

NEW GREEN POSSIBILITIES

THE PENANG CLIMATE ADAPTATION PROGRAMME

Sofia Castelo
23 July 2021



BANGKOK
DESIGN
WEEK 2021



A European Union
Programme

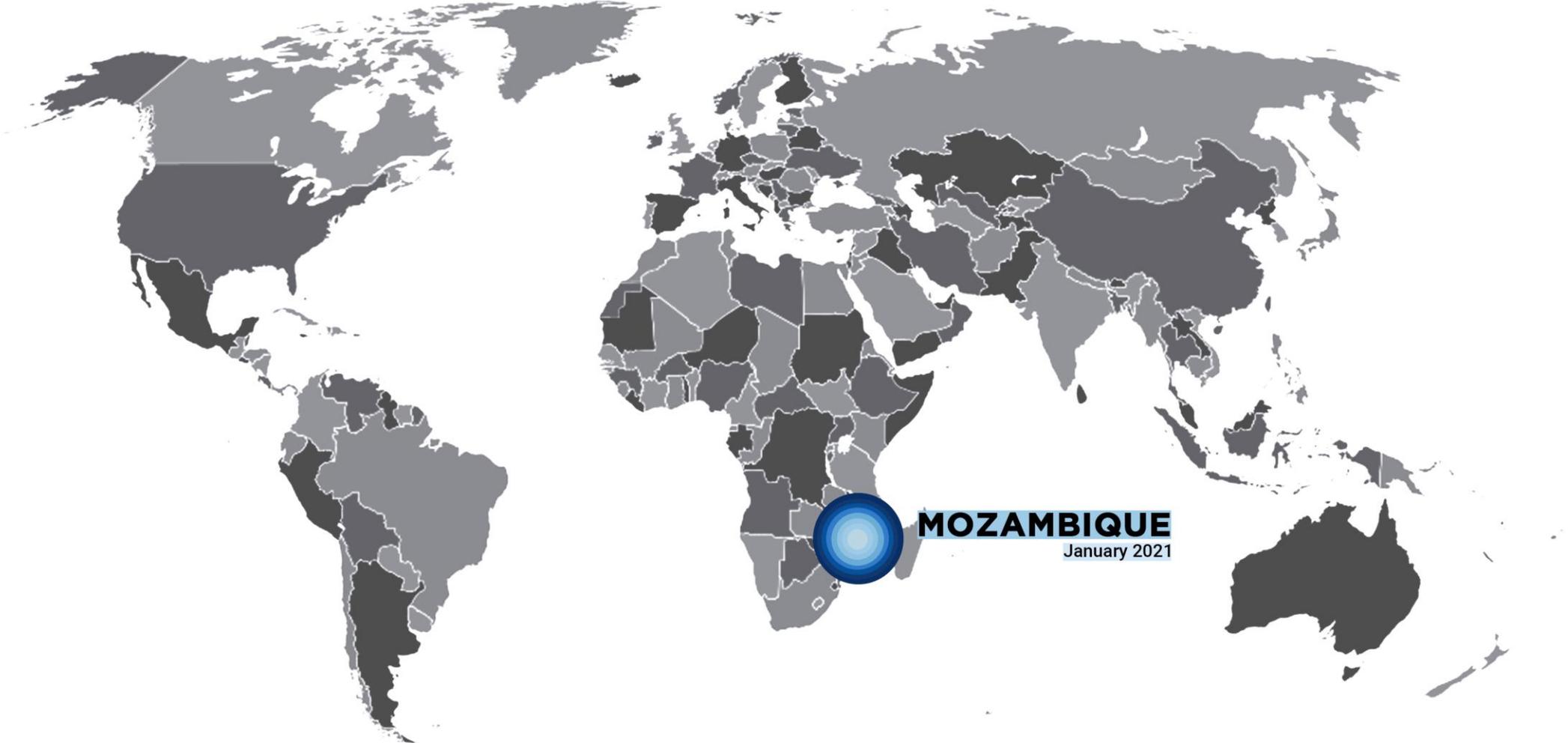


thinkCITY
REJUVENATING THE CITY TOGETHER

CONTENTS

- 1** Introduction : Climate Change Scenario in Malaysia
- 2** Approach to municipal climate programmes
- 3** The Penang Nature-based Climate Adaptation Programme
- 4** Think City Expertise

EXTREME WEATHER EVENTS IN 2021



The impacts of climate change in Malaysia range from infrastructure damage, health implications, reduced liveability in cities, food insecurity, to the increased cost of energy usage

Southeast Asia is one of three regions in the world which will be hardest hit by climate change in the near future.

Special Report on Global Warming of 1.5° C, IPCC, October 8th, 2018

More extreme weather events

Flooding

Damage to infrastructure and private property

Heat waves

Negative impact in human and ecosystem health

Agriculture production losses

Malaysia's urban areas were not at risk from heat stress in 2000 but will be in 2050.

Impact 2050 – The Future of Cities, Technical report, UCCRN, 2018

Rise of temperatures

Impact on health

Less livability conditions

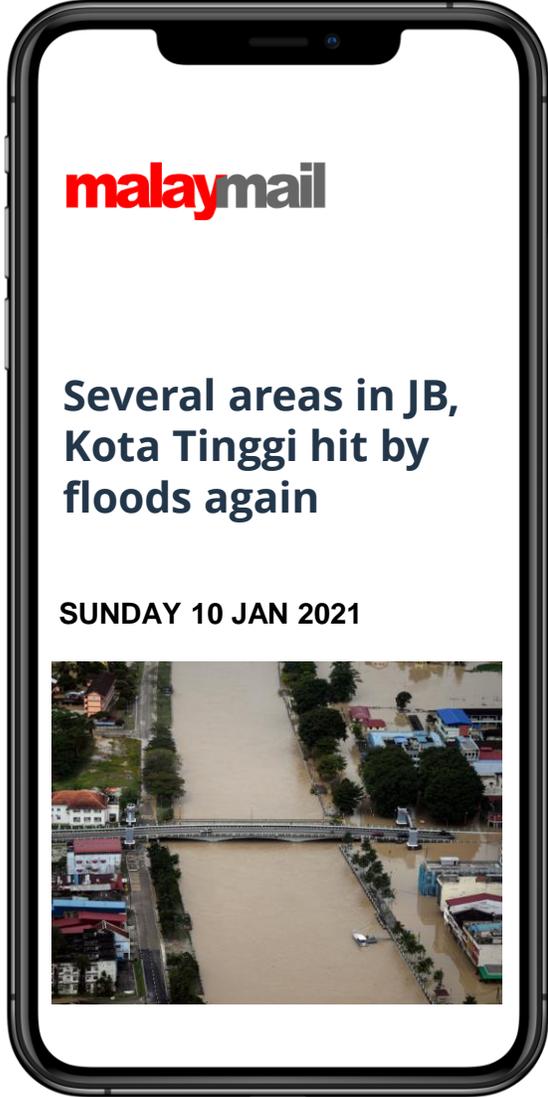
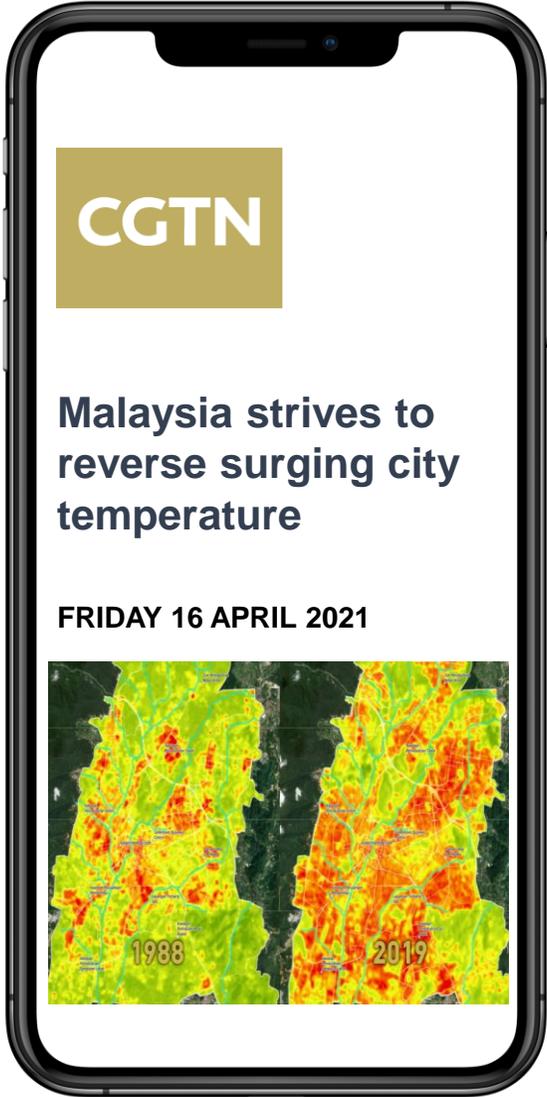
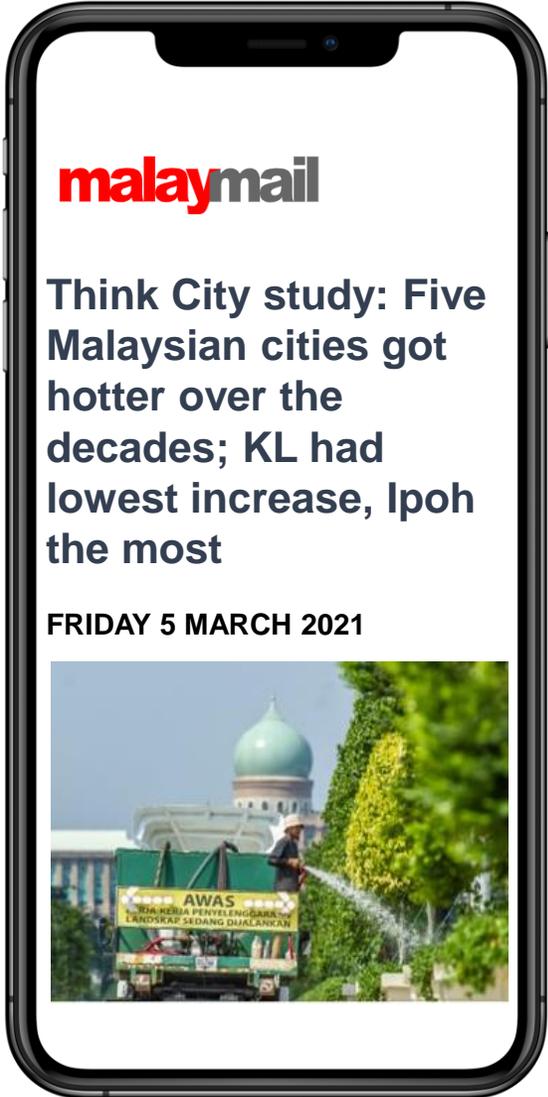
Increased costs

