

## INTRODUCTION

**NATIONAL PARKS** **Community in Nature**

### CITY IN NATURE

In its sixth year, the Festival of Biodiversity is an annual celebration of Singapore's biodiversity, in commemoration of the International Day of Biological Diversity on 22 May.

Singapore has, over the decades, gradually moved towards becoming a City in Nature, one where nature-based solutions are incorporated to make our country more livable, and at the same time, climate resilient - one approach that is reflected in this year's theme for the International Day of Biological Diversity, "Our Solutions Are in Nature".

**TRANSFORMING SINGAPORE INTO A CITY IN NATURE**

Our City in Nature vision is guided by four key strategies - extending our natural capital, integrating nature in gardens and parks, restoring nature into the built environment, and strengthening connectivity between Singapore's green spaces. It focuses on the further adoption of natural-based solutions, supported by active community involvement. Science, landscape design will help to mitigate the impacts of growing urbanisation - coupled with climate change and an ageing green space.

**Climate Change: Strengthening Our Natural Defences**

As a small island, Singapore is particularly vulnerable to the impacts of climate change, including extreme weather events such as intense rainfall, that are likely to increase in frequency. We can mitigate these impacts through solutions found in nature.

**Nature Conservation Milestones**

A flagship plan launched in 2015, the Nature Conservation Masterplan outlined the course of Singapore's biodiversity conservation plans. It is a cornerstone of our efforts in becoming a City in Nature.

**For Nature and Us**

Ecosystem services are the benefits derived from healthy, functioning ecosystems that all living things depend on for survival. Ecosystems support and regulate vital systems that are important for sustaining life on the planet. They provide sources of food, water and medicine, and are places of cultural value.

To ensure Singapore's continued health and sustainability, we can tap on and further apply nature-based solutions that we already have. These solutions will enable us to transition into a City in Nature and bring about:

- Climate Resilience
- Ecological Resilience
- Social Resilience

## Climate Resilience 1

### CLIMATE RESILIENCE

Climate change is caused by the increase in greenhouse gas emissions like carbon dioxide (CO<sub>2</sub>) from human activity, such as the burning of fossil fuels and deforestation. The resulting operational use of global warming has not only led to increasing temperatures, but also rising sea levels and changing weather patterns. These impact the livability of the Earth. As a small island, Singapore is particularly vulnerable. Therefore, there is a need to draw up our natural defences to be resilient in the face of a changing climate. This means tapping on ecosystem services to mitigate the impending impacts, as well as to restore or even improve the integrity of existing infrastructure.

**Carbon Sequestration**

This process of capturing and storing carbon begins with primary producers such as plants. Through photosynthesis, they remove CO<sub>2</sub> from the atmosphere and use it for growth. The carbon is stored in their leaves, roots and stems, and eventually in the soil.

**And You Know?**

Our trees store about 4.1 million tonnes of carbon which is equivalent to almost five times the carbon emissions produced by households in Singapore annually.

**Temperature Reduction**

Singapore has been warming at a rate of 0.22°C per decade, more than twice the global average. This is partially due to the urban heat island effect - where urban surfaces such as buildings and roads trap and emit heat. Urban greenery - trees and plants - plays an important role in cooling the urban landscape by shading surfaces, particularly in hot zones, and through evapotranspiration. Studies have shown that the planting of additional trees in a street, for example, can reduce the urban heat island effect by up to 1°C.

**Streetscape Greenery**

Vertical Greenery, like the Vertical Forest, are built with nature trees that provide shade while allowing sunlight to filter through. Our first vertical forest, more than 100,000 trees, will be planted in industrial areas and along greenways. This integrated greenery will cool these areas, help to improve air quality, and beautify their surroundings. More than 30,000 trees will be planted on Jurong Island alone. Seen on the right are aerial impressions of Jurong Island Highway before and after enhancement of the greenery.

## Climate Resilience 2

**Skyrise Greenery**

NHRA aims to have 200 ha of skyrise greenery by 2030, an increase from the current 120 ha. Skyrise greenery, such as vertical greenery systems and green roofs, effectively shields building facades, significantly reducing the energy used for cooling.

