CHAPTER 2

MAJOR ENVIRONMENTAL ISSUES IN KUALA LUMPUR AND THE KLANG VALLEY REGION: AN ILLUSTRATION

INTRODUCTION

This chapter of the report illustrates some of the major urban environmental issues in Kuala Lumpur and the Klang Valley region following rapid development and population growth. Due to its location, topography, history and the detailed manner in which development has been planned and executed, several of these issues are obviously peculiar and specific only to Kuala Lumpur and the Klang Valley, but many of the issues are also common to many cities in developing Southeast Asia and the APEC region and are therefore applicable to them as well.

KUALA LUMPUR AND THE KLANG VALLEY REGION

Figure 2.1 shows the general topography, major roadways and land use pattern of Kuala Lumpur and the Klang Valley region. Basically Kuala Lumpur and the merging Klang Valley conurbation are located in a bowl-like topography with an opening into the Straits of Melaka and to the south towards Seremban. The rest is surrounded by relatively hilly topography reaching the foothills of the Main Range to the east. Much of the original forest cover has been replaced by urban land use, and development has now encroached into the foothills resulting in surface erosion and increased incidence of flash floods. The region is well served by road networks whose efficiency is hampered only by traffic congestion.

Perhaps one of the most outstanding features of urbanization and urban development in the Klang Valley is the dramatic growth and dominance of the Federal Capital Kuala Lumpur (lat. $3^{o}8'$; long. $101^{o}44'$E) and the conurbation that follows --- along the Federal Highway to Port Klang and the North-South Highway to Rawang and beyond and to Nilai and Seremban. In the mid-nineteenth century, Kuala Lumpur was only a small trading post serving the tin mines of Ampang, then the chief mining area in the Klang River basin. In the early 1870s, the population of Kuala Lumpur was estimated at around 2,000 consisting essentially of Chinese miners and Malays (Tsou 1967). By 1959, the population expanded further to 315,000, an increase of over 12 folds within just over 60 years. Eleven years later in 1970, metropolitan Kuala Lumpur had some 485,000 people within its boundary representing about 43% of the population of the State of Selangor, and 8% of the population of Peninsular Malaysia (Pryor 1973). Following the proclamation of Kuala Lumpur as the Federal Capital in 1973, the boundary was extended from the original 93 sq.km to 243 sq.km and in the 1980 census contained some 937,000 people representing about 60% of the population of the State of Selangor. In the 1991 census, the figure expanded further to reach 1.15 million.

Today, Kuala Lumpur is the largest urban centre in the country and is currently expanding as part of a merging conurbation stretching from Port Klang by the Straits of Melaka in the west to the foothills of the Main Range in the east, a distance of approximately 48 km. The major centres which combine to form the conurbation are Kuala Lumpur, Petaling Jaya, Subang Jaya, Batu Tiga, Shah Alam, Klang and Port Klang in the west, Kuala Lumpur-Rawang-Bukit Beruntung stretch to the north and Kuala Lumpur - Sri Petaling - Tasik Selatan - Serdang - Kajang - Bandar Baru Bangi - Nilai to the south. The south stretch will soon be joined by the newly formed Putra Jaya and Cyber Jaya (Figure 2.2). In between these general directions of growth, rapid development continues to take place so that before long not only the valley gets "filled up" by urban land uses but the spill-over effect of such development can also be felt well beyond the valley boundary with far-reaching consequences, both on the natural environment as well as the life style of the population (Abdul Samad 1982; Brookfield *et al.* 1991). What follows is a discussion of the consequences of urban growth in Kuala Lumpur and the Klang Valley on the natural environment, the management response and its effectiveness and some outstanding issues that need redress.

ENVIRONMENTAL CONSEQUENCES OF RAPID URBAN GROWTH

One of the early symptoms of impact of rapid urban growth is the transformation and, in many cases, the deterioration of the natural environment. Forests and other natural vegetation have now been replaced by infrastructure, residential homes, office space and business houses, industries and other commercial buildings. In more recent years, apartments and condomoniums appeared to have become popular and their number has increased substantially within Kuala Lumpur and surrounding areas in the last year or two. Too often not enough provisions are set aside for open spaces and green areas. Indeed, the percentage of green spaces in Kuala Lumpur has changed very little since the Kuala Lumpur Structure Plan was launched in 1984.

Climate

One area in which the impact of urban growth on the natural environment has been clearly demonstrated is the climate. In the city, the effects of the complex geometry of the urban surface, the shape and orientation of the buildings, the over-concentration of man-made structures, the peculiar thermal and hydrological properties of the urban morphology, the heat generated by the many forms of combustion processes, the traffic and industries, and the amount of pollutants released into the city's atmosphere all combine in a peculiar manner to create a climate which is quite distinct from that of the surrounding rural areas.

