



Integration for Biodiversity in Singapore

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1. Introduction

Singapore reported¹ that Singapore as a party to the CBD is committed towards integrating conservation and sustainable use of biodiversity into relevant sectors of society (Article 6 of the CBD). Singapore's vision is to be a "City in a Garden", where greenery is incorporated into the city's landscape and in everyday life of the people. Synergies among government agencies, research institutions, and NGOs are the cornerstone towards the success of Singapore's vision and biodiversity conservation strategies.

This note will highlight the key government agencies, tertiary and research institutions, biodiversity interest groups and private sector that are involved in biodiversity related activities. Successful partnerships for biodiversity conservation involving 3P sectors – public, people and private will also be highlighted.

Stakeholders

2. The Public Sector

This section highlights the institutional and legal framework that is in place, in particular the three key ministries and their respective statutory agencies that are relevant to biodiversity conservation.

NParks and Agri-food and Veterinary Authority of Singapore (AVA) are statutory boards within the Ministry of National Development (MND) that deal directly with biodiversity related issues. Other statutory boards such as URA, NEA and PUB are responsible for Singapore's land use, environmental infrastructure, and water resources respectively. Inter-agency coordination is well aligned towards Singapore's vision of a "City in a Garden", where biodiversity conservation is taken into account in development projects.

Ministry of National Development (MND)

The mission of MND is to develop world-class infrastructure; create a vibrant and sustainable living environment; and build rooted and cohesive communities. It has played a key role in transforming Singapore into a global city, with green recreational infrastructure and quality affordable public housing.

Urban Redevelopment Authority (URA)

The URA is the national land use planning authority. URA has to cater for the economic, social and environmental needs of the city-state. This is done primarily through the Concept Plan and the Master Plan, which provide integrated planning framework for sustainable development.

¹ Singapore (2009). 4th National Report to the Convention on Biological Diversity, National Parks Board Singapore, September 2010, 67 pp.

Building and Construction Authority (BCA)

The BCA is responsible for the development of an excellent built environment for Singapore. “Built environment” refers to buildings, structures and infrastructure that provide the setting for the community’s activities. Singapore is moving towards a more resource-efficient built environment, and BCA champions the development of green features and sustainable technologies in buildings through the Green Mark Incentive Scheme, for instance, which provides cash incentives to developers and building owners who make efforts to achieve at least a BCA Green Mark Gold rating or higher in the design and construction of new buildings

The Building and Construction Authority (BCA) has also developed a new Green Mark scheme for parks to certify parks for its environmental friendliness, and this will include recognition of conservation features. This new system of certification aims to encourage park managers to build up interest, and learn the necessary skills and management techniques for biodiversity conservation within Singapore’s urban green space (BCA, 2008). To help build up competency in this area, NParks’ Centre for Urban Greenery and Ecology (CUGE) will be extending its training curricula and research to include the management and conservation of urban ecosystems.

Agri-Food and Veterinary Authority (AVA)

AVA was established on 1 April 2000 with the following core functions:

- i. ensure food safety;
- ii. ensure resilience in food supply;
- iii. safeguard animal and plant health;
- iv. safeguard animal welfare;
- v. promote agrotechnology;
- vi. invest in research and development; and
- vii. protect endangered wildlife.

AVA’s core functions (iii) and (vii) are directly relevant to biodiversity. It regulates the import of animals and plants, their related products, and also has the jurisdiction to protect wild animals and birds island-wide and is also responsible for controlling the trade in wildlife. AVA is the national authority responsible for the implementation and enforcement of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). AVA administers and enforces five laws pertaining to biodiversity; Wild Animals and Birds Act 1965, Animals and Birds Act 1965, Control of Plants Act 1994, Endangered Species (Import and Export) Act 2006, and Fisheries Act 1966.

