

Chapter 9. Singapore

Summary	239
Key issues	239
Introduction	240
Table 1. Land use in Singapore	240
Institutional arrangements	242
Government organisations	242
Ministry of National Development (MND)	242
National Parks Board (NParks)	243
Other ministries	244
Other organisations	245
NBSAP origin and background	245
Box 1. Workgroup 5 on Nature Conservation	246
Action programs for biodiversity conservation	247
Table 2. Singapore's NBSAP programs	248
Strategic approaches to biodiversity conservation	248
Green plan review committee	249
Box 2. Objectives of the RCNC	250
Relationship to development planning	250
Cross-sector aspects of the BSAP	250
Budgeting for the NBSAP	251
Biodiversity hot spots and action priorities	252
Aligning the BSAP to global and ASEAN instruments	255
Protected Areas under the CBD	255
Convention on Wetlands of International Importance	255
UNESCO Man and the Biosphere (MAB)	256
ASEAN Heritage Parks and Reserves	256
ASEAN Agreement on the Conservation of Nature	257
Lessons learned	257
Chronology	259
Suggested reading	259
Endnotes	261

Singapore

Koh Kheng Lian

SUMMARY

Land-scarce Singapore, with only 647.5 sq. km and a population of about four million (which continues to grow), has set aside five per cent of its land for nature conservation. Will this percentage be maintained in the future? The Singapore Green Plan and Workgroup 5 on Nature Conservation, 1993, form the basis of a NBSAP for the island. Singapore uses the Green Plan and other relevant instruments (e.g. The Master Plan 1995) to implement the Convention on Biological Diversity (CBD).

While Singapore lost some of its precious biodiversity during the period of industrialisation and urbanisation in the 1960s to late 1980s, it has made use of cultivated greenery to developed into what it terms a “Garden City”. Although this is no substitute for the natural environment, it, together with Singapore’s reforestation and other schemes to replant some of its indigenous species, has improved an otherwise blighted industrial and urban city. Another significant development in recent years has been the focus on ex-situ conservation. Singapore is in the process of formulating a set of policy guidelines under Article 15 of the CBD. It hopes to be both a user and provider of genetic resources.

Key issues

A number of issues are vital if Singapore is to effectively undertake planning on biodiversity:

- Priority issues should be more clearly defined and be consistent with the overall objectives of global initiatives (e.g., UNESCO MAB, IUCN Protected Area Management Categories) as well as biodiversity instruments of the Association of Southeast Asian Nations (ASEAN), such as the ASEAN Declaration on Heritage Parks 1984. The current Singapore approach, manifested in the various relevant Singapore Green Plans (1992–1993), is too sectoral and insular.

- Institutions whose activities have an effect on biodiversity should be strengthened. They should forge effective partnerships with other local and international institutions, such as the Nature Society (Singapore), IUCN and The Nature Conservancy. Senior Minister Lee Kuan Yew recently called for closer partnership among these organizations, including The Nature Conservancy.
- Land-use planning should be continually reviewed to ensure that land allocated for nature and “green” spaces is enhanced and not diminished (e.g., increase the current plot ratio for public and private housing in some areas so as to maximise the use of land, thus leaving more green areas).
- Building capacity across all sectors is imperative.

Introduction

Situated 137 km north of the equator, and almost invisible on the world map, Singapore occupies a mere 647.5 sq. km. It has a hot, humid, tropical climate of about 25–30°C year-round, with two monsoon seasons annually. The climate is ideal for nurturing a variety of ecosystems, including forests, mangroves, mud flats and corals, all with diverse flora and fauna. At one stage in Singapore's biodiversity history, the small Bukit Timah Nature Reserves had more species of flora and fauna than the whole of North America, according to world conservationist David Bellamy. Other terrestrial (inland and coastal) and marine areas were also a rich in natural resources.

The island has a hilly region at its centre, a rather flat area consisting of sand and gravel on the east, and hills and valleys consisting of sedimentary rocks along the northwest. Land use in Singapore is shown in Table 1.

Table 1. Land use in Singapore

Land use	Area: sq. km
Built-up areas (including new industrial sites)	323.0
Farms	10.4
Forest	28.6
Marsh and tidal waste	15.5
Other (including waters, open spaces, public gardens, cemeteries, non-built up areas in military establishments and unused land)	270.6
Total (main island and offshore islands)	648.1

Source: *Facts and Figures, 1999.*

The condition of Singapore's flora and fauna has steadily deteriorated during the last two centuries. Some biodiversity resources were lost during the colonial era at the turn of the 20th century; many vertebrates and some vascular plants were extinguished as a result of habitat loss in the process of development by the British. Perhaps the greatest onslaught on Singapore's natural areas came after independence in 1959 and the breakaway from Malaysia in 1965. Singapore had to industrialise for its economic survival. Industrialisation programs began in the 1960s and continued aggressively into the 1970s and 1980s; this included clearing of land and reclamation of mangroves to make way for road and airport infrastructure and other developments. Some marine habitats, such as the coral ecosystems, were also destroyed due to land reclamation. During this period of industrialisation and urbanisation, nature conservation — perhaps inevitably — did not figure highly on Singapore's agenda for survival².

In 1968, at the height of industrialisation, Singapore began to develop the concept of a "Garden City" to try and replace its disappearing ecosystems³. This cultivated greenery is intended to complement the natural green areas of the country. Over the last 30 years this initiative has had a huge impact on Singapore's physical environment⁴.