Studies on city climate abound in the literature. Almost all the major metropolises of the world have been shown to have their own peculiar climate affecting the manner in which air pollutants are being dispersed, human comfort, energy consumption, architecture, health and other social costs. Kuala Lumpur and the Klang valley conurbation are no exception.

A study on the impact of urbanization on climate in Kuala Lumpur - Petaling Jaya area (Sham 1980) shows that in agreement with previous works in the mid-latitude region (e.g. Oke 1979; Chandler 1965), sunshine duration is approximately 9-10% less in the urban areas, and so are relative humidity and frequency of surface winds greater than 1.5 ms^{-1}. The corresponding decreases are 2-15% and 9-10% respectively. Winds less than 1.5 ms^{-1} appear to occur more frequently in the urban area than in the countryside. But even here, the wind patterns are difficult to predict. Buildings and other man-made structures in the urban area complicate the airflow pattern and hence air pollution dispersion (Sham 1986). In the Klang Valley, the situation becomes more complex due to the proximity to the sea and the detailed valley topography. Here, there is a reversal of windflow during day and night (Sham 1981). At night, the windflow is from the easterly quarter, blowing from Kuala Lumpur - Petaling Jaya towards Shah Alam, Klang and Port Klang. During the day, the flow pattern is reversed; the wind blows from the sea inland. Such flow patterns are likely to cause much of the pollutants produced from within the Klang Valley to remain very much where they are.

Probably the single most important aspect which has been extensively examined in the study of urban climate in Malaysia is the changing forms and intensity of the heat island. Observations carried out over the last several years in the Klang Valley indicate that the commercial centres are usually several degrees warmer than the surrounding countryside (Sham 1973a & b, 1979, 1980). On the average, the mean annual temperature difference between the city and the airport was approximately 1-2^{o}C but under calm nights, the urban-rural temperature differential could go up to 6-7^{o}C (Sham 1984).

The effects of urbanization is not only confined to horizontal temperature but also extended in the vertical direction with far-reaching consequences. Overseas studies have shown that the thermal influence of a large city commonly extends up to 200-300m and even to 500 m and more (Oke 1974, 1976, 1979). When the warm air is advected by the wind, an urban "plume" in the downwind region is formed; in calm conditions, an urban "dome" may be created (Figure 2.3). Under the latter conditions, at night, the city can even create its own circulation with wind blowing from the cooler surrounding area into the warm city centre bringing with it plume from the outskirts into the city area. In both cases, these modified air layers are invariably being capped by an elevated inversion inhibiting upward dispersion of pollutants. To a limited extent, this mid-latitude finding has been verified in the Klang Valley study using both observed and standard meteorological data (Sham 1979).

The development of an "urban dome" and "urban plume" in the Klang Valley conurbation has a far-reaching effect not only on urban centres in the Klang Valley but also on the immediate urban centres and rural surroundings. If the spacing between cities is insufficient, their alignment with the wind may cause a cumulative pollution build-up. In view of the land-and sea-breeze effects noted earlier, this can be particularly significant in determining levels of air quality in the Klang Valley area. Here, as a result of rapid urbanization, urban centres of Kuala Lumpur, Petaling Jaya, Subang Jaya, Shah Alam, Klang and Port Klang are all conglomerated within a distance of 40 km of one another. In such a situation, the combined emissions from these urban centres may form into a giant plume affecting the surrounding area. In addition, the plume from one city can also become fumigated into the atmosphere of a second one downwind in a similar manner to those shown by Oke (1976).

Air Pollution and Haze

Of all the pollutants monitored, total suspended particulates appeared to be the one that posed the greatest problem. Since about 1989 and with the exception of 1993, its total annual concentration has always exceeded the 90 $\mu g\ m^{-3}$ level, the Malaysian Guidelines for Total Suspended Particulates (TSP). For certain parts of the year (normally in late August, September and October), the problem of air pollution may be compounded by the existence of the "haze". Due to the high concentration of population in the Klang Valley area, a lot more people are exposed to the excessively high level of air pollution; and especially for the aged, the very young children and those with bronchial and asthmatic problems, the situation can be both hazardous and, in some cases, critical to their survival.

