

# Logistics of Natural Resources in Hong Kong – A Case Study of Urban Ecological Problems in a Locality with High Density Population<sup>1</sup>

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## Summary

The purpose of the paper is to examine the interaction between the natural resources, the environment and the human population in Hong Kong. It is a case study of urban ecological problems in a locality with very high density population. With more than four million people dwelling in a total area of about 400 square miles, which is extremely poorly endowed with natural resources, Hong Kong has a population density of ca. 100,000 persons per square mile, a figure which is seldom exceeded anywhere in the world. This fact gives rise to a variety of ecological problems in Hong Kong, some of which are quite unique.

Our logistics study shows how the limits are rapidly being approached in land availability and water and food supply with growth of population which will double in about 35 years from now at the current annual growth rate of 2 per cent. So it will not be over-exaggerated that if the population growth is not checked immediately and effectively, no technological legendemain and economic development can fend off the time of reaching the "carrying capacity" of the finite environment of Hong Kong and all efforts to augment the "carrying capacity" will merely postpone the time of mass starvation and increase the agony when it inevitably occurs.

## I. Introduction

Natural resources, by definition, exist naturally and cannot be further expanded. To discuss their logistics is to examine the interaction between the resources, the environment and the human population. In so doing, the dynamic and strategic aspects are emphasized and their importance stressed.

Hong Kong is a small place with a total land area of just over 400 square miles comprising of

- a) Hong Kong Island – 30 sq. miles
- b) Kowloon Peninsula – 4 sq. miles
- c) New Territories – 366 sq. miles

It is highly industrialised, relatively affluent and rapidly developing. It is situated on the South China coast and is very near to the Tropic of Cancer so that it enjoys a temperate sub-tropical climate. The population of over 4 million live mainly in the urban area which occupies about 10 per cent of the total land<sup>2</sup>. This gives rise to a population density of ca. 100,000 persons per square mile, a figure seldom exceeded anywhere in the world. Only 13 per cent of the total land area is suitable

<sup>1</sup> The original version of this paper was presented at the 11th Commonwealth Universities Congress held in August 1973 in Edinburgh. The authors are indebted to Professor M. H. Hsing for helpful suggestions and remarks.

<sup>2</sup> The 1971 Census, A Graphic Guide, Census and Statistics Department, Hong Kong, 1972, p. 24.

for farming. The remainder consists largely of steep, unproductive hillside. This, however, is the area where further urbanisation and other developments could take place. Such developments may have important and far reaching consequences to the utilisation and conservation of natural resources. We shall outline the inter-linked nature of the problems.

## II. Resource Realities

Hong Kong is extremely poorly endowed with natural resources. Except for quarries and sand, whose exploitation has contributed greatly to the post-war development of the building and construction industry, there are virtually no mineral deposits of any sub-stantial economic significance, although after World War II, lead, iron ore, quartz, wolfram (tungsten), tin, feldspar, clay, kaolin and even occasionally gold and silver, were mined for a fairly long period but on a very limited scale<sup>3</sup>. The total value of the output of minerals in Hong Kong in 1955 amounted to about HK\$ 6 million, to which should be added the amount of about HK\$ 3 million for the output from the quarries, and the income of about HK\$ 5 million accruing from the sand monopoly, giving the total value of mining output equal to approximately HK\$ 14 million. This was roughly 0.4 per cent of the total colony's income for that year. The bulk of the minerals output was destined for export. Mining in Hong Kong is a trivial and declining industry. For the time being, only iron ore, quartz, feldspar, clay and kaolin are continuing to be mined; the mining of the other items have long since ceased. No deposits of energy material, such as coal and oil, have ever been discovered in Hong Kong. Hong Kong now spends annually about HK\$ 790 million on energy materials; all of them imported from abroad<sup>4</sup>.

The main natural resources of Hong Kong are the land, its geographical location, and the sea surrounding it. While the land provides space for the people to live and to grow some food, the sea is the major local source for the supply of protein. Hong Kong's geographical location is unique. Economically, Hong Kong as a natural harbour, is one of the most important gate-ways to China, a factor which made Hong Kong a prosperous entrepôt for the past century. However, at present Hong Kong relies on its ready accessibility to the other parts of the world to support a modern competitive industry. The fresh water supply for the colony is derived from the seasonal monsoon which brings yearly large quantities of rainfall to Hong Kong, filling our 17 reservoirs with a total water capacity of some 67 billion gallons<sup>5</sup>. For the time being, the local water supply can almost meet the total demand for it. Water, therefore, is the most vital natural resource of Hong Kong.

## III. Population

In a little over a century and a quarter, Hong Kong has been transformed from an unimportant and sparsely-inhabited area into a prosperous "City-state". Except for

<sup>3</sup> S. G. Davis, *The Geology of Hong Kong*, Hong Kong Government Printer, 1952, pp. 109–123. Edward Szczepanik, *The Economic Growth of Hong Kong*, Oxford University Press, 1958, pp. 40–44.

