science laboratories were upgraded in 560 schools. As a result of

the Ministry's initiative to increase efficiency in teaching and learning in schools, a 2018 report shows a 56% increase in the usage of Virtual Learning Education by teachers and students through various mediums<sup>73</sup>.

### 5.1.3 Public health

Public health law is a set of laws that provide the legal powers and duties of the government to assure the conditions for the population to be healthy, such as identifying, preventing, and ameliorating health risks. In general, the Malaysian public health law is influenced by international law, especially related to human rights, the international spread of diseases, and public health standards. In a broader perspective, public health legislation, policies and institutions may also relate to other legislation and policies (environment, climate change, etc.) regulating national socio-economic development.

In Malaysia, the public health law has evolved independently, leading to profound structure, substance, and procedures for detecting, controlling, and preventing injury and disease. Major national policies and plans related to health in Malaysia include the National Environmental Health Action Plan 2013, the National Strategic Plan for Dengue Prevention and Control 2016-2020, and the Health Management Action Plan for Haze 2020.

The MOH is the main regulatory body supported by authorised medical and enforcement officers to enforce the law on public health through its central, state and district offices. In addressing the impacts of climate change and environmental hazards, the MOH has established health guidelines and action plans for events such as floods, haze, and climate-sensitive diseases.

In Malaysia, the health impacts of climate change and the environment on the population and children are based on the community's previous experiences and prevailing needs. Although children are not specifically mentioned in the macro-level strategic plans, children have been addressed as part of the vulnerable population in most management guidelines, including attending to their mental health during disasters. Teenagers' and children's health, including children with disabilities, has been addressed by the Family Health Development Unit of the MOH through programmes such as the School Health Programme.

## 5.2 Gaps and Opportunities

Overall, while Malaysia's laws and policies attempt to engage with environmental issues and address the effects of climate change, children's issues have not been well recognised within existing national climate change and environmental frameworks. On the other hand, law and policies relating to children or public health does not address climate change and environmental harms. Based on UNICEF's four principles for child-sensitive climate policies, the above analysis has identified four key areas where opportunities for improvement exist.

### 5.2.1 Issues with the governance framework

Principle 1 states that the nation's governance framework should be ambitious and urgent. Most of the policies and laws reviewed came into existence before climate change became a global issue. Due to this, the content of these policies and laws are not in line with Malaysia's pledges to commit to climate change issues at the international level, particularly after Malaysia's ratification of the Paris Climate Agreement in 2016. They are not ambitious enough, nor reflect the urgency of the current situation.

For example, the EQA 1974 and other environment-related laws do not reflect important climate concerns or SDG attainment, which are pertinent to the environment and public health agenda. Terms such as 'sustainable development' and 'climate change' are not available within any part of the Act, which is a concern as the Act is supposed to be the main legislation to implement environmental policy directives targeting sustainable development. Climate change is also not mentioned in the Renewable Energy Act 2011. There is no mechanism to indicate that this Act serves to increase the share of electricity generation by renewable energy sources to promote sustainable development, climate change mitigation, and environmental protection.

Policies that do directly address climate change are outdated. For example, the NPCC 2009 has not been revised since 2009, and this policy has not resulted in holistic responses on mitigation and adaptation within the law. Unlike many other countries which have already developed climate change laws as their main greenhouse gas emission reduction strategy, Malaysia's legal framework remains rudimentary with no specific law on climate change, except for the Renewable Energy Act 2011.

#### *5.2.1.1 Issues on understandings of the right to a healthful environment*

There is no specific provision in the Federal Constitution that speaks about recognising or protecting the public's right to a healthful environment. Consequently, Malaysia's approach to environmental management through policy and legal measures has not evolved from a Constitutional mandate to afford the public a right to clean air, water, and the environment. Rather, these measures are more a response to intolerable environmental conditions.

However, Article 5, Part II of the Constitution contains a provision on fundamental liberties, which states that 'no person shall be deprived of his life or personal liberty save in accordance with the law'. While this article does not specifically deal with environmental rights, this article should be widely interpreted to allow for the right to a healthy environment. Some Malaysian judges have indeed made efforts to deal with issues on the right to a clean environment in a more liberal manner<sup>74</sup>, and this should be further encouraged and embraced.

#### *5.2.1.2 Issues with the legal interpretation of child abuse*

While the environment is mentioned in some child policies and laws, they have mainly addressed environmental issues from the social perspective, such as abuse, neglect, and exploitation. They do not recognise the negative aspects of climate change or environmental pollution and degradation nor prescribe strategies on mitigation and adaptation in the context of children.

The Child Act 2001, which is almost 20 years old, needs revision to align with new and emerging international climate change commitments and SDGs. Currently, the definition of 'abuse' under the Act includes two main elements: (1) there was a violation of an individual's human and civil rights, and (2) the violation is done by any other persons.

To prove whether the victim's human and civil rights were violated or not, it is necessary to determine whether the victim has any rights under any existing legislation. Even though the Malaysian Constitution does not refer to 'human rights', the Constitution guarantees 'fundamental liberties' as preserved in Part 11.9.

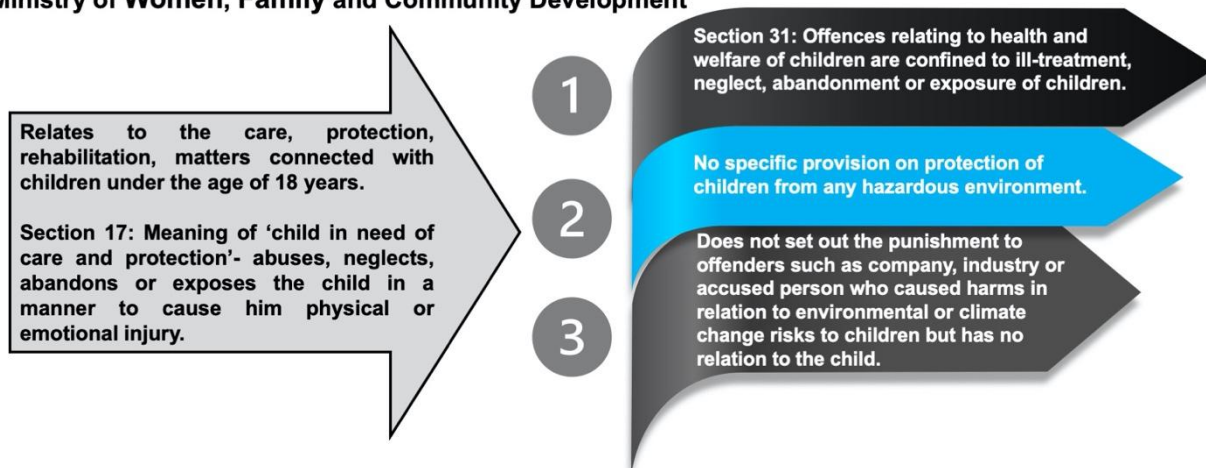
Even though the provisions of Section 31 (5) extend that a person may be convicted for causing suffering or injury to a child's health, offences relating to the health and welfare of children are limited to ill-treatment, neglect, abandonment, or exposure. There is no specific provision under

the Child Act 2001 in protecting children from any hazardous environment or climate change and any act detrimental to child health.

The scope of 'other person' is not extended to parties who caused harm to children in the context of environmental or climate change risks. The Act sets out the punishment to parents, guardians, or person legally liable, but not to other offenders like companies, industries, or accused persons who have no relation with the child, under the definition of 'any person' in the definition of child abuse (Figure 43).

## Child Act 2001

Ministry of Women, Family and Community Development



*Figure 43: Issues on understandings of child abuse in the Child Act 2001*

To date, there is no criminal case where the accused person is charged under the Child Act 2001 for creating a harmful environment that endangers the child's health. Hence, law and enforcement are inadequate to protect children from being exposed to environmental and climate change harm, including procedural law.

While the inclusion of provisions for environmental harm in child protection regulations is not yet commonplace worldwide, some examples do exist. For example, the Illinois Department of Children and Family Services' Abuse and Neglect Investigations Rule 300 includes environmental harm in its system on allegations of abuse and neglect<sup>75</sup>.