Haze and "haze episodes" are not exactly new phenomena in the Klang Valley. Its occurences were already realised as early as the 1960s. However, the haze became a problem only relatively recently when it began to significantly affect visibility, disrupt air travel schedules and shipping, and aggravate health. The September 1982 haze and those of 1990 and 1996 attracted a great deal of public attention, disrupted traffic and posed health hazards. At its peak the August 1990 haze recorded suspended particulate levels exceeding 785 $\mu g\ m^{-3}$.

A more severe and prolonged "haze episode" occured during September and October this year (1997) and continued to persist at intervals until November. The main cause of the "haze episode" was basically the forest fires in Kalimantan and Sumatera involving some 300,000 hectares of land and the meteorological conditions prevailing at the time. In the latter case, the south west winds blew across Kalimantan and Sumatera bringing along with them the pollutants from the forest fires to Singapore and almost all parts of Malaysia. The episode was exacerbated by the fact that it coincided with the *El Nino* phenomenon which affected Indonesia and most of Southeast Asia at the time prolonging the dry season.

Samples of air pollution levels as indicated by the air pollution index (API) (Figure 2.4) taken during the haze period in September and October of 1997 for four urban centres in the Klang Valley are shown in Table 2.1. It is observed that all centres experienced "unhealthy" condition for more than 50% of the time; Kuala Lumpur had 69.4%, Petaling Jaya 57.2%, Klang 63.8% and Kajang 54.0%. For "very unhealthy" days, Kuala Lumpur had the highest share with 20.4%, Petaling Jaya 8.2%, Klang 4.2% and Kajang 4.0%. Kuala Lumpur also recorded 2.0% of days with "dangerous" API.

Gaseous emissions in the Klang Valley are generally low; the lead level in the atmosphere, for example, is now well under control. The annual concentration of SO_2 has been found to be generally low although there appeared to be a tendency for a slight increase for Kuala Lumpur during the 1994-96 period (DOE 1996).

Transport vehicles are the principal source of pollution. The DOE reported that in 1996, the Federal Territory of Kuala Lumpur had the highest vehicle population with close to 1.5 million registered vehicles. This did not include the number of vehicles entering the Federal Territory which was estimated at around 1.0 million daily. It is unlikely that the demand for transport use will be any lesser in the future. Efficient public transport system appears to be the only solution. Efforts to introduce the electric train commuter and the light rail transport (LRT) to ease traffic congestion in Kuala Lumpur and the Klang Valley have received tremendeous support from the public but obviously more efforts are needed before a long-term solution could be found.

Table 2.1: Percentage frequency of occurence of days with specific API categories for four urban centres in the Klang Valley during the haze period, Sept.-Oct. 1997.

API Category	Kuala Lumpur	Petaling Jaya	Klang	Kajang
Good (0-50)	0.0	8.2	4.2	20.0
Fair (51-100)	30.6	34.6	32.0	26.0
Unhealthy (101-200)	49.0	49.0	59.6	50.0
Very Unhealthy (201-300)	18.4	8.2	4.2	4.0
Dangerous (301-500)	2.0	0.0	0.0	0.0

Source: Calculated based on data from DOE

Noise

Studies conducted by the DOE (1996) on selected schools and hospitals in the Klang Valley indicate that the noise level exceeded 65 dB(A). The major sources were traffic and construction activities. The noise level at public places ranged from 65 dB(A) to 80 dB(A).

Water Resources

Apart from its influence on the atmosphere, urbanization also exerts a considerable pressure on water resources. Following rapid population growth and higher demands from the commercial and industrial sectors, the water supply system in Kuala Lumpur and the Klang Valley continues to be under strain. This can be further aggravated if prolonged drought similar to that of 1978 recurs (Sham 1994). During the 1978 drought, the rainfall in the catchment area was well below average for 10 months. In fact, for six consecutive months from May to October, the rainfall in the water catchment was only 71% of the average fall; the year as a whole received 21% less than what it received in a "normal" year.

In addition to pressures on water supply, urbanization (through changes in the physical surfaces) also affects the magnitude of surface runoff. Such effect is clearly illustrated by the runoff coefficients and percent imperviousness of surfaces. It is observed that the runoff coefficients of fully built-up areas range between 0.85 to 0.90 (indicating that nearly all storm rainfall will run off directly) while those of parks and forested areas range between 0.30 to 0.35 (Fricke and Lewis 1976; Douglas 1984). The degree of imperviousness for different urban land uses is also very significant in determining runoff. Here, the area used for terrace houses, for example, has a higher percentage of imperviousness (85%) as compared to those of semi-detached and detached bungalow houses (52% and 41% respectively) (Douglas 1984).