The Wild Animals and Birds Act (WABA) 1965 provides for island-wide protection of almost all fauna, with the exception of 6 common species of birds. Section 5 of the WABA prohibits the “killing, taking or

keeping of any wild animal or bird” without a license. The penalty for an offence under section 5 is a fine of SGD 1,000 and the forfeiture of the animal or bird. The Wild Animals and Birds (Bird Sanctuaries) Order provides for certain areas to be set-aside as bird sanctuaries where the killing, taking, netting or snaring of any bird is prohibited. NParks has been administratively empowered by AVA to assist in the enforcement of the WABA.

The Animals and Birds Act 1965 and the Control of Plants Act 1994 empower AVA to safeguard animal and plant health and animal welfare. The Animals and Birds Act 1965 is for preventing the introduction into, and spreading within, of diseases of animals, birds and fish into, within and from Singapore, as prevention of cruelty to animals, and for measures pertaining to the general welfare and improvement of animals, birds or fish in Singapore, and for purposes incidental thereto. The Control of Plants Act 1994 is an Act related to the cultivation, transportation, import and export of plants and plant products and the protection of plants and plant products against pests and diseases by the regulation of the introduction of pests into Singapore and use of pesticides, and for purposes incidental therewith.

The Endangered Species (Import and Export) Act (ESA) 2006 gives effect to CITES by controlling the importation, exportation, re-exportation and introduction from the sea of certain animals and plants, and parts and derivatives of such animals and plants, and for related matters. The prohibition of sale of tiger and rhinoceros parts and derivatives are mentioned specifically in the subsidiary laws. Offences in terms of import and export of species under this act carries a penalty of SGD 50,000 for each of such scheduled species and cumulatively up to SGD 500,000 and/ or a jail term not exceeding two years.

The Fisheries Act (FA) 1966 is an Act for the protection and conservation of fisheries, the control of fishing, marketing and distribution of fish, the use and control of fishing ports and harbours, and for measures pertaining to the general welfare and improvement of the fishing industry in Singapore and for purposes incidental thereto.

National Parks Board (NParks)

NParks is responsible for providing and enhancing Singapore's green infrastructure, making Singapore a City in a Garden. NParks manages 4 Nature Reserves which cover about 33.26 km², 2 National Parks (i.e., Singapore Botanic Gardens and Fort Canning Heritage Park), maintains over 320 parks which occupy, oversees about 24.16 km² of roadside planting, and maintains over 100 km of park connectors. The National Parks Board Act 2005 provides for NParks' establishment as a statutory board, and also accords NParks the mandate in managing national parks, nature reserves and public parks.

As the scientific authority on nature conservation, NParks is Singapore's environmental steward, fostering "an urban conservation model that values the city's rich biodiversity as a strategic asset" (National Parks Board, 2008). In this role, NParks spearheads and coordinates the monitoring of Singapore's native biodiversity. NParks is primarily responsible for biodiversity-related regional and international agreements and conventions. It is Singapore's national focal point for the Convention on Biological Diversity.

NParks administers the Parks and Trees Act (PTA) 2005 which provides for the protection of animals and plants within national parks, nature reserves and public parks. The definition of animal in the PTA is defined as “any mammal (other than man), bird, reptile, amphibian, fish (including shellfish), insect or any other living creature, vertebrate or invertebrate, and includes any egg or young thereof”. The PTA makes it an offence to capture, disturb or collect any animal or organism; and to use or possess any instrument or device for the purpose of capturing any animal. It also makes it an offence for a person to carry out an activity, which cause or may cause injury or death of any animal or organism. The Act also prohibits any person to bring or release any animal, including domestic animal into the nature reserve except with prior approval.

In terms of protection for plants which is defined as “any member of the plantae, protista, monera or fungi kingdom, and includes any angiosperm, gymnosperm, pteridophyte, bryophyte, algae, lichen or fungus”, it is an offence to cut, collect, displace any tree or plant or any part thereof within the national park or nature reserve. Additionally, it is also an offence to carry out any activity within any national park or nature reserve, which cause or may cause “alteration, damage or destruction to any property, tree or plant”. The penalty for these offences is a fine not exceeding SGD 50,000 or an imprisonment term not exceeding 6 months or both.

