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# The Environmental Impact Assessment process in Singapore with particular respect to coastal environments and the role of NGOs

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**Abstract.** The recent history of industrial and urban development in Singapore, the Environmental Impact Assessment (EIA) process, and the way EIAs are used in development planning is briefly reviewed. EIAs are carried out in secret when, and if the Government deems them necessary. Coastal ecosystems are used as examples to show that an almost total loss of mangrove, sandy beach and coral reef systems has taken place at the expense of development, and in a political environment where the EIA is supposedly utilized. The role of the main Non-Government Organisation (NGO) of Singapore, the Nature Society of Singapore, in affecting conservation is also discussed.

**Abbreviations:** EIA = Environmental Impact Assessment; NGO = Non-Governmental Organisation.

## Introduction

Singapore consists of the island of Singapore and 58 islets in the surrounding territorial waters. The main island is ca. 42 km long, 23 km wide, 574 km<sup>2</sup> in area (633 km<sup>2</sup> including the islets), and has a coastline of 150 km length (Tan 1993). The population at June 30, 1990 was 3 016 400 with a population density of 4705 persons per km<sup>2</sup>.

Singapore developed an industrial base within three decades from the 1960s onwards, and continues to develop at a significant pace, particularly in the high value-added industries and housing, commercial and service sectors. Little original vegetation cover remains. Creation of additional reclaimed land has taken place along much of the southern and eastern coasts, and closing of most inlets, estuaries and mangals for obtaining fresh water sources has taken place along the west and north coasts. Alteration and channelization of almost all natural water courses and modification of land forms has also taken place (e.g. Chua 1983). Despite this, Environmental Impact Assessments (EIAs) are carried out when, and if the Government deems them appropriate, and then usually in confidence.

The following briefly outlines the nature of the EIA process in Singapore, examines some of the past and

present coastal environmental impacts of development, and the role of Non-Governmental Organisations (NGOs) in this process.

## The EIA process

### *The period 1960-1980*

Much of the industrial, urban and housing development that took place in the period from 1960 to the mid and late 1980s in Singapore was carried out without an environmental impact assessment other than addressing the geotechnical safety aspects (e.g. Chionh 1984). At best, a fairly loose, informal Government review process existed to ascertain whether a proposed project was suitable for a particular location.

### *The present period, since 1989*

The Pollution Control Department within the Singapore Ministry of the Environment has the responsibility in screening applications for factory, industrial and other developments (both private and governmental). Environmental impact assessments have been more formally carried out since around 1989. Environmental impact assessments are carried out when an industry or development requires it (pers. comm. Pollution Control Dept. 1994). There is a general statement within the Clean Air Act of 1971 which allows the Government to impose an EIA on an industry or development, and the Water Pollution Control and Drainage Act from 1975 also allows for an EIA to be imposed.

In general, a Singapore Government Department or affiliated body, or a private developer wishing to carry out a development, forwards the proposal to the Pollution Control Department (often working closely with the Urban Redevelopment Authority) for an initial assessment as to whether the project requires an EIA (Tan 1993). If an EIA is required, the Department either carries out the EIA study, or the Department or company seek tenders to conduct an EIA from private

consulting organisations.

Within Singapore, there is a strong tendency to plan and approve a Government sponsored development first, and perhaps, then conduct an EIA Note that in the Singapore Government's national report for the 1992 UN conference, it was stated that "the principles guiding Singapore's environmental policies can be summarised in this order of priority: (a) satisfy the people's economic needs first; (b) control population growth; (c) prevent pollution at source; (d) conduct EIA for all development projects ..." (Anon. 1992a, p. 9). Obviously this could be read as meaning that, if (a) above assumes priority over (d), in some cases (d) would not be carried out.

There is no public participation in the EIA process other than that of an individual, or group writing a letter to the editor of the Singapore Straits Times (the local paper) once the paper announces the Government's development intentions. The EIAs are not available to the public as they are 'submitted in confidence' for assessment by the Pollution Control Department (pers. comm., P.C.D. 1994). This strategy has led to a degree of cynicism about the EIAs amongst the public, NGOs

and other environmental groups. Kong & Yeoh (1994) indicate that the Singapore Government has a very poor record in creating effective feedback channels, and where feedback was allowed, paid no heed.

#### *Coastal environmental impacts: 1960s-1990s*

Development along the coastal margin serves as a good example of the impacts experienced during the last 30 years in a country where EIAs were supposedly being carried out to mitigate impacts of developments on the environment.