Increased costs of food

Increased energetic costs



Recent study by Think City reveals that Malaysian cities are getting hotter since the 90s – up to 6.75°C increase in peak surface temperature, including Johor



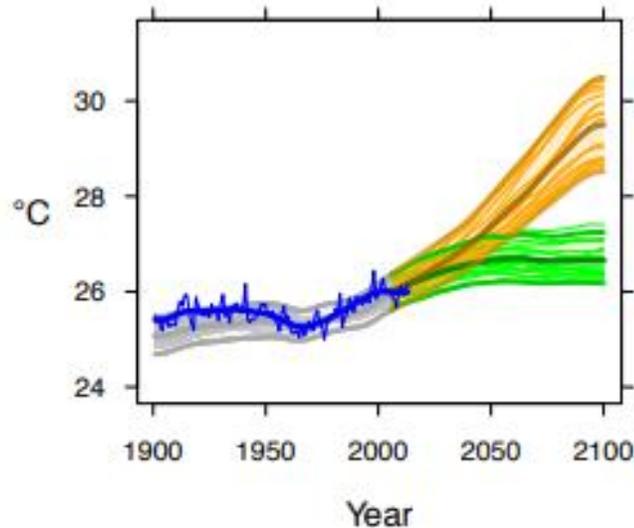
Climate and Health Country profile - 2015

MALAYSIA

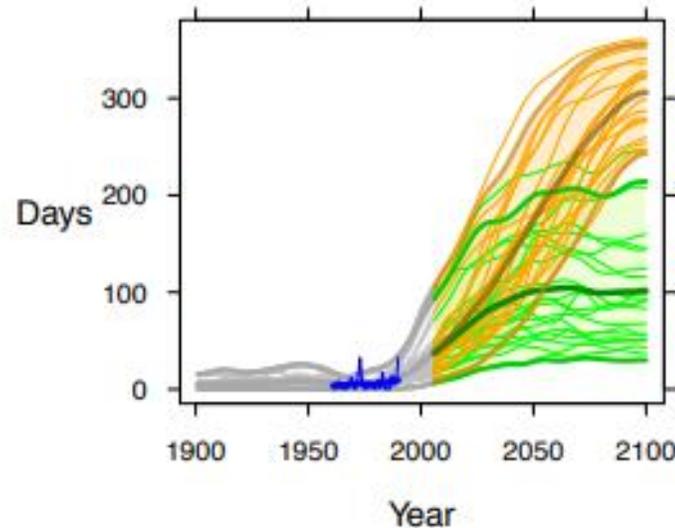
COUNTRY-SPECIFIC CLIMATE HAZARD PROJECTIONS

The model projections below present climate hazards under a high emissions scenario, Representative Concentration Pathway 8.5 [RCP8.5] (in orange) and a low emissions scenario, [RCP2.6] (in green).^a The text boxes describe the projected changes averaged across about 20 models (thick line). The figures also show each model individually as well as the 90% model range (shaded) as a measure of uncertainty and, where available, the annual and smoothed observed record (in blue).^{b,c}

MEAN ANNUAL TEMPERATURE



DAYS OF WARM SPELL ('HEAT WAVES')



20 days/year with heatwaves in 1980
200 days/year with heatwaves in 2050

Climate change impact estimate on Malaysia's GDP

Table 1: Impacts of global warming (3°C) on the world GDP (% change/year)

	2027	2037	2047	2067	Long Run
Australia	-0.051	-0.107	-0.172	-0.326	-1.083
New Zealand	0.043	0.073	0.087	0.073	-0.798
Rest of Oceania	-0.452	-0.924	-1.422	-2.470	-5.171
China	-0.205	-0.438	-0.692	-1.247	-2.918
Hong Kong	-0.356	-0.765	-1.216	-2.205	-5.288
Japan	-0.042	-0.100	-0.173	-0.356	-1.335
South Korea	-0.025	-0.071	-0.136	-0.313	-1.498
Mongolia	-0.214	-0.415	-0.631	-1.105	-2.710
Taiwan	-0.535	-1.121	-1.740	-3.034	-5.978
Rest of East Asia	-0.819	-1.752	-2.752	-4.849	-9.490
Brunei Darussalam	-0.372	-0.815	-1.308	-2.385	-5.563
Cambodia	-1.175	-2.439	-3.758	-6.482	-12.101
Indonesia	-1.242	-2.594	-4.020	-6.973	-13.267
Laos	-1.039	-2.164	-3.342	-5.765	-10.621
Malaysia	-1.091	-2.293	-3.568	-6.229	-12.118
Philippines	-1.206	-2.592	-4.093	-7.275	-14.798
Singapore	-0.905	-1.958	-3.106	-5.562	-11.652
Thailand	-0.766	-1.605	-2.500	-4.401	-9.243
Vietnam	-0.802	-1.636	-2.500	-4.276	-7.959
Rest of Southeast Asia	-1.342	-2.767	-4.237	-7.234	-12.924
Bangladesh	-0.854	-1.671	-2.491	-4.142	-7.591
India	-1.023	-2.099	-3.222	-5.532	-10.351
Nepal	-0.505	-1.012	-1.537	-2.628	-5.731
Pakistan	-0.483	-1.001	-1.557	-2.753	-6.435
Sri Lanka	-1.129	-2.320	-3.569	-6.154	-11.716
Rest of South Asia	-1.081	-2.105	-3.133	-5.206	-9.606
Canada	0.062	0.111	0.151	0.203	-0.218
United States of America	-0.015	-0.037	-0.067	-0.147	-0.622

ECONOMIC IMPACT

3% DECLINE IN GDP IN THE MEDIUM TERM DUE TO CLIMATE CHANGE (2040)

6% DECLINE IN GDP IN THE MEDIUM TERM DUE TO CLIMATE CHANGE (2060)

12% DECLINE IN GDP IN THE LONG TERM DUE TO CLIMATE CHANGE (2100)

CITIES ARE MOST AT RISK



MAIN CLIMATE CHALLENGES

Temperature rise

Sea level rise

Flooding due to changes in rainfall patterns

MAIN INFRASTRUCTURE IMPACTS

- Power grid
- Water supply
- Public health facilities

- All coastal infrastructure
- Transportation

- Drainage
- Housing
- All supply chains

RISK OF NOT TAKING ACTION



Multiple impacts at all levels with many unknowns

Climate Change Scenario in Johor

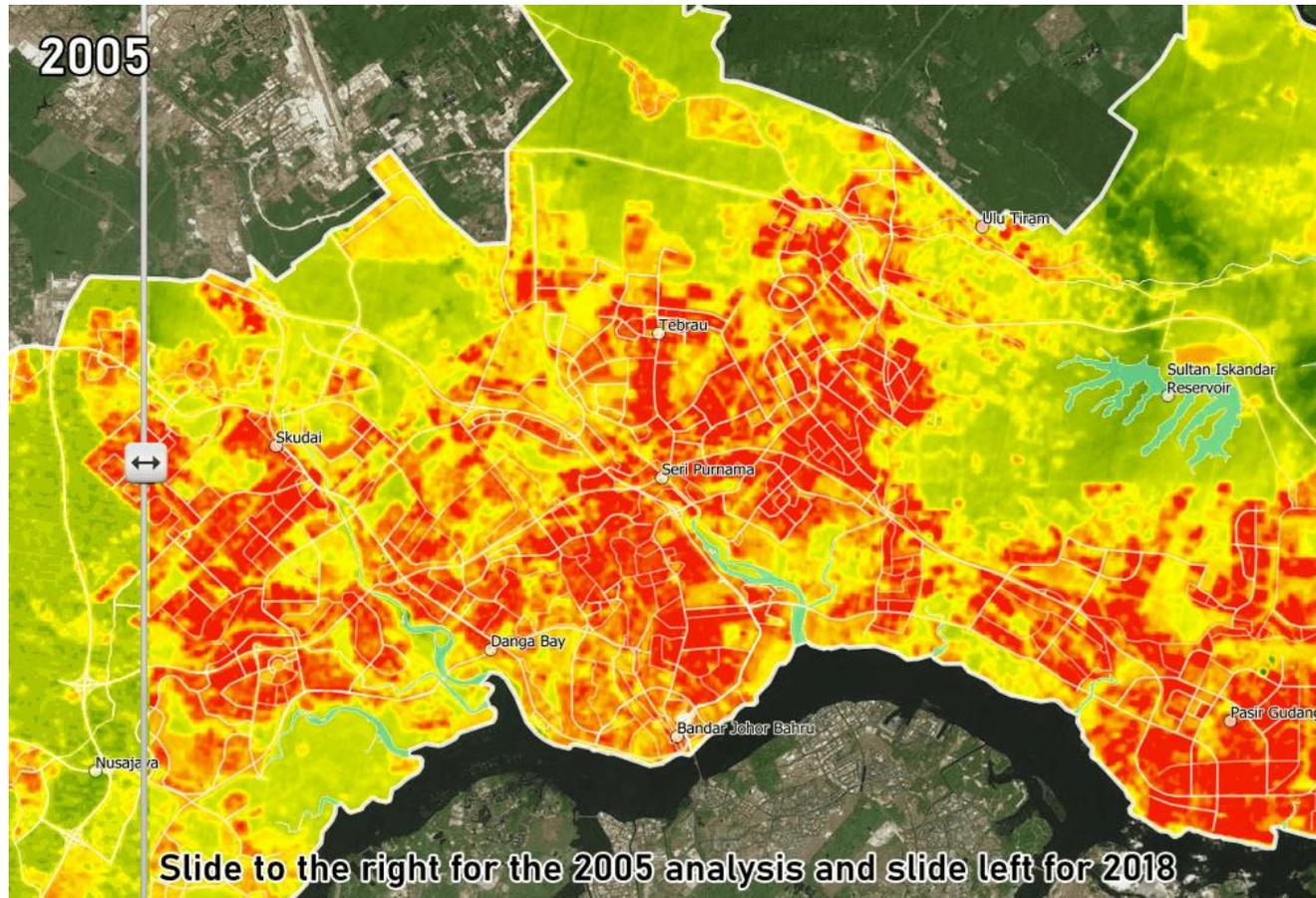
Temperatures

JOHOR BAHRU

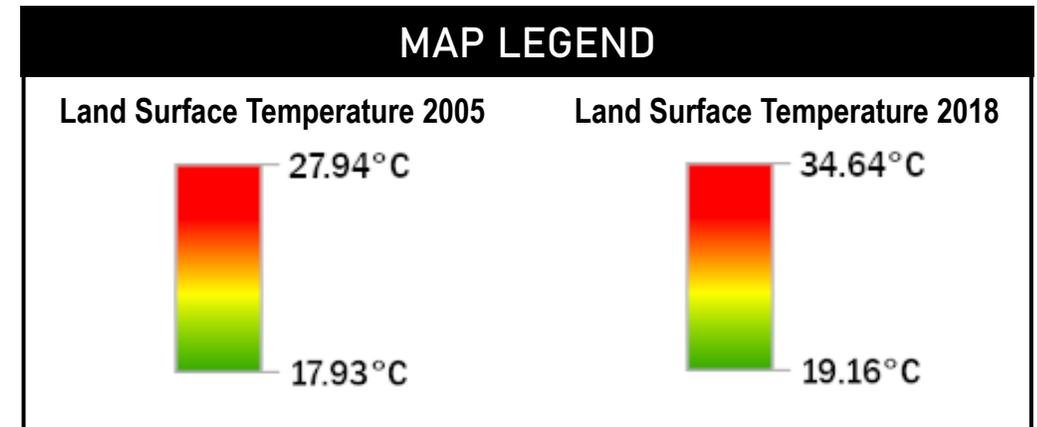
Increase of temperature in the last 13 years

