

A profile of the protected area system of Singapore

■ By Sahlee C. Bugna

General information

The Republic of Singapore is located off the southern tip of the Malay Peninsula and is composed of one major and more than 50 adjacent islands, with a total area of 648 km². The main island is separated from Malaysia by the narrow Johor Strait on the north, and from Indonesia's Riau Archipelago by the Singapore Strait on the south. The country has no prominent relief features, although the centre of the island has a series of low hills of granite and igneous rocks, the highest of which is Bukit Timah at 176 metres. In the west and southwest of the island is a series of low ridges formed from sedimentary rocks. The coastline is mostly flat and muddy although 5,400 ha of this have now been covered by extensive landfill. Numerous short streams, including the Singapore River, drain the island (FAO, 2001).

Before the British colonization in 1819, most of the island was covered with 82% lowland evergreen dipterocarp rainforest, 13% mangrove and 5% freshwater swamp. By 1890, about 90% of the vegetation had already been cleared. Singapore is currently largely urban in character, although some natural rainforest can be found in the Bukit Timah Nature Reserve and the adjacent Central Catchment Area. If Singapore had retained its natural vegetation, the country should have scored high in terms of biological richness. Unfortunately, the loss of natural habitat also meant the disappearance of most of the country's wildlife. Bird fauna is recorded at 295 species, and only two

mammals and three birds listed in the IUCN red lists occur in Singapore. There are also no known Endemic Bird Areas in the country (MacKinnon, 1997).

Since Singapore has very little natural resources, most of its environmental problems are characteristic of a highly urbanised city. These include pollution from industrialisation, urbanisation and the protection of nature areas (Tan, 1998). Major threats to protected areas are the possibility of degazettement; increasing recreational use, and the small size of the reserves, which increases edge effects, isolation and extinction (MacKinnon, 1997).

The protected area system

Legal framework

Forest protection in Singapore began in the 1840s, when the government "absolutely prohibited the further destruction of forests on

the summits of hills". Forest reserves, first established in 1882 when the Forest Department was created, were meant to supply timber and firewood, prevent soil erosion, protect water supply, and improve the climate. In 1936, however, all existing reserves, except for Bukit Timah and parts of the mangroves at Pandan and Kranji, were revoked and regazetted in 1939.

In the years that followed, a number of laws were passed establishing protected areas for various purposes. Nature reserves were created through the 1951 Nature Reserves Act. Bird sanctuaries were established through the 1981 Birds (Sanctuaries) Order, which was passed pursuant to the Wild Animals and Birds Act. The Parks and Trees Act of 1985 provided for public parks and the formation of the office of the Commissioner of Parks and Recreation. The National Parks Act of 1990 repealed the Nature Reserves Act, made provision for national parks and nature reserves, and established the National Parks Board (MacKinnon, 1997).

In 1971, the government approved the Concept Plan, which broadly outlines land use policies and aims to make Singapore a Tropical City of Excellence (FAO, 2001). These were then translated into detailed proposals for local areas called Development Guide Plans (DGPs), the implementation of which is coordinated by the Master Plan Committee (MPC) composed of all public authorities in Singapore. The basic



The Summit Path ... One of the Many Detours from the Main Path

Photo courtesy of Bukit Timah Nature Reserve

Ratification of Agreements Related to Biodiversity Conservation:

Convention on Biological Diversity – 1995
Convention on International Trade in Endangered Species of Wild Fauna and Flora – 1986

environmental concerns considered in the DGPs were (Tan, 1998):

- Identification of development constraints and major land uses that affect the environment (e.g. airports, areas for pollutive and hazardous industries);
- Projection of land needs for environmental infrastructure (such as incinerators, and sewage treatment plants);
- Determination of possible areas for major utility installations and infrastructural needs that may cause pollution;
- Selection of possible areas for nature conservation; and
- Continued protection of water catchment areas.

A new Concept Plan was released in 2001, which has been translated into 55 detailed DGPs (FAO, 2001).