The coastal environment along much of the south coast of Singapore consisted of mangrove swamps and estuaries fronted by fringing coral reef, and the east coast by sandy beaches (Corlett 1991; Wong 1969, 1992; Turner et al. 1994). Today, almost the entire south and east coasts consist of reclaimed land and this process is continuing. Reclaimed land constitutes 6 % of the land area of Singapore and much of this area has been formed at the expense of various types of coastal ecosystems (Fig. 1). The land area of Singapore in 1960 was 581.5 km<sup>2</sup> and by 1986 was 620.5 km<sup>2</sup> (Wong 1992).

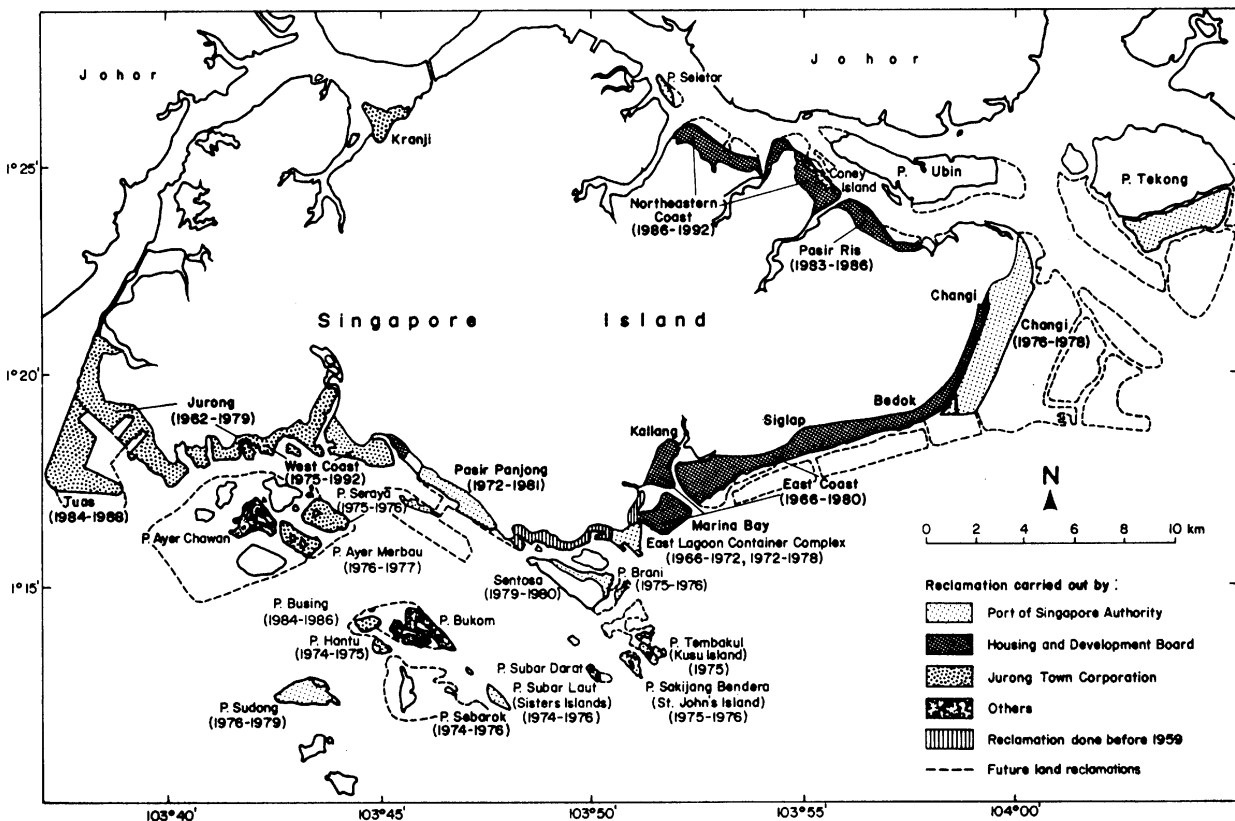


Fig. 1. A map of Singapore illustrating the major areas of foreshore reclamation (after Wong 1992).

45 km<sup>2</sup> of land was added to Singapore in the period 1955 to 1989 (Olszewski & Chia 1991).

All reclamation work is covered under the Foreshore Act, with reclamation areas up to 4 ha being authorised by the Minister of Law, and areas larger than this requiring Parliamentary approval (Wong 1992). To the author's knowledge (official information is exceedingly difficult to obtain), only one or two EIAs were conducted on the past or present reclamation projects.