The PTA also provides for the establishment of National Parks and Nature Reserves under Section 7. Currently there are two national parks (Singapore Botanic Gardens and Fort Canning Park) and four Nature Reserves (Central Catchment Nature Reserve; Bukit Timah Nature Reserve; Labrador Nature Reserve; and Sungei Buloh Wetland Reserve) gazetted under the Act.

Ministry of the Environment and Water Resources (MEWR)

MEWR’s mission is to deliver and sustain a clean and healthy environment and water resources for all in Singapore. MEWR aims to maintain a quality living environment, and improve Singapore’s environmental sustainability. The two key statutory boards under its purview are:

- National Environment Agency (NEA)
- PUB, the National Water Agency

MEWR is also the national focal point for a number of multilateral environmental agreements on climate change, ozone depletion, hazardous waste, hazardous chemicals and persistent organic pollutants. Singapore became a party to the United Nations Framework Convention on Climate Change in 1997 and the Kyoto Protocol in 2006.

National Environment Agency (NEA)

NEA, which was established on 1 July 2002, focuses on the implementation of environmental policies through its divisions on environmental protection, environmental public health and meteorological services. NEA programmes include pollution control; solid waste management; energy efficiency; radiation protection and nuclear safety; prevention and control of vector-borne diseases; public hygiene

and cleanliness; management of hawker centres; meteorological services; 3P (People, Public and Private) Partnerships; and environmental training.

Public Utilities Board (PUB)

PUB, the national water agency, manages water supply, water catchment and used water in an integrated way. PUB's mission is to ensure an efficient, adequate and sustainable supply of water. The Public Utilities (Reservoirs and Catchment Areas) Regulations 2006 regulates activities within the protected central catchments, catchment parks and reservoirs.. Some of the prohibited activities include no damage to any plant, shrub or tree or any part of the same; no killing, hunting, shooting or trapping any animal; or any act, which causes damage to flora or injury to fauna.

Ministry of Education (MOE)

The Ministry of Education (MOE) is responsible for the formulation and implementation of education policies, and administers for example, government and government-aided primary schools, secondary schools, junior colleges and private schools. The Higher Education Division within MOE oversees the provision of tertiary and technical education in Singapore, including three autonomous universities (the National University of Singapore, the Nanyang Technological University and the Singapore Management University).

3. Tertiary and Research Institutions

The table below lists some of the major research bodies in Singapore dealing with biodiversity and nature studies. Their work has contributed to better understanding of the nature, status and health of biodiversity that exists in Singapore.

Table 1: List of Research Institutions.

Name	Profile
The Centre for Tropical Forest Science (CTFS)	The CTFS is an administrative unit of the Smithsonian Tropical Research Institute (STRI), and its mission is to promote and coordinate long-term biological and socioeconomic research within tropical forests and forest dependant communities. Currently, National Institute of Education (NIE) and CTFS have a Memorandum of Understanding to undertake collaboration on research and educational activities in Singapore's forests.
National Institute of Education (NIE)	NIE is Singapore's sole teacher training institute and is an integral part of the educational service. Within NIE, Natural Sciences and Science Education Academic Group offers amongst many other graduate programmes, applied plant sciences, chemistry, environmental science, and zoological sciences.
National University of Singapore (NUS) Raffles Museum of Biodiversity Research (RMBR) Tropical Marine Science Institute (TMSI)	RMBR The Department of Biological Sciences (DBS) at NUS provides courses in Ecology/Biodiversity, Cell/Molecular/Developmental Biology and Biophysical Sciences. The biodiversity programme is centred around the Raffles Museum of Biodiversity Research (RMBR), which hosts the single largest collection of fauna in Southeast Asia, with at least 400,000 catalogued specimens. Staff members and students of the RMBR are engaged in research in conservation biology, ecology and systematics covering the terrestrial, freshwater and marine environments. TMSI The TMSI is a research institute formed within NUS. It is involved in research, development and consultancy in tropical marine science, providing postgraduate level teaching and research opportunities in that field.
Polytechnics	Polytechnics in Singapore offer several tertiary courses in environmental stewardship. Singapore Polytechnic - Diploma in Environmental Management and Water Technology

	Temasek Polytechnic - Diploma in Environment and Water Technology Nanyang Polytechnic - Diploma in Chemical and Green Technology
Singapore Herbarium	Singapore Herbarium houses about 650,000 herbarium specimens, focusing on those originating from the Malesian region (Peninsular Malaysia, Thailand, Indonesia, Philippines and New Guinea), with the most extensive collections from Singapore and Peninsular Malaysia dating from the 1880s. Current taxonomic research in the Herbarium focuses on bryophytes, begoniaceae, convolvulaceae, orchidaceae and zingerberaceae.