Singapore's political party, the People Action Party, has been in power since independence in 1965. It has carried out a program of industrialisation and urbanisation through a system of land-use planning which classifies different zones for different purposes, including residential, industrial and natural areas.

The country's population is close to four million, with a density of over 5,600 people per sq. km. Singapore has come a long way from its colonial days, becoming an economic success. Its three major industries are electronics, petroleum products and chemical products. It is a leading financial and commercial centre with excellent transportation and communication links to the rest of the world.

The Bukit Timah Nature Reserve has over 2,000 plant species, 80 mammal species and 100 bird species, as well as many freshwater species⁵ (the status of flora and fauna outside nature reserves has not been determined). The Central Catchment Area is being reforested⁶, and a S\$100,000 reforestation project — a joint effort of the National Parks Board (NPB) and the National University of Singapore's Botany Department — is underway to make the botanic gardens (one of the country's two national parks) into one of the world's leading equatorial gardens. The purpose of the project is to replant

indigenous species to ensure their survival⁷. These conservation projects will go some way in propagating some of the plant species endangered due to loss of habitat.

Institutional arrangements

Institutions are the backbone of policies and laws in a country. Unlike other countries in the region, where matters relating to biodiversity are within the governance of the Ministry of Environment, in Singapore it is the National Parks Board (NParks), a statutory board under the Ministry of National Development, which manages the nature reserves and national parks. NParks was established under the *National Parks Act* (Cap. 198A, 1985), the objective of which was to “make provision for national parks and nature reserves and to establish a National Parks Board (NParks) and for matters connected therewith”.

Government organisations

Ministry of National Development (MND)

MND is responsible for the physical development of Singapore. The state owns about four-fifths of the land: this comprises former crown land, land reclamation and compulsory land acquisition. Under the *Land Acquisition Act*⁸ the state or its agencies is empowered to acquire land for any public purpose, or for any work or undertaking which is of public benefit, public utility or public interest.

The key to Singapore's allocation of natural and green spaces is its approach to land-use planning, which MND administers. Singapore has a meticulous system of land-use planning under a statutory Master Plan, which is derived from the *Planning Act*⁹. The Act determines the nature and intensity of land use at a particular site through zoning, density ratio, and plot ratio prescriptions. The most recent version of the Master Plan, published in 1998, incorporates Development Guide Plans for each of Singapore's 55 planning areas. The Master Plan Written Statement includes zoning for “Open Space” (e.g., Wooded Area, Swamp Area, Nature Reserve, Natural Open Space and Public Promenades). These areas are intended to be retained in their state mainly as open space and land reserve. The open spaces are called “landbanks”, however, as they may be used at some future date for other purposes.

The components of MND's mandate with the greatest impact on biodiversity are as follows:

- national parks, including botanic gardens and nature reserves;
- construction and industrial development and planning and development control, including strategic planning and Development Guide Plans (i.e., the 1998 Master Plan); and
- primary production, including fisheries and agriculture.

National Parks Board (NParks)

The National Parks Board (NParks) is the main MND agency dealing with biodiversity matters. NParks is the scientific authority for nature conservation, the national focal point for biodiversity for the ASEAN Biodiversity Program, and the domestic management agency for the Convention on Biological Diversity (CBD).

NParks has the mandate to manage national parks and nature reserves that are “dedicated, set aside and reserved for, inter alia, the propagation, protection and preservation of the flora and fauna of Singapore...the study, research and dissemination of knowledge in botany, horticulture, biotechnology...”. In other words, it manages the greenery in Singapore, including the Garden City initiative.

It is significant that NParks is a statutory board under the Ministry of National Development. MND, as the ministry responsible for the physical development of Singapore, oversees the integration of natural areas and other green spaces into its overall physical development of Singapore.

NParks’s portfolio also includes the following biodiversity-related elements:

- the Singapore Botanical Gardens Division;
- the Research and Advisory Branch;
- the herbarium–library;
- the Nature Conservation Branch;
- the Primary Production Department (In April 2000, a new agency named the Agri-Food and Veterinary Authority (AVA) was established to carry out this function);
- nature reserve management;
- Sungei Buloh Nature Reserve;
- the Urban Redevelopment Authority; and
- the Physical Planning Division.

NParks liaises with MND. The policy decisions made by MND accord with the wider national vision of developing Singapore into a Garden City. In 1998, Lim

Hng Kiang, the Minister for National Development stated that: "All green spaces will be turned into gardens. Our aim is: anyone stepping out of his or her home will be stepping into a garden city environment...The idea that Singapore is a garden city has been well sold, but now we want to go one step beyond and try to give every Singaporean visitor the sense that he is in a garden" (*The Straits Times*, 11 December 1998).

The original statutory Master Plan, first formulated in 1952–1955 and approved in 1958, was revised a number of times. It was the blueprint of Singapore's land use system. It proved to be inadequate for the growing city, however, and in 1988 a comprehensive non-statutory Concept Plan was initiated by the MND to supplement it. This was revised in 1991. The Concept Plan is a strategic planning instrument that provides the overall policies and directions for land use, including conservation of natural areas, green spaces and transportation networks. It was translated into detailed plans at the local level through 55 Development Guide Plans (DGPs). The new statutory Master Plan of 1998 incorporated the amendments for the DGPs as approved by the Minister of National Development on 24 December 1998.

The MND and NParks also coordinate with other government ministries and their agencies to formulate policies on the conservation of flora and fauna.

