

VIEWPOINT
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Climate Resilience Through Regeneration



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Bishan-Ang Mo Kio Park in Singapore.

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When we think of resilience in the face of climate change, we typically think of strengthening our defences against floods, droughts, heat waves and other extreme weather events. But what if we can turn climate resilience from a defensive strategy into a pathway for new opportunities and shared co-benefits?

Achieving good, not just avoid the bad

Investing in climate mitigation and adaptation is often seen as a cost to pay today to reduce the probability of potentially catastrophic losses in the future. This is a sensible perspective, given the potential economic consequences associated with rising sea levels, extreme weather events, and supply chain collapses in the future. But focusing solely on reducing risks could potentially blind us to the possibilities for achieving good in addition to just avoiding the bad.

The idea of regeneration offers an important shift in perspective. It pushes us to think how climate solutions can go beyond minimising risks and

harm—to also holistically restore and enhance natural ecosystems, and generate co-benefits such as social wellbeing and economic vitality.

The power of regeneration is perhaps most evident in the use of *nature-based solutions*. Take for example Bishan-Ang Mo Kio Park in Singapore, which was once vulnerable to flood risk in the event of extreme rainfall. Rather than enlarging the existing concrete drain to accommodate the rare incidence of extreme precipitation, the canal was converted into a naturalised river system with vegetated riverbanks and wetland biotopes. This has created substantial economic and social co-benefits. Not only does the river system now act as a natural floodplain with increased stormwater capacity to reduce flood risks, its bioengineered river edges provide the community a recreational space to immerse in nature. Biodiversity has increased by 30% since the restoration.

Regenerative practices can also strengthen the viability of climate mitigation tools such as carbon credits. Projects to restore degraded lands

through the generation of *carbon credits* can be structured to bring in revenue streams, which provide local communities with an incentive to protect these ecosystems. Embedding these socioeconomic co-benefits alongside the preservation of nature provides potential buyers an added incentive to not only buy these credits, but to pay more for them.

The Mikoko Pamoja project in Kenya is a successful case study of the power of regenerative practices. Launched in 2010, it is the world's first community-based project to sell carbon credits from the conservation and restoration of mangrove forests. It now protects 117 hectares of mangroves annually. Revenue from the protection of these mangroves funds further protection and reforestation, providing a virtuous feedback loop. It also supports various community development projects, such as providing clean water for 3,500 people and educational materials for 700 schoolchildren. These socio-economic benefits provide long-term incentives for the protection of the mangroves.

A whole-of-society approach

A key enabler of a regenerative approach is collective participation across all sectors and communities. Governments have a role in setting relevant regulations and investing in public infrastructure to strengthen resilience and reduce risks. Businesses have an interest in ensuring the resilience of their operations, assets and

supply chains. Academics and civic groups can complement these resilience measures through research and actions closer to the ground. Taking a whole-of-society approach fosters a sense of shared ownership and commitment and generates solutions that are better tailored to diverse needs.

In Singapore, we are beginning to see such collective action in heat adaptation efforts. As a tropical city, Singapore is particularly vulnerable to heat stress in the face of worsening climate change. A whole-of-society approach is necessary to protect the safety and livelihoods of workers, strengthen the long-term economic resilience of businesses, and develop solutions customised to the needs of individuals.

The *government* launched a three-tier Heat Stress Advisory in 2023 to guide the public on precautionary measures they can take to minimise heat stress. The government has also developed guidelines that address the unique needs of outdoor workers, athletes and students in schools. For example, the government introduced measures to reduce the risk of heat stress for outdoor workers, while allowing flexibility for employers to adjust and implement measures based on their localised conditions.

More *businesses* have started to take measures to protect their workers, such as redesigning workplaces for better ventilation, scheduling intense physical work to cooler parts of the day, and ensuring proper rest and hydration

Managing Heat Stress

Heat stress occurs when our body is not able to cool itself sufficiently, and excess heat builds up, which may cause damage to the body. Warmer or more humid weather could lead to an increased risk of heat stress and related illnesses, such as heat cramps, heat exhaustion and heat stroke.



Heat Stress Advisory for General Population for Prolonged Outdoor Activities

LOW HEAT STRESS WBGT (°C) < 31	MODERATE HEAT STRESS 31 ≤ WBGT (°C) < 33	HIGH HEAT STRESS WBGT (°C) ≥ 33
Activity: • Continue normal activities	Activity: • Reduce outdoor activities • Take regular breaks (indoors/under shade)	Activity: • Minimise outdoor activities: stay under shade where possible • Take more frequent and/or longer breaks (indoors/under shade)
Action: • Hydrate normally	Action: • Drink more fluids • Monitor body for signs and symptoms of heat-related illness	Action: • Drink more fluids • Monitor body for signs and symptoms of heat-related illness • Cool actively during breaks (e.g. sponging, pouring water over arms and legs)
Attire: • Wear normal attire	Attire: • Avoid multiple layers of clothing • Use an umbrella or wear a hat	Attire: • Avoid multiple layers of clothing • Use an umbrella or wear a hat • Wear lightweight and light-coloured clothing with thin and absorbent material

The Wet Bulb Globe Temperature (WBGT) provides an indication of heat stress by taking into account the combined effects of:

- Air temperature
- Humidity
- Wind speed
- Solar radiation

Effects Of Heat Stress Depends On The Individual
Personal factors such as our general health, level of activity and attire may also affect our risk level of heat stress. Hence, people more vulnerable to heat stress should exercise greater caution:

- Elderly
- Children and infants
- People who are ill, have recently recovered, or have chronic conditions
- Pregnant women
- People who recently travelled from cooler climates

This advisory is to help the general public plan their prolonged, outdoor activities. Those who are engaged in specific activities should refer to the respective sectorial guidelines. For example, outdoor workers should refer to guidelines from the Ministry of Manpower, and students should follow the guidance of their schools. These guidelines do not apply to the SAF and the Home Team, as they adopt a comprehensive set of heat injury prevention measures that factor in the heat acclimatisation level of servicemen, intensity of training activity, and on-site medical support during the conduct of training.