4. Biodiversity Interest Groups

NGOs and interest groups form an integral part of Singapore's conservation community, and their contributions are wide-ranging. This includes assisting government agencies in nature surveys, data collection, publication, volunteer projects, education and public awareness. NParks has established a strong network of green volunteers and like-minded individuals who are strong supporters of biodiversity conservation activities.

Table 2: List of Major NGOs and Interest Groups.

Name	NGO/Interest	Group Conservation Profile
The Animal Concerns Research and Education Society (ACRES)	NGO	ACRES works towards improving living conditions and welfare of captive animals, and educating the public on humane animal care. It has conducted road shows and talks to raise awareness of animal welfare, and works closely with schools and students as part of their community involvement project. Website: http://www.acres.org.sg/
Blue Water Volunteers (BWV)	NGO	BWV is a marine conservation NGO that supports research activities and promotes awareness of local marine habitats through four main programmes: (1) ReefFriends, (2) ReefWalks, (3) ReefTalks and (4) ReefExhibits. Website: http://www.bluewatervolunteers.org/
Hantu Blog	Interest Group	Hantu Blog is a non-profit environmental awareness movement for Pulau Hantu, an off-shore island renowned for its reef biodiversity. It also works towards enhancing awareness of Singapore's coastal and marine habitats. Website: http://www.pulauhantu.org/
Naked Hermit Crabs	Interest Group	Naked Hermit Crabs comprises volunteers who provide guided walks at Singapore's coastal habitats at Chek Jawa, Pulau Semakau, and Kusu Island. Website: http://www.nakedhermitcrabs.blogspot.com/
Nature Society Singapore (NSS)	NGO	NSS is a non-profit NGO committed to the research, appreciation, and conservation of the natural heritage in Singapore. It has partnered NParks on numerous projects, the latest being the 2008 version of the Red Data Book. NSS has also provided various recommendations on policies concerning Singapore's natural heritage. Website: http://www.nss.org.sg/
Singapore Environment Council (SEC)	NGO	SEC evolved from the National Council on the Environment (NCE), which was formed in November 1990. SEC is an independently managed, non-profit NGO, and an approved charity. It promotes, coordinates, and organises numerous environmental causes and events in Singapore. Website: http://www.sec.org.sg/
Singapore Underwater Federation (SUF)	NGO	SUF centres around scuba diving activities and helps support scientific knowledge of Singapore's natural ecosystem services, and enhancing cooperation with various stakeholders.
TeamSeagrass	Interest Group	TeamSeagrass is part of Seagrass-Watch, the largest scientific, non-destructive seagrass assessment and monitoring programme in the world. They monitor the seagrass population in Singapore, and collect data to better understand and manage Singapore's seagrass meadows. Website: http://www.teamseagrass.blogspot.com/
Wild Singapore	Interest Group	Wild Singapore is an online guide on Singapore's wild areas, with constant updates on biodiversity conservation activities and nature guided walks. Website: http://www.wildsingapore.com/
World Wide Fund for Nature (WWF) Singapore	NGO	WWF is an international NGO that works towards conserving the biodiversity, ensuring sustainable use of renewable natural resources, and promoting pollution reduction. WWF has recently set up an office in Singapore in 2006, which will implement education and outreach environmental programmes, facilitate dialogue on corporate social responsibility, and explore new ways to finance a sustainable environment. Website: http://www.wwf.sg/

5. Private Sector

Private companies and corporations are also active in Singapore's conservation efforts providing funding and sponsorship for conservation projects. Additionally, some companies provide staff volunteer support for conservation projects, while others contribute scientific expertise. Listed below are some of the private companies that have partnered NParks on conservation projects:

Table 3: Private Companies Involved in Biodiversity Conservation

Name	Conservation Profile
The Hongkong and Shanghai Banking Corporation Limited (HSBC)	HSBC's Care-for-Nature was launched in 1989 as a long term conservation and outreach project. It has funded and supported many community driven environmental activities and infrastructures, which include the construction of boardwalks at Chek Jawa, a treetop walk at MacRitchie Park, and running of the HSBC Volunteer Programme.
Keppel Corporation Limited	Keppel Corporation has provided funding support to many conservation efforts, such as the coral nursery project.
Sembawang Shipyard Pte Ltd	A major leader in the international ship-repair and shipconversion industry, Sembawang Shipyard has started an environmental care and protection project - "Green Wave", an annual competition open to all students in the primary, secondary and tertiary levels. The objective is to motivate students and develop in them a sense of responsibility for the environment through innovative ideas and projects. It has seen warm reception since it first started in 2003. In 2008, a total of 260 entries were received with participation from about 1,000 students.
Shell Singapore	Shell Singapore has partnered NParks in numerous conservation programmes, including the Shell-NParks Nature Nurtures Programme at SBWR, and provided sponsorship to NSS for the publication of the second edition of The Singapore Red Data Book. Started in January 2007, the Nature Nurtures Programme aims to reach out to teens from challenging backgrounds to build up their skills and selfconfidence through nature.
Toyota Motor Corporation	Toyota has partnered NParks and 5 secondary schools in the "Reforestation and Reach Out Project" to promote environmental education and nature awareness. Students from the schools undertook volunteer reforestation and nature education projects, sharing creative and innovative ideas in environmental education and conservation.
Underwater World Singapore (UWS)	UWS has embarked on an intensive public awareness initiative, through exhibits, enrichment programmes, outreach talks, and various other marine conservation projects with partners and institutions.
Wildlife Reserves Singapore (WRS)	WRS manages the Singapore Zoo, Night Safari, and Jurong Bird Park. In the areas of conservation and research, WRS is carrying out projects on the oriented pied hornbill and pangolin.

6. Sectoral and Cross-sectoral Integration of Biodiversity

In land and resource constrained Singapore, the need to integrate biodiversity and environmental considerations into city planning is all the more important to build a "City in a Garden". Here, mainstreaming of biodiversity is profiled in the education, land-use planning, national development, water and waste management sectors. The blueprints that chart Singapore's development future have incorporated biodiversity conservation where possible, and addressed mitigation of climate change and other environmental issues that will impact biodiversity. Encouragingly, students are increasingly involved in conservation activities, as part or outside school curricula. Singapore's water and waste management infrastructure has also included provisions for the conservation of biodiversity where possible.

Education

Knowledge and awareness are pre-requisites for action, and hence biodiversity is incorporated in the school curriculum at the primary, secondary and tertiary levels. Biodiversity is covered in the formal curriculum across all levels via the Science and Humanities syllabuses. Specifically, it is covered in Primary Science, Lower Secondary Science, Upper Secondary Biology and GCE 'A' level Biology. For the Humanities subjects, the concept of biodiversity is covered in Primary Social Studies, Lower Secondary Normal (Technical) Social Studies, Lower Secondary Geography, Upper Secondary Geography, Upper Secondary Social Studies and GCE 'A' level Geography. Tertiary institutions offer various undergraduate and postgraduate courses in biology, ecology, life sciences, bioengineering, and environmental science. School activities such as the Community Involvement Programme (CIP), Community in Bloom (CIB), and Adopt-a-Park also complement the main curriculum and help to develop in students a sense of awareness and appreciation for the environment.

Community Involvement Programme (CIP)

CIP is aimed at building social cohesion and civic responsibility amongst students. Schools select suitable activities for their pupils at the different levels, including environmental programmes that nurture a sense of responsibility towards nature and the environment. Students maintain an updated logbook of their activities, and in time, cultivate a positive attitude and a sense of ownership in what they have achieved.