**Mangroves and Nature Reserves**

Vegetated and forest areas - from nature reserves to mangroves - store our carbon sinks. For example, Serangoon Biodiversity Reserve is home to the largest tract of mangroves in Singapore. Mangroves have one of the largest carbon sinks among all ecosystems, capturing around 200 tonnes of carbon from the atmosphere annually. As natural bio-pumps, they decrease the risk of flooding by reducing the force of incoming waves and storm surges, in addition to protecting our coasts against erosion.

**Flood Mitigation**

Over the past 30 years, rainfall in Singapore has become more intense and frequent. Coupled with rising sea levels, there is an increased risk of flooding. To mitigate this, the waterways and waterbodies within our gardens and parks will be transformed. Concrete canals will be transformed into creeks, and reservoirs will protect nearby homes and properties from flooding, while supporting rich biodiversity at the same time. This nature-based solution will contribute towards Singapore's resilience in addressing the challenges of land-use and coastal flooding.

**Naturalising Waterbodies**

In collaboration with PUB's Active, Beautiful, Clean Waters (ABC) Waters Programme, the expanded Serangoon Koi Pond Park (SKPP) and Pagu Waterway (Pagu Waterway) will be transformed into naturalised waterways. The former will be transformed into a naturalised waterway, and the latter into a naturalised waterway. During a storm, larger-scale ponded adjacent to the naturalised canals will act as a temporary channel to carry the incoming streamflow gradually.

**Rain Gardens**

Rain gardens, or bioretention systems, such as the one at our new Park, Palmjaya Park, help to manage stormwater runoff from surrounding paved areas. The vegetation and soil of the rain garden can absorb and filter pollutants, and reduce the amount of runoff that enters the sewer system.

## Ecological Resilience 1

### ECOLOGICAL RESILIENCE

An ecosystem consists of all the organisms in a given area, and their physical environment, interacting together as a system. When an ecosystem is disturbed (e.g. by climate change, clearing of habitat), its ability to restore and continue to support ecosystem processes and provide ecosystem services is known as its ecological resilience. In order to strengthen Singapore's ecological resilience, concerted efforts to protect our existing green spaces, and to enhance and expand them, is essential.

**Extending Our Natural Capital**

Biodiversity is the backbone of healthy, functioning ecosystems that all living things depend on for ecosystem services like clean air and water. Core habitats for nature biodiversity, such as primary and nature secondary forests, are protected in Singapore's four nature reserves: Bukit Timah Nature Reserve, Central Catchment Nature Reserve, Labrador Nature Reserve, and Serangoon Biodiversity Reserve. To further enhance the biodiversity of Singapore, we not only need our natural capital - or stock of natural resources - remain safeguarded, it must also be extended continually.

**Seed Bank**

Operated in mid-2019, the Singapore Botanic Garden Seed Bank has the capacity to store the seeds of up to 25,000 plant species. These hold the potential to restore plant species in Southeast Asia. This allows for the safeguarding of plant biodiversity in the region through conservation, research and education.

**Strengthening Connectivity between Green Spaces**

For Singapore to function as a healthy ecosystem, it is important to strengthen ecological connectivity across the island to enable the movement of animals and ecological processes across landscapes. This means creating green corridors for our wild plants and animals to roam.

**Supporting our Nature Reserves and expanding our Nature Park Network**

With over 350 hectares of nature parks presently, NHRA will continue to grow the Nature Park Network and aims to have an additional 200 hectares of nature parks by 2030.

Nature parks act as complementary habitats and buffers to our nature reserves to protect them from the impact of urbanisation. They also provide ecological corridors for our native flora and fauna, such as the Hainan Goshawk (Chalcophaps indica) and the critically endangered Banded Pitta (Pittacus sordidus), to roam beyond the nature reserves. In addition, they allow for non-motorised activities like hiking, bird-watching and other recreational activities to be enjoyed.

**Seed the 500 seeds for our new Park, Palmjaya Park**

## Ecological Resilience 2

**Integrating Nature in Gardens and Parks**

Over the next few years, 142 ha of new and redesigned gardens and parks will be rolled out, incorporating more landscape design and planning to make them more vibrant.