Several major impacts have occurred and continue to occur as a result of coastal reclamation and associated construction activities. On the main Island these include the near complete loss of the fringing reef ecosystem, substantial loss of mangrove habitat (originally approx. 13 % of the total land area now down to < 3 %; Fortes 1988; Corlett 1992; Turner 1994; Turner et al. 1994) and fauna (e.g. crocodiles were once common, now totally absent), substantial loss of adjacent estuarine and freshwater habitats and fauna, virtually near complete replacement of sandy beaches and flora, significant marine sedimentation, and high levels of suspended sediment and a resulting reduction in visibility (down from 8 m to 2 m; Chou 1988; Nichol & Gupta 1990; Chou & Chia 1991) and impacts on coral growth and survival (Fig. 2). In the 1990s the major impacts are predominantly sedimentation, particularly in coral reef and mangrove environments, high suspended sediment concentrations, and destruction of marine habitats (Ho 1992). On the offshore islands only 1 % of the original mangrove habitat remained by 1980 (Chou et al. 1980; Chou 1994a). Secondary impacts include noise and air pollution.

These impacts are in addition to marine pollution primarily from shipping. Singapore is the world's busiest port in terms of the shipping tonnage of ship arrivals (92 655 ship arrivals in 1993; Anon. 1994a). In 1988, 3.23 million barrels of mainly crude oil entered the region daily via the Strait of Malacca (Fortes 1988). It is also the third largest refining centre in the world (Chia & Chionh 1987). Shipping accidents, spills, and operational shipping and refining activities (including deliberate dumping of ballast) have resulted in 4 705 000 tons of oily waste discharged into the South China Sea per year (Fortes 1988). Although Tan (1993, p.10) states that "the water quality [of the coastal waters around Singapore] meets the recreational water standards", many Singaporeans and visitors consider the waters unswimmable because of the visual impact of high suspended sediment loads, and physical impacts of the presence of oil slop and sludge, tar balls, floating garbage, and occasional sewage and solid waste from southern Malaysia (especially Johor Bahru) (Anon. 1991).

## The Role of Non-Government Organisations

The major NGOs in Singapore include the Singapore Nature Society, and the Singapore Reef Conservation Committee. The most significant NGO in Singapore is undoubtedly the Singapore Nature Society - formerly the Malayan Nature Society (Singapore Branch). This Society, some of its members (e.g. Briffett & Sim 1993) and associated groups have been primarily responsible for driving the agenda for environmental preservation and conservation in Singapore for a considerable period of time. But its role is seen as ranging from interference to mild approval by the Singapore Government. Three examples of the interaction between this NGO and affiliates and the Singapore Government follow.

### *Proposed construction of a golf course at Lower Pierce Reservoir*

In 1991 the Singapore Government PUB stated that it would build an 18-hole golf course within the Lower Peirce Reservoir, an area designated for water catchment and 'protected' as a Nature Reserve under The National Parks Act 1990. The golf course was to be the 15th to be built with another 15 to be constructed by the time Singapore's population reaches 4 million. At present forests represent 3 % of the land area of Singapore (2079 ha; only 100 ha of primary forest) while golf courses represent 2% of the land area. Construction of the proposed course would result in the loss of 40 000 trees (82 species), many over 80 yr old, and impacting 163 species of plants and 485 species of animals, adjacent freshwater swamp forests, the local climate and freshwater reserves, and have a host of other direct and indirect impacts (Anon. 1992b).

The Government commissioned an EIA on the impacts of the proposed golf course. The results and conclusions were not made public.

The Singapore Nature Society independently carried out an EIA on the Lower Pierce Reservoir. They published a report on the potential impacts of the development proposal detailing the impacts listed above and many others (Anon. 1992b). They concluded that significant impacts would occur and argued against the construction of the golf course at the Lower Pierce site. Following a period of stand-off and articles and letters in and to the Straits Times, the proposal was withdrawn.