(verified by remote sensing data on surface temperatures - Landsat 8)

↑↑ Max. 6.7°C
↑↑ Min. 1.2°C



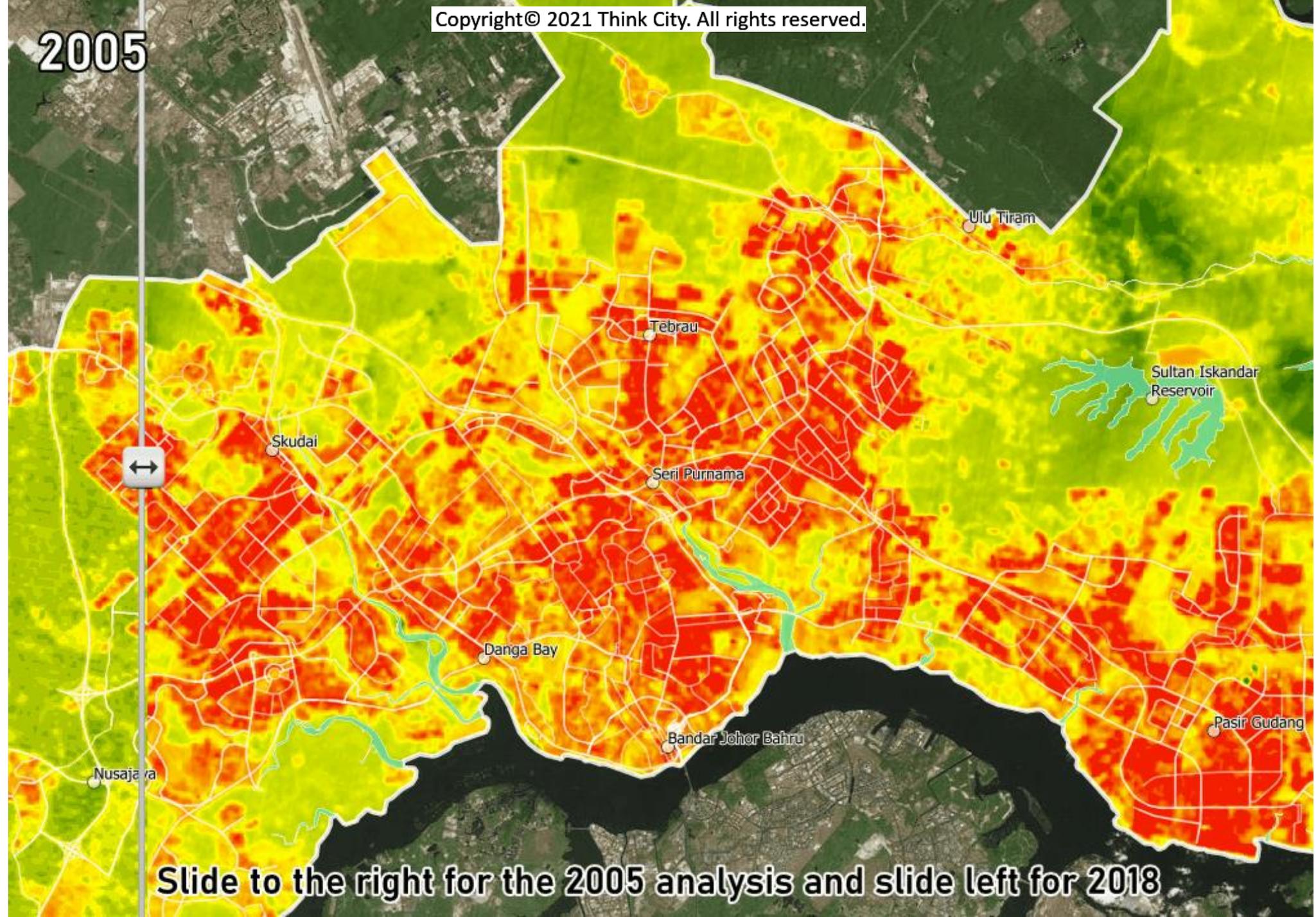
- A study by Think City showed an **increase of 6.7°C** in **Johor Bahru's district** surface temperature between **2005 and 2018** (e.g. Highest increases: Nusajaya, Bandar Dato' Onn near Tebrau and Tanjung Langsat)
- Rise attributed to JB's **increased built environment, rate of gentrification** and **increase in number of heavy steel industries** (e.g. Kawasan Perindustrian Tanjung Langsat and Pasir Gudang: over 33°C)



2005

2018

2005



Slide to the right for the 2005 analysis and slide left for 2018

Sea Level Rise

Sea level rise is a major threat to coastal areas specially the Western coast of Peninsular Malaysia

LAND PROJECTED TO BE BELOW ANNUAL FLOOD LEVEL IN 2050

Improved elevation data indicate far greater global threats from sea level rise and coastal flooding than previously thought, and thus greater benefits from reducing their causes.

[DETAILS AND LIMITATIONS](#)

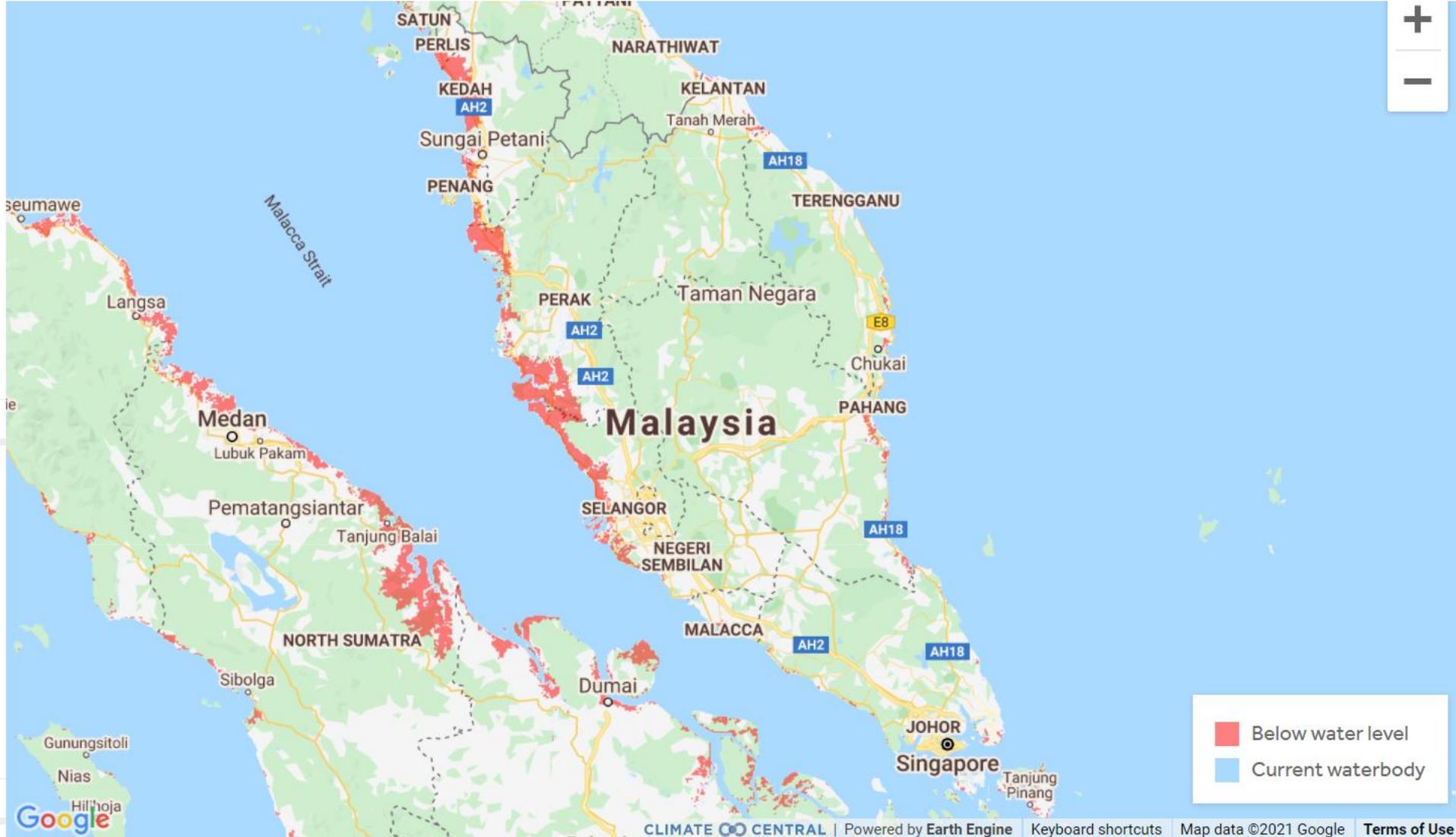
[Report](#) [Scientific Paper](#) [In the News](#)

Elevation Data Used (i)

- Best available (i)
- CoastalDEM® v1.1 (i)
- Legacy data (i)

[CHANGE OTHER SETTINGS](#)

[Video Tutorial](#) (i)