Community In Bloom (CIB)

The "Community in Bloom Schools (CIBS)" programme helps pupils discover science and the natural environment through fun, interactive and hands-on gardening activities. Using the school gardens as outdoor classrooms, students can learn through experiential learning. Teacher's resource books (for primary and secondary levels) have been created to assist teachers to run activities, which are crafted to integrate existing curriculum subjects in a fun and creative way. Through these activities, students get to develop science process skills, teamwork, entrepreneurial skills and basic horticultural skills. Since the inception of CIB in 2005, the number of schools (ranging from preschool to tertiary levels) has increased over the years, from 38 schools in 2005 to 90 schools in 2008.

Adopt-a-Park

The "Adopt-a-Park" programme enables schools, grassroots organisations and the private sector to take ownership in nature outreach and habitat rehabilitation. Parks may be selected for adoption based on their proximity to the adopting organisation. The scheme is for a period of three years, after which a review will be carried out by NParks to assess the possibility of extending the adoption for another 3-year period.

Land Use Planning

The Concept Plan is Singapore's strategic land use and transportation plan which guides the physical development over 40-50 years. The plan is reviewed every 10 years. It takes an integrated approach in

considering various land needs and ensures that future development balances economic growth, environmental stewardship and social progress. The mid term review of the Concept Plan that was launched in 2001 was carried out in 2006. One of the broad strategies arising from the review is: “Enhancing Quality of Life and Sense of Identity: The quality of life can be enhanced by providing for a greater variety of leisure options. At the same time, there is also a need to selectively retain Singapore’s built and natural heritage to foster our sense of belonging.”

The Master Plan is the medium-term (10-15 years) statutory land use plan that translates the broad, long-term strategies of the Concept Plan into detailed plans. URA reviews the Master Plan every 5 years, and the latest Master Plan was gazetted at the end of 2008. In recognition of the need to protect Singapore’s Natural Heritage, all 22 Nature Areas, including the 4 Nature Reserves were retained. Careful, judicious planning is critical to help keep Nature Areas while Singapore continues to grow. Where possible, Nature Areas are incorporated into parks so that they can be retained and made accessible for public enjoyment. By prioritising developments in urban areas, Nature Areas are kept pristine for as long as possible for future generations to enjoy.

Sustainable Development; Inter-Ministerial Committee on Sustainable Development (IMCSD)

To further consolidate efforts to balance Singapore’s economic imperatives with environmental sustainability, an Inter-Ministerial Committee on Sustainable Development (IMCSD) comprising of the following Ministries was established in January 2008 to develop Singapore’s sustainable development blueprint:

- Ministry of the Environment and Water Resources (co-chair)
- Ministry of National Development (co-chair)
- Ministry of Finance
- Ministry of Trade and Industry
- Ministry of Transport

Sustainable development for Singapore means, being able to support future economic and population growth while maintaining a quality living environment that is clean, green and healthy so as to achieve our vision for Singapore to be a lively and liveable global city. The blueprint, unveiled in April 2009, details new targets and initiatives to improve resource efficiency, enhance Singapore’s urban environment, build capabilities, and foster community action. Key long-term goals aimed at enhancing greenery and achieving a clean, blue and green environment up to 2030 have been identified, for example:

- Increase the green park space by 9 km² to 42 km² by 2020, and reach a park provision of 0.008 km² per 1,000 population by 2030
- Increase the length of park connectors from 100 km in 2007 to 360 km by 2020

- Introduce 0.3 km² of skyrise greenery by 2020 and 0.5 km² of skyrise greenery by 2030
 - Open 8.2 km² of reservoirs and 90 km of waterways for recreational activities by 2020 and have 9 km² of reservoirs and 100 km of waterways open for recreational activities by 2030
- The Sustainable Development Blueprint provides key recommendations to protect and enhance biodiversity. This includes the implementation of a National Biodiversity Strategy and Action Plan, and the development of the City Biodiversity Index, which aims to promote biodiversity conservation among cities globally.