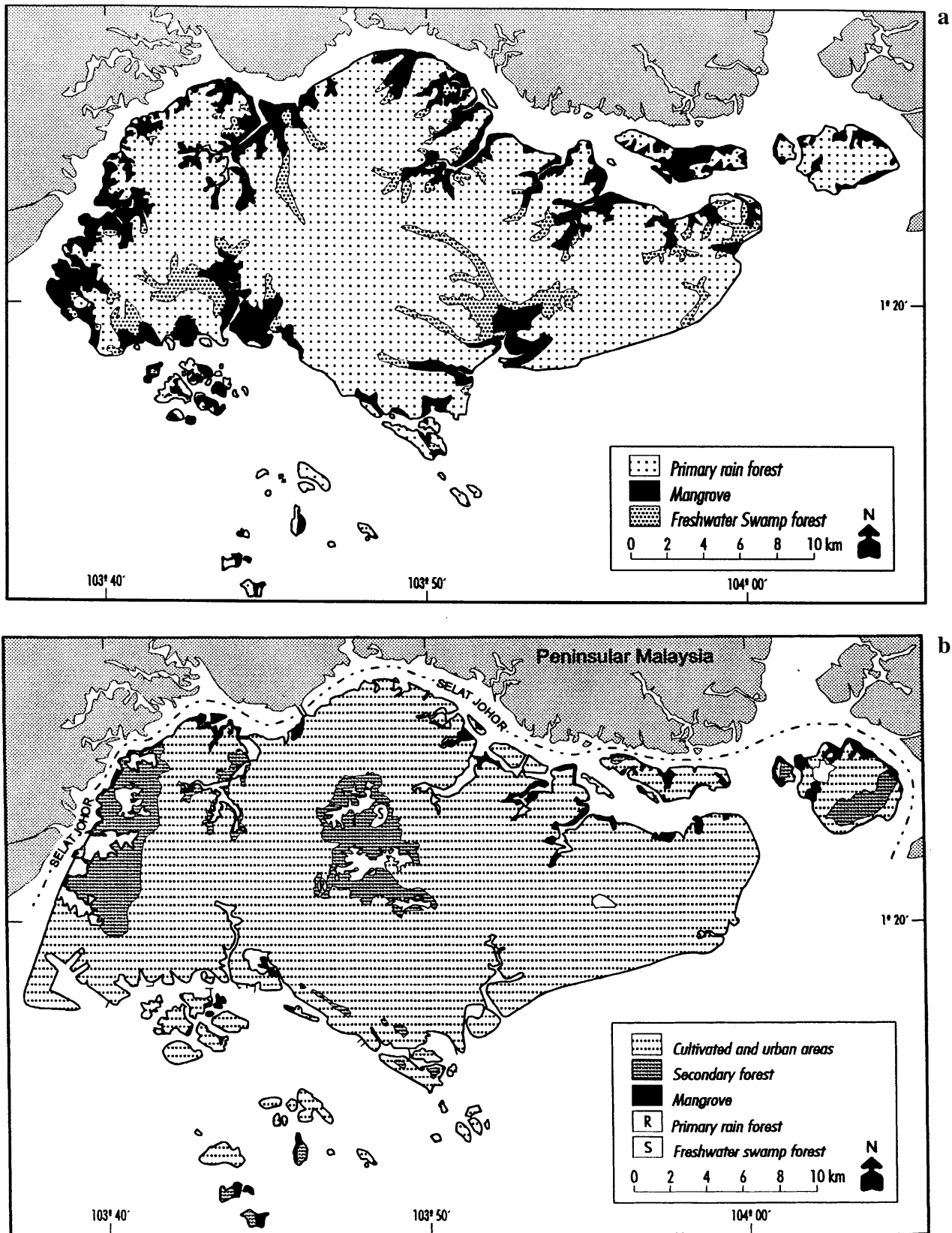


Fig. 2. a. Extent of mangroves in 1851; b. Extent of mangroves in 1994 (from Turner 1994, with permission).

## **Recommendations for the conservation of nature in Singapore**

In 1990 the Singapore Nature Society published a master plan for the conservation of nature in Singapore (Briffett 1990). They identified a number of sites of ecological and natural importance for conservation, preservation and management. The majority of these were coastal sites such as mangrove and estuarine wetland areas. The Singapore Government, in its 1991 Concept Plan, and in the Green Plan (Anon. 1992c) accepted many of these sites as of conservation status and classified 28 of the Nature Society sites as 'open green areas' (cf. Savage 1992).

Some of the highest priority conservation sites will not be conserved, however. One of these is the Senoko bird sanctuary (Anon. 1994c). Senoko is a wetland and mangrove area on the northern tip of the Island. It is extremely rich in bird life (181 species sighted), including several rare and highly endangered species, and is crucial to the long term survival of resident Herons (Briffett 1990) and probably other birds (e.g. rare raptors). The Ministry of National Development (MND) recently rejected an appeal and petition from 25 000 Singaporeans to conserve 70 ha in Senoko as a nature park. An MND spokesman, supported by the Minister of Environment, stated if the 70 ha are conserved, we will lose about 6000 flats and an industrial site of 20 ha" (Anon. 1994d). Alternatives to this development have not been considered. For example, there are 14 golf courses in Singapore with 15 more planned. The sport is elitist (it costs ca. US\$ 100 000 for Singaporeans and around US\$ 170 000 for foreigners to join and nonmembers are restricted from entering the grounds), is played by an extremely small percentage of Singaporeans (a total of around 30 000 including foreigners but excluding tourists; Ben-Ari 1994), and heavily patronised by the ruling Government party. An 18-hole course can range from around 60 to 320 ha, depending on the additional facilities (Pleumarom 1992). Converting one existing or proposed golf course to urban development on the Island would provide the necessary land so that the Senoko coastal area could be conserved. Such an heretical idea would probably be anathema to the local politicians and golf enthusiasts!