Other ministries

The Ministry of Trade and Industry, the Ministry of the Environment and the Ministry of Communications are also involved with some aspects of biodiversity. The Ministry of Environment (ENV) is concerned with pollution and public health matters, although, where pollution impinges on biodiversity, the ministry coordinates with NParks. ENV is the national focal point for the three ASEAN Working Groups (biodiversity issues may involve more than one group):

- the Working Group on Nature Conservation and Biodiversity;
- the Working Group on Marine and Coastal Environment; and
- the Working Group on Multilateral Environmental Agreements.

The Cabinet is responsible for all government policies and for determining the emphasis given to conservation in Singapore's overall development. It reports to Parliament and comprises the Prime Minister, his deputies and the ministers in charge of the various ministries. The Ministry of Foreign Affairs, with its ASEAN Dialogue Relations Branch and ASEAN Task Force Coordinator, deals with matters relating to ASEAN, including biodiversity (e.g., ratification of the ASEAN Agreement on the Conservation of Nature and Natural Resources 1985). The branch coordinates such matters with the other relevant ministries.

Other organisations

Non-governmental organizations (NGOs) are also involved in various aspects of biodiversity, such as research into genetic resources. NGOs include the Institute of Molecular Agrobiolgy, the Institute of Molecular and Cell Biology, Integrated Marine and Environmental Management and the Environmental Technology Institute.

NGOs promote public awareness and carry out environmental education. The Nature Society (Singapore) is active in nature conservation. The Singapore Environment Council, established in 1995, serves as a facilitator to NGOs and other green groups in Singapore. Schools and other tertiary institutions have also been promoting environmental education and awareness. The Asia-Pacific Centre for Environmental Law, established in 1996 by the National University of Singapore's Faculty of Law has, as one of its objectives, capacity building in environmental legal education and research in the Asia-Pacific region. Other NGOs, such as the Singapore Reef and Marine Conservation Committee, Singapore Underwater Federation, and the Royal Singapore Yacht Club, are also making valuable contributions to local biodiversity conservation.

NBSAP origin and background

Singapore signed the Convention on Biological Diversity (CBD) on 10 March 1993 and ratified it on 21 December 1995. Article 6 states that each Contracting Party shall do the following, in accordance with its particular conditions and capabilities:

1. Develop national strategies, plans or programs for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programs which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and
2. Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs and policies.

The NBSAP incorporates "existing strategies, plans or programs" as set out in the CBD. The NBSAP, under Article 6, is contained in the Master Plan 1998 and originated from the three Singapore Green Plans:

- The Singapore Green Plan: Towards a Model Green City (1992), which set policy and strategic directions for nature conservation and other aspects of biodiversity;

- The Singapore Green Plan (SGP): Action Programs (1993); and
- The Singapore Green Plan: Workgroup 5, Nature Conservation (1993), one of the workgroups established pursuant to the 1993 Action Programs.

After ratifying the CBD it took Singapore about three years to prepare the First National Report (FNR) required under the convention. The FNR was prepared by the NParks Board and the FNR Drafting Committee, and was published in December 1997. The members of the FNR Drafting Committee were drawn mainly from the following government ministries and their agencies:

- Ministry of National Development;
- Ministry of the Environment;
- Attorney-General's Chambers;
- National Parks Branch of the MND;
- Agri-Food and Veterinary Authority;
- Urban Redevelopment Authority;
- National Science and Technology Board;
- Centre for Natural Product Research; and
- Institute of Molecular Agrobiolgy.

The primary focus of the FNR is implementation of Article 6 of the CBD. Work on the report began in 1992–1993, soon after the Earth Summit, with the preparation of various Singapore Green Plans¹⁰. These form the basis of Singapore's CBD policies, strategies and programs.

Box 1. Workgroup 5 on Nature Conservation

Members of the workgroup were drawn from a range of government ministries and agencies. The only NGO represented was the Nature Society (Singapore). This strong government base gave the group full political backing. There should have been greater public representation, although the group did conduct feedback sessions with the public after completing its report in March 1993. The strategies and action programs recommended by the group respond to Article 6 of the CBD. The terms of reference were as follows:

- identify five per cent of the land area of Singapore to be set aside as natural areas (3,130 hectares);
- identify strategies to manage natural areas;
- identify green links to parks and natural areas;

- identify marine areas worthy of conservation and recommend measures for their protection;
- identify measures to promote the appreciation of nature; and
- identify the potential for and implications of ecotourism.

The following criteria were used to designate sites as natural areas:

- natural environment, in terms of landscape and wildlife;
- ecological merits;
- societal utilisation, e.g. potential for reservation, education and scientific research;
- coexistence with adjoining or nearby developments;
- opportunity costs (site should take account of alternative uses).

Workgroup 5 recommended 18 nature areas for conservation; after the public feedback session one more nature area was added. It mapped out these 19 areas for nature conservation, which constituted five per cent of the country's total land area. They include wooded or forest areas, marsh lands and mangrove swamps, ridges and hillocks and offshore islands (see Annex 1). While identified as natural areas, they are not formally protected from development, with the exception of two nature reserves: Bukit Timah Nature Reserve and the Central Catchment Area. These are protected under the National Parks Act (Rev. Ed. 1997).

The Master Plan 1998 categorises natural areas as "open space" or "park and garden". These areas are also considered "land banks" for future development, however. Although they have been set aside as natural areas, the government can at any time choose to use the land for other purposes.

Action programs for biodiversity conservation

The FNR provides a general approach to Singapore's implementation of the CBD and highlights the CBD Articles pertinent to the Singapore context. According to the report, Singapore's BSAP comprises the following elements:

- the Singapore Green Plan (comprising the various relevant Singapore Green Plans);
- the Research Management Plan: The Nature Reserves for Research and Education (this was completed in 1995, is being implemented and is under regular review);

Biodiversity Planning in Asia

- the Nature Reserves Recreation Master Plan, completed in 1996 and being implemented. It undergoes regular review. The 19 nature areas have been incorporated into the updated Master Plan (1998).