<sup>4</sup> *Hong Kong Monthly Digest of Statistics*, April 1974, Rev. Ed., p. 14.

<sup>5</sup> *Hong Kong Monthly Digest of Statistics*, April 1974, Revised Edition, p. 48.

the period 1941–1945 the population has grown steadily ever since 1841, when Hong Kong was ceded to Britain as a colony. A total population of 90,000 in 1841 grew to 1.64 million in 1941<sup>6</sup>, and from 2.4 million in 1951 to 4 million in 1972. Thus in the past 20 years the population has doubled, a phenomenon which can only be appropriately called “population explosion”. Two major factors are contributing to this, namely the influx of refugees from China after 1949 and the high natural growth rate.

Although in recent years illegal entries of refugees continue to some extent, the volume is believed to be reduced to around 10,000–20,000 a year. The annual birth rate is also on the decline, from 4 per cent in 1956 to about 2 per cent in 1971<sup>7</sup>. (Note: Two thirds of the “developing” countries have birth rates ranging from 3.7 per cent to 5 per cent). Thus, in the last 15 years from 1964 to 1971 Hong Kong’s birth rate has been almost halved. Furthermore, there is some evidence that a decline in the age-specific birth rate is under way, particularly among younger women. This is attributable largely to the operation of the Hong Kong Family Planning Association. It can be predicted, with a good deal of certainty, that the birth rate in Hong Kong will remain at the present level of about 2 per cent in the next decade<sup>8</sup>.

The future size of the population depends on the inter-relationship of three factors: The birth rate, the death rate, and the migration rate. The difference between the birth rate and the death rate is the rate of “natural increase” of population; and the sum of the natural growth rate and the migration rate gives the annual growth rate of the population. As mentioned above, the annual growth rate for Hong Kong will be around 2 per cent. This is, however, not a happy figure for us, because it is a well known phenomenon that at an annual growth rate of 2 per cent the population size will double in about 35 years. Accordingly, by the year 2010 Hong Kong’s population may exceed 8 millions, a figure which will definitely intensify the existing urban problems and pose serious ecological threats to Hong Kong. In what follows we shall restrict our discussion to those urban problems which we feel are particularly serious and unique to Hong Kong, namely housing, water supply, land utilization and waste disposal.

#### IV. Housing the Poor

One of the Hong Kong Government’s proudest and most conspicuous achievement is the erection of public estates which now accommodate more than 1.6 million people. Over 1 million of these are ex-squatters who have been rehoused in Resettlement Estates at a density of 24 sq. ft. per adult or its equivalent. The remaining 600,000 are housed either in Government Low Cost Housing, or under special arrangements by Housing Authorities and Housing Societies. More than 2 million

<sup>6</sup> Hong Kong: The Industrial Colony, 1971, Keith Hopkins, p. 26.

<sup>7</sup> Recent Fertility Declines in Hong Kong – the Role of the Changing Age Structure, in: Population Studies, July 1968; Hong Kong: The Continuing Fertility Decline, 1967, in: Studies in Family Planning, Aug. 1969; Hong Kong’s Fertility Decline, 1961–1968, in: Population Index, January–March, 1970.

<sup>8</sup> C. Y. Choi, Some Possible Consequences of the Changing Age-Structure of Hongkong’s Population, contributed paper presented to the 2nd Asian Population Conference, Tokyo, Nov. 1–13, 1972, p. 6.

people live in permanent private houses and about 300,000 in temporary private houses. Finally, there are about 78,000 marine population living on boats<sup>9</sup>.

In each Resettlement Estate there is an average of 44,000 people, scattered in about twenty massive blocks. Although this average density is ten times greater than the maximum recommended density in British housing development, the housing condition in some pre-war private tenements is much worse. Before 1953, almost all non-squatter residents in the metropolitan area were housed in privately-owned tenement buildings. In the past 25 years the condition in the private housing area improved immensely — the average living space per household has shot from 155 sq. ft. in 1957 to 408 sq. ft. in 1969, and the median living space per person has gone up from 19 sq. ft. to 60 sq. ft. in the same period, but the general level is still very far behind the median of 111 sq. ft. per person in Singapore and 96 sq. ft. per person in Taipei.

According to a survey conducted in 1969, living conditions in private housing are still fantastically crowded and are dominated by the traditional tenement floors. Among the 2.3 million people living in private houses, about 65,000 are still in old tenement flats, 1.4 million in room/cubicles, 70,000 on boats and about 127,000 in temporary structures (squatters) and about 86,000 in bedspaces, verandas, cock-lofts and roof-shacks, etc.<sup>10</sup>.