### *The Pulau Semakau and Pulau Sakeng Region*

The Nature Society and other individuals have a history of attempting to influence Government policy on preserving some of Singapore's southern islands, where many of the best coral fringing reefs remain and where some of the island terrestrial environments are relatively intact. For example, in the early 1960s, the

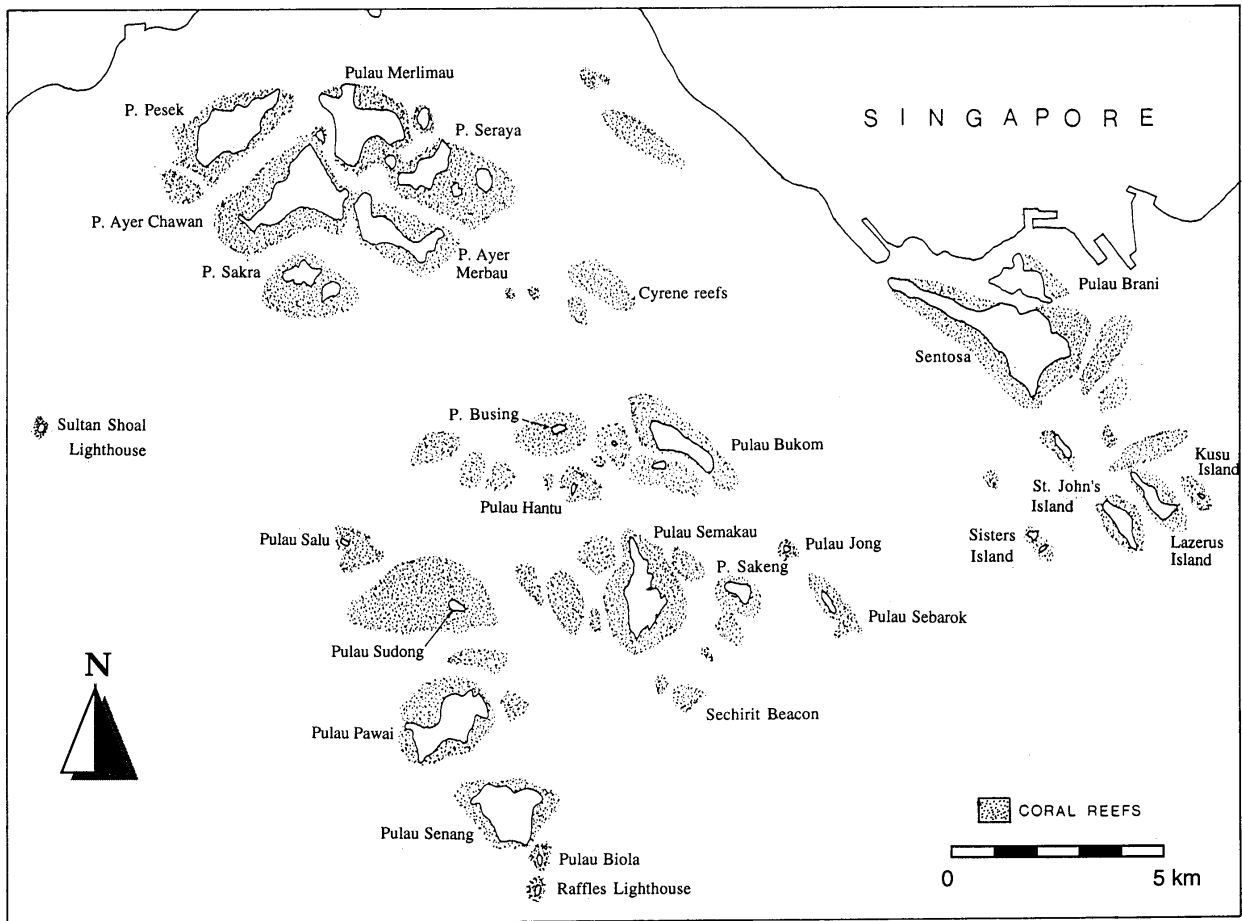
Nature Society were unsuccessful in persuading the Government to conserve one of the southern islands (Chia & Chionh 1987). This trend has continued as has the trend of coastal environmental degradation (Chou 1994b).