### *5.2.1.3 Issues with the legal interpretation of environmental pollution*

The EQA 1974 has a limited scope in dealing with public health issues due to pollution. The Act applies a restrictive approach to defining a word or term, based on the employment of the word 'means', which shows that the definition enacted is hard and fast and that no other meaning can be assigned to the defined word.

Under the present amendment, [Am. Act A953: s.2; Subs. Act A1441 2012] 'pollution' *means*: 'an act or process, whether natural or artificial, resulting in the introduction of any pollutant into the environment in contravention of the acceptable conditions as specified in the regulations made under Section 21'. This narrow interpretation strictly confines the meaning of pollution within the scope of Section 21 without any linkages being made to human factors such as public

health or welfare. Such interpretation would imply that pollution's adverse impact on human health, including that of children, would not be a factor to be considered when enforcing the law.

### 5.2.2 Children not addressed as a specific target group

Principle 2 states that the governance framework should be rights-based. Children are categorised as a high-risk group in most of Malaysia's macro-level policies, plans, and laws. While Malaysia agrees on the importance of a health response to climate change and environmental issues, the scope of existing policies and laws are not extended to include factors pertinent to children. With the exception of a few notable examples (e.g. Baby Friendly Hospitals, CyberSAFE), most of these policies, plans and laws do not contain specific strategies for protecting children and their unique rights as spelt out by the UNCRC in the context of environmental and climate risk.

Thus, current frameworks are meant to address the issues from the general public health perspective without focusing on children or other susceptible population groups. However, we know that children face additional risks of exposure and lower tolerance levels to the impacts of climate change and environmental degradation compared to adults.

Under the EQA 1974, for example, the pollution emission standards represent the minimum environmental standards or practices that do not affect the general population adversely. However, these minimum standards do not consider population groups with particular makeup or states of health, such as children and infants. Hence, instead of having policies that allow people to tolerate substantially higher pollution levels, a preventive approach to diseases and environmental risks needs to be adopted for children.

However, from our consultation and strategic meetings with stakeholders, it is understood that many programmes and policies have included children as part of the general implementation plan, some more explicitly than others. For example, the National Disaster Management Agency (NADMA) recognises that children are among the most impacted populations during a disaster, per the Sendai Framework for Disaster Risk Reduction 2015. As part of its public education, NADMA initiated the Community Based Disaster Risk Management Programme, which includes a public education module on the community's roles in disaster management. The module includes prioritising vulnerable groups such as children, the elderly, women and people with disabilities before, during, and after disasters. This programme has also been conducted at schools to enhance students' resilience and preparedness against disasters.

### 5.2.3 Issues with the coherence between policies, laws, and plans

Principle 3 states that the governance framework should be holistic and multi-sectoral. Article 3 of the UNCRC states that 'in all actions concerning children, whether undertaken by public or private social welfare institutions, courts of law, administrative authorities or legislative bodies, the best interests of the child shall be a primary consideration'. In general, this assessment found a huge gap in the holistic and multi-sectoral coherence of child-sensitive and child-friendly climate change and environmental policies, plans, and laws across sectors.

Health laws, child protection laws, and environmental laws were developed with different aims and target groups. Matters relating to the control of non-communicable and communicable diseases, environmental protection, sanitation, and the prevention of injuries are under different regulatory bodies authorised to enforce different laws, despite these areas of law being often concerned with the same subject matter or types of hazards posed.

When health is mentioned in laws and policies, the nature of the reference is often merely descriptive and not translated into meaningful or targeted commitments and actions. For example, while the National Transport Policy 2019-2030 mentions reducing carbon and air pollutant emissions, the relevant health issues have not been included, which might have triggered an alternative approach to the action plans to safeguard human health from the emissions. Likewise, the Renewable Energy Act 2011 does not address carbon emissions in the context of health, despite emissions being one of the leading causes of morbidity and mortality, particularly for children.

Within policies and laws targeted at children, while the focus is on strengthening efforts to create a safer and more friendly environment for children, there are no distinctive efforts to protect the children's health and environment in terms of climate change, environmental pollution, and degradation. Currently, the Ministry of Women, Family and Community Development (MWFC) has no programmes relating children to climate change and environmental health.

Sustainable development and climate change resilience are strategic thrusts in the National Physical Plan 3 2016-2020, focusing on conserving the natural environment, low carbon development, and land-use planning for sustainable growth and disaster risk areas. In the same plan, children are addressed separately in the strategic thrust of inclusive communities, addressing access to facilities and services and public spaces for healthy growth. However, there is a lack of integration between both strategic thrusts.

#### *5.2.3.1 Coherence issues within environmental law and policy*

The control of health impacts from the industrial environmental pollution on the population, including children, are mainly dealt with under the National Policy on the Environment 2002. This policy relies on the EIA process in assessing the environmental health effects of potentially harmful activities. However, not all industrial activities are classified under the prescribed activities that require this assessment process.

Furthermore, the EQA 1974's licensing system and enforcement mechanisms to regulate the potentially harmful activities of polluters related to water, air, and hazardous wastes, is problematic. It gives greater consideration to the economic well-being of the industry instead of the environmental or human welfare. It is conspicuously lacking in consideration for financial, health, or environmental costs incurred by affected communities or specific groups such as children.

License issuance thus becomes an administrative matter: as long as pollution is licensed, it is lawful. For example, the licensing process makes no consideration for the river loading capacity, which refers to the greatest concentration of pollutants that a river can assimilate without causing the water to get polluted. Consequently, if all factories comply with the regulatory standard in discharging their effluent to rivers, the cumulative impact of these discharges may cause pollution if the river's capacity to dilute them is overshot. Furthermore, the contravention license allows for the discharge of pollution exceeding the limit despite the possible impact on human health or the environment.

#### *5.2.3.2 Coherence issues between federal and state law*

In practice, the jurisdictional areas of federal and state governments as defined in the Constitution can lead to the non-uniform implementation of laws, especially between states in Peninsular Malaysia with that of Sabah and Sarawak. Historically, the Constitution made

extensive changes to accommodate the special position of Sabah and Sarawak, allowing these two states to enjoy some executive, legislative, judicial, and financial autonomy not available to the 11 Peninsular states. This means that not all federal legislation enacted will apply to the whole of Peninsular Malaysia, Sabah, and Sarawak. For example, the EQA 1974, a federal law, applies to Peninsular Malaysia, Sabah, and Sarawak. However, certain provisions of the Act, such as the EIA, are supported with other legal provisions in Sabah and Sarawak.

State governments need to ensure that policies carried out in their state align with policies formulated at the federal level. It is known that the environment and matters related to the environment, such as land, forestry, and agriculture, fall under the State List of the Constitution. However, in case of conflict between state and federal law, the federal law shall prevail as stipulated in Article 75 of the Constitution. Being the supreme law of the land, provisions in the Constitution should be upheld.

Thus far, there has been minimal effort to amend the existing state-level legislation to integrate and implement the NPCC 2009 principles. Only one state, Sabah, has a State Policy on the Environment 2017, which attempts to reflect the principles and guidelines of the NPCC 2009 and includes the line that 'Sabah will actively participate in national and global efforts to mitigate negative effects of climate change due to the increase of greenhouse gases and to adapt to unavoidable global changes, which may affect the livelihood of the peoples of the State'.

#### 5.2.4 Lack of avenues for the participation of children or their representatives

Principle 4 states that the governance framework should be inclusive. Under the EQA 1974 Section 51, in gazetting regulations, the minister must seek advice from an advisory board known as the Environmental Quality Council, which comprises 18 members representing relevant bodies concerned with the environment and pollution. The Council members currently do not include agencies concerned with children. Currently, the MWFCD, the custodian of children's welfare, has only been involved in the Social Impact Assessment of the EIA and has yet to be included in the Environmental Quality Council.

The Children Representative Council (*Majlis Perwakilan Kanak-Kanak*) Malaysia was founded by the Social Welfare Department under the MWFCD, consisting of 30 children aged 13 to 17 years old. This is the main platform where children's concerns can be sought during the policy revision. For example, two council members of the Children Representative Council sit on the National Council for Children established by the MWFCD<sup>76</sup>. However, currently, most activities of the Children Representative Council have been confined to education and inculcating awareness on climate change and environmental degradation.