Recognizing the seriousness of the housing problem, the Government has announced a 10-year housing development programme<sup>11</sup> with the purpose of building, within 10 years, enough permanent homes, (1.8 million units), self-contained and with good amenities and in a reasonable environment, for the people in Hong Kong. When implemented, this will mean the virtual disappearance of squatter areas and the elimination of the worst of over-crowding.

## V. Water Supply

The daily consumption of fresh water is increasing with the growth of population and the standard of living. So much so that the present 67 billion gallons reservoir-capacity is barely adequate, and will not be sufficient to ensure adequate supply from one dry season to another. To keep pace with the need, several plans are in hand: (a) Importing water from neighbouring areas; (b) Constructing more reservoirs; (c) Constructing desalination plants.

Importing water from neighbouring areas is expensive and limited in scope (two thirds of the water from the East River in China having been already exported to Hong Kong).

Constructing more reservoirs involves the use of precious land. In fact, it is estimated that with the construction of the project "High Island Scheme" (which will double the present storage capacity) there will be insufficient water catchment areas in Hong Kong to develop more reservoirs. The High Island scheme

<sup>9</sup> Census and Statistics Department, Hong Kong Population and Housing Census, 1971, Basic Tables, Hong Kong Government Printer, 1972; Tables 17–18.

<sup>10</sup> Hong Kong Population and Housing Census 1971, Basic Tables, Hong Kong Government Printer, 1972, Tables 17–19.

<sup>11</sup> Hong Kong (Annual Report), 1973.

is the construction of a reservoir by building dykes between a group of conveniently situated off-shore islands on the Eastern shore of the New Territories. The enclosed seawater is then pumped off to be replaced by fresh water. This type of scheme involves the elimination of natural shore line including the life supporting mangroves and is thus not devoid of ecological consequences.

Desalination plants are the fresh water supply sources which are independent of weather conditions. It is expensive but reliable. However, desalination involves the heating up of vast quantities of sea-water. This results in two major problems: The consumption of fuel with its exhaust products which may be a major pollutant; and the dissipation of unused energy in the form of heated, concentrated saline solution. The latter has major ecological consequences to marine life. However, this source of fresh water supply may well be essential.

## VI. Land Utilisation

With an average population density of 100,000 per square mile in the urban districts and a total area of 400 square miles, land utilisation is a primary problem for Hong Kong. A number of important facts may be discussed: (a) Urban development, (b) Industrial development, (c) Recreational facilities.

Let us examine these in turn. Within the urban district, Hong Kong is a concrete jungle with an average living space per person of 60 square feet. Within this space recreational facilities are non-ideal and in scarce supply. Fortunately, an efficient transport system can convey a large number of the urban dwellers out to enjoy the natural beauty with which Hong Kong is endowed in its uplands and beaches. However, indiscriminate intrusion into nature reserves again has ecological consequences. The public need to be educated and deterred from such habits as: accidental and wanton destruction of flora and fauna, causing hill fires, and the casual disposal of rubbish. Several studies are underway to improve recreational facilities, and at the same time to safeguard nature conservation. It is a co-ordinated approach to plan land utilisation for urban and industrial expansion, as well as to ensure the provision of recreational facilities, thus ensuring a richer life for all. The natural resources must be exploited to meet the demand at the appropriate time, after assessing the consequences.

There is a continuing demand on industrial land. Hong Kong's industries are one of her principal life lines and deserve special attention. Their survival depends on their competitiveness, high adaptability and productivity and ability to expand. The minimisation of the production cost is also paramount. This often leads to practices which are detrimental to the environment, such as air and water pollution, caused by the discharge of industrial effluent without proper prior treatment, noise pollution caused by undamped exhaust system. The noise problem, in fact, has a new dimension in Hong Kong as the airport is situated in the heart of the city and the flight path goes over 1 million of the population. Industry, however, relies on air transportation for speed of importing raw materials and exporting finished products. Therein lies an obvious conflict: Industrial production leads to higher standard of living and a rosy future but also produces pollution which leads to a degradation of the quality of life and a dismal prospect.

Of topical interest is the proposed investigation into the building of an oil-refinery. The risk of large scale oil pollution, the advantages of a new industry which may lead to petrol chemical developments and will ensure a more stable oil and raw material supply, and the use of land which otherwise can be used for recreation, are some of the pros and cons.

Irrespective of industrial development, urban development expands with the increase in population and the standard of living. Other industries such as tourism also demand urban facilities to be developed in a wider area. This demand again encroaches on the nature reserves. Large scale land reclamations are causing the loss of shore land at the expense of marshes and mangroves, and deforestation is creating more badlands and causes climatological unbalance. Both may harm the nature reserves in a fundamental way. With the population increase and urban development the man-made waste grows. Waste disposal becomes a major problem in Hong Kong as in other developed countries. This will be discussed further after we briefly examine the land utilisation for farming.