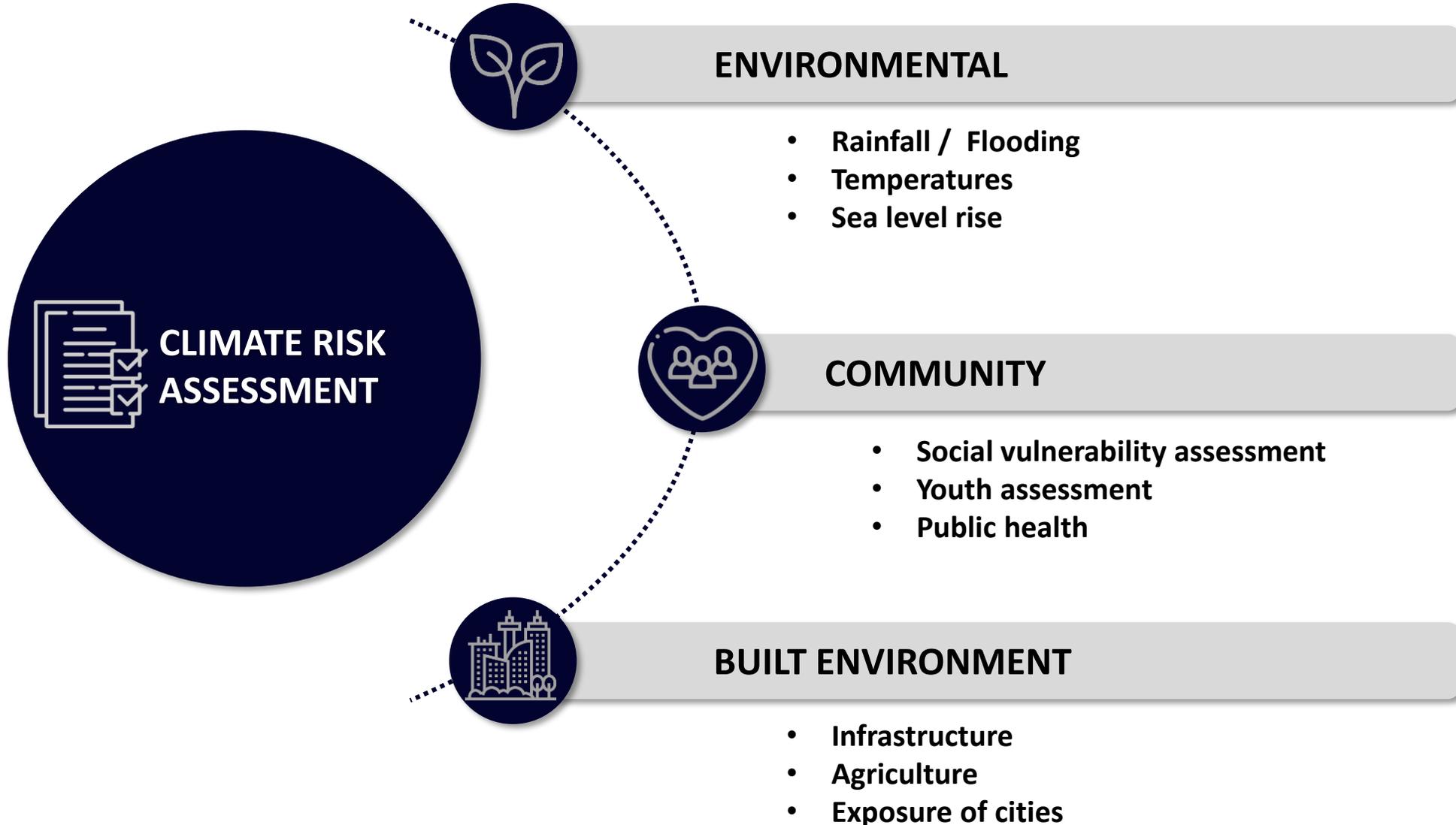


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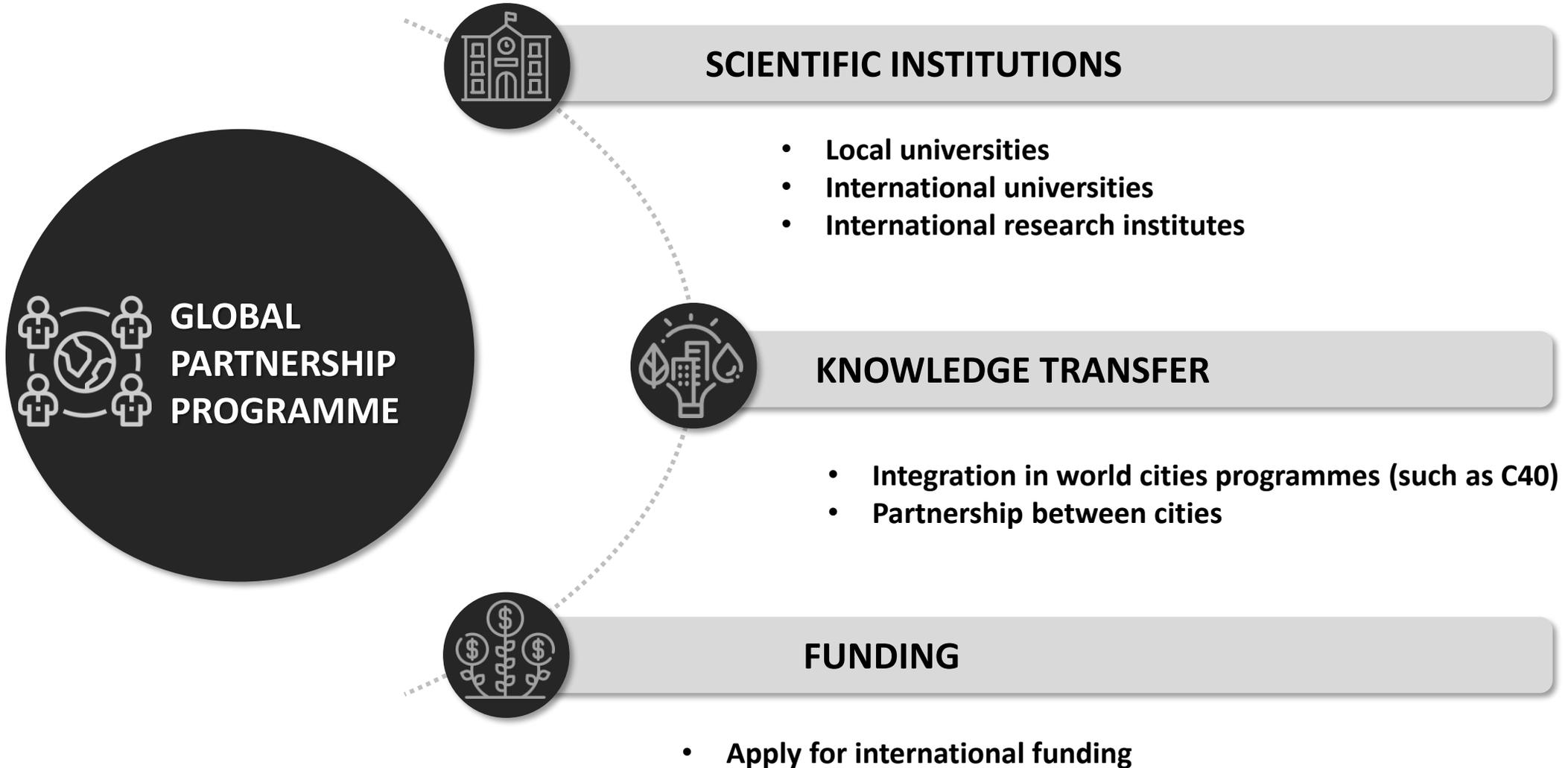
Proposal for an Integrated Approach to Climate-related Issues in Malaysia

Climate-integrated components allowing comprehensive monitoring and evaluation of progress.



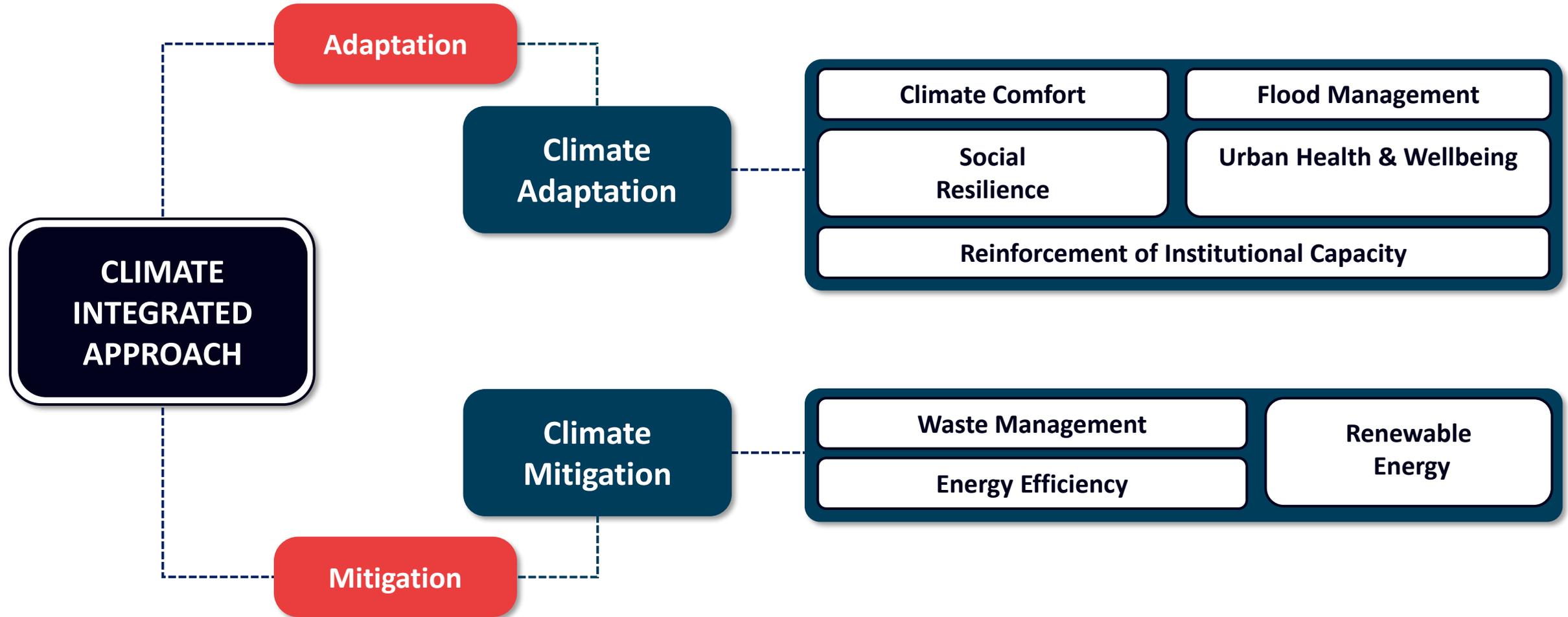
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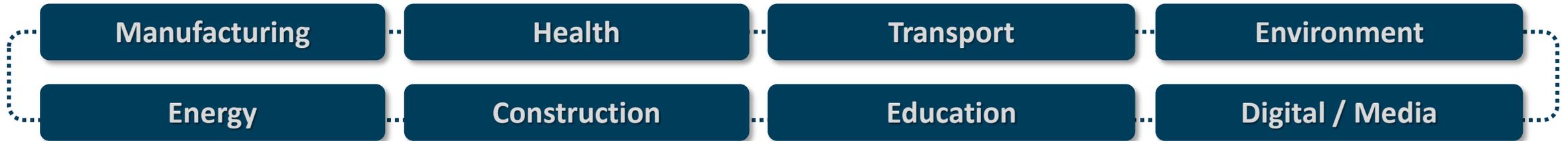
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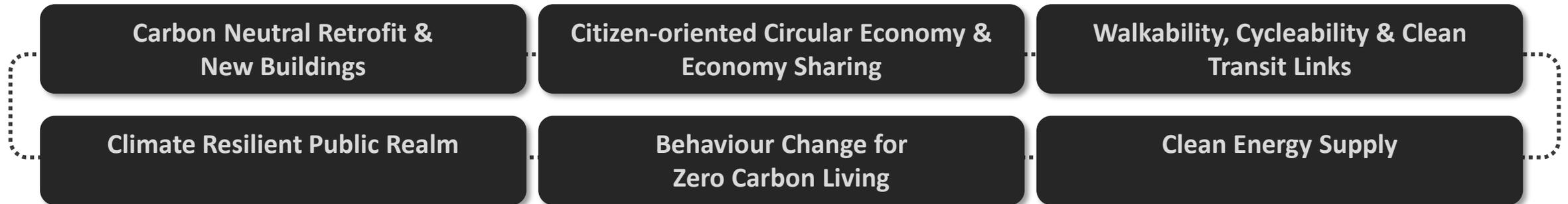
CLIMATE INTEGRATED APPROACH