## 6 CONCLUSIONS AND RECOMMENDATIONS

Overall, this study has revealed the crucial interconnections between climate and environmental challenges and children's health and well-being in Malaysia, as presented in the model in Figure 44. The model consolidates the objectives, methods, and findings from our research on the ground and our assessment of the current policy and legal framework.

Climate change, including extreme rainfall, heatwaves, and sea-level rise, give rise to secondary challenges in the forms of environmental disasters, reduced agricultural productivity and lack of access to water resources, which are particularly detrimental to children's health. Concurrently, the model highlights the association between climate challenges and social challenges, which can exacerbate the health problems of disadvantaged groups such as the poor and marginalised. The key findings of this study can be summarised into six important points:

***Climate change, environmental degradation, and pollution are intensifying in Malaysia alongside rapid development.*** The robust growth of the Malaysian economy and population has led to unaddressed negative externalities on the environment, which includes higher greenhouse gas emissions, accelerated environmental degradation, and increased waste generation. Malaysia's annual average air quality concentration has been consistently above the WHO's maximum level for safety. The country has been experiencing increasing rainfall intensity over the years, which has led to increased incidences of floods, landslides, mudslides, tropical storms, and other weather-related events. It is projected that Malaysia will experience a higher frequency, duration, and magnitude of heatwaves in the future, alongside lengthened wet spells.

***While the rights of children in Malaysia are reasonably protected, the level of protection varies with societal and geographical conditions.*** In the global context, Malaysia has a relatively low poverty headcount ratio. However, poverty rates are higher among certain vulnerable groups. Some groups also have limited access to their rights, such as refugee and stateless children. Children in Malaysia have access to free education from preschool to secondary school, translating to high school enrolment rates and basic literacy. While health literacy is included in the education syllabus, topics are not diversified across different grades, and the syllabus is not updated regularly. Malnutrition, nutritional insufficiency, and overnutrition coexist across the population, with notable deficiencies of key nutrients such as Vitamin D and Calcium.

***Accelerated climate change, environmental degradation, and pollution present serious risks for children in Malaysia in general.*** Climate change in Malaysia is increasing the frequency and intensity of flood events and the range of disease-bearing vectors. In Malaysia, increases in leptospirosis and typhoid fever have been recorded after major flood events, both of which are especially dangerous for children. Warmer conditions and increased rainfall have enhanced the breeding capacity of the mosquitoes which transmit dengue, a disease that particularly affects children and young adults. Worsening air quality in Malaysia has been linked to the increase in the risk of hospitalisation for respiratory diseases among children. Improper disposal of hazardous industrial wastes has also resulted in multiple public health emergencies of which children make up the majority of the victims.

***Children living in marginalised communities are more vulnerable to climate and environmental risks.*** In marginalised communities, climate and environment-related risks are



further exacerbated by poverty, illiteracy and limited access to information. Marginalised children are more susceptible to infectious diseases. Lack of access to clean water and sanitation, which become even more restricted during extreme weather events, results in higher diarrhoeal disease, malaria, and dengue rates among children in these communities. Heavy rains and storms affect the children's access to schools and basic health services due to the lack of safe transport during these times. People who depend on climate-sensitive economic activities for their livelihood find it increasingly difficult to provide for their families, increasing the pressure on children to drop out of school to work. Low-quality housing also means that children can find themselves at risk during extreme weather events. Furthermore, extended periods of staying indoors can take a toll on children's mental health.

***While girls tend to be more vulnerable to climate and environmental risks than boys, both genders are affected differently.*** Our case study with the urban poor found that girls felt especially unsafe when confined indoors in cramped quarters in a large household due to severe weather conditions. Our case study with an indigenous community found that girls are more likely to drop out of school to work when sources of income become scarce. However, this was the opposite in the urban poor and island communities, where boys tended to drop out of school and work to help their families.

***While Malaysia's governance framework does address climate and environmental issues to a certain extent, all aspects of children's rights have not been adequately considered within the framework.*** Most relevant policies and laws have not been updated to reflect Malaysia's current climate pledges or SDG commitments. They maintain outdated understandings of key concepts, like the non-recognition of a citizen's right to a healthful environment, a narrow understanding of child abuse that excludes climate and environmental hazards, and rigid definitions of types of pollution. In most policies and plans, children are not explicitly recognised as rights-holders and important stakeholders, ignoring their higher risks of exposure and lower tolerance levels to climate and environmental risks than adults. Health, child protection, and environmental governance frameworks were developed with different aims, even though they indirectly focus on the same target group, the vulnerable population. Matters related to the control of diseases, environmental protection, sanitation, and the prevention of injuries are under different regulatory bodies, reflecting a lack of integration across the governance framework. There is also a lack of streamlining between federal and state laws on these issues.

These findings underscore the importance of specifically addressing environmental issues from a child's perspective and not as part of the general population. Urgent action must be taken at the community and policymaking levels to ensure that children's needs are at the heart of Malaysia's climate change adaptation and mitigation strategies. Our recommendations in pursuing this goal can be distilled into five main areas covering governance, education, advocacy, research, and public-private partnerships.

