

濕地注能——探索基於自然的解決方案

POWERING OUR WETLANDS – EXPLORING NATURE-BASED SOLUTIONS

米埔濕地位於香港西北部，是一片充滿生機的自然寶藏：
 Located in northwest Hong Kong, the Mai Po Wetlands is a vibrant ecological treasure:

生物多樣性的家園
 A sanctuary for biodiversity

氣候變化的守護者（碳匯及天然屏障）
 A defender against climate change
 (carbon sink and natural barrier)

在滙豐銀行慈善基金的支持下，世界自然基金會香港分會開展了為期五年的「濕地注能」項目，運用基於自然的解決方案（NbS），守護和修復米埔及大灣區的濕地，並推廣這些創新解決方案至更廣泛的地區。
 With support from The Hongkong Bank Foundation, WWF-Hong Kong launched the 5-year "Powering Our Wetlands" project, leveraging Nature-based Solutions (NbS) to protect and restore wetlands in Mai Po and the Greater Bay Area, while promoting these innovative solutions to a broader region.

四大行動範疇 FOUR WORKSTREAMS

1 保護與修復紅樹林，提升碳匯能力 ENHANCING CARBON SINKS THROUGH MANGROVE PROTECTION AND RESTORATION

- 評估紅樹林的碳封存（吸收二氧化碳）的潛力，了解其在應對氣候變化中的重要作用
 Measure the carbon sequestration potential of Mai Po mangroves to understand their role in combating climate change.
- 制定保護策略，維持紅樹林的生態系統，並提升其提供的生態服務
 Develop strategies to sustain and enhance mangrove ecosystems and their ecological services.



2 生態魚塘管理，提升氣候韌性 BUILDING CLIMATE RESILIENCE WITH ECO-FISHPONDS

- 將閒置魚塘轉為紅樹基圍，充分發揮其生態功能及減緩氣候變化
 Restore semi-abandoned fishponds into *gei wais* planted with mangroves to maximize their ecological function and mitigate climate change.
- 安裝化糞池，改善污水處理，提升村民的居住環境及生境質量
 Install septic tanks to prevent direct sewage discharge, improving both villagers' living environment and habitat quality.
- 實施生態魚塘管理措施，為水鳥提供重要生境
 Implement eco-fishpond management practices to provide critical habitats for waterbirds.



3 可持續利用生物物質 SUSTAINABLE USE OF BIOMASS

透過實驗與優化，將濕地入侵植物轉化為多孔碳，用於可持續儲能，實現資源再利用
 Through experimentation and optimisation transform biomass from invasive wetland plants into porous carbon for sustainable energy storage, unlocking the potential of renewable energy storage solutions.



4 社區參與及經驗分享 COMMUNITY ENGAGEMENT AND KNOWLEDGE SHARING

- 舉辦培訓和活動，向持份者傳播濕地價值及基於自然的解決方案
 Conduct training programs and public awareness campaigns to educate stakeholders about the value of wetlands and NbS.
- 鼓勵社區參與及支持濕地保育和修復
 Encourage community participation and support wetland conservation and restoration.



成效一覽 IMPACT METRICS



2,300+

超過 2,300 位基層市民受惠
 Over 2,300 underprivileged community members benefited

1,800+

種植了超過 1,800 棵紅樹苗
 More than 1,800 mangrove seedlings planted in restored *gei wais*



150+

超過 150 位具影響力的持份者參與了解基於自然的解決方案（NbS）
 Over 150 influential stakeholders engaged to understand Nature-based Solutions (NbS) wetlands



150+

超過 150 位滙豐義工協助捕撈生態魚塘漁獲及種植紅樹苗
 Over 150 HSBC volunteers assisted with fish harvests and mangrove planting



從外來入侵植物到 可再生儲存能源的解決方案？ FROM INVASIVE PLANT TO RENEWABLE ENERGY STORAGE SOLUTION?