The few remaining forests in Singapore are almost all within the protected area network. These are largely governed by the 1990 National Parks Act and the Parks and Trees Act of 1975 (FAO, 2001).

In 1992, the government released the national environmental master plan called the Singapore Green Plan (SGP), which sets out strategic directions to further improve the country's living environment and raise public health standards. It covers the core areas of environmental management, infrastructure development and public health (FAO, 2001). The Draft Singapore Green Plan 2012, on the other hand, is the country's master plan to achieve environmental sustainability over the next decade. Its key thrusts are to:

- Ensure a quality living environment through innovative and effective use of technology and efficient use of scarce resources to minimise the impact of human activities on the environment;
- Encourage active participation of all sectors to maintain a quality living environment while pursuing economic pros-

perity; and

- Contribute to the protection of the global environment.

Laws enacted to protect Singapore's environment are listed below.

Protected areas

Singapore's rapid urbanisation and industrial growth have exerted a heavy toll on its flora and fauna. Habitats were destroyed when coastal areas were reclaimed to provide more land, and forests were cut down to provide residential and commercial sites. Today, environmental policy dictates that 5% of the land area should be set aside for nature reserves, national parks, catchment areas, bird sanctuaries and gardens. Nature reserves and national parks are governed by the National Parks Act (NPA) and the National Parks Regulations. The Act mandates the National Parks Board to control and manage national parks and nature reserves. Parks established as catchment areas are governed by the Public Utilities Act and the Public Utilities (Catchment Area Parks) Regulations. The Parks and Recreation Department and the National Parks Board plan, develop, maintain and regulate the parks and green areas of Singapore.

In 1990, the Singapore Nature Society formulated a "Masterplan for the Conservation of Nature in Singapore", which identified 28 sites, comprising areas that have and have no protected status, as the most important sites for biodiversity conservation. Three are within gazetted

nature reserves, while the rest includes four wetland areas (Kranji, Khatib Bongsu, Sungei Buloh and Senoko), two islands (Pulau Tekong and Pulau Ubin) and a mangrove area (Mandai), all of which are to the north of Singapore. Bukit Timah is considered the most important single site although none of Singapore's protected areas are rated as of global importance (MacKinnon, 1997).

Protected areas in Singapore include:

Bukit Timah Nature Reserve - The 164-ha Reserve retains the only substantial area of primary rainforest left in the country. The forest has been a botanical collecting ground for more than a century, and has yielded the first known specimens of many species of Malayan plants. Several small native animals can still be found in the reserve including the Long-tailed Macaques, the Common Tree shrew, the Flying Lemur (*Cynocephalus variegatus*) and the rare Pangolin or Anteater. The dominant tree family is the Dipterocarpaceae, which generates the bulk of commercial tropical hardwood timber.

Sungei Buloh Nature Park - Designated a nature reserve in 1989, the 87-ha park is made up of mangrove mudflats, brackish water ponds and freshwater ponds. Mangrove trees characterise the plant life of the reserve. The park is an important stopover and refuelling point for migratory birds, some coming from as far as Siberia and

Table 1. Selection of Environmental Laws

Legislation	Year
Fisheries Act	1966
Wild Animals and Birds Act	1981
Parks and Trees Act (for parks not gazetted as national parks)	1985
Preservation of Monuments Act (Revised)	1985
Endangered Species Act	1989
National Parks Act	1990
Prevention of the Pollution of the Sea Act	1990
Public Utilities Act, Chapter 261 (water catchment areas)	2001
Animals and Birds Act (Revised)	2002

Source: Tan, 1998

China. It is also home to resident herons, kingfishers, doves, bee-eaters, tailorbirds, woodpeckers and munias.

Mangroves and accompanying wildlife such as mudskippers, crabs, shellfish, water snakes, birds, spiders, moths and monitor lizards can be seen throughout the year. Resident birds include herons, bitterns, sunbirds, coucals and kingfishers. Migratory birds, particularly shorebirds such as egrets, sandpipers, plovers, stay from September to March. The park is named after the rivers Sungei Buloh Besar and Sungei Buloh Kechil, which flow alongside the area.