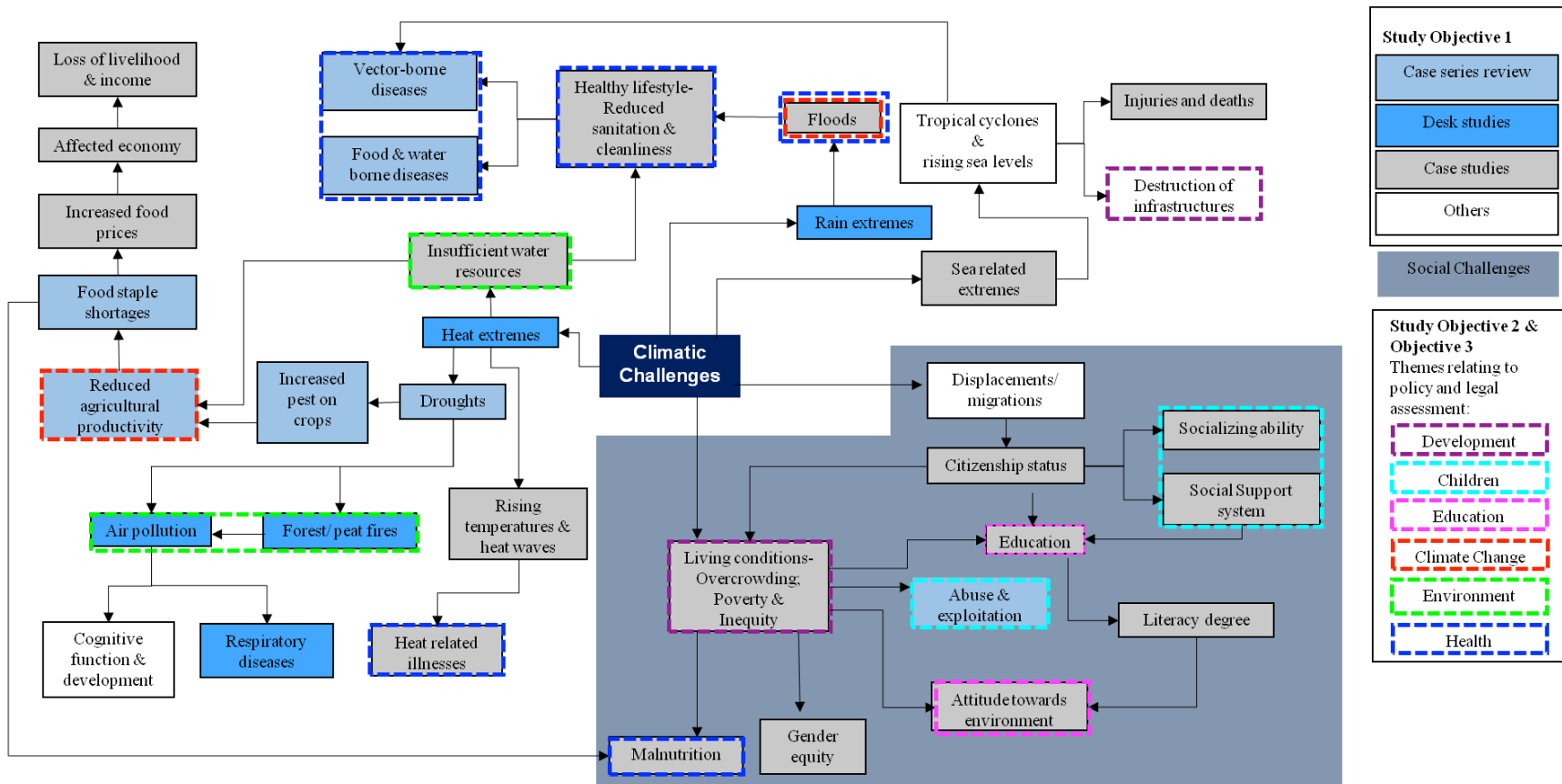


Figure 44: Model on the impacts of climate change on children in Malaysia

## 6.1 Recommendation 1: Child-sensitive governance framework

The SDGs are about inter-generational and intra-generational equity involving the fulfilment of responsibilities to ensure a safer, cleaner, healthier, and more inclusive environment for both today's children and their children. As Malaysia adopts the concept of SDGs, they become a guiding principle in the setting of policy and legal frameworks to consider children's needs within each of the dimensions of economic and social development and environmental sustainability.

As laws and policies are the main points of reference guiding the planning and implementation of all projects and programmes, it is strongly recommended that these **laws and policies explicitly address children as rights-holders and stakeholders** to ensure inclusivity. The upcoming policies, laws, and plans being formulated should meaningfully consider children's needs, rights, and vulnerabilities. Climate and environmental justice issues concerning children's rights to a healthy environment should be systematically and widely interpreted by the Constitution and integrated into national policy and law.

While various guidelines on climate and environment-related diseases are presently available, each sector has its own leading objectives and action plans. It is necessary to **ensure that all sectors are aligned in addressing the impacts of climate change** and environmental pollution and degradation on children, including mental health and well-being issues. The National Environmental Health Action Plan 2019 lists children's environmental health as the priority of environmental health issues in Malaysia. This presents an opportunity to draw the attention of all sectors to the vulnerabilities of children's health in the face of climate change and environmental degradation in Malaysia.

Within the Malaysian legal framework, there is an urgent need to **recognise environmental hazards as a potential cause of harm to children**, considering their additional risks of exposure and lower tolerance levels to the impacts of climate change and environmental degradation compared to adults. The judiciary can explore ways in which parties that perpetrate environmental crimes, especially crimes that affect children and other vulnerable groups, can be brought to justice more effectively within the Malaysian justice system. Furthermore, enforcement capacity in regulating environmental hazards, especially when understood in the context of preventing child 'abuse', should be strengthened.

There is a need to **improve coordination and synergy between federal and state levels on issues related to children's environmental health**. The Sabah State Policy on the Environment 2017 can be used as a guide for other individual states to develop their own State Action Plans on Climate Change, covering areas of adaptation, mitigation, and capacity building while focusing on impacts upon vulnerable groups, particularly children. The federal government can explore ways to synergistically support state governments in this endeavour, especially in terms of transparency, monitoring and evaluation of plans and intervention programmes.

We understand that the NPCC 2009 and EQA 1974 are now under review by KASA, and the Climate Change Act and National Adaptation Plan are currently being formulated. Furthermore, many of the discussed policies and plans have reached the end of their referencing term in 2020. Hence, this is an opportune time for relevant ministries to consider the above gaps and opportunities to update their policies, laws, and plans and improve implementation accordingly.

## 6.2 Recommendation 2: Climate-smart education

Increasing environmental awareness and education on climate change, health, hygiene, and environmental management can contribute to children's well-being, alongside building their resilience against climate change and environmental degradation impacts. However, climate change and environment are not formal individual subjects in the Malaysian curriculum.

To address this gap, we recommend including **educational content on climate change, the environment, and sustainable development in the curriculum** and the current (2013-2025) and future Malaysian Education Blueprints. To effectively supplement the current curriculum and co-curricular delivery system with intersectional climate change content, teachers must be supported and equipped with the latest knowledge on climate change science and local impacts and solutions to successfully teach these topics to their students.

With the increasing severity of these extreme events, there is a need for specific **initiatives towards climate-smart schools and relevant infrastructure** necessary to maintain access to and quality of education, even under such scenarios. Schools should be climate-smart to withstand climate impacts so that school closures are minimised as much as possible. The current innovations developed for online learning during COVID-19 can also be evaluated for adaptation into a climate-smart education ecosystem for the future.

## 6.3 Recommendation 3: Advocacy for children and vulnerable groups

Children's participation in issues that affect them is part of their fundamental right, enshrined in Article 12 of the UNCRC. The advantages of including children in formal decision-making processes include improved decision-making through discussions grounded in children's realities, greater understanding of children's concerns and capacities, enhanced public awareness about participation that facilitates a culture of participation, and development of children's knowledge and skills<sup>77</sup>.

However, despite important progress made, children are yet to be viewed as key stakeholders in Malaysia's policy and rule of law initiatives. Hence, it is important to ensure the **meaningful participation of children in climate- and environment-related processes** through direct participation and engagement or via representatives where child safeguarding and protection measures are required. The participation of children in these policy processes should be coordinated effectively across all ministries and government bodies for a more coordinated oversight.

The **inclusion of civil society, particularly youth groups and networks, academia, and private actors**, is important to broaden reach and participation to ensure the representation and inclusion of diverse groups, particularly children from marginalised communities. Existing forums that facilitate child participation, such as the National Youth Forum led by children themselves and the ASEAN Children's Forum, can be further leveraged.

Digital platforms are also growing in importance in terms of participation and civic engagement. Social media can facilitate participation as it provides young people with a platform to express their views on issues that affect them or their communities<sup>78</sup>. Such synergies can be built alongside strengthened frameworks for online child protection in Malaysia.

#### 6.4 Recommendation 4: Research and development

This study is an exploratory study of the current situation in Malaysia in the context of climate change, children's health and the rights of the child. More research is needed to further explore the impacts of climate change and environmental degradation on children's well-being and adaptive capacities in Malaysia.

One priority area would be research into the **development of a comprehensive child-centric guideline on all health components or indicators related to climate change and environmental degradation** needed to assess children's health, including mental health and well-being. This can include appropriate risk assessment tools to be incorporated into existing children's periodic health screenings and monitoring programmes to identify children-at-risk for preventive measures. This guideline can be used as a basis for enhancing communication, coordination, and integration within and between various sectors' policies, plans, and programmes.

More research is also required to assess the effectiveness of the current education and delivery system in delivering content related to climate change and sustainable development. As a starting point, there should be research into the **development of climate change training modules for teachers**, including educational materials focusing on children's health and well-being, climate change and environmental degradation. We also recommend research and development into innovative alternative education modalities to minimise the disruption of education during periods of environmental and climate stress.

Research is also needed to **develop monitoring and evaluation mechanisms for climate- and environment-related intervention programmes** for application at local, state, and federal levels. An essential aspect of monitoring and evaluation should consider the extent to which such programmes are aligned well across all sectors and governance levels. A uniform approach to monitoring and evaluation will provide evidence to support and assist in planning future programmes.

To support the research and development process, **data collected should be disaggregated to represent children and other marginalised communities**. Such detailed and disaggregated data will allow for more accurate policy decisions to address issues unique to these vulnerable groups. It will also enable Malaysia to include children-specific indicators in national (including reporting for disasters and floods) and international reporting (including the NDCs and National Communications and Biennial Update Reports for the UNFCCC).

#### 6.5 Recommendation 5: Public-private partnerships

Many of the recommendations above, and climate mitigation and adaptation programmes in general, require massive capital, expertise, and innovation and come with considerable risk. The public sector is often seen as the driver of environmental pollution, degradation, and climate change but can also be an integral part of the solution.

It is recommended that both the government and private sector actors explore ways to pool resources through **public-private partnerships to address pressing issues related to children, the environment, and the climate**. The public sector can partner with the government to jointly execute child-sensitive climate mitigation and adaptation plans at scale and speed by focusing on efficiency and long-term impact while remaining rooted in public oversight.