挑戰 CHALLENGES

1 外來入侵植物 INVASIVE SPECIES

近年，原於中美洲和南美洲的入侵植物薇甘菊（*Mikania micrantha*）為香港濕地的生物多樣性帶來嚴重威脅。這種生長迅速驚人的多年生攀爬藤本植物會遮蔽樹木，阻擋陽光，導致樹木死亡並為濕地管理帶來重大挑戰。

In recent years, the invasive plant *Mikania micrantha*, native to Central and South America, has threatened the wetland's biodiversity and caused management challenges. This fast-growing perennial climbing vine smothers trees, blocking sunlight and causing their death.

解決方案 SOLUTION

世界自然基金會香港分會和香港城市大學能源與環境學院的林鎮浩教授合作開發了一個項目，將採自米埔濕地的薇甘菊（*Mikania micrantha*）轉化為用於儲能的多孔活性碳。

In collaboration with WWF-Hong Kong, Professor Jason Lam from City University of Hong Kong's School of Energy and Environment developed a project to transform *Mikania micrantha* collected from Mai Po Wetland into porous carbon for energy storage.



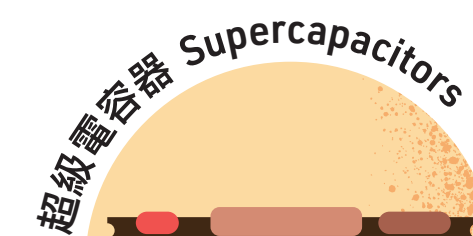
香港城市大學林鎮浩教授
Professor Jason Lam, City
University of Hong Kong

這種方法不僅促進薇甘菊的收集，還有助於研究可再生能源儲存的解決方案，支持生態保護、緩解能源危機以及香港的碳中和目標。
This approach not only promote the collection of *Mikania micrantha* but also contributes to renewable energy storage solutions, supporting ecological protection, energy crisis mitigation, and Hong Kong's carbon neutrality goals.

薇甘菊超級電容器的製作 THE MAKING OF MIKANIA MICRANTHA SUPERCAPACITOR

這個過程簡單且具有成本效益。通過實驗和優化，使用薇甘菊製成的超級電容器展現出儲存大量電能的能力，能為玩具風車、音樂盒、微LED燈供電。

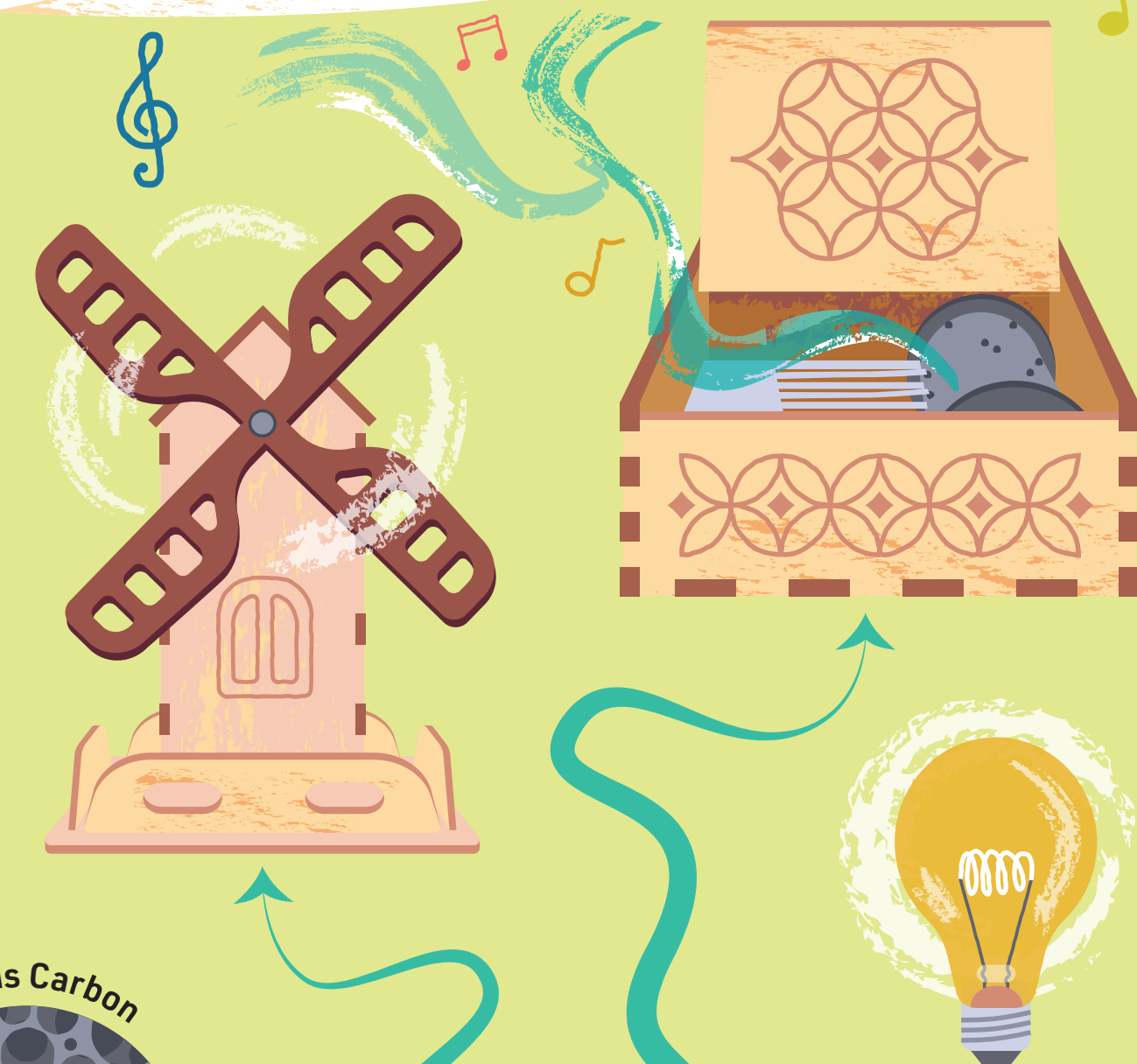
The process is simple and cost-effective. Through experimentation and optimization, supercapacitors made from *Mikania micrantha* demonstrated the ability to store significant electrical energy, powering a toy windmill, music box, and mini LED light bulb for extended periods.