GOAL : To establish targets for climate-proofed and carbon neutrality

SECTORS

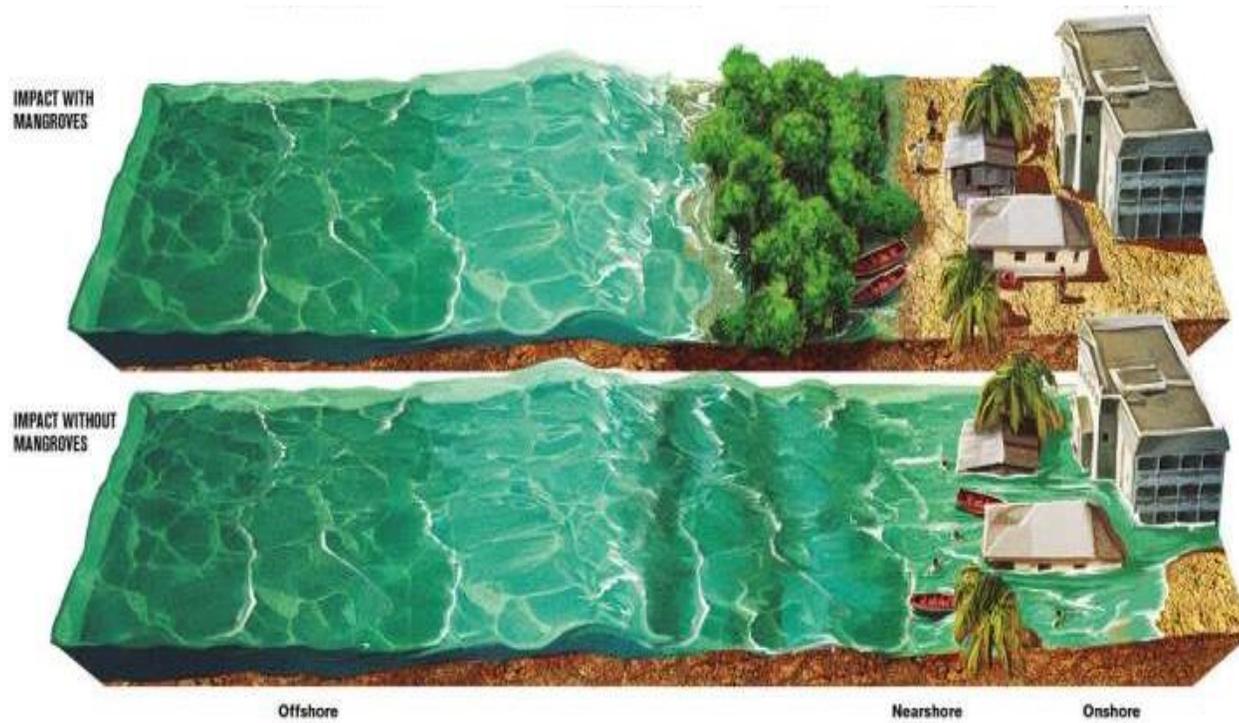


PROJECTS (Preliminary Listing)



The importance of risk assessment – example of sea level rise

Malaysia has a **medium-high vulnerability to sea level rise**; the threat is stronger in the **western coast of Peninsular Malaysia**, where vulnerability peaks due to it being the location of the biggest **coastal urban areas**



The country's total cost of sea level rise with and without adaptation is estimated to be RM 662 million and RM 27 billion per year respectively in 2100.

Source: Sarkar, Md. Sujahangir Kabir & Begum, Rawshan & Pereira, Joy & Jaafar, Abdul & Saari, Mohd Yusof. (2014). Impacts of and Adaptations to Sea Level Rise in Malaysia. Asian Journal of Water, Environment and Pollution. 11. 29-36.

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GOALS

To use nature-based solutions to reduce climate change impacts in Penang, reducing threats to human life, infrastructure and property

SCIENCE-DRIVEN :

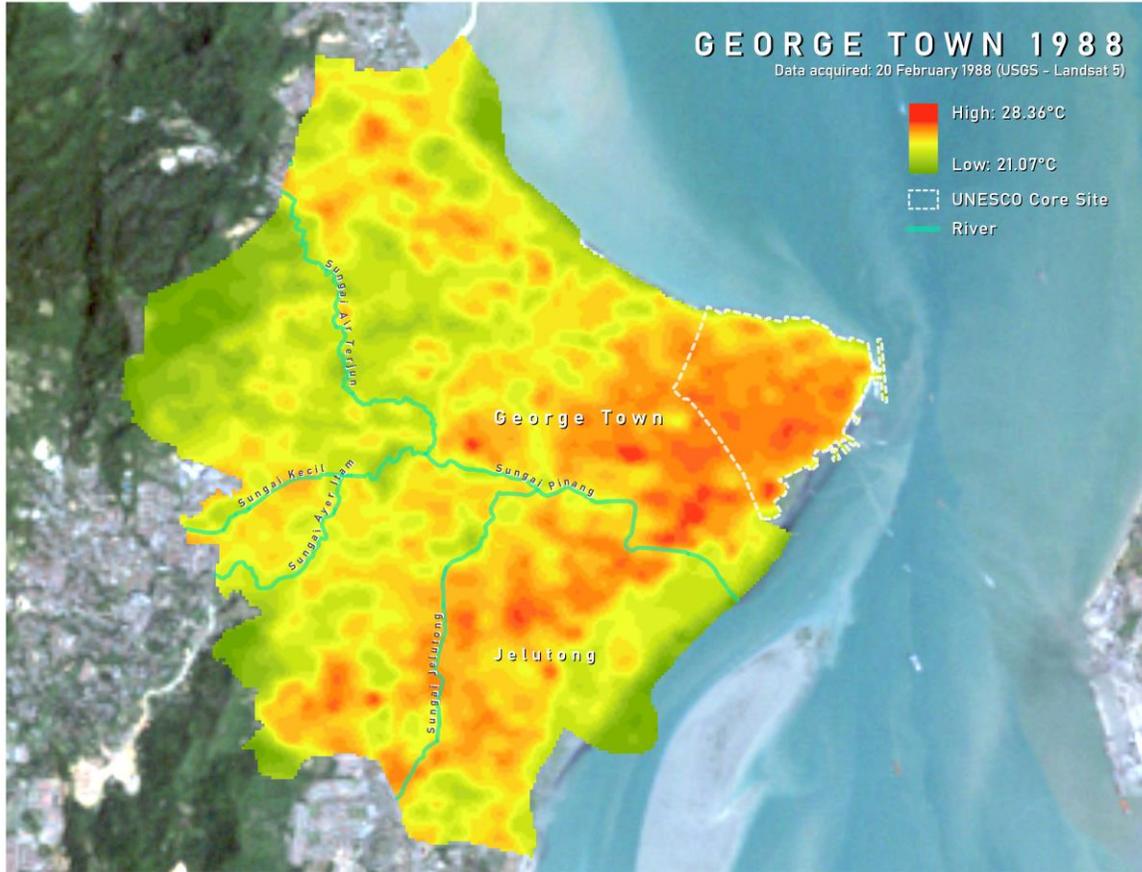
- Design
- Results/ Impact Assessment

GEORGE TOWN

Increase of temperature in the last 32 years
(verified by remote sensing data on surface temperatures - Landsat 8)