In 1992 the Straits Times (Anon. 1992a) reported that the landfills in Singapore were rapidly filling up, and that the Environment Ministry would start dumping non-incinerable waste off the eastern part of Pulau Semakau. Waste (predominantly ash) would be dumped within a 350 ha area between the islands of Pulau Semakau and Pulau Sakeng and several intertidal and sub-tidal reefs (Fig. 3). Although the Straits Times stated that the bunds of marine clay built to form the enclosure would be lined to prevent seepage, clay sediment has been, and still is being dumped along the eastern margin of Pulau Semakau without bunds in place. More recently, the Government announced that 'silt curtains' would be utilized to contain the silt within the 350 ha bund construction area (Anon. 1993c).

Opposition to the construction of the dumping ground, real concerns about pollution and increasing sedimentation and smothering of coral reefs, and calls for conservation of the islands and surrounding mangrove flats and coral reefs by the Nature Society, recreational diving groups and others (e.g. Waller 1993) have largely gone unheeded, although apparently the Government is considering the possibility of some coral conservation areas. The terms of reference for tenders for an EIA on the effects of disposing of dredged sediments in various areas around Singapore, including around Pulau Semakau, has recently been issued (August 1994) to some consulting companies by The Port of Singapore Authority (PSA). However, this is seen as a somewhat cynical exercise, coming as it does, years after the decision was taken to develop the dumping ground. In addition, given the previous and ongoing sedimentation and marine pollution impacts, it is difficult to see how marine and coral conservation areas can coexist within industrial zones as they do in, for example, Chia's Singapore coastal management strategy (see Fig. 6.1 in Chia 1992).

It should be noted that many Singaporeans believe that either there are no coral reefs in Singapore, or that they are dead (White 1991; National University of Singapore, student surveys).

The impacts on the inhabitants of the two islands have been considerable, but they were seemingly ignored by the Government. Residents were not given any choice but to leave the islands. Over 1000 people were removed from Pulau Semakau in 1977 (Waller 1993). 150 residents were removed from Pulau Sakeng in late 1993 (Anon. 1993b). P. Sakeng formed the second last Malay kampung in Singapore, and the 44 families,



**Fig. 3. a.** The extent of coral reefs and islands prior to reclamation (early 1960s).

whose relatives lived here prior to the foundation of Singapore in 1819, are descendants from Riau seafarers. All the islanders were relocated to Singapore Housing and Development Board (HDB) flats in Singapore. While access to work opportunities, schools and amenities would obviously be improved, the seaside and island lifestyle, food gathering, extended family and social group structure, and social and recreational freedom was largely lost.

The impact of reclamation and offshore dumping on the islands and coral reefs of Singapore may clearly be seen in Figs. 3-5. The future scenario planning by the Urban Redevelopment Authority (Fig. 5) will result in significant destruction of the remaining coral reefs if carried out.

Overall, in these three examples, the NGOs have played a significant role in research and assessment of natural ecosystems in Singapore. The Government Min-

istry of Environment conducts little research of its own in this area, although the National Parks Board does carry out some research within the parks under its jurisdiction. The NGOs have had varying success in convincing the Government to conserve and manage natural areas; they were very successful in the case of the Lower Peirce site, moderately successful in the master plan conservation sites, and have largely failed (along with others) in the case of the southern islands sites. It should be noted that the success rate can change over time, as the Singapore Government is not averse to changing, de-gazetting or reversing the status of conservation areas and nature reserves (Anon. 1992b).