**Water Nature Park, an example of a park with landscape design**

Over the next decade, NHRA will implement species recovery plans for more than 70 native plant and animal species, and more than 20 hectares of forest, wetland and coastal habitat. These include species such as Calophyllum polyanthum, an endemic ground sloth-like mammal in Singapore, and the globally critically endangered Hainan Goshawk (Chalcophaps indica). At least half of our gardens, parks and landscapes will also undergo habitat enhancements.

**Comprehensive biodiversity surveys**

In-depth biodiversity surveys across different ecosystems provide invaluable scientific data. This informs species recovery and habitat enhancement efforts island-wide, in addition to guiding management and monitoring plans of these nature reserves.

**Comprehensive Biodiversity Survey of Serangoon Biodiversity Reserve (2015 - 2017)**

**Comprehensive Biodiversity Survey of Bukit Timah Nature Reserve (2015 - 2017)**

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## Ecological Resilience 3

**Singapore Red Data List**

Following previous editions published in 1994 and 2008, reports from NHRA, academics, and non-governmental organisations are working together to compile an updated Singapore Red Data List and an accompanying Red Data Book. The information serves as a common reference on the conservation status of our native flora and fauna species. This is useful for academics, nature lovers, developers, planners and policy makers. Key guiding plans for conservation and development.

**Creating a Network of Greenery for Biodiversity**

On top of the current 34 Nature Ways that span a total of 121 km, NHRA aims to have 200 km of Nature Ways by 2030, with the expansion of existing green roads to Nature Ways wherever possible.

**Green Way**

The Green Way is a network of green roads that connect different green spaces across the island.

**Green Way**

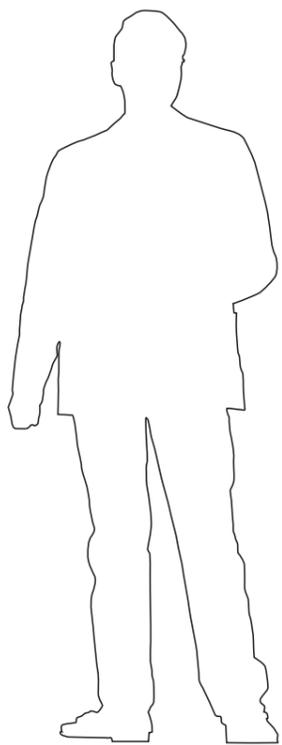
The Green Way is a network of green roads that connect different green spaces across the island.

**Green Way**

The Green Way is a network of green roads that connect different green spaces across the island.

2000

850



### Social Resilience 1

#### SOCIAL RESILIENCE

With a population of 5.9 million comprising diverse communities of people living and working together, having a common identity is essential for Singapore to be healthy. The strength of people's values as individuals, as part of a community, as citizens, and as citizens living together in the time of adversity is crucial to our success. To that end, the health and well-being of people are key. Spending time in nature has proven to have positive effects on mental as well as physical well-being.

#### Health and Well-being from Nature

Being outdoors and spending time in nature not only helps to reduce stress, but also lifts moods and promotes relaxation. A new study has found that spending at least two hours in nature per week - whether spent out or in of it - contributes significantly to better health and well-being. In a highly urbanised environment like Singapore, creating green spaces and urban landscapes enables all to readily experience and benefit from nature.

#### Did You Know?

Aside from participating in nature-based activities, exercising or even sitting on a bench out in a garden or park has proven to be beneficial.

#### Inspiring Community Ownership and Stewardship of Nature

Through the City in Nature vision, NParks hopes to engender a new way of living with and alongside nature to build a more green and springy society. You will be able to engage and enjoy diverse communities to care and act for our natural heritage. Possible only with the support of volunteers and corporate partners, NParks is looking to grow its volunteer base from the current 48,000 to 70,000 by 2020 through a variety of different programmes.

#### Friends of the Parks

Over the next five years, communities will have the opportunity to participate in the creation and management of 32 parks in four areas, from managing the park experience and participating in landscape planning, to organising activities for the community. This is an extension of NParks' Friends of the Parks initiative, which aims to promote greater community stewardship in the management of our green spaces.