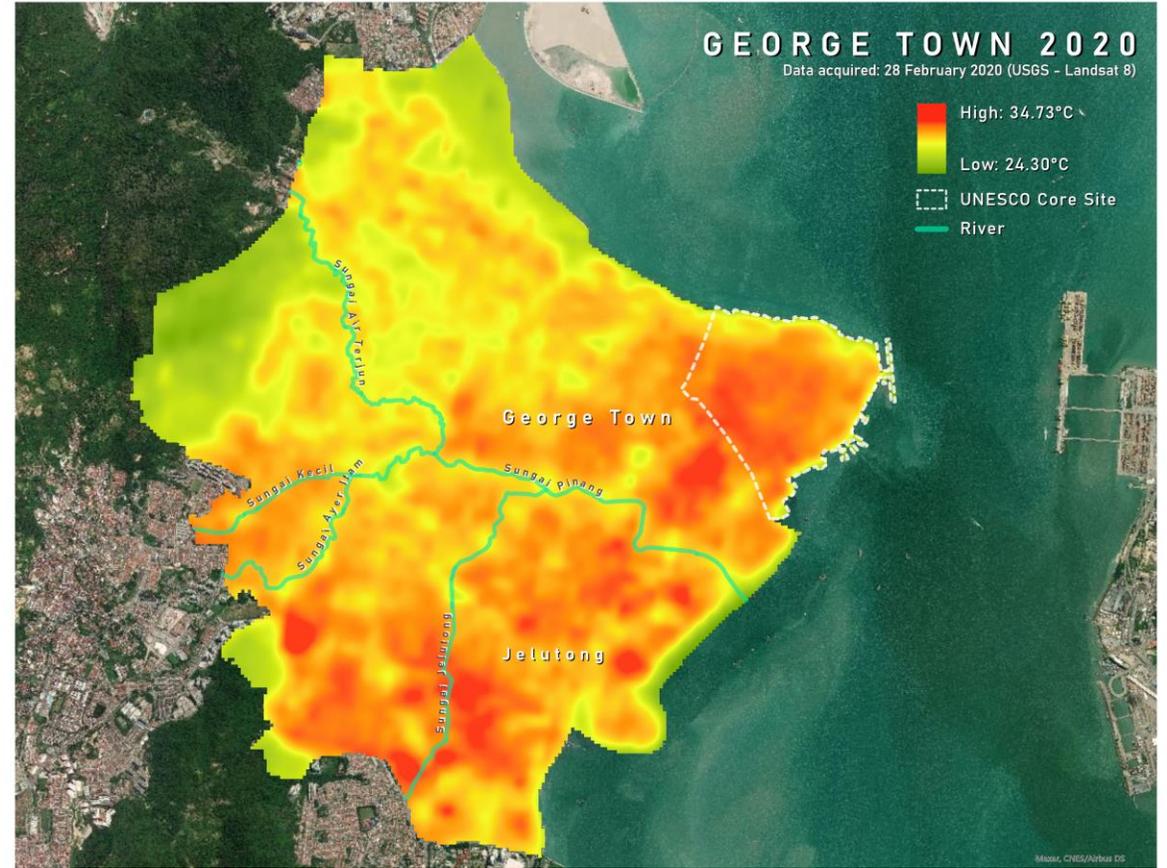
↑↑ Max. 8.7°C
↑↑ Min. 2.4°C

1988



Max. 28.5 °C
Min. 21.2 °C

2019

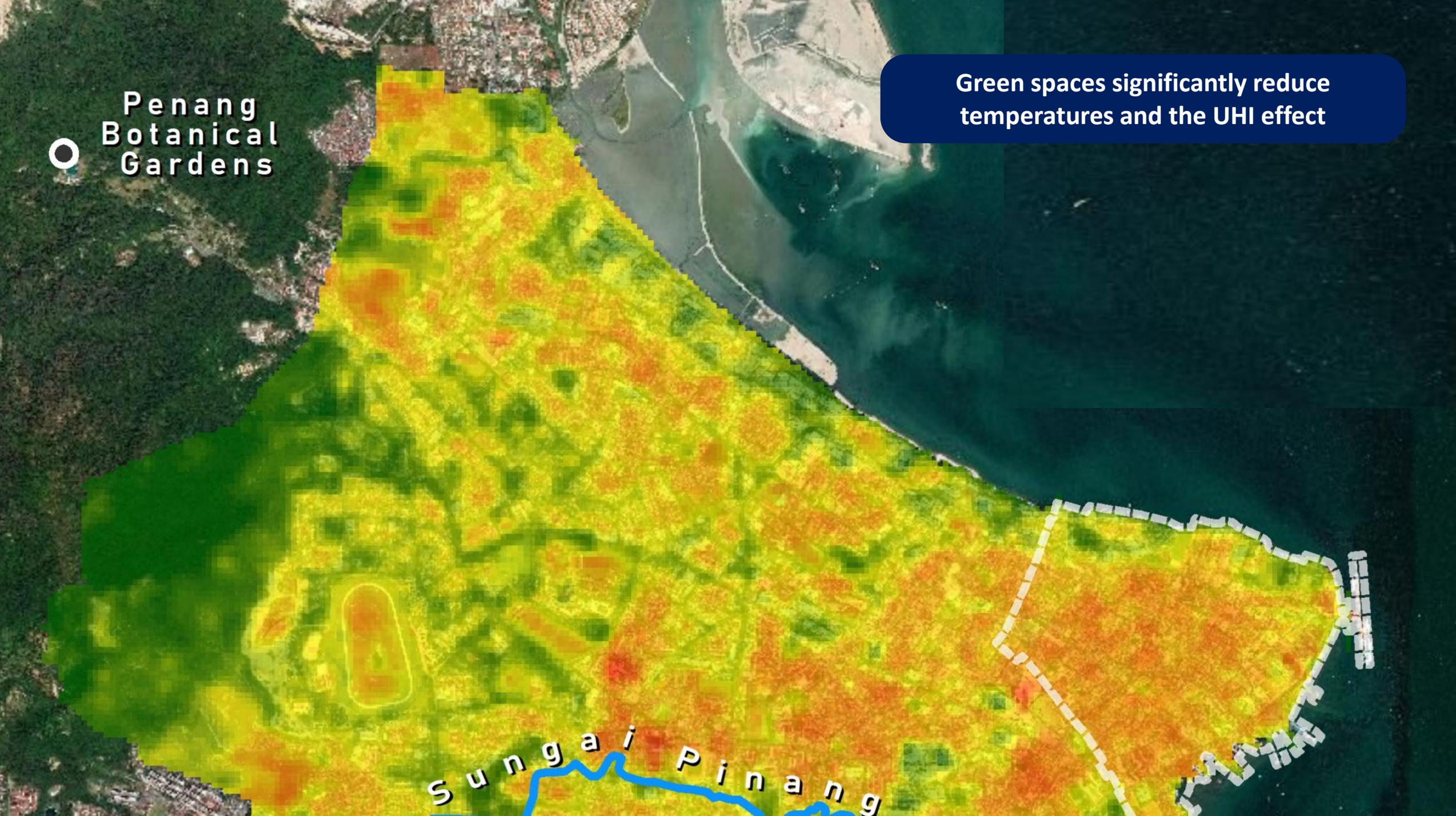


Max. 37.2 °C
Min. 23.6 °C

Green spaces significantly reduce temperatures and the UHI effect

○ Penang Botanical Gardens

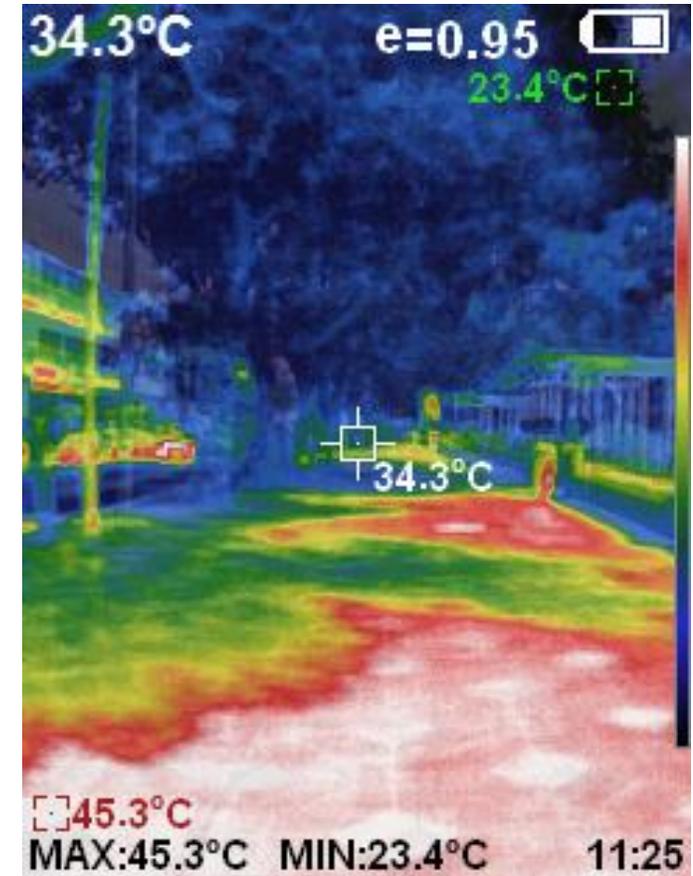
Sungai Pinang



THERMAL IMAGES

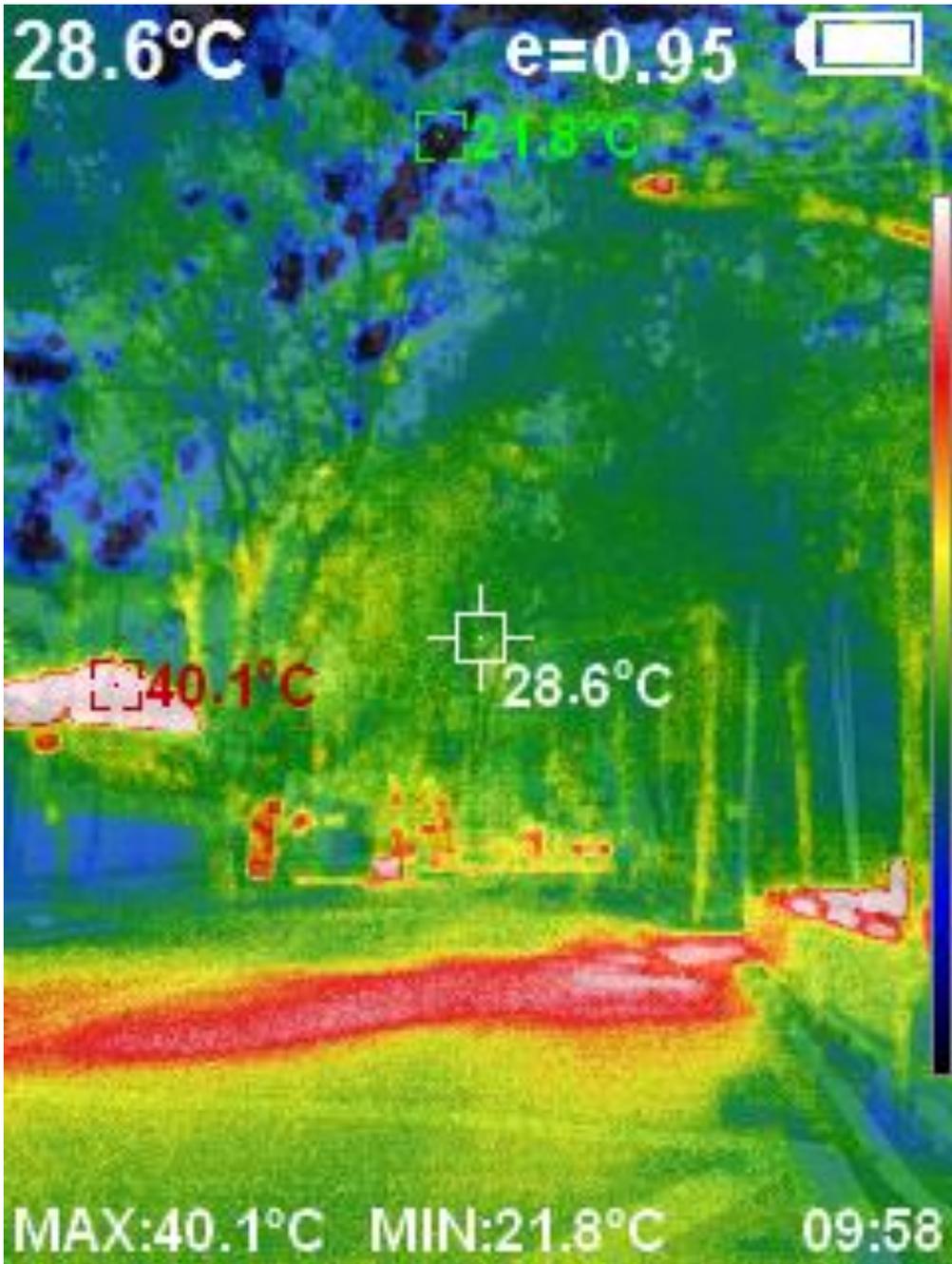
Thermal images can assess in:

- a) identifying the most heat stressed urban areas at street level;
- b) evaluation of impact of pilot projects at street level;
- c) assessing heat absorbing characteristics of different materials can assist in making informed choices.

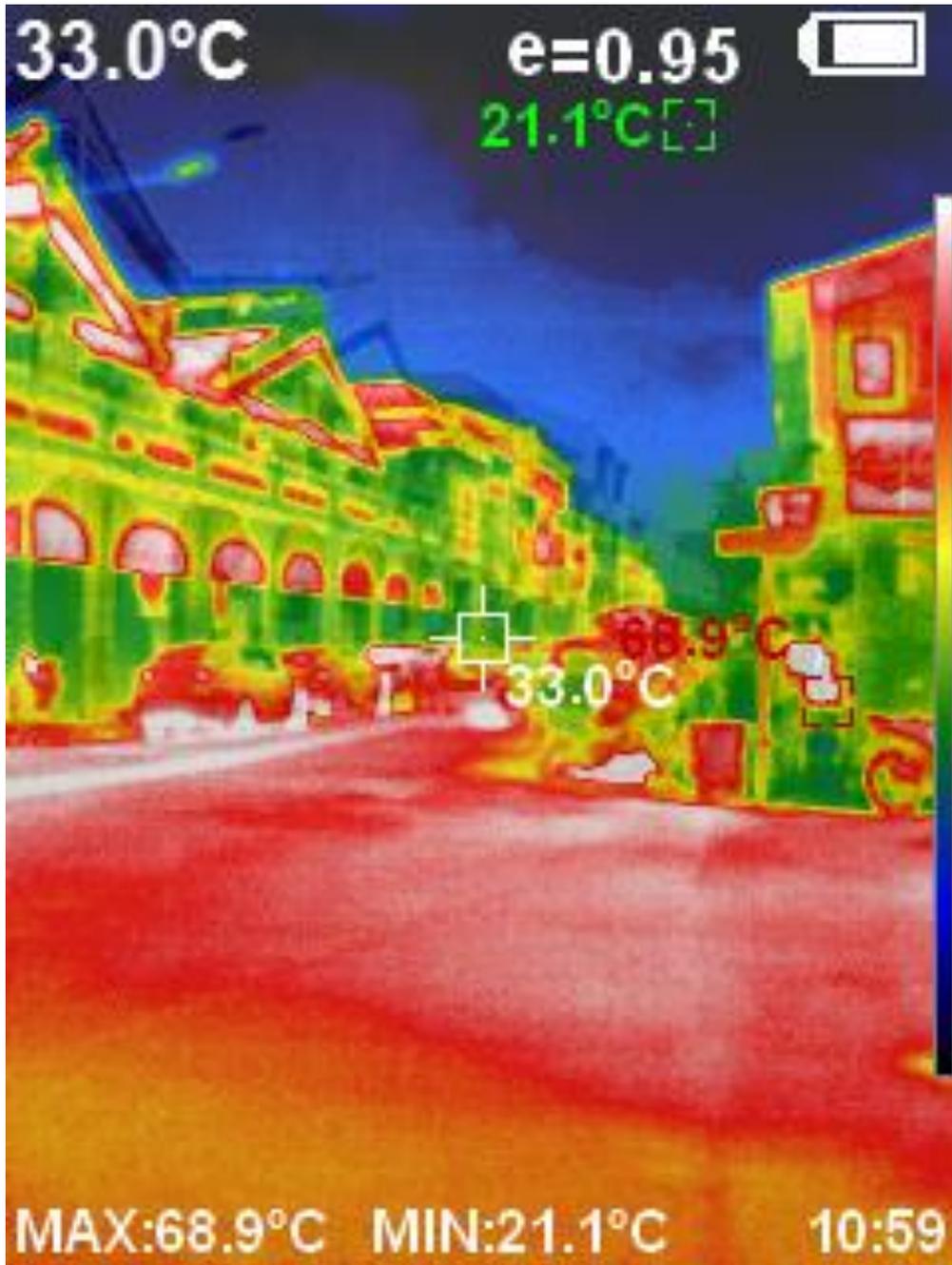


Images 2-3. Thermal imaging of partially shaded tree-lined street in Lebuhraya Light, George Town, Penang. A difference of approximately 10C in surface temperature can be observed between shaded and non-shaded paved area.

Source: Produced by Think City with Perfect Prime IR0006 Thermal Imager Camera.



Jalan Brown
12.07.2019
9.58am



Lebuh Gereja
12.07.2019
10.59am