Table 2 sets out the national conservation programs under Article 6 of CBD.

Table 2. Singapore's NBSAP programs

Action Program	Status	Monitoring and evaluation
Singapore Green Plans (SGP)	Specific action programs formulated in 1993. Implementation ongoing	Six committees compile quarterly reports updating progress of action programs
Research Management Plan: The nature reserves for research and education	Completed in 1995; being implemented	Regular review
Nature Reserves Recreational Master Plan	Report completed in 1996; being implemented	Regular review

Source: FNR, pp. 36

A number of biodiversity reports have been published¹¹. Other aspects of BSAP implementation, ranging from reforestation to the biodiversity inventories, include the following:

- reforestation of the Central Catchment Area and Nature Reserves;
- replacing indigenous species in the botanic gardens;
- adding 43.8 ha of land to the Bukit Timah Nature Reserve (1995);
- amendments to the *Parks and Trees Act* to provide for tree conservation areas and increase fines for cutting down trees in conservation areas (Cap. 216, 1996 Revised Edition);
- flora and fauna inventory for the Bukit Timah Nature Reserve.

Strategic approaches to biodiversity conservation

The government has had to make difficult decisions to balance the conservation of natural areas with the needs of an urban population. The lack of physical space for a growing population is a major constraint.

Despite its past lack of attention to conservation, Singapore still has a significant number of indigenous species. There are few records, however, of what has disappeared over the years. In aiming to weave biodiversity conservation

into a tapestry of complex land-uses, a number of strategies, including the following, were identified in the FNR.

Database, research and capacity-building: Reliable data is one of the foundations of biodiversity conservation. Special attention will be paid to this aspect, which underpins all environmental policy and conservation management. The focus will be on research, development of a biodiversity database, and associated capacity-building.

Maintenance of biodiversity and designated nature areas: Under the Singapore Green Plan 1992, the government is committed to setting aside five per cent of land for nature conservation. The Green Plan states: "In our planning, we will continue to balance land allocated for development with land set aside for green areas and open spaces." Only three per cent has, in fact, been protected by legislation.

NParks's main purpose in conserving biodiversity resources is to protect the size and condition of the country's natural areas. Monitoring the status of all remaining natural systems is required so that action can be taken to arrest any further deterioration. Management practices should prevent additional fragmentation of natural ecosystems.

Regional and international networking: Singapore will continue to strengthen its regional partnerships, particularly in database work, research and capacity-building. Singapore is an active participant in programs of the ASEAN Regional Centre for Biodiversity Conservation (ARCBC)¹².

Priority ranking: This is intended to increase database work, research and capacity-building as well as maintenance of the five per cent of land set aside for nature conservation and monitoring the health of representative ecosystems. Current projects include networking and institution building, training, research and development, and information management systems.

Green plan review committee

The public is becoming more vocal about environmental issues. In particular, there is a growing debate about the need for a well-defined system of protected areas. Public concern has been expressed over the loss of ponds and mangroves, which have been destroyed for public housing¹³. Several nature reserves and areas of reserved land earmarked for the construction of water catchment tanks have also been the subject of controversy¹⁴. Some members of the public argue that ecological planning should be introduced which integrates natural features and landscapes with development. Greater trans-

parency in government decision-making and development planning has also been demanded.

Public consultation, in the form of feedback sessions, was carried out in regard to the Development Plan Guides (DPGs), which are detailed plans to implement proposals under Singapore's Concept Plan of land-use allocation. Under the DGP process, the public is given an opportunity to submit comments.

In 1999, government established the Singapore Green Plan Review Committee for Nature Conservation (RCNC). Its terms of reference are as follows:

- review the 1992 SGP and the 1993 SGP objectives and action programs of the Working Committee on Nature Conservation and recommend appropriate changes to keep them relevant;
- identify new objectives, if necessary, and propose new action programs;
- identify and recommend relevant agencies to lead the action programs in the revised SGP; and
- estimate the funds and personnel required to implement the action programs.

Box 2. Objectives of the Review Committee for Nature Conservation (RCNC)

The RCNC has completed its work but has not yet published a report. The committee's main objectives were as follows:

- to maintain five per cent of the land area of Singapore as nature areas;
- to manage and monitor the health of terrestrial natural areas, and to monitor the biodiversity status of species, particularly rare and endangered species;
- to monitor marine areas worthy of conservation and recommend measures for their protection; and
- to promote nature appreciation, public awareness, nature conservation education and wilderness recreation, and to examine the implications of ecotourism.

Relationship to development planning

Cross-sector aspects of the BSAP

The CBD encompasses a broad range of issues, and requires partnerships with various ministries to carry out its programs. The mission of the Urban Renewal

Authority (URA), for example, is “to plan and facilitate the physical development of Singapore into a tropical city of excellence”. This involves nurturing environmental well-being by careful land-use planning through the Concept Plan, 55 Development Plan Guides, and Conservation Master Plan. Likewise, the proposed use of open spaces for road and airport infrastructure by the Ministry of Communications, or the management of water catchment areas by the Public Utilities Board may involve biodiversity issues. Although NParks cooperates closely with each sector agency when its activities affect biodiversity resources, it has relatively little power when confronting these major development organisations.