Water Management: Active, Beautiful and Clean (ABC) Waters Programme

Relevant to biodiversity conservation, is PUB's management of water catchment areas and its Active, Beautiful and Clean (ABC) Waters Programme. Currently Singapore has 15 reservoirs, 32 major rivers and 7,000 km of canals and drains. The ABC Waters Programme provides for complementary initiatives in managing catchments and waterways in Singapore. One of the strategies is to soften the landscape of the canals and drains by recreating freshwater ecosystems to the extent possible.

As part of the ABC Waters Programme, PUB and NParks are collaborating to manage 3 catchments in Singapore (Western, Central and Eastern) and to soften the landscape of the canals and drains by recreating freshwater ecosystems to the extent possible. Efforts cover the Nature Reserves and Nature Areas delivering goods and services in terms of climate amelioration, water capture and water quality. Drains, canals and reservoirs are also transformed into recreational and conservation areas. In the upgrading of Sungei Tampines for flood prevention, extra care was taken to preserve and protect the existing mangroves by constructing a diversion canal to channel away the excess floodwaters.

Waste Management: Pulau Semakau

Singapore has developed an integrated waste management system that is also environmentally friendly. Pulau Semakau is Singapore's only landfill which is located about 8 km from mainland Singapore. Dubbed as the "Garbage of Eden" by New Scientist in 2007, it also harbours rich biodiversity in a reclus of seven habitats; coastal forest, coral reef, coral rubble, mangrove forest, rocky habitat, sandy shore and seagrass meadow.

7. Partnerships

Singapore's efforts to conserve biodiversity can be attributed to a healthy relationship among the people, private and public sectors. This section highlights several success stories of such synergies, and also profiles 3P partnerships (collaboration between all three sectors). Singapore is moving towards enhancing its 3P collaborations, with concerted efforts to make funding available to support the work of NGOs and facilitate networking among the sectors (IMCSD, 2009). For example, organisations from across the people, private and public sectors will be able to tap on a SGD 1.5 million 3P Partnership Fund to explore ideas on environmental sustainability.

Research and Conservation Partnerships

- The Coral Nursery Project: This is collaboration between NParks, NUS, NEA and Keppel Corporation. Officially launched on 31 July 2007, this 2-year SGD 500,000 project focuses on the

ex-situ conservation of corals. It aims to enhance the ecological health of these corals by maximising the survival potential of naturally occurring “corals of opportunity” (corals fragmented by impact).

- **Dipterocarp Arboretum at Yishun Park:** With funding support of SGD160,000 from Banyan Tree Holdings Limited, NParks has set up Singapore’s first Arboretum in Yishun Park. The project started in 2007 with the planting of saplings, and by June 2008, over 800 trees are being showcased, spanning more than 70 Dipterocarp species. This Arboretum serves as a living gallery of trees for education and research.
- **Plant Conservation Strategy:** This collaborative effort between NParks, NIE and the NUS aims to improve the conservation status of rare and endangered plants in Singapore through in-situ monitoring and ex-situ propagation.
- **Pulau Ubin Conservation and Management Plans:** HSBC has been one of the frontrunner sponsors of conservation projects in Singapore. In line with its long-standing partnership with NParks, HSBC jointly launched the Pulau Ubin Conservation and Management Plans in 2005, which includes amenities such as the Ubin-HSBC Volunteer Hub and visitor facilities at Chek Jawa Wetland. In addition, HSBC made a donation of SGD 800,000 to the Pulau Ubin Conservation Fund, which would be used to enhance biodiversity conservation, outreach and research initiatives on Pulau Ubin.
- **Reef Friends Programme:** This joint project between NParks and BWV monitors the status of hard corals, mobile invertebrates and reef fish at 9 locations around the islands south of Singapore. The survey methods applied are internationally recognised techniques developed by Reef Check and the Global Coral Reef Monitoring Network. The sites include Pulau Hantu, Pulau Semakau, Pulau Jong, The Sisters and Raffles Lighthouse. The programme began in 2005, and consists of about 40 active volunteers from different professional backgrounds, including journalists, tertiary students and teachers.
- **The Singapore Red Data Book (2008):** A 3P collaboration between NParks, NUS, NSS and funded by Shell, follows a previous publication in 1994 which includes contributions from a wide range of experts from governmental agencies, NGOs, tertiary institutions and members of the public. In total, this new edition of the Red Data Book features over 300 flora and fauna species, including a checklist of all the threatened species in Singapore. This book provides a basis for developing long-term strategies for biodiversity conservation.
- **The Singapore Hornbill Project:** This is a 3P partnership among NParks, Jurong Bird Park, NUS, NTU, and the Bird Ecology Study Group of the Nature Society (BESGroup) to enhance the population and distribution of the Oriental Pied Hornbill, a locally endangered bird in Singapore. Since the project started in 2006, the hornbill population is observed to have increased from 30 to 50 in two years.