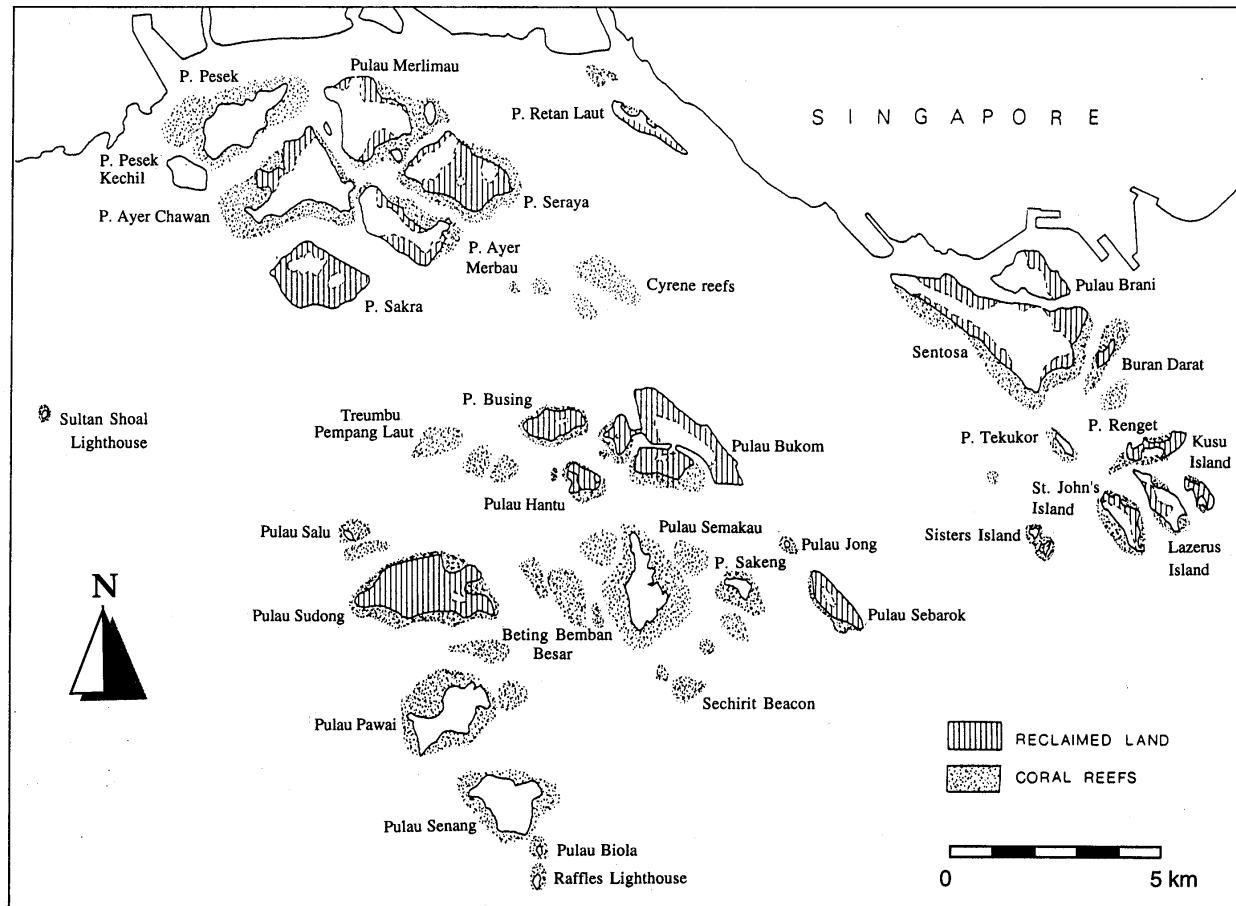


Fig. 4. The extent of reclaimed land in the southern islands up to 1984.