The NBSAP is incorporated in long-term development plans — at least in theory — although implementation has at times been very unsatisfactory. The fact that the Singapore Master Plan 1998 has incorporated the DGPs, and the SGP is under review testifies to a continuing recognition of the need to update the government’s objectives. While the government takes a proactive but pragmatic stand on all environmental issues, its approach to date is too insular, not taking into consideration the global and regional laws relating to biodiversity¹⁵.

The NBSAP is complemented by the Garden City concept. The aim of the government is for all citizens to have a “sky garden” in their homes (most people live in high-rise flats) and a garden outside their homes. Every vacant space, be it part of a drain or a major transport facility such as the Singapore Changi Airport, can be utilised in creating a green city and, potentially, in contributing to biodiversity conservation.

Budgeting for the NBSAP

NParks pays the cost of maintaining a team to administer CBD matters. For collaborative projects with other ministries, the costs are shared. Private sponsors also donate funds for specific projects.

The government includes NParks operating costs in its centralised budget. In 1996/97, for example, it provided S\$44.28 million. NParks also has a revolving fund of advances from the government, which are free of interest and have no fixed period of repayment. In addition, it makes money from rentals, admission charges, gardening course fees, donations and sale of publications, earning approximately S\$9 million (US\$5.23 million) in 1996/97.

The Singapore Environment Council (SEC) facilitates the financing of environmental projects and has established the Central Environment Fund (CEF) scheme, a tax exempt fund for donors. This is intended to encourage green

groups to register with SEC to obtain tax exemption for donors. An example is the Singapore Reefs and Conservation Committee, which obtained assistance from the SEC on tax exemption for funding for its project on marine life.

Biodiversity hot spots and action priorities

Lim Kim Seng, Chair of the Conservation Committee of the Nature Society (Singapore), examined the status of Singapore's biodiversity in the context of the Singapore Green Plan and made the following recommendations¹⁶:

- identify all the remaining areas of nature conservation merit and include them in the Singapore Green Plan;
- determine the size and boundaries of all nature areas;
- legislate legal protection for nature areas;
- formulate compatible and comprehensive management plans for all nature areas;
- legislate the requirement for Environmental Impact Assessment (EIA) of all proposed development in or near nature areas;
- formulate plans for the restoration of biodiversity in nature areas;
- formulate species recovery programs for threatened species;
- formulate programs for the control of alien species;
- educate and empower the public; and
- establish a dialogue and partnership between governmental and non-governmental bodies concerned with biodiversity conservation.

These recommendations were supported by some sobering statistics:

- 39 per cent of all native coastal plants (97 of 251) are extinct;
- 96 per cent of mangrove systems have been destroyed;
- 26 per cent of all seed plants are extinct and 65 per cent are threatened;
- 25 per cent of 91 mammals are extinct and 58 per cent of the remaining mammals are at risk;
- 34 per cent of birds are extinct and 38 per cent of the remaining species are at risk¹⁷.

The committee's specific recommendations relate to the following natural areas.

Sungei Buloh Nature Park: This is Singapore's first wetland reserve and is still not protected by law. A lease expires in 2008, at which time the land can

be reverted to another purpose. An unsound proposal put forward in October 1999 to have fishing, boating and canoeing within its boundaries created a public uproar, and the project was withdrawn when no tenders were received.

Pulau Ubin: This is a key area for many threatened species, such as the Oriental Pied Hornbill, Red Junglefowl, Leopard Cat and the globally threatened Strawheaded Bulbul. Dugong is found in its waters. The island retreat, a weekend getaway for many Singaporeans, is threatened by wide-ranging development such as resorts and camps. There are plans to build an MRT (Mass Rapid Transit) line and a housing estate as part of a proposed development to house Singapore's burgeoning population.

Lorong Halus: This is a small but important site for freshwater avifauna, including nationally threatened species like Lesser Whistling-duck, Cotton Pygmy-goose, Greater Painted-snipe and Little Grebe. The area also has stands of riverine mangrove along Sungei Belukar. The site is a haven for migrating raptors, such as the globally threatened Great Spotted Eagle.

Sungei Changi (Changi Creek): Mangrove-lined banks along Sungei Changi create a scenic and pleasing vista of an endangered biome. At low tide, exposed mud banks attract numerous invertebrates, mudskippers and herons. Half of the extant true mangroves in Singapore (ten species) occur here, including the locally endangered *Bruguiera parviflora* and six which are nationally at risk: *Avicennia officianalis*, *A rumphiana*, *Ceriops tagal*, *Rhizophora apiculata*, *R mucronata* and *Xylocarpus granatum*.

In the adjacent Changi Beach Park and in need of protection are individual stands of *Pemphis acidula* and *Cycas rumphii*, both relics of the original coastal vegetation. The former is believed to be the last surviving specimen in Singapore and the latter is also locally endangered. These areas are important feeding and roosting grounds for resident herons, including the nationally threatened Grey Heron and Black-crowned Night-heron. Other species associated with mangroves are found here, such as Striated Heron, Pied Fantail, and Ashy Tailorbird. Also present are five species of kingfisher, two parakeet species and the nationally threatened Oriental Magpie-robin.

The SGP Workgroup 5 on Nature Conservation recommended that four sites rich in corals be preserved as marine nature areas: St. John's Island, Pulau Hantu, Pulau Semakau and Pulau Sudong. To date, however, there are no specific laws for their protection, or for the other areas identified by the group. Lye Lin Heng, Legal Adviser to the Nature Society (Singapore), wrote:

In 1996, the Urban Redevelopment Authority (URA) identified the area around St John's Island, Sisters' Island, Lazarus Island, Kusu Island and Pulau Seringat for protection as a "marine nature area". The National Parks Board (NPB) has assumed responsibility for assessing all development projects for this site. However, it would appear that its main concern is to keep coral and marine life safe from reclamation work and other land-based operations. There are no separate laws for the protection of this area¹⁸.