Rainfall patterns have become more irregular and the volume of rainfall has increased **15%** in the past 40 years. This situation will worsen in the future, leading to flooding



THE PROBLEM

High vulnerability due to location and development stage



HEAT STRESS

Penang is expected to experience a minimum temperature rise of 1.5°C (up to 6°C in heat waves) by 2030, compared to 2018

Hospitals do not identify heat stress/stroke.



FLOODING

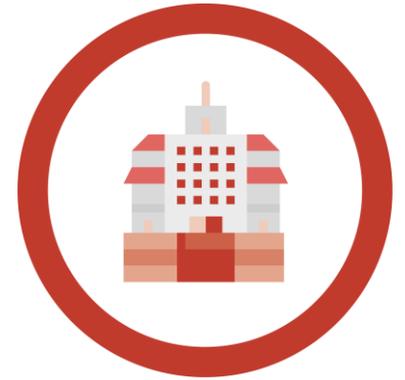
15% increase in the volume of rainfall since 1980. In Nov '17, the heaviest rainfall registered in Penang's history led to flooding of urban areas, causing the loss of 7 lives and more than 1 billion RM in damages.



SOCIAL

Vulnerable communities, women and girls are disproportionately impacted by climate change.

Youth is unengaged



INSTITUTIONAL

Hospitals do not identify heat stress/stroke.

No municipality adaptation framework has been developed yet.

There is no unit for disaster risk reduction.

THE PROGRAMME

GOAL 1



Reduce temperatures and UHI effect by strategically planting trees and introducing green spaces in the city

GOAL 2



Reduce and if possible eliminate the number of flooding events by using upstream retention.