For example, infrastructure innovations spearheaded by the private sector can be adapted into national programmes towards climate-smart schools. Advances in private education systems can be applied in the development of climate-smart educational materials and training modules. Corporate social responsibility strategies can be adopted in joint programmes focusing on increasing child participation in climate- and environment-related processes. Particularly in the context of climate finance, such partnerships can remove the strain on the government budget by transferring significant funding risks to the private sector.

Detailed sector-based recommendations focusing on smart partnerships with an emphasis on intersectoral and inter-ministerial synergies are listed in Table 12, together with the proposed timeframe for prioritisation. It is recommended that stakeholders, including the Government of Malaysia, civil society organisations, the private sector, youth organisations, and the United Nations use these key findings and recommendations as input for developing specific recommendations and actions with clear roles and responsibilities, timelines, and resources.

Table 12: Recommendations by sector

SECTOR	ISSUES	RECOMMENDATIONS	TIMEFRAME*
Governance	<ul style="list-style-type: none"> <li>Lack of child-sensitive policies and legislations</li> <li>Fragmentation in policies and implementation</li> <li>Pollution and illegal hazardous waste disposals from industries</li> </ul>	1. To consider children's vulnerabilities to climate change and environmental risks in relevant policies, laws, and plans	Short and medium
		2. To strengthen institutional capacity, including inter-ministerial capacity, and to improve intergovernmental coordination across sectors, including federal-state coordination	Short
		3. To develop monitoring and evaluation mechanisms for climate- and environment-related issues with a focus on children	Short
Health	<ul style="list-style-type: none"> <li>Vector-, food-, water-borne and respiratory diseases</li> <li>Heat-related illnesses</li> <li>Sanitation and hygiene</li> <li>Social support systems</li> <li>Food insecurity</li> <li>Mental health</li> </ul>	1. To develop a comprehensive child-centric guidelines on all health components or indicators related to climate change and environmental degradation, including natural disasters	Short to medium
		2. To strengthen health policies and laws to take into account the extra vulnerability of children to climate change, environmental degradation and natural disaster.	Short to medium
		3. To strengthen existing social protection systems to better protect children and respond to natural disasters/ climate change and public health pandemic	Short to medium
Education	<ul style="list-style-type: none"> <li>Access to education</li> <li>Capacity and resources</li> </ul>	1. To enhance education on environmental health and to strengthen environmental evaluation systems	Short
		2. To increase the availability of resources and educational materials on climate change and environmental sustainability	Short
		3. To strengthen the education system to be more resilient to climate change, environmental risks and natural disasters	Medium to long
Children	<ul style="list-style-type: none"> <li>Child protection</li> <li>Gender equity</li> <li>Safe environment</li> </ul>	1. To increase advocacy and representation for children's rights to a safe and healthy environment, ensuring equity and inclusion	Short
		2. To recognise environmental hazards as a potential source of harm to children's health and well-being, and implement measures to reduce these risks.	Medium to long
Climate change and the environment	<ul style="list-style-type: none"> <li>Vector-borne diseases</li> <li>Rain and heat extremes</li> <li>Forest/peat fires</li> <li>Air and water pollution</li> <li>Water scarcity</li> <li>Injury and death</li> <li>Floods, cyclones, sea-level rise</li> <li>Damage to infrastructure</li> </ul>	1. To update the NPCC 2009 to include children's health vulnerabilities to climate change and environmental risks	Short
		2. To establish a Climate Change Act that addresses the climate change impacts on children's health and well-being	Short
		3. To include disaggregated data on children's health, climate, and the environment in national and international reporting	Medium
		4. To improve the delivery of essential supplies and services such as water and healthcare in remote and vulnerable areas, including during natural disasters.	Medium

Private sector and civil society	<ul style="list-style-type: none"> <li>• Advocacy and representation</li> <li>• Funding resources</li> <li>• Expertise and innovation</li> </ul>	<ol style="list-style-type: none"> <li>1. To provide inclusive platforms for the representation of children in policy and decision-making processes.</li> <li>2. To establish public-private partnerships in support of child-sensitive climate change adaptation and mitigation strategies and actions</li> <li>3. To promote innovation to mitigate and adapt to climate change, with a particular focus on children</li> </ol>	<p>Short and medium</p> <p>Short, medium and long</p> <p>Short, medium and long</p>
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(\*Short term: 1-2 years; Medium term: 3-5 years; Long term: >5 years)



# ANNEXES

## Annexe 1: Study details

Table 13: Integrated Study Framework

DRIVING FORCE	PROGRAM OUTPUT (PO)	METHOD APPROACH	EXPECTED OUTPUT	KEY STAKEHOLDER
<p><b>ANTROPOGENIC STRESSES</b></p> <ul style="list-style-type: none"> <li>➤ Ozone depletion</li> <li>➤ Desertification/deforestation</li> <li>➤ Forest fires</li> <li>➤ Loss of Biodiversity</li> <li>➤ Population growth</li> <li>➤ Urbanization upsurge</li> <li>➤ New industrialization</li> <li>➤ Non-sustainable consumption</li> <li>➤ Transboundary chemical transport</li> </ul> <p><b>CLIMATE DRIVERS</b></p> <ul style="list-style-type: none"> <li>➤ Extreme rainfall</li> <li>➤ Drought</li> <li>➤ Temperature rises</li> <li>➤ Tropical cyclones</li> </ul> <p><b>IMPACT DRIVERS</b></p> <ul style="list-style-type: none"> <li>➤ Flood</li> <li>➤ Heat waves</li> <li>➤ Infectious diseases</li> <li>➤ Air pollution</li> <li>➤ Water pollution</li> <li>➤ Pervasive poverty and Inequity</li> </ul>	<p><b>PO1</b> Integrated analysis on the impacts of climate change and environmental degradation on children's health, nutrition, education and economic status using existing data.</p>	<p>Desk studies</p> <ul style="list-style-type: none"> <li>➤ Air pollution and temperature</li> <li>➤ Wildfire haze</li> <li>➤ Rainfall and heat</li> </ul> <p>Systematic Review Case series report</p> <p>Community case studies</p> <ul style="list-style-type: none"> <li>➤ Gaya Island, Sabah</li> <li>➤ Klang Valley</li> </ul> <p>Questionnaire surveys, focus group discussions (FGD), in-depth interviews (IDI) with community (marginalized children, parents, teachers)</p>	<p>Environmental Health</p> <ul style="list-style-type: none"> <li>➤ Respiratory diseases</li> <li>➤ Respiratory mortality</li> <li>➤ Hospital admissions</li> <li>➤ Burden of diseases</li> <li>➤ Risk estimates of air pollution, rainfall and heatwaves</li> </ul> <p>Well-being</p> <ul style="list-style-type: none"> <li>➤ Extent of poverty</li> <li>➤ % access to formal education</li> <li>➤ Nutritional status (% obesity and stunting)</li> <li>➤ % crime rate</li> <li>➤ Health status: children and family health indicators</li> <li>➤ Health education</li> <li>➤ % access to basic infrastructure (water and electricity)</li> <li>➤ Access to healthcare</li> <li>➤ Gender</li> <li>➤ Child labour</li> <li>➤ Social inclusion</li> </ul> <p>Disaggregated by gender, age, socio-economic status (SES) and disability</p>	<p><b>PO 4</b> Recommendations to UNICEF Malaysia, government agencies and other stakeholders on how to tackle issues affecting children caused by climate change and environmental degradation.</p> <p>Ministry of Health (MOH)</p> <ul style="list-style-type: none"> <li>➤ Family Health Development Division</li> <li>➤ Disease Control Division</li> <li>➤ Environmental Health Unit</li> <li>➤ Institute of Medical Research (IMR)</li> </ul> <p>Ministry of Environment and Water (KASA)</p> <ul style="list-style-type: none"> <li>➤ Climate change unit</li> <li>➤ Environmental Management Unit</li> <li>➤ Department of Environment (JAS)</li> <li>➤ Malaysia Meteorological Department (MMD)</li> <li>➤ National Hydraulic Research Institute of Malaysia (NAHRIM)</li> </ul> <p>Ministry of Women, Family and Community Development (MWFCD)</p> <ul style="list-style-type: none"> <li>➤ Department of Social Welfare Malaysia (JKM)</li> <li>➤ International Relations Division</li> <li>➤ Children Policy Unit</li> </ul> <p>❖ Ministry of Energy and Natural Resources (KeTSA)</p> <p>❖ Ministry of Housing and Local Government (KPKT)</p> <p>❖ Ministry of Rural Development (KPLB)</p> <p>❖ Economic Planning Unit (EPU)</p> <p>❖ National Disaster Management Agency (NADMA)</p> <p>❖ Malaysia Green Technology and Climate Change Centre (MGTC)</p> <p>❖ Child Commissioner of Malaysia (SUHAKAM)</p>
	<p><b>PO2</b> Assessment of existing climate and environment policies and plans and identification of gaps and opportunities.</p>	<p>Content analysis of policies/ plans on</p> <ul style="list-style-type: none"> <li>➤ Climate change and the environment</li> <li>➤ Relevant Sustainable Development Goals (SDGs) targets children's well-being, education, development, health, economic status</li> </ul>	<p>Gap analysis</p> <ul style="list-style-type: none"> <li>➤ Mapping of key actors</li> <li>➤ Adaptation and mitigation: interventions and good practices</li> </ul>	<p>Ministry of Education (MoE)</p> <ul style="list-style-type: none"> <li>➤ Educational Planning and Research Division</li> </ul>
	<p><b>PO3</b> Mapping of key actors and intervention on climate change and environmental management, and identification of good practices and gaps in child-centred climate action in Malaysia.</p>	<p>FGDs, IDIs and consultation workshops with government, UN, NGOs, private sector and youths</p>		