The Working Group referred to the need to obtain permission from the Land Office for collection of corals, stating that "The Marine Police is also conducting regular checks to curb destructive activities like coral harvesting". The group concluded, "...the existing legislative, enforcement and administrative arrangements are adequate to ensure proper protection of these marine coral areas. Wider publicity of the regulatory provisions is recommended to enhance public awareness."

The existing laws for marine conservation are clearly inadequate, relating only to the taking of coral and shells from the sea bed, and prohibiting fishing by means of explosives, poisons or trawl nets. There are no specific laws to protect marine life, either generally, akin to the Wild Animals and Birds Act covering terrestrial environments, or specifically, akin to the National Parks Act, which applies to terrestrial protected areas.

Laws are needed to protect these sites as Marine National Parks or Marine Nature Reserves, akin to the terrestrial nature reserves and national parks. The laws should protect the aquatic flora and fauna of these areas, preserve their breeding grounds and habitat; facilitate their regeneration where they have been depleted; regulate recreational and other activities; and promote scientific study and research. It should be an offence to fish, take, remove or be in possession of any coral, shell, marine animal or plant from these areas. The anchoring of vessels should be prohibited, as should the destruction of any object within the protected areas. The National Parks Board should be vested with the legal authority to oversee all aspects relating to marine conservation¹⁹.

In 1990, the Nature Society (Singapore) published a Master Plan for the Conservation in Singapore. It selected 28 sites for conservation, some of which were incorporated into the 19 nature conservation areas under the SGP. Of the 19 nature areas, three are protected by legislation: the Bukit Timah Nature Reserves, the Central Catchment Area, and the Singapore Botanic

Gardens (forest areas). The boundaries of the other “green open spaces” have not been clearly demarcated. Because of land scarcity, these areas are not protected from development.

In 1998 advocates from 28 NGOs, clubs and institutions submitted a petition, the “Proposals for Upholding the Singapore Green Plan”. It called for clear demarcation of the boundaries of the Green Plan nature areas, for EIAs to be conducted for projects which are likely to have an impact on these areas, and for all the sites to be given a legal nature reserve status.

Aligning the BSAP to global and ASEAN instruments

To date implementation of the various Singapore Green Plans relevant to the BSAP has been too narrow and sectoral. To enhance and facilitate the implementation of the CBD, BSAP implementation should be broadened to include the objectives of global and ASEAN instruments (hard and soft laws) relating to biodiversity. The Singapore Green Plans should reflect other global and ASEAN biodiversity instruments such as the following examples.

Protected Areas under the CBD

Categories to be protected under the Singapore Green Plan, or any future classifications, should take into consideration the IUCN Protected Area Management Categories recommended under the CBD. The IUCN guidelines on management objectives of protected areas cover natural and human-made areas as well as those which are a combination of both.

The IUCN guidelines can be modified by the more stringent definition of protected areas under Article 13 of the ASEAN Agreement for the Conservation of Nature and Natural Resources, 1985. Singapore was one of the signatories to the agreement, although it has not as yet ratified it. Article 13 is considered one of the most sophisticated and forward-looking provisions in the ASEAN Agreement.

Convention on Wetlands of International Importance, 1971 (Ramsar)

Singapore should ratify Ramsar, one of the most important international biodiversity conventions. Ramsar recognises wetlands that constitute a resource of great economic, cultural, scientific and recreational value. Under Article 2 (2), areas of internationally significant ecology, botany and zoology can be put on the Wetlands List. Sungei Buloh Nature Park, for example, has a varied ecosystem comprising mangroves, open grasslands, brackish waters, and mudflats supporting a variety of waterfowl including migratory bird species. A management plan is in place to realize the goal of attracting more

bird life. When the bird population increases, Singapore should accede to Ramsar and propose Sungei Buloh for inclusion. This would enhance its profile at the international level. NParks, which is charged with the management of Sungei Buloh, could enter into partnerships with other stakeholders and involve them in meeting the convention's reporting obligations.

UNESCO Man and the Biosphere (MAB)

Five of the ten ASEAN countries are signatories to MAB and have sites designated as MABs. Although no longer a member of UNESCO, Singapore can participate in the MAB as other non-member countries have done. "Biosphere reserves" in terrestrial and coastal areas may constitute protected areas under the framework of UNESCO's interdisciplinary program. Sungei Buloh is one of the areas that could be brought under the UNESCO MAB. This would contribute to implementation of the CBD and Agenda 21, and help achieve a sustainable balance between biodiversity conservation and ecotourism, which might otherwise be in conflict. The 87-hectare site has attracted many tourists and there is potential for further ecotourism development. Being in the UNESCO MAB and international network would raise the status of Sungei Buloh and help strengthen its management. UNESCO assistance would help foster links with other MABs and develop a new relationship between conservation and development.

ASEAN Heritage Parks and Reserves

Singapore was one of the six ASEAN countries which signed the Heritage Parks and Reserves Declaration in 1984, but was also one of the two member countries not to declare any heritage park or reserve under the declaration. The declaration was made to support the "uniqueness, diversity and outstanding values of certain national parks and reserves of ASEAN member countries that deserve the highest recognition so that their importance as conservation areas could be appreciated regionally and internationally."