- **Sponge taxonomy and distribution:** This is a joint study between NParks and NUS on the taxonomy and distribution of intertidal sponges of Singapore. This project has recorded over 100 species of sponges, of which more than 40 are new records, and at least one that is new to science. Research is still ongoing.
- **Seahorse project:** This project is a collaboration between NParks and Temasek Polytechnic, aimed at breeding native seahorse species within aquaculture facilities at Temasek Polytechnic.
- **TeamSeagrass:** TeamSeagrass is a collaborative effort between NParks, private companies, schools and volunteers to monitor the seagrass population in Singapore, and collect data to better understand and manage Singapore's seagrass meadows. The sites include Chek Jawa, Pulau Semakau, Cyrene Reef, Tanjong Rimau (Sentosa), Tuas and Labrador Nature Reserve. The main TeamSeagrass volunteers monitor the former 4 sites, while the site at Tuas is monitored by Schering-Plough Corporation as part of their Corporate Responsibility and Environmental Stewardship Programme. The site at Labrador is monitored by Raffles Girls School, as part of their Science Research Programme.
- **West Coast Park Rejuvenation:** This 3P collaboration among Shell, NParks and Commonwealth Secondary School aims to rejuvenate a one-hectare mangrove habitat at West Coast park with 200 new saplings. The saplings will be planted in phases, and monitored over time by Commonwealth Secondary School, Shell staff and contractors. The project is fully funded by Shell, with a contribution of SGD 100,000, while NParks has set up a training programme to enhance the volunteers' capacity in areas such as wildlife and environmental management.

Partnerships on Education and Outreach

- **Nature Nurtures Programme:** The Shell-NParks Nature Nurtures Programme was launched in January 2007 with the aim of motivating teens to contribute positively to society through skills and confidence-building activities in a natural setting. Students participate in teamwork activities that develop interpersonal skills and respect for the environment. Held during weekends at the Sungei Buloh Wetlands Reserve, activities include coastal clean-ups and mangrove salvaging.
- **The Seashore Life Programme:** This is a joint collaboration between NEA and HSBC under its Care-for-Nature environment conservation and education programme (see also Chapter 3.1.4). It aims to educate students on seashore life and its habitats, harmful effects of litter as well as actions they can do to protect the natural ecosystem.
- **Toyota Reforestation and Reach Out Programme:** SBWR's "Reforestation and Reach Out" programme started in August 2004, with sponsorship from Toyota Motor Corporation. Five schools participated in the 3P partnership programme, which aims to involve students in reforestation activities in the area around the Outdoor Classroom, which showcased the different habitats of the Wetland Reserve, namely the mangrove, back mangrove, secondary

forest and freshwater pond. Their experience was enhanced through a series of workshops conducted by SBWR staff and volunteers. Sessions include plant drawings, public speaking, presentations, resource searching and creation of education materials.

- Wireless Learning Trail: The Wireless Learning Trail at SBWR pioneers the use of webcams installed on Ultra Mobile Personal Computers (UMPC) as an education tool for visitors. Park visitors can receive wetland information and pictures by scanning the 2-Dimensional barcodes that are positioned strategically alongside a boardwalk through the mangrove forest. This is a public-private sector initiative among NParks, Infocomm Development Authority of Singapore, MOE and iCELL Network Pte Ltd.