Figure 45: List of activities

## Annexe 2: Selected detailed findings

**Future HWN Relative to Historical Period (1976-2005)**

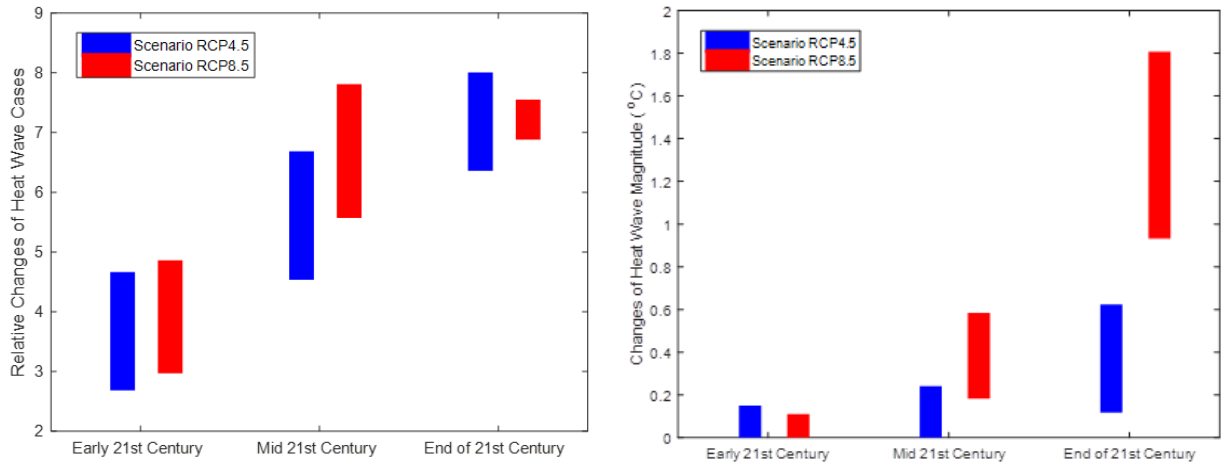
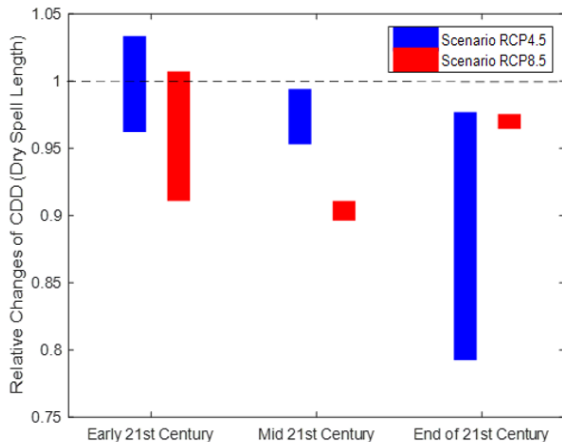


Figure 46: Relative changes of future heatwave numbers (HWN) for the early 21<sup>st</sup> century, mid-21<sup>st</sup> century, and late 21<sup>st</sup> century for RCP4.5 and RCP8.5 downscaled projections (left panel); relative changes of future heatwave magnitude at Subang for the early 21<sup>st</sup> century, mid-21<sup>st</sup> century, and the end of 21<sup>st</sup> century for both RCP4.5 and RCP8.5 downscaled projections (right panel)

**Future CDD Relative to Historical Period (1976-2005)**



**Future CWD Relative to Historical Period (1976-2005)**

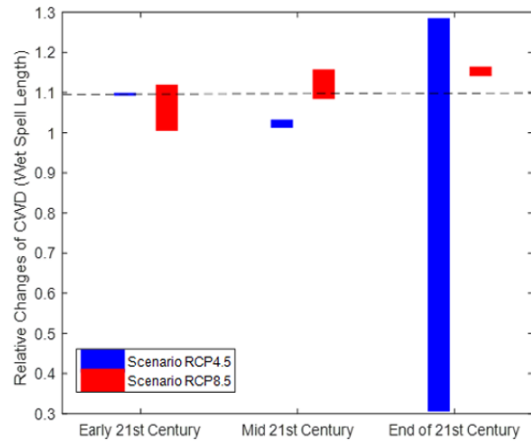


Figure 47: Relative changes of dry spells (Consecutive Dry Days, CDD, left panel) and wet spells (Consecutive Wet Days, CWD, right panel) for the early 21<sup>st</sup> century, mid-21<sup>st</sup> century, and late 21<sup>st</sup> century for both RCP4.5 and RCP8.5 downscaled projections

Table 14: Studies on environmental issues and their effects in Malaysia<sup>79</sup>

SCOPE	ISSUES	REFERENCES
Air pollution	Bad indoor air quality is due to the presence of indoor air pollutants such as CO, CO <sub>2</sub> , PM, volatile organic compounds, NO <sub>2</sub> and airborne microbes.	Choo & Jalaludin (2015), Rawi et al., (2015)
	Traffic-related air pollutants are linked to acute respiratory infection among children.	Rahman et al. (2017)
	Asthma attacks among children were significantly related to the PM <sub>10</sub> and NO <sub>2</sub> levels in the air.	Zailina et al., (1997), Afroz et al., (2003)
	Lead exposure in indoor and outdoor air was significantly (16 times) higher in urban areas than in suburban areas.	Zailina et al. (1996)
	Impact of transboundary outdoor air pollution on respiratory disease.	Sahani et al., (2014), Sulong et al., (2017)
Pesticide and/or food	Health risk assessment of road dust exposure towards children.	Wahab et al., (2020), Othman et al., (2020)
	Effects of organophosphate pesticide mixture exposure on the neurodevelopment of primary school children in paddy farming areas.	Hashim (2015)
Water	Pesticide residues in fruit and vegetables.	Zawiyah et al. (2007)
	Health impact of bauxite exposure in the environment (air and water) due to bauxite mining in Pahang.	Abdullah et al, (2016), Kusin et al., (2018)

Modified from: Abdullah (2020)