2 傳統超級電容器 TRADITIONAL SUPERCAPACITORS

多孔活性碳是製備超級電容器的關鍵材料，但其製備過程通常使用高污染性和不可再生的化石原料。

Porous and chemically stable activated carbon is common material for preparing supercapacitors. Traditionally, the preparation of carbon-based materials of supercapacitors requires the use of polluting and non-renewable fossil feedstocks.



步驟 STEP 1

收集薇甘菊後，將其葉子和枝幹切割、清洗並風乾以便保存。

After collecting *Mikania micrantha*, its leaves and branches are cut, washed, and dried for preservation.

步驟 STEP 2

將切碎的薇甘菊在高溫下碳化，並添加三聚氰胺（富含氮的有機化合物）以增強材料的表面功能性。

Shredded *Mikania micrantha* is carbonized at high temperature, with melamine (a nitrogen-rich organic compound) added to enhance the material's surface functionality.

步驟 STEP 3

然後將其與氫氧化鉀（KOH）混合並加熱成活化多孔碳，該碳會與粘合劑和導電劑一起塗覆在碳氈上。

Then it is mixed with KOH and heated to produce porous carbon, which is coated onto carbon felt with a binder and conductive agent.

步驟 STEP 4

在風乾後，塗覆的碳氈作為超級電容器的電極，浸入稀硫酸中以完成組裝。

After drying, the coated felt served as supercapacitor electrodes, immersed in dilute sulfuric acid to complete assembly.

紅樹林：基於自然的氣候解決方案及沿岸防禦屏障

MANGROVES AS A NATURE-BASED CLIMATE SOLUTION AND COASTAL DEFENSE

什麼是基於自然的解決方案（NbS）？ WHAT ARE NATURE-BASED SOLUTIONS (NbS)?