The Lower Peirce Trail - The forest is home to more than 840 flowering plants, 100 ferns and 256 animal species, including the Black-naped Oriole, Long-tailed Macaque, Oriental Whip Snake, Pitcher Plantain Squirrel and White-throated Kingfisher.

Pasir Ris Park - The 70-hectare park is a mangrove area located at the north-eastern part of Singapore and dissected by the rivers Sungei, Api Api and Sungei Tampines. Pasir Ris is Malay for "beach-belt rope", implying a narrow beach. The park is used mostly for recreation with lawns, planted ornamental trees and landscaped features. The mangrove area consist of the more common species, such as trees of *Avicennia alba*, *A. officinalis* and *A. rumphiana*, *Bruguiera cylindrica*, *Ceriops tagal*, *Rhizophora apiculata*, the ferns *Acrostichum aureum*, *A. speciosum* and the shrubs *Acanthus ebracteatus* and *A. ilicifolius*. Rare species include *Aegiceras corniculatum*, *Bruguiera parviflora* and *Rhizophora stylosa*, which are all considered endangered locally (Kelvin et al., 2001).

Institutional arrangements

The following institutions admin-

ister environmental and biodiversity conservation policy in Singapore:

Ministry of Environment (ENV) - It handles overall management of the environment. First established as a department in the 1970s within the Prime Minister's Office, the ENV is responsible for providing the infrastructure for waste management, as well as enforcing and administering legislation relating to pollution control and public health (Tan, 1998).

National Parks Board, Ministry of National Development - The Board is responsible for managing the country's national parks and reserves for general nature conservation. Its



A flock of Little Egrets takes flight in Sungei Buloh Wetland Reserve

Photo courtesy of Sungei Buloh Wetland Reserve

mission is to develop plans that improve recreational facilities while preserving the ecological balance of the natural heritage in nature parks (FAO, 2001). The Board also serves as the National Biodiversity Reference Unit for the ASEAN Regional Centre for Biodiversity Conservation (ARCBC).

The Parks and Recreation Department, Ministry of National Development - The Department is in charge of other green areas, parks and landscaping. Parks are the responsibility of the Parks and Recreation Department, within the Ministry of National Development. The Parks and Recreation Department is responsible for constructing new parks and green open spaces. Under Section 25 of the Parks and Trees Act, the Commissioner for National Development is responsible for making rules for the management and con-

trol of public parks. Limitations on activities within public parks are detailed in the 1983 Parks and Trees Rules (FAO, 2001).

Singapore has an active environmental NGO movement, which coordinates activities closely with the government, media and industry. The Singapore Environment Council, formerly known as the National Council for the Environment, serves as the umbrella environmental organisation for local NGOs. The SEC aims to promote environmental awareness among the citizenry and constantly organises public education programmes on the environment, including seminars on the need for recycling and waste minimisation (Tan, 1998).

Nature groups include the Nature Society of Singapore (NSS), which began as the Malayan Nature Society in the 1940s and is dedicated to the study, conservation and enjoyment of the natural heritage in Singapore, Malaysia and surrounding regions. The Society published a Masterplan for the Conservation of Nature in 1990, participated in the deliberations for the Singapore Green Plan and was instrumental in the establishment of the Sungei Buloh Nature Park, among others (www.nsg.org.sg).

The Singapore Zoological Gardens also plays a major role in conservation by educating the public on the plight of Singapore's wildlife. Activities include Animal Shows and Animal Feeding Programmes, captive breeding, and a Wildlife Conservation Fund. A "Partners in Conservation Programme" also allows the organisation to coordinate conservation activities with both government and non-government agencies in Thailand, Malaysia, Indonesia, Cambodia, Laos and Vietnam.

The status of the protected area system

The Protected Area Systems Review of the Indo-Malayan Realm

stated that due to increasing demand for land, conservation of the few remaining forests has received a low priority. Almost all original habitats have been transformed and only tiny portions of rainforest and forest on limestone remained, including a reduced area of mangrove and modest secondary forest. Although the protected area system covers what remains fairly adequately, there is an apparent gap in the protection of mangrove forests. These, however, are represented in several recreational parks (MacKinnon, 1997). Protected areas have not been spared from human impact since these are not fenced, are often surrounded by residential or industrial areas, and subject to high visitor pressure (FAO, 2001).