The declaration calls for cooperation to conserve and manage such parks and reserves. It would enhance Singapore's wider concept of a Garden City to designate its nature reserves, comprising Bukit Timah Nature Reserve and Central Catchment Area, as ASEAN Heritage sites, particularly now that an inventory has been made of the flora and fauna there (NParks 1999). The Bukit Timah forest, 2800 hectares in size, probably has the highest biodiversity concentration in the world. Its designation as a heritage site would advance Statement 6.5 of the ASEAN Hanoi Plan of Action 2002–2020, which calls for the promotion of regional coordination for the protection of ASEAN Heritage Parks and Reserves.

ASEAN Agreement on the Conservation of Nature and Natural Resources

This agreement, signed in 1985, has not come into force since only three of the six signatory countries have ratified it (Singapore not being one of them). The agreement complements the CBD; more importantly, it deals with some issues that are not covered by international conventions like the CBD, such as the protection of “endangered and endemic” species in the ASEAN region that are not within the ambit of CITES.

Singapore needs to take a broad approach to revising its laws relating to biodiversity. This has become even more significant as the country negotiates a Free Trade Agreement with the United States. Singapore needs to demonstrate that it has a good environmental record, including the area of biodiversity conservation.

Lessons learned

In the throes of industrialisation and urbanisation, Singapore has had to sacrifice some natural areas and, with them, some of its biodiversity. While its land-use system has conserved some natural areas, most of them are not protected by legislation. In light of the scarcity of land in Singapore, the government has taken a pragmatic approach to its BSAP.

It is very unlikely that the amount of land set aside for nature conservation, currently five per cent, will be increased. It will be difficult, in fact, to maintain the five per cent. Planners are attempting to integrate nature areas into housing and industrial development; recently, for example, the URA stated, “developments on land earmarked for urbanisation will be fully intensified to optimise the potential for land, so that nature reserves and nature parks do not have to be developed for as long as possible”. There are schemes to locate several community facilities under one roof and redevelop existing sites in a more intensive manner. In addition, the plot ratio for private housing development has been increased (plot ratio is the maximum permissible intensity for developments within a demarcated area). While this will help to slow the demand for new land, more research is needed to devise and promote space-saving ideas if the government is to deliver on the promise of the various Green Plans. If more land can be saved, there will be no need to use the green area land bank.

Parks or buffer zones should be built around existing nature areas to conserve them. These parks would serve as recreation areas for the communities. In the future, it would be difficult to take away these parks from the people, thus preserving the nature areas.

“Park connectors” have been proposed by NParks. Also known as green connectors, they are linear open spaces linking major parks, nature reserves, natural open spaces and other places of interest. They serve a recreational function and will help to keep intact surrounding green spaces and natural areas. These connectors will be located mainly along drainage reserves, linking population centres and transportation routes with major parks. When completed they will form a green network over the whole of Singapore²⁰.

Singapore has also made up for some loss of natural habitats by focusing on ex-situ conservation as a national, regional and global resource. Existing institutions, such as the Singapore Botanical Gardens Herbarium, have raised the level of public awareness about biodiversity. The herbarium, which dates back to the Straits Settlements in the 19th century, has one of the oldest collections of preserved specimens in the world.

New institutions have been set up in recent years to promote ex situ conservation of the existing flora and fauna in Singapore and from other parts of the world. An example is the Raffles Museum of Biodiversity Research, established in 1998. Its objective is to document biodiversity resources in the region, establish a regional database for biodiversity matters, and increase expertise in pure and applied research in biodiversity among local and international biologists. Some of the zoological collection dates back to that of the former Raffles Museum, established in 1849.

Other institutions concerned with various aspects of genetic resources are the Department of Biological Science (Science Faculty, National University of Singapore), the Bioscience Centre (established in 1993) and the Institute of Molecular Agrobiolology. The institute is currently involved in harmonising interstate regulations concerning the transboundary movement of genetically modified organisms within the ASEAN region. The Centre for Natural Product Research, established in 1993, the Economic Development Board and the Institute of Molecular and Cell Biology, and the National University of Singapore are making important contributions as well²¹.

The pragmatic approach taken by Singapore in implementing the CBD must be constantly assessed to maintain the fine balance between the conservation of biodiversity and the needs of development. Greater emphasis needs to be placed on an integrated approach to reflect the wider perspective of global and regional concerns.

Chronology

1958	Original Master Plan published, amended from time to time
1992	Singapore Green Plan: Towards a Model Green City.
1993	Singapore Green Plan: Action Programs. Singapore Green Plan: Work Group 5 on Nature Conservation. Singapore signs the CBD on 10 March
1995	Singapore ratifies the CBD on 21 December.
1997	<i>First National Report under the Convention on Biological Diversity</i> prepared by the National Parks Board and the Report Drafting Committee, and published in December.
1998	The Republic of Singapore Master Plan and its Written Statement The ASEAN Regional Centre for Biodiversity Conservation (ARCBC), established; National Parks Board (NParks) is the focal point for Singapore.
1999	The Singapore Green Plan Review Committee for Nature Conservation (RCNC) set up by the government to review the three Singapore Green Plans (1992-1993); the results have not been published

Suggested reading

Burton Ong Tze-En. 1999. *Regulating Access to Genetic Resources: The Singapore Perspective on Article 15 of the Convention on Biological Diversity* (unpublished).

Chou Loke Ming. 1999. Coral Reefs. In Briffett, Clive and Ho Hua Chew, eds. *State of the Natural Environment in Singapore*, pp. 35-45.