聯合國環境大會（2022）對基於自然的解決方案（NbS）的定義：

採取行動保護、養護、恢復、可持續利用和管理自然或經改造的陸地、淡水、沿海和海洋生態系統，以有效和適應性地應對社會、經濟和環境挑戰，同時對人類福祉、生態系統服務、復原力和生物多樣性產生惠益。

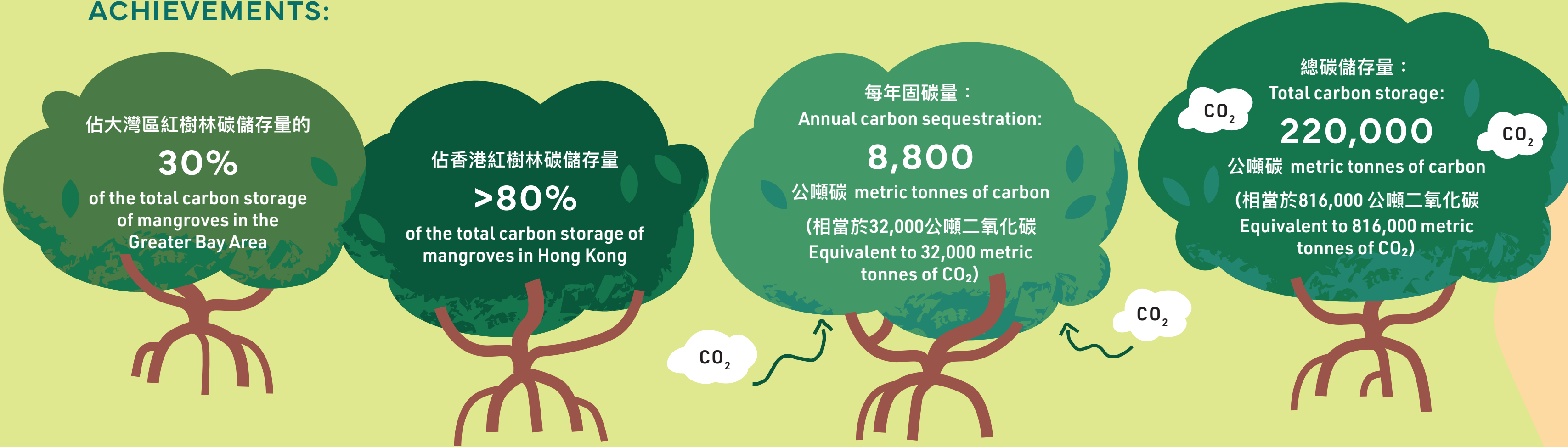
Definition of NbS (UNEA, 2022):

Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.