GOAL 3



Strengthen social resilience, vulnerable communities, women and girls empowered

GOAL 4



Institutional capacity in public health reinforced

Knowledge management platform created for municipal adaptation

Climate-resilient street trees study developed

PROGRAMME COMPONENTS



Industrial areas



Backlanes



Pocket parks



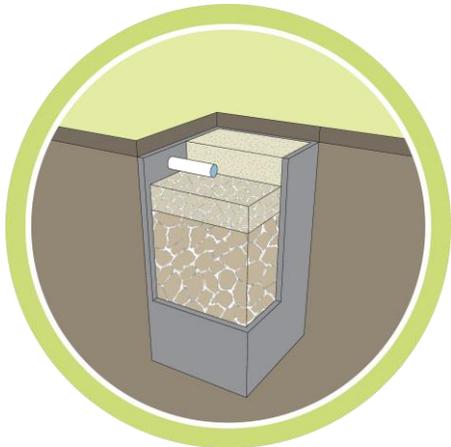
Green facades



Connected canopies



New tree-lined streets



Infiltration wells



Blue corridors

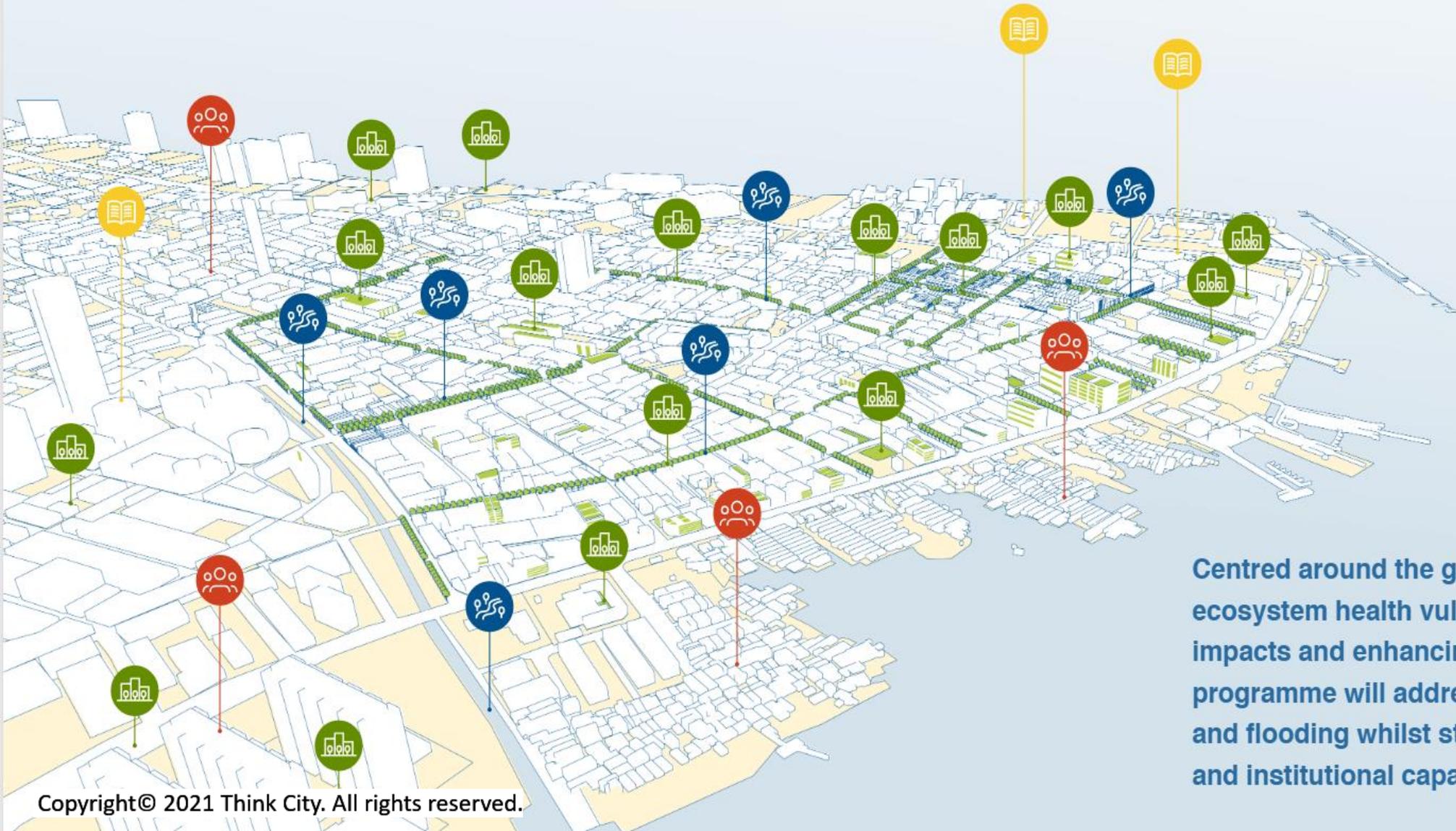


Swales



Retention areas upstream

Overall Programme Components



 Urban greening	 Social resilience
 Stormwater management	 Institutional capacity

Centred around the goals of reducing human and ecosystem health vulnerability to climate change impacts and enhancing urban resilience, the programme will address the issues of heat stress and flooding whilst strengthening social resilience and institutional capacity.

NATURE-BASED CLIMATE ADAPTATION PROGRAMME FOR THE URBAN AREAS OF PENANG ISLAND



EXPECTED OUTCOMES

Reduction of 1.5°C in temperatures in urban areas and 5-7°C in shaded areas 6 to 8 years after completion of the plan

Reduced number of deaths due to heat stroke

Reduced flooding and GDP losses

Reduced vulnerabilities

Improved community readiness

All impacts will be assessed

International Recognition of the Penang Climate Adaptation Programme

Think City was awarded the Climathon Global Cities Award for the Penang Climate Adaptation Plan in 2020 having competed against four other major city programmes

Miami, USA

Karthoum, Sudan

Dublin, Ireland

Penang, Malaysia

Salvador, Brazil

malay  mail

COVID-19

HOME / MALAYSIA

Penang's nature-based approach to tackling climate change wins Climathon Global Awards

Monday, 03 Feb 2020 02:20 PM MYT
BY OPALYN MOK



A view of one of the decorated backlanes located at Lebuhr Pantan in George Town February 3, 2020. — Picture by Sayuti Zainudin

GEORGE TOWN, Feb 3 — Penang's climate adaptation programme centred on nature-based solutions has been named the winner of the inaugural Climathon Global Awards under the Cities category.

It was selected for the honour from a pool of more than 100 applications.

Penang state exco Jagdeep Singh Deo, who announced the achievement, said Penang topped the list out of five city finalists with its programme that is a multi-agency collaborative effort.

JANUARY 2020



SEPTEMBER 2020



Concept Note of the programme was endorsed by the Adaptation Fund board to receive USD 10,000,000 for implementation.

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Think City's Demonstrated Expertise

A DECADE OF URBAN REJUVENATION

10,000

Community members directly impacted

>100

Completed projects on conservation and advocacy of intangible cultural heritage

>100

Buildings with heritage value conserved



ARMENIAN PARK (GEORGE TOWN)



STADIUM NEGARA & FORT CORNWALLIS
CONSERVATION MANAGEMENT PLAN

>1,000

Youths impacted through more than 20 youth engagement (capacity building) programmes

>100

Space activation projects

>120

Public realm improvement interventions



CORONATION AVENUE (JOHOR BAHRU)



LANEWAYS IMPROVEMENT PROGRAMME

>100

Urban knowledge publications

+ social inclusion projects

Johor Area Rehabilitation Organisation



LAMAN TUN PERAK (KUALA LUMPUR)



SEKOLA BAROKA (JOHOR BAHRU)

RESILIENCE COMMUNITY OF PRACTICE

Environmental Resilience & Climate Change

1. ADVOCACY

- Successfully organized and hosted the 1st Climate Action Week in Malaysia
- Earth day celebratory 1-week webinar programme
- Launched a 1-year environmental campaign in Malaysia in 2020 aligned with UNEP initiative 'IT'S TIME #FOR NATURE'.

2. CLIMATE ADAPTATION

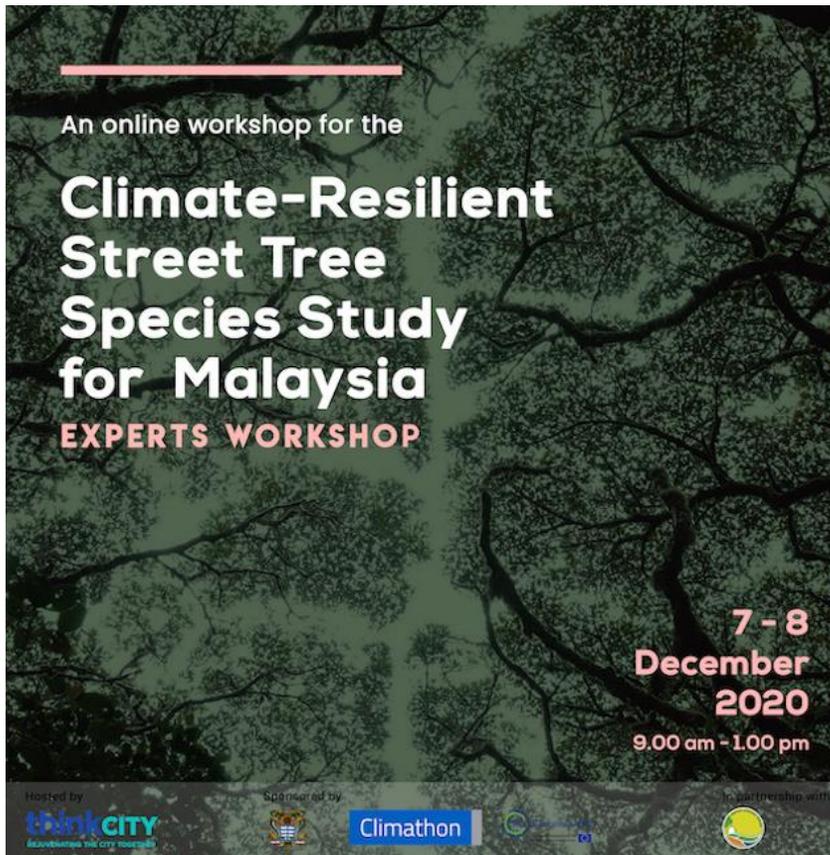
- Development of the 1st climate adaptation urban programme for Malaysia, the Nature-Based Climate Adaptation Programme for Urban Areas of Penang Island
- Development of the Climate-resilient street trees' species study for Malaysia

3. ECOSYSTEM RESTORATION

- Development of Sungai Perai river restoration and ecosystem regeneration project
- Initiated the 'PRE' (Protect, Restore and Expand) programme for Mangrove Forests in Malaysia

The Climathon Global Cities Award is funding our national climate-resilient street tree species study, which has the support by several public and private bodies

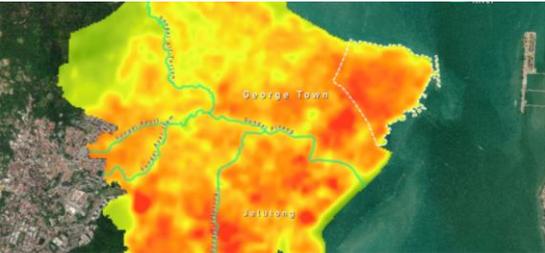
Climate-resilient Street Tree Species Study for Malaysia



- A **national study** to identify optimal tree species for urban greening that will withstand the effects of climate change
- Sponsored by the **Climathon Global Cities Award** to conduct a research paper and policy report, as well as develop an open-collaborative online database and public outreach campaign
- The study has the support of a range of **key stakeholders**. For example: EIT-Climate KIC, Crowther Lab, Majlis Bandaraya Pulau Pinang, and Jabatan Landskap Negara
- Key achievements to date
 - Experts' workshop held
 - Research paper submitted to the Crowther lab
 - Methodology presented to Perhilitan and Perhutanan

Our environmental services and history of success

 **Data analysis & insight generation**



DATA ANALYSIS :
Land Surface Temperature Study

 **Strategy & policy development**



CLIMATE PLANS :
Penang Nature-based Climate Adaptation

 **Community engagement**



PUBLIC AWARENESS :
Penang Climate Action Week

 **Project management & implementation**



URBAN GREENING:
Laman Tun Perak Pocket Park



SITE STUDY :
Sungai Perai Pollution Mapping



STRATEGIC PLANS :
Sungai Perai Action Plan 2018 – 2022



COMMUNITY INNOVATIONS:
Climate Hackathon



PUBLIC REALM:
Armenian Park



EXPERTS WORKSHOP :
Climate resilient trees study



COMMUNITY INITIATIVES:
Kebun Kita(R) urban farm



DEMONSTRATIVE PROJECT:
Demonstrative projects @ WUF9

Non-exhaustive

BANGUNAN U. A. B

Thank you

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