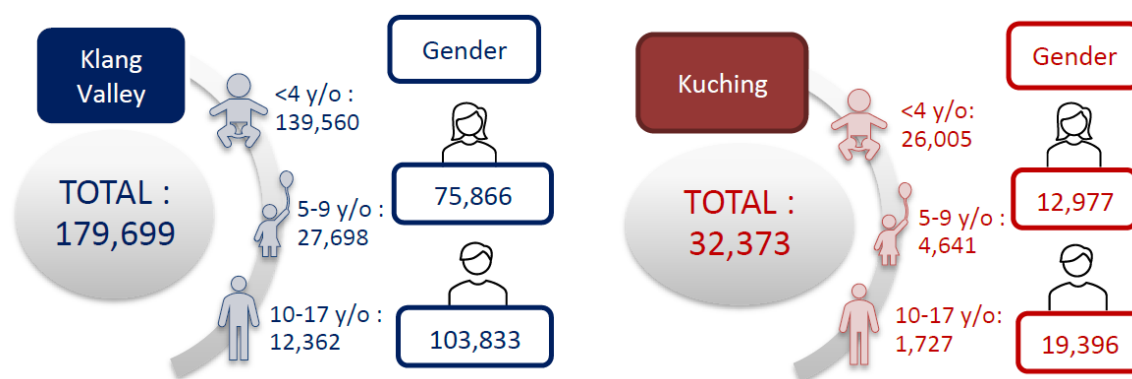
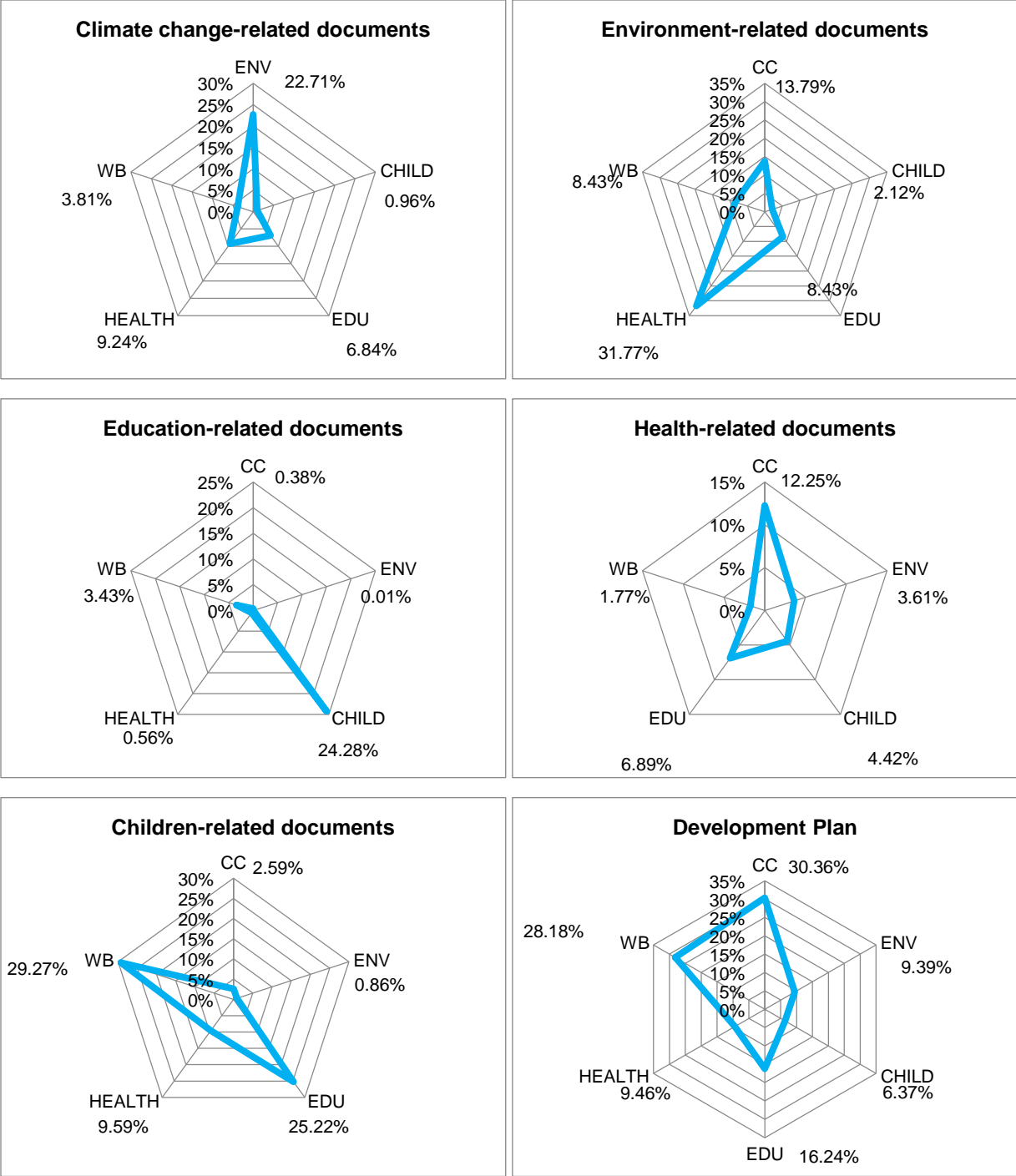


Figure 48: Total hospital admissions for respiratory diseases in Klang Valley and Kuching



CC: climate change; ENV: environment; EDU: education; WB: well-being

Figure 49: Keyword web analysis in documents analysed

Table 15: Main health outcomes of the selected studies for Desk Study 2

AUTHORS & YEAR	CITY/ COUNTRY	INCOME GROUP	STUDY PERIOD	MAIN FINDINGS
Abdul Rahman et al. (2017)	Klang Valley, Malaysia	UM	2006-2010	PM <sub>10</sub> contributes to a high risk of acute bronchiolitis
Alizadeh et al. (2016)	Tehran, Iran	UM	2009-2011	There was a significant correlation between NO <sub>2</sub> and SO <sub>2</sub> and admission due to asthma in children.
Asa & Jinsart (2016)	Rayong, Thailand	UM	2011-2014	Symptoms among children within 1 km from the industrial were significantly higher compared with children who live within 10 km from the industrial area
Bai et al. (2018)	Hefei, China	UM	2015-2016	NO <sub>2</sub> , PM <sub>2.5</sub> and CO were significantly associated with increased hospital visits for acute childhood bronchitis
Çapraz et al. (2017)	Istanbul, Turkey	UM	2013-2015	Hospital admissions for respiratory diseases are associated with a 10 mg/m <sup>3</sup> increase in PM <sub>2.5</sub> and NO <sub>2</sub>
Chen et al. (2016)	Shanghai, China	UM	2007-2011	Each 10 µg/m <sup>3</sup> increase in O <sub>3</sub> and PM <sub>10</sub> was associated with increased outpatient visits for allergic rhinitis.
Dastoorpoor et al. (2018)	Ahvaz, Iran	UM	2008-2015	Exposure to O <sub>3</sub> , PM <sub>10</sub> , and NO <sub>2</sub> increased the risk of respiratory mortality in Ahvaz, Iran
Deng et al. (2018)	Changsha, China	UM	2011-2012	Each 10 µg/m <sup>3</sup> increase in PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> , and CO were associated with increased hospital visits for asthma
Ding et al. (2017)	Chongqing, China	UM	2013	SO <sub>2</sub> was significantly associated with persistent cough symptoms, and NO <sub>2</sub> was significantly associated with current wheezing symptoms
Enkh-Undraa et al. (2019)	Ulaanbaatar, Mongolia	LM	2015-2016	PM <sub>2.5</sub> was associated with ILI risk among school children
Feng et al. (2016)	Beijing, China	UM	2008-2014	PM <sub>10</sub> showed adverse effects on asthma in children
Ge et al. (2018)	Guangzhou, China	UM	2012-2015	Each 10 µg/m <sup>3</sup> increased in O <sub>3</sub> and PM <sub>10</sub> were associated with increased outpatient visits for allergic rhinitis
Ismail et al. (2019)	Kajang and Hulu Langat, Malaysia	UM	2018	PM <sub>2.5</sub> and PM <sub>10</sub> were significantly associated with cough and wheezing. However, there was no significant association between CO, NO <sub>2</sub> and SO <sub>2</sub> with respiratory health symptoms
Jiang et al. (2018)	Changsha, China	UM	2011-2012	Childhood pneumonia was associated with postnatal exposure to outdoor PM <sub>10</sub>
Li et al. (2018)	Ningbo, China	UM	2014-2015	Each 10-µg/m <sup>3</sup> increase in PM <sub>2.5</sub> , PM <sub>10</sub> , NO <sub>2</sub> , and SO <sub>2</sub> were associated with the increase of hospital visits for pneumonia in children
Li et al. (2018a)	Hefei, China	UM	2014-2015	Every 10 mg/m <sup>3</sup> increase in PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> and CO concentration were associated with an increase in URTI
Liu et al. (2016)	Shanghai, China	UM	2011-2012	Exposure to NO <sub>2</sub> (increment of 10 µg/m <sup>3</sup> ) during the first year of life was significantly associated with asthma and allergic rhinitis
Liu et al. (2017)	Yichang, China	UM	2014-2015	Each interquartile range increase in PM <sub>2.5</sub> , PM <sub>10</sub> , NO <sub>2</sub> , CO, and O <sub>3</sub> concentrations was significantly associated with increased paediatric respiratory outpatient visits, respectively
Liu et al. (2019)	Jinan, China	UM	2011-2015	Each 10 µg/m <sup>3</sup> increase of PM <sub>2.5</sub> was associated with an increase in total and male hospital admissions
Luong et al. (2017)	Hanoi, Vietnam	LM	2010-2011	An increase in 10 µg/m <sup>3</sup> of PM <sub>10</sub> , PM <sub>2.5</sub> and PM <sub>1</sub> was associated with an increase of 1.4%, 2.2% and 2.5% risk of respiratory diseases admission
Luong et al. (2018)	Vietnam	LM	2010-2014	An increase of 10 µg/m <sup>3</sup> in O <sub>3</sub> level was associated with an increase of 2.1% risk of admissions for respiratory diseases.
Lv et al. (2017)	China	UM	2014	An increment of 10 µg/m <sup>3</sup> in PM <sub>2.5</sub> and PM <sub>10</sub> was correlated with a 6% and 4% rise in the number of admissions for pneumonia, respectively.
Ma et al. (2018)	China	UM	2009-2012	Each 10 µg/m <sup>3</sup> increment in NO <sub>2</sub> concentration was significant with a 2.04% increased number of hospital emergency admissions for respiratory diseases.
Nakhlé et al. (2015)	Lebanon	UM	2012	Respiratory admission among children was associated with PM <sub>2.5</sub> and PM <sub>10</sub> concentrations