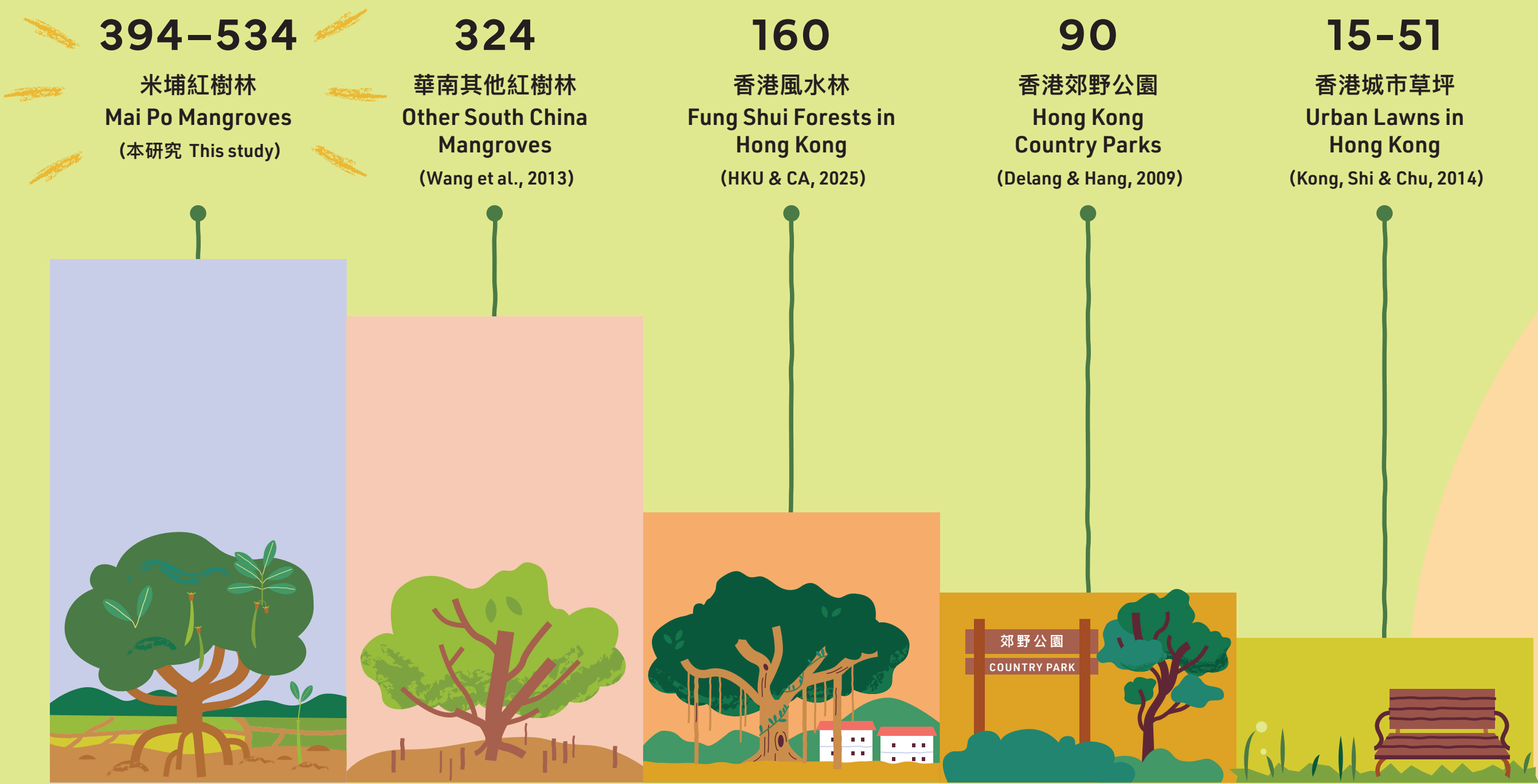
米埔紅樹林：超級固碳者 MAI PO MANGROVES: A CARBON SEQUESTRATION CHAMPION

合作夥伴：香港中文大學（首席研究員：黎育科教授） Collaborator: The Chinese University of Hong Kong (PI: Prof. Derrick Y.F. Lai)

成就： ACHIEVEMENTS:



固碳潛力比較（單位：公噸碳/公頃）： CARBON SEQUESTRATION POTENTIAL (METRIC TONNES OF CARBON/HECTARE):