ENV (Ministry of the Environment). 1992a. *Singapore's National Report for the 1992 UN Conference on Environment and Development Preparatory Committee*. Singapore: Ministry of the Environment.

ENV (Ministry of the Environment). 1992b. *The Singapore Green Plan: Towards a Model Green City*. Singapore; Ministry of the Environment.

ENV (Ministry of the Environment). 1993a. *The Singapore Green Plan: Action Programs*. Singapore: Ministry of the Environment.

ENV (Ministry of the Environment). 1993b. *The Singapore Green Plan: Workgroup 5, Nature Conservation*. Singapore: Ministry of the Environment.

Ho Hua Chew. 1999a. Towards a Greener Plan for Nature Preservation in Singapore. In Briffett, Clive and Ho Hua Chew, eds. *State of the Natural Environment in Singapore*, pp. 108-133.

Ho Hua Chew. 1999b. "What Place Nature." *Elements*, Vol. 6 Issue 1, 3.

- Ho Hua Chew. 1993. *Feedback on the Singapore Green Plan* (Nature Conservation).
- Hugh T. W. Tan. 2000. "A Showcase of Endangered Native Plants in Singapore." *Elements*, pp. 8-14, Vol. 8 No. 2, April-June 2000.
- Keng Hunt. 1998. Park Connectors. In Yuen, Belinda (ed.). *Planning Singapore: from Plan to Implementation*, pp. 31-41.
- Koh Kheng Lian. 2000. Singapore: Fashioning Landscape for 'The Garden City'. In *Landscape Conservation Law: Present Trends and Perspectives in International and Comparative Law*, pp. 39-46.
- Koh Kheng Lian. 1999. *Ecosystem Management Approach to Biodiversity Conservation: The Role of ASEAN*. Paper presented at the First ASEAN Environmental Forum, 20-24 September 1999, Hanoi, Vietnam (unpublished).
- Koh Kheng Lian. 1994. Singapore. In *Legislation for Implementation of the ASEAN Agreement on the Conservation of Nature and Natural Resources: Country Report* (April 1994), pp. 133-202. IUCN (The World Conservation Union).
- Lim Kim Seng. 2000. "Conserving Singapore's Biodiversity." *Nature Watch*, Volume 8 No. 2, April-June 2000, pp. 2-7.
- Lye Lin Heng. 1999. Legal Protection of the Natural Environment. In In Briffett, Clive and Ho Hua Chew, eds. *State of the Natural Environment in Singapore*, pp. 83-94.
- Malayan Nature Society (Singapore Branch). 1990. *Master Plan for the Conservation of Nature in Singapore*.
- Ministry of Information and the Arts. 1999. *Facts and Pictures*. Singapore: Ministry of Information and the Arts.
- NParks. 1999. "Biodiversity in the Nature Reserves of Singapore". *The Gardens' Bulletin*.
- "Tree-Planting Campaign Focuses on Reforestation: Drive to Restore Richness of Singapore Nature Reserves." *The Straits Times*, 4 November 1991.
- Turner, I.M. and J.W.H. Yong. 1999. The Coastal Vegetation of Singapore. In Briffett, Clive and Ho Hua Chew, eds. *State of the Natural Environment in Singapore*, pp. 5-23
- Wee, Y. C. and P. Ng. 1994a. *The Singapore Red Book Data: Threatened Plants and Animals of Singapore*. Singapore: Nature Society.
- Wee, Y. C. and P. Ng. 1994b. *A First Look at Biodiversity in Singapore*. National Council on the Environment.

Endnotes

1. *Elements*, newsletter of the Singapore Environment Council, Vol. 7 Issue 3, p. 1.
2. *ENV*, 1992a.
3. Koh Kheng Lian, 2000.
4. Alexandra A Seno, in the 5 December 1997 issue of *Asiaweek*, wrote: "With its landscaped grounds and profusion of greenery, Singapore well deserves the 'Garden City' title".
5. Parks, 1999.
6. 1991.
7. *The Straits Times*, 6 November 1992.
8. Cap. 152, 1985 Revised Edition.
9. Cap. 232, 1998 Revised Edition.
10. Singapore Green Plan: Towards a Model Green City, 1992; and the Singapore Green Plan: Action Programs, 1993.
11. Parks, 1999 (This was published pursuant to the FNR and is confined to the nature reserves of Singapore). See also Wee and Ng, 1994a and b.
12. ARCBC, based in the Philippines, was established in 1998. It is the main focal point for ASEAN member countries and between ASEAN and EU partner organizations. Its overall objective is: "To intensify biodiversity conservation through improved cooperation in a comprehensive regional context by assisting in setting up a network of institutional links among ASEAN countries and between ASEAN and EU partner organizations." ARCBC is an important ASEAN initiative; its work includes regional initiatives on biodiversity conservation, such as developing databases and information referral systems. Other project components include networking and institution building, training and research.
13. Ho Hua Chew, 1999.
14. "URA and PUB turn down an invitation to discuss the use of nature reserve land to build new water tanks". *The Straits Times*, 17 November 1998.
15. Koh Kheng Lian, 1999.
16. Lim Kim Seng, 2000.
17. See also Hugh T.W. Tan, 2000.
18. Lye Lin Heng, 1999 (pp. 90-91 emphasise the inadequate protection for marine nature areas); see also Turner and Yong, 1999 and Chou Loke Ming, 1999.
19. See also Ho Hua Chew, 1999a and Chou Loke Ming, 1999.
20. Keng Hunt, 1998.
21. Burton Ony Tze-En, 1999.