AUTHORS & YEAR	CITY/ COUNTRY	INCOME GROUP	STUDY PERIOD	MAIN FINDINGS
Ma et al. (2019)	China	UM	2009-2010	Exposure to PM <sub>2.5</sub> was associated with increased hospital visits for asthma was for children under eight years old
Nhung et al. (2018)	Vietnam	LM	2007-2014	Increments of an interquartile range (21.9 µg/m <sup>3</sup> ) in the 7-day-average level of NO <sub>2</sub> were associated with a 6.1% increase in pneumonia hospitalisations
Nhung et al. (2019)	Vietnam	LM	2007-2016	An IQR increase in O <sub>3</sub> concentrations (85.8 mg/m <sup>3</sup> ) was associated with a 5% decrease in the odds of discharge from hospital among children with ALRI
Norbäck et al. (2018)	China	UM	2010-2012	NO <sub>2</sub> was associated with asthma and rhinitis. Meanwhile, PM <sub>10</sub> was significantly associated with nocturnal cough
Norbäck et al. (2019)	China	UM	2010-2012	NO <sub>2</sub> was associated with asthma, rhinitis and current wheeze
Norbäck et al. (2019a)	China	UM	2005-2012	NO <sub>2</sub> and PM <sub>10</sub> were associated with decreased remission of wheeze and rhinitis. Exposure to PM <sub>2.5</sub> was associated with a higher prevalence of wheeze
Qiu et al. (2018)	China	UM	2015-2016	An increase of 10 µg/m <sup>3</sup> in PM <sub>10</sub> was associated with an increase in total respiratory admission among children (≤14 years)
Shan et al. (2016)	China	UM	2014	Children visits with wheezing increased from 0 to nearly 20 % with every interquartile increase of PM <sub>2.5</sub> .
Song et al. (2018)	China	UM	2013-2015	Each 10 µg/m <sup>3</sup> increase of NO <sub>2</sub> , PM <sub>2.5</sub> , and SO <sub>2</sub> corresponded to an increase of 0.66%, 0.13% and 0.33% in daily hospital outpatient visits for children with respiratory diseases, respectively.
Suryadhi et al. (2019)	Indonesia	LM	2012	An IQR increase in mean NO <sub>2</sub> exposure increased the risk for ARI by 18%
Wang et al. (2019)	China	UM	2014-2016	Each IQR increase in NO <sub>2</sub> and O <sub>3</sub> concentrations were significantly associated with death due to pneumonia
Wu et al. (2019)	China	UM	2016-2018	Exposure to PM <sub>2.5</sub> and PM <sub>10</sub> was significantly associated with an elevated risk of exacerbation of asthma
Xia et al. (2017)	China	UM	2013	A 10 µg/m <sup>3</sup> increase in PM <sub>10</sub> and PM <sub>2.5</sub> were associated with increase admission for upper respiratory infection among children under 14 years
Xia & Yao (2019)	China	UM	2014	A 10-µg/m <sup>3</sup> increase in PM <sub>2.5</sub> was associated with a 4.3% increase in acute lower respiratory infection.
Zhang et al. (2019)	China	UM	2015-2016	NO <sub>2</sub> was significantly associated with cumulative effects of asthma in single- and multi-pollutant model
Zheng et al. (2017)	China	UM	2014-2015	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , and NO <sub>2</sub> were associated with hospital visits for acute upper respiratory infections
Zhu et al. (2019)	China	UM	2016-2018	PM <sub>10</sub> , NO <sub>2</sub> , and SO <sub>2</sub> raised uncontrolled-asthma rate

Abbreviations: CI=confidence interval; ER=excess risk; ERR=excess relative risk; OR=odds ratio; RR=relative risk; SO<sub>2</sub>=sulfur dioxide; VOC=Volatile organic compound

Table 16: List of chemicals found at the dumping site and their health effects<sup>80</sup>

CHEMICAL	EXPOSURE ROUTE	SYMPTOMS	CANCER RISK
<b>Benzene</b>	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation to eyes, skin, nose, and/or respiratory system, dizziness, headache, nausea, staggering gait, anorexia, lassitude (weakness and exhaustion), dermatitis, bone marrow depression	Carcinogenic to humans. May cause leukaemia
<b>Acrylonitrile</b>	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation to eyes and/or skin, asphyxia, headache, sneezing, nausea, vomiting, lassitude, dizziness, skin vesiculation, scaling dermatitis	Possibly carcinogenic to humans. Increased risk of tumours in the brain, lung, and bowel cancer
<b>Acrolein</b>	Inhalation, ingestion, skin and/or eye contact	Irritation to eyes, skin, and/or mucous membrane, decreased pulmonary function, delayed pulmonary oedema, chronic respiratory disease	Not classifiable as to its carcinogenicity to humans
<b>Hydrogen Chloride</b>	Inhalation, ingestion, skin and/or eye contact	Irritation to nose, throat, and/or larynx, cough, choking, dermatitis	Not classifiable as to its carcinogenicity to humans
<b>Methane</b>	Inhalation, ingestion, skin and/or eye contact	Breathing difficulties (i.e. suffocation and increased breathing rate), nausea and vomiting, loss of consciousness, weakness, headaches and dizziness, loss of coordination	Probably not carcinogenic to humans
<b>Toluene</b>	Inhalation, ingestion, skin and/or eye contact	Headaches, dizziness, loss of consciousness, loss of coordination, sleepiness	Not classifiable as to its carcinogenicity to humans
<b>Ethylbenzene</b>	Inhalation, ingestion, skin and/or eye contact	Irritation to eyes and/or throat, chest constriction, dizziness	Possibly carcinogenic to humans
<b>d-limonene</b>	Inhalation, ingestion, skin and/or eye contact	Breathing difficulties, skin irritation	Not classifiable as to its carcinogenicity to humans



## NOTES

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