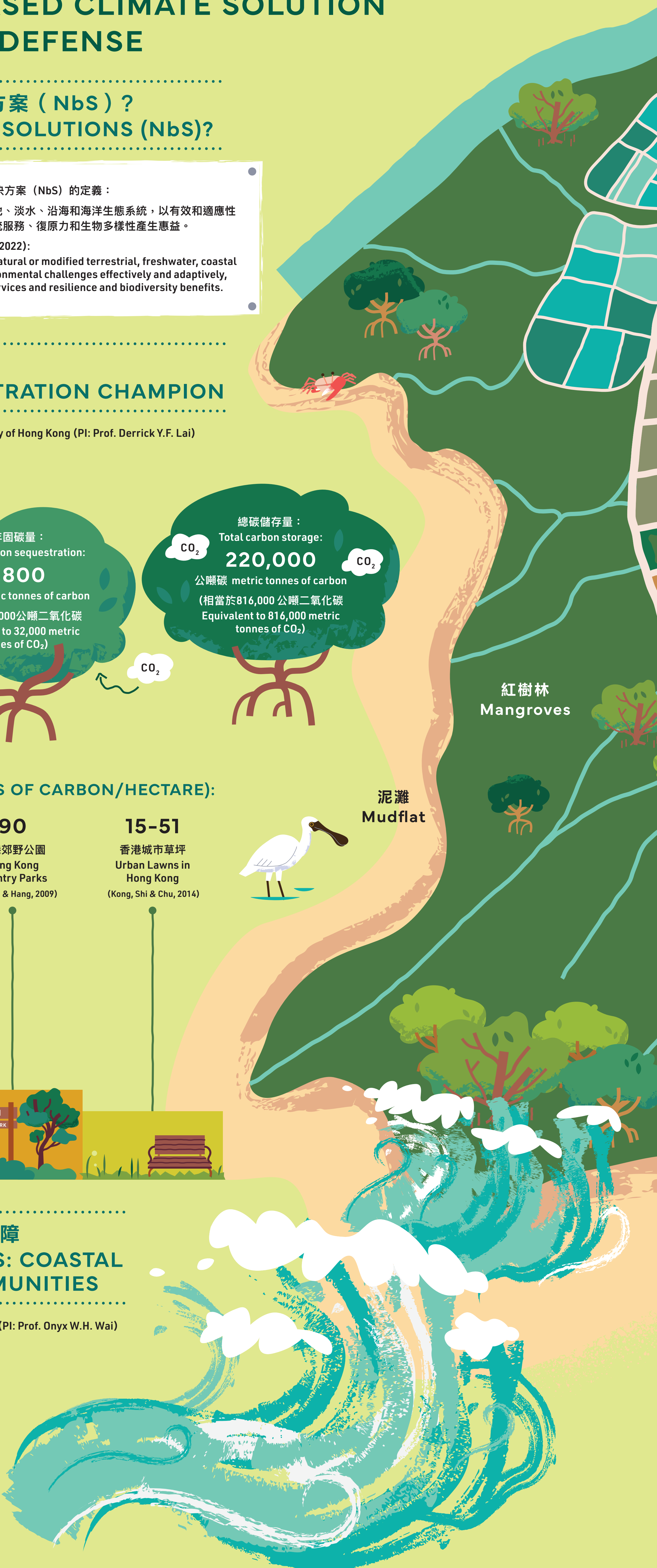


米埔的泥灘與紅樹林：沿岸防禦屏障 MAI PO'S MUDFLATS AND MANGROVES: COASTAL DEFENSE PROTECTING LOCAL COMMUNITIES

合作夥伴：RED及香港理工大學（首席研究員：韋永康教授） Collaborator: RED & PolyU (PI: Prof. Onyx W.H. Wai)

米埔濕地如何保護社區？ HOW DO MAI PO WETLANDS PROTECT COMMUNITIES?

- 減弱波浪能量
Wave and Storm Surge Attenuation
- 米埔泥灘可減少高達 80% 的波浪能量，以及30%的風暴潮能量
Mai Po's mudflats reduce up to 80% of wave energy and 30% of storm surge energy.
 - 紅樹林進一步吸收剩餘的30% 波浪及風暴潮能量
Mangroves further absorb 30% of the remaining wave and storm surge energy, providing an additional layer of protection.



增強社區韌性 ENHANCING COMMUNITY RESILIENCE

減少洪水風險，保護沿岸社區，降低災害影響
Mangroves play a vital role in mitigating flood risks, protecting coastal communities, and reducing the impacts of natural disasters



我們如何支持濕地和紅樹林？ HOW CAN WE SUPPORT WETLANDS AND MANGROVES?

1 倡導保護 ADVOCATE FOR PROTECTION

- 支持米埔濕地，向外宣傳其生態重要性
Support Mai Po Wetlands by promoting its ecological significance to others
- 支持濕地保育，保障其作為氣候緩減和沿岸防禦的功能
Support wetland conservation, safeguarding their role in climate mitigation and coastal defense.

2 支持濕地管理與修復 SUPPORT WETLAND MANAGEMENT AND RESTORATION

- 支持米埔自然保護區的管理
Support the management of the Mai Po Nature Reserve.
- 支持合適的閒置魚塘改造為種植紅樹的基圍，提升生物多樣性，碳封存能力及防洪效果
Support the restoration of suitable semi-abandoned fishponds into gei wais planted with mangroves, enhancing biodiversity, carbon sequestration, and flood prevention.

3 擴展大灣區紅樹林監測 EXPAND MANGROVE MONITORING ACROSS THE GREATER BAY AREA

- 將米埔的紅樹碳封存監測方法應用至大灣區更多地點，提升碳儲量估算的準確性
Apply the mangrove carbon sequestration monitoring protocol developed in Mai Po to other locations in the Greater Bay Area, improving the accuracy of carbon storage assessments.