For updates, download the myENV app

Heat stress information is available at www.weather.gov.sg
Connect with us on www.nea.gov.sg

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for workers. For example, Grab and Deliveroo have begun issuing heat advisories to their riders,¹ while Changi Airport Group has started distributing protective sun wear and deploying water trucks during the hotter months.²

More academics are also conducting research to understand and address various heat adaptation needs in the community. Researchers from the Singapore University of Technology and Design are surveying residents on their heat adaptation behaviours and household features, to create a menu of low-cost, effective cooling options.³ Experts from the Heat Resilience and Performance Centre at the National University of Singapore have been developing solutions such as wearable devices and smart uniforms to monitor heat stress.^{4,5} They are now looking to investigate heat risks to more vulnerable groups, including outdoor workers and hospital patients.⁶ More ground-up participation from civic groups can complement such efforts to ensure that solutions are accessible to all.

Thinking resilience beyond borders

A regenerative approach requires us to consider the interconnectedness of ecosystems, economies, and communities.

Southeast Asia has highly inter-dependent food, energy and water systems, as well as shared trade and financial links. This means that climate impacts on any one sector or country can quickly

In 2023, the Singapore government launched a three-tier Heat Stress Advisory to guide the public on precautionary measures they can take to minimise heat stress.

Image: National Environment Agency

ripple across borders. For example, as the region's largest waterway, the Mekong River is a primary source of freshwater for drinking, farming and industry, and supports tens of millions of livelihoods. However, droughts occurring upstream, such as in Laos, Thailand or Cambodia, can result in less water flowing downstream into regions such as the Mekong Delta in southern Vietnam, leading to large-scale crop failures and water shortages. Declining water levels in the river can also threaten hydropower power generation in countries across the Lower Mekong River Basin, reducing electricity supply.

A regenerative approach requires us to channel adaptation efforts beyond our borders and manage transboundary risks. This is increasingly being recognised around the world. IPCC AR6 recommends that national adaptation plans consider these transboundary risks and coordinate regionally to build systemic resilience.⁷ Research coalitions such as Adaptation Without Borders have emerged, bringing together research capacities to help identify, assess and manage these risks. Closer to home, the ASEAN Integrated River Management Project was launched in 2023 to establish functional management mechanisms for major transboundary rivers in the region.⁸

Singapore has started to contribute to regional adaptation, primarily through research. Singapore has been sharing the findings of its Third National Climate Change Study with other ASEAN members states, to enable them to better

understand and adapt to the impacts of climate change. Researchers at the National University of Singapore's Tropical Marine Science Institute have been working closely with their counterparts in universities in the region, to study the impacts of climate change on the region's agriculture sector and measures to enhance regional food security. The Nanyang Technological University's Earth Observatory of Singapore has been advancing the scientific understanding of sea level rise and storms in the region. As climate change escalates, we must build on these efforts to address knowledge gaps, build capacity, and strengthen regional coordination to drive collective resilience.

Hope for climate action

Climate action is not easy. It demands trade-offs, sustained investments, and cooperation at every level. But regenerative principles and practices remind us that climate action is not just about surviving the challenges ahead, but also about creating new opportunities and shared benefits for communities and businesses. By embedding such principles into our plans and investments, we can move beyond a mindset of scarcity and loss, and build a future where both people and the planet can thrive. 🗨️

[1] Source: "Mentally, you have to push through': Delivery riders' long hours, hot days", Straits Times, 2024. <https://www.straitstimes.com/singapore/mentally-you-just-have-to-push-through-delivery-riders-endure-longer-hours-hotter-days>

[2] Source: "Enhancing Heat Resilience for Airside Personnel", Changi Airport Group, 2025. <https://www.changiairport.com/en/corporate/our-sustainability-efforts/environment/enhancing-heat-resilience.html>

[3] Source: "Who bears the heat of climate change? Helping communities deal with rising temperatures", Straits Times, 2025. <https://www.sutd.edu.sg/news-listing/who-bears-the-heat-of-climate-change-helping-communities-deal-with-rising-temperatures/>

[4] Source: "Why runners are swallowing electronic pills to help build next-generation wearables", Straits Times, 2023. <https://www.straitstimes.com/tech/why-runners-are-swallowing-electronic-pills-to-help-build-next-generation-wearables>

[5] Source: "Smart uniform to monitor heat stress in soldiers among ideas mooted in new research centre", Straits Times, 2023. <https://www.straitstimes.com/singapore/smart-uniform-to-monitor-heat-stress-in-soldiers-among-ideas-mooted-in-new-research-centre>

[6] Source: "NUS scientist wants to expand research to help vulnerable groups in S'pore, S-E Asia beat the heat", Straits Times, 2025. <https://www.straitstimes.com/singapore/environment/nus-scientist-wants-to-expand-research-to-help-vulnerable-groups-in-spore-se-asia-beat-the-heat>

[7] Chapter 16 of IPCC AR6 discusses four inter-regional risk channels (trade, finance, food and ecosystems) and how adaptation can govern these risks (see Chapter 16.3: Cross-Chapter Box INTEREG | Inter-regional Flows of Risks and Responses to Risk). <https://www.ipcc.ch/report/ar6/wg2/chapter/chapter-16/>

[8] Source: "State of River Basin Reporting to start in seven priority rivers in Southeast Asia", Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), 2024. <https://www.pemsea.org/resources/news/state-river-basin-reporting-start-seven-priority-rivers-southeast-asia>