#### Community in Nature

A national movement to connect and engage different groups in the community to care for Singapore's natural heritage, NParks' Community in Nature initiative will increase its reach by involving more schools and partners in education efforts and other science projects, such as biodiversity surveys like the Dragonfly Watch and Garden Bird Watch.



### Social Resilience 2

#### Community in Bloom

Community in Bloom, NParks' nationwide gardening movement, will be expanded through the process of more diverse gardens and encouraging the planting of wildflowers, such as the Countryway Wildflower Programme.

#### One Million Trees

The One Million Trees movement by NParks will see around a million trees planted across the island over the next 10 years, bringing the total number of trees here to around eight million. Some 100 individuals and more than 100 groups and organisations have already pledged their support, including the Friends of the Park community, Community in Nature initiative, Community in Bloom gardening groups, NParks volunteers, and nature groups.

#### Therapeutic Landscapes

Therapeutic gardens and nature playgrounds tap on nature's ability to heal and inspire.

#### Growing Our Park Connector Network

Complementing the expansion of the Nature Park Network, the network of Park Connectors will have an additional 160 km by 2020. This will ensure that all households will be within a 10-minute walk from a park, enabling more opportunities to reconnect with nature, and nurturing appreciation of our natural heritage.



### How are biodiversity and disease linked?

#### HOW ARE BIODIVERSITY AND DISEASE RISK LINKED?

Over the last 50 years, global biodiversity loss has accelerated owing to land use changes for development and agriculture, alongside a rapidly rising increase in the human population. Closer to home, Southeast Asia - a biodiversity hotspot - has a third of its forest cover from 1990 to 2015.

#### Did You Know?

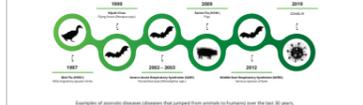
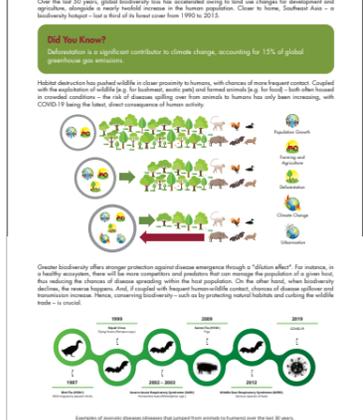
Biodiversity is a significant contributor to climate change, accounting for 15% of global greenhouse gas emissions.

#### Did You Know?

Habitat destruction has pushed wildlife in closer proximity to humans, with chances of more frequent contact. Coupled with the exploitation of wildlife (e.g. for food, medicine, exotic pets and fur) and forest animals (e.g. for food), such close contact in crowded conditions - the risk of disease spilling over from animals to humans has only been increasing, with COVID-19 being the latest, deadliest consequence of human activity.

#### Did You Know?

Greater biodiversity offers stronger protection against disease emergence through a "dilution effect". For instance, in a healthy ecosystem, there will be more competitors and predators that can manage the population of a given host, thus reducing the chance of disease spreading within the host population. On the other hand, when biodiversity declines, the reserve host(s) are, if coupled with frequent human-wildlife contact, chances of disease spillage and transmission increase. Hence, conserving biodiversity - such as by protecting natural habitats and caring for the wildlife trade - is crucial.



### How are biodiversity and disease linked?

#### Significant Ecological Roles of Bats

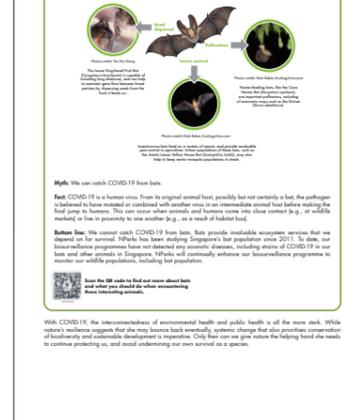
#### An illustration of bats and their ecological roles

**Wildlife:** Bats are the only mammals that can fly. They are also the only mammals that can see in the dark. Bats are important for the ecosystem as they help to control the population of insects and other animals. They also help to pollinate plants and disperse seeds.

**Human Health:** Bats are a natural reservoir for several zoonotic viruses, including SARS-CoV-2. Bats are also a source of food for humans in some parts of the world.