About 10% of Hong Kong's land is used for agricultural purposes<sup>12</sup>. Paddy fields for rice production are on the decline as the same field can produce multi-crop vegetables and flowers to give better financial returns. Rice production amounts to less than 5% of the total needs while vegetable production accounts for around 40% of the local consumption. Pig and poultry farming are very widely spread and uncontrolled. The local supply amounts to 15% of the total fresh pork and 60% of total fresh poultry consumed. Thus, these local products represent only a small fraction of the staple food needed.

On the other hand the farm area presents a dismal picture as far as nature conservation is concerned. Not only intensive farming needs careful management to avoid soil quality degradation, but there is a lack of sanitary provisions. The animal manure and waste amount to an equivalent waste produced by over 1 million human population. This is causing heavy organic pollution especially to local streams and is part of the big problem of waste disposal which, if uncontrolled, can destroy the natural environment.

## VII. Sewage Disposal

The ability of the environment to absorb waste is also a resource, perhaps the first one to be exhausted in the industrial nations<sup>13</sup>. Waste accumulation again intensifies rapidly with increase in population and the standard of living. Hitherto, Hong Kong disposes its waste products by discharging them into the sea. Little or no pretreatment is used. Until recently, the rapid sea currents were sufficient to disperse the waste products and render them harmless. However, within the last few years, waste products increased nearly ten-fold and industrial effluents are becoming more and more significant. Studies have already been started to

<sup>12</sup> Agriculture in Hong Kong, A Hong Kong Government Information Services publication. The Government Printer, Hong Kong, April 1972; Agriculture and Fisheries Department, Quarterly Report, Oct.—Dec. 1973.

<sup>13</sup> J. P. Holdren and P. R. Ehrlich, *Global Ecology, Readings Toward a Rational Strategy For Man*, Harcourt Brace Jovanovich, Inc., New York, 1971, p. 7.

examine a number of important aspects. (a) Tidal and current flow within the regions where sewage discharges are taking place. (b) Sewage treatment requirements. (c) Effects of land reclamation on tidal and current flow. (d) Effect on marine life.

The preliminary result of these studies shows that in certain areas where the cleansing process is efficient, namely where currents are rapid, the pollution level is tolerably low, whereas in other regions, such as in a tidal cove, the pollution level is reaching the danger limits. It also shows that more and more regions are now receiving effluents. So sewage treatment requirements have been proposed.

At this stage the problem does not appear to be catastrophic, and the treatment requirements called for are mainly of the primary type. However, with continuing destruction of natural shore land due to construction work and reclamation the tidal cleansing is becoming less efficient and marine life is more easily affected.

Marine life has a particularly important role in Hong Kong. Currently, fishing in local waters is a sizeable industry. In the future it is anticipated that marine culture may become a major industry producing the much needed protein food.

The cost for pollution control of the sea may prove to be extremely expensive but this may well be recoverable through the benefit it brings.

### VIII. Approaching the "Carrying Capacity"

It is a well-known phenomenon in biology that when a population of organisms grow in a finite environment, sooner or later, it will encounter a resource limit. This phenomenon of reaching the "Carrying Capacity" of the environment applies to a bacterium in a culture dish, to a buffalo on a prairie and, inevitably, to the Homo Sapien in this finite environment of Hong Kong.

Our logistics study shows how the limits are rapidly being approached in land availability and water and food supply with the growth of population. It is hard to envisage how Hong Kong will cope with this problem when the population is doubled at the beginning of the twenty-first century. Thus, it will not be over-exaggerated that if the population growth is not checked immediately and effectively, no technological legendemain can fend off the misery to come, and all the efforts to augment the "carrying capacity" will merely postpone the time of mass starvation and increase the agony when it inevitably occurs<sup>14</sup>.

In concluding this paper we may therefore ask the question: Are there enough men to save the "man"? Maybe the resourcefulness of man is the one natural resource which could balance the lack in the others.

<sup>14</sup> This view is complimentary to the implication of the Club of Rome model which attempts to show by computer simulation that there are limits to global growth, imposed by the earth's finite size, which will be reached sooner or later (perhaps within 100 years). The computer model is based primarily on the interactions of five parameters — population growth, pollution, depletion of natural resources, food supply and capital investment. The preliminary findings have been published as a book called *The Limits to Growth* by Meadows, D. H. and Randers, D. L. J. and Behreus IV, W. W., (New York 1972); see also *Thinking about the Future: A Critique of the Limits to Growth*, the Science Policy Research Unit, Sussex University Press, 1973, as well as "The Ecological Debate" in *University Quarterly, Higher Education & Society*, summer 1973.