Despite these issues and the urbanisation of Singapore, it counts among its achievements the protection of about 2100 hectares of nature reserves. Management of the reserves emphasize the reforestation of degraded areas that adjoin development areas, as well as the gradual reintroduction of indigenous flora and fauna in the country's forests.

Nineteen nature areas covering 5% of the total land have been identified for ecological, recreational and scientific purposes. Other efforts to re-green the country, such as the development of open spaces, parks, gardens and a network of green links have been continually introduced into the urban environment (Draft Singapore Green Plan 2012).

The way forward

Conserving the natural resources that can still be found in Singapore poses a tremendous challenge given the scarcity of land and the increasing local population. A key challenge therefore is to prevent encroachment of the few remaining nature areas.

One way to realize the full ecological benefits of the remaining natural areas is through the estab-

lishment of a "park connector" network, which aims to maximise under-utilised land such as drainage reserves, foreshores and road reserves by turning them into green corridors, linking parks and natural sites. The government plans to develop a total of 245 km of park connectors by 2010. These will provide additional recreational areas, act as nature corridors, and bring greenery to urban and residential areas. Other greening efforts include extensive tree planting and the development of more parks and reserves (FAO, 2001).

In terms of wildlife protection, efforts should concentrate on minimising extinction rates in existing reserves and maximising benefits from man-made habitats. Suggested measures include protecting the margins of existing reserves and leading recreational pressure away from the most sensitive areas (FAO, 2001).

Aside from existing legislation related to parks and reserves, the Singapore Green Plan (SGP) 2012 provides the direction for protected area management in the next decade. One of its objectives is to ensure the quality of the living environment, which includes the enhancement of the country's environmental inheritance. SGP 2012 reiterates the state's commitment to maintain the 5% of land set aside for nature areas, and provides the direction that will transform Singapore from 'a Garden City' into 'a City within a Garden'. To this end, the government aims to:

- Develop more parks in residential developments and plant more trees and shrubs along expressways and roads;
- Protect green and ecologically sensitive areas;
- Implement transparent Environmental Impact Assessments for new tourism projects;
- Review and enforce strict anti-pollution regulations of the sea

to prevent illegal discharges;

- Minimise the impact of land reclamation on marine ecosystem; and
- Explore the possibility of mitigating marine pollution using biological interventions.

To achieve these goals, the government needs the active support of the local community. Over the years, environmental programmes have been launched to increase public awareness of conservation issues with the help of educational and grassroots institutions and the private sector. The key in the next decade will be to develop the attitude among members of the public that they are personally responsible for the state of the environment. The SGP 2012 also emphasizes the need to develop partnerships between the public and private sectors, to give more groups the opportunity to participate in environmental programmes. ■

Sahlee C. Bugna is the Writer-Researcher of ARCBC.

References

Government of Singapore. Singapore Green Plan 2012.

Kelvin, Lim; Dennis Murphy; T. Morgany; N. Sivasothi; Peter KL Ng; B.C. Soong; Hugh Tan; K.S. Tan and T.K. Tan. 2001. A Guide to Mangroves in Singapore. Raffles Museum of Biodiversity Research, National University of Singapore and Singapore Science Centre. Singapore.

Lim Kim Seng. 2000. Conserving Singapore's Biodiversity. Nature Watch.

MacKinnon, John (Ed.). 1997. Protected Area Systems Review of the Indo-Malayan Realm. Asian Bureau for Conservation and The World Conservation Monitoring Centre. England.

Tan, Alan K.J. 1998. Asia – Pacific Centre for Environmental Law Report on Singapore: Preliminary Assessment of Singapore's Environmental Law. Faculty of Law, National University of Singapore.

National Parks Board of Singapore website (www.nparks.gov.sg)

Nature Society of Singapore website (www.nss.org.sg).