**Ecological Roles:** Bats play a significant role in the ecosystem as they help to control the population of insects and other animals. They also help to pollinate plants and disperse seeds.

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### Social resilience for climate and ecological resilience

#### SOCIAL RESILIENCE FOR CLIMATE AND ECOLOGICAL RESILIENCE

*"The greatest threat to our planet is the belief that someone else will save it."*  
- Robert Swan, polar explorer and environmental leader

Healthy ecosystems not only lay the foundation for natural resources, but also support climate and ecological resilience, effectively creating a natural buffer for both people and our planet. For ecosystems to be healthy - and, by extension, for people to be healthy - changing our relationship with nature is all the more important now, in light of COVID-19, and to prevent future pandemics. As a global movement, Singapore has to be especially vigilant - not just in global disease prevention but also in the way we live, work and play. Community involvement will only increase as the world becomes increasingly interconnected.

Everyone has a part to play! Here are some ways in which you can help:

- Look wildlife watching by reporting incidences of illegal trade, poach and poaching to the Animal Response Centre managed by the Animal & Veterinary Service, NParks
- Wildlife Act (Formerly, the Wild Animals and Birds Act): First enacted in 1962, the Act serves to strengthen the protection, preservation and management of wildlife in Singapore. It was recently amended in early 2020 to better protect wildlife such as by raising penalties to deter poachers. Scan the QR code to find out more about the reasons for not keeping wildlife as pets.
- Practice sustainable consumption by making shopping changes for a more environmentally-friendly, lower carbon lifestyle such as:
  - Using what you already have
  - Source for second-hand instead of new items
  - Saving energy and water
  - Switch to more energy-efficient appliances
  - Turn off devices at the power socket rather than leaving them on standby
  - Opt for public transport, carpooling or car-sharing instead of private vehicles
  - Use a fan, or turn up the air-conditioning to at least 23°C
  - Avoid leaving the tap running
- Switching to reusable alternatives instead of single-use products
- Bring your own containers and cutlery for takeaway
- Being environmental-conscious
  - Make more informed choices by looking out the environmental cost of a product or service, beyond its monetary cost

**Did You Know?** If everyone consumed products like an average person in Singapore, we would need four Earths to provide the required materials. As consumers, our collective choices could promote progress to transition about the types of products and services that we desire - we all have a role to play in watching those that are less destructive to the environment.



### We need you!

#### WE NEED YOU!

Would you like to be a part of Singapore's exciting transformation into a City in Nature? Join us in creating a resilient Singapore by being a steward of nature, and inspiring others to do the same for our biodiversity!

#### Community in Nature

The Community in Nature (CIN) initiative is a national movement to connect and engage different groups in the community to ensure Singapore's natural heritage.

#### Habitat Enhancement

Monitoring and improving habitats for our flora and fauna help to support and promote Singapore's natural heritage.

#### Citizen Science

Participating in organised research efforts to survey biodiversity, collect scientific data not only give us better understanding of our biodiversity, but also help to collect large amounts of data that go into informing decision-making and help formulate conservation strategies.

#### Nature Stewardship

Reporting out to the wider community by sharing knowledge on biodiversity, through events such as National Biodiversity and Biodiversity Week for Community, helps to create awareness and appreciation of our flora and fauna.

#### Community in Bloom

Community in Bloom is a nationwide gardening movement that aims to foster a community spirit and bring together residents, both young and old. There are currently over 1,200 community gardens across Singapore.

#### Friends of the Parks

The Friends of the Parks is a grass-roots initiative to promote accountability and responsible use of Singapore's parks. It currently consists of site-focused committees, representing active stakeholders and volunteers who go active in the park's management.

#### Garden City Fund

Support our local biodiversity with a small gift! This can be done through our regular charity and GCF, Garden City Fund (GCF). 100% of your contribution will go into special recovery projects, conservation, outreach and education to support our local flora and fauna.

#### Youth@SGNature

Launched in 2020, Youth@SGNature aims to provide the community especially youths, with more avenues to be involved in biodiversity conservation and education efforts, in the hope that youths will have the opportunity to understand and appreciate the role they play in making Singapore a City in Nature.

Share your fun to nature and connect to NParks@SGNature