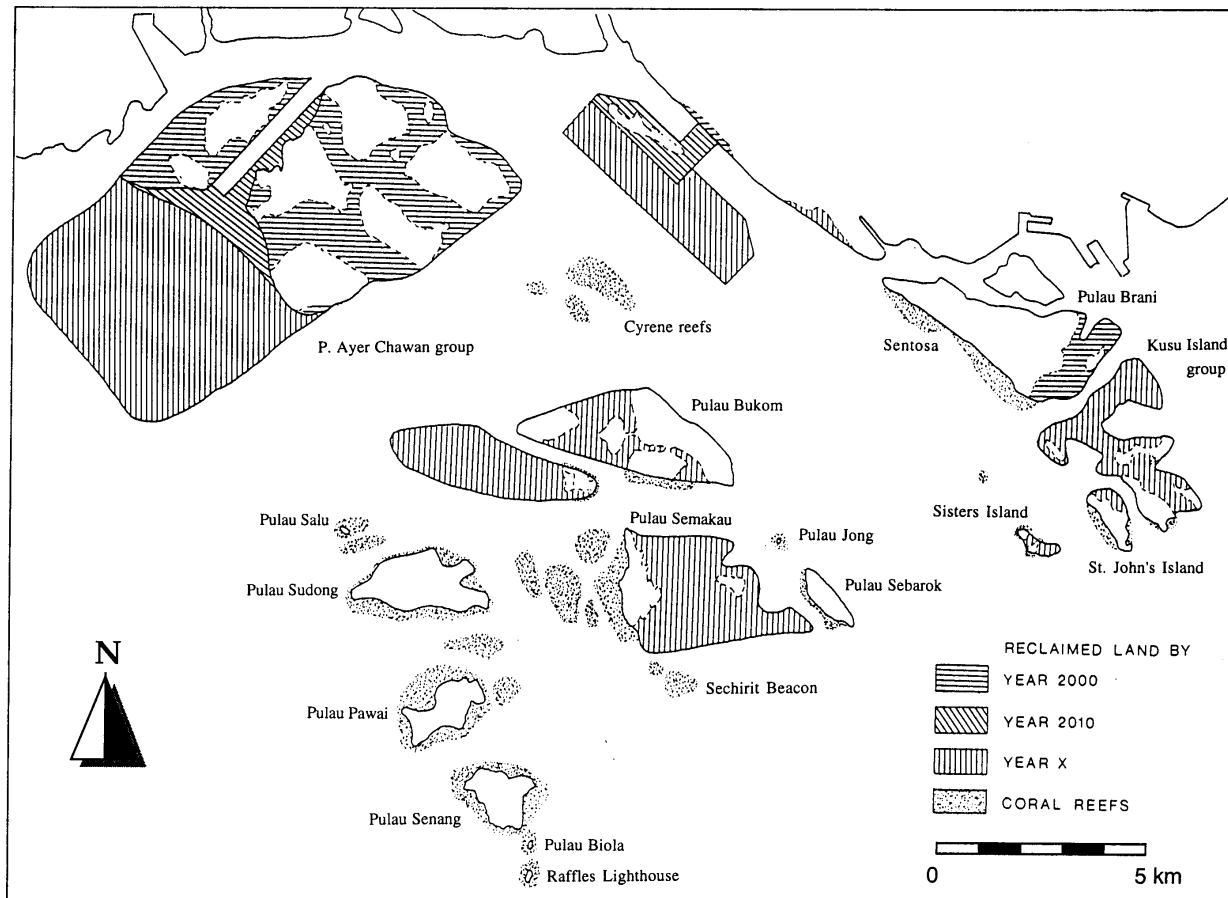
## Conclusion

There is a strong tendency within the Singaporean Government agencies to promote Singapore as a 'clean and green' city state, and to adopt a rather self congratulatory stance in the SE Asian region (e.g. Kuan 1988). While it is well ahead of other nations in the region in rehabilitation of its rivers, provision of clean potable water, construction and operation of tertiary sewage treatment facilities, and the enforcement of strict anti-littering laws, a significant proportion of the Island's and surrounding regions ecosystem (especially the coastal zone) has been, and is continuing to be either affected severely or destroyed. This has occurred and continues despite 'formal' EIA procedures in place. While some pragmatic planning decisions were and are necessary, there is, as Briffett (1993, p. 11) notes, considerable scope for more preventive action to be taken in

the early stages of project design and planning (cf. Chia & Chionh 1987, p. 153; Briffett & Malone-Lee 1992). A strong conservation ethic is also required. An EIA process should be invoked at the initial stage of any planning or development proposal, the personnel reviewing the EIA should not be the project or development proponents, or at least not solely, and this process should be conducted with full public participation and subsequent public review.

NGOs and individuals have had mixed success in influencing Government policy and actions in Singapore. Their work in researching and defining conservation areas has been significant. But, as Chua (1993) noted in the case of coastal management planning, a strategic management plan for Singapore, largely prepared by Chia (1992), was viewed, at best, as a reference document and few of its recommendations were implemented.





**Fig. 5.** Reclamation for various future times as proposed by the Singapore Urban Redevelopment Authority (after Ho 1992).

There is considerable cause for concern that the Singapore Government's attitude towards the EIA process and its lack of concern for preserving and conserving natural ecosystems, will be translated to ASEAN and other Nations with which it has, or will have development aims. The Singapore Government does not appear to impose, or request EIAs in its overseas joint or funded developments. It is not enough to provide, for example, engineering training and solutions for sewerage and water treatment in overseas investments, and to transfer the 'clean and green' philosophy when this merely means the creation of manicured lawns and gardens. This is especially true in the light of recent developments in, for example, China (with whom Singapore is engaged in several development projects) where there is a reported 4 % to 9 % annual increase in air pollution, waste water and solid waste (Anon. 1993a; Anon. 1994b).

Singapore can possibly become a player in the South-east Asian region in environmental management, but only if it is prepared to adopt a more holistic, ecosystem conservation ethic and environmental impact assessment and mitigation procedures. It can also save and conserve its meagre remaining coastal resources if it adopts a less strident development policy and a more creative, eco-conscious planning approach.

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