The implication of these altered relationships in the water balance equation is that runoff in the built-up area is more peaked and flashy than it otherwise is. This has given rise to an increased frequency of flash floods in urban centres. With more development in the Kuala Lumpur area, this is expected to be further aggravated.

Water Pollution

In urban areas as in Kuala Lumpur and the Klang Valley region, ill-managed construction sites can cause severe problems downstreams as the sediments generated tend to choke channels, raising their beds and reducing their ability to carry flood flows. For Sungai Klang and its tributaries, silting has long been a problem due to construction and other land clearing activities within the drainage basin. This has also affected the harbour area in Port Klang costing millions of ringgit for dredging works at the navigation channels.

Apart from pollution by siltation, water bodies in Kuala Lumpur and the Klang Valley area are also polluted with other forms of wastes. Needless to say, most of the pollutants discharged from industries and residential areas find their way to Sungai Klang. Major sources include wastes from agro-based industries, manufacturing, livestock farming and domestic wastes. It is not surprising therefore that Sungai Klang has been categorized as being among the most polluted rivers in the country both in terms of BOD and ammoniacal nitrogen (NH_3-N).

In addition, levels of heavy metals are also high in Sungai Klang. Levels of cadmium, iron, and mercury have all exceeded the standard for class III of the Interim National Water Quality Standard for Malaysia.[1]

Solid Wastes

Following increases in population, the volume of solid wastes in the Klang Valley area also increases. In Kuala Lumpur alone the solid waste generation was estimated to increase to 4000 tonnes/day by the year 2000.

[1] Water Supply Class III means extensive treatment required. Fishery III means common, of economic value, and tolerant species, livestock drinking.

Landfill and controlled tipping are the two commonly practised methods of waste disposal in the Klang Valley area. While this method is the least costly, it also has many disadvantages including contamination of underground water, odours, airborne dusts and flies especially when the land fills are not properly designed and managed. In addition, there is also the problem of finding suitable disposal sites for the future. Land within and around the Klang Valley is getting more scarce and more expensive by the day.

Household and municipal wastes and their disposal pose an enormous challenge to environmental managers in Kuala Lumpur and the Klang Valley. The increased volume of waste generation in the area calls for an efficient disposal system. A day lost in collection will lead to a piling up of these wastes and under the hot humid condition, the wastes decompose very rapidly, producing obnoxious odour and attracting flies and vermin. Some form of centralized incineration may have to be considered for future disposal of waste in the area. In the meantime perhaps separation of household wastes and recycling could be helpful to alleviate the problem of shortage of land for waste disposal and, of course, environmental degradation.

Squatters

One issue which is very often related to the problem of waste disposal in city areas is that of squatters. In Kuala Lumpur, squatter settlements were believed to have first emerged during the Economic Depression of the late twenties and early thirties (Frier-Simon and Khoo 1976). By 1970, the number of squatters in Kuala Lumpur was estimated to be about 103,370. The number subsequently increased to 243,154 in 1978 (Hairi 1987). Following efforts by the DBKL to resettle the squatters in low-cost flats, their number decreased to 220,055 in 1982 and to 156,151 in 1985 representing some 17% of the total population of Kuala Lumpur (DBKL 1985). However, while the number of squatters in Kuala Lumpur declined, that of other areas in the Klang Valley (Petaling Jaya, Gombak, Hulu Langat and Klang) showed an increase. It is unlikely that the squatter problem will be resolved in the near future. It will remain a significant feature of urbanization for sometime to come; in the meantime, a mechanism has to be found to manage the underserved area.

Environmental problems in the squatter areas are exacerbated by the fact that these areas are essentially unplanned with narrow streets and poor drainage and provided with only very limited amenities and other basic needs. Because squatter areas are generally underserved with public amenities, they invariably become potential sites for environmental degradation, fire, health and flood hazards. The last of these hazards is particularly frequent in the flood prone areas along the Sungai Klang and its tributaries.

CONCLUDING REMARKS

This chapter has attempted to highlight some of the major urban environmental issues in Kuala Lumpur, the Federal Capital of Malaysia, and the Klang Valley, the most urbanized and industrialized part of the country. Generally the chapter notes that while some of the environmental issues are specific only to Kuala Lumpur and the Klang Valley, many of them are common to almost all cities in Southeast Asia. The government has been taking various mitigating measures within its means to minimize the negative side-effects of urbanization and to enhance environmental quality, but the need to have a more systematic programme on the planning and management of the urban systems everywhere is all too obvious.

Figure 2.1: The Klang Valley showing generalised land use pattern and major roadways.

Figure 2.2 : Major urban centres making up the Klang Valley conurbation.

Figure 2.3: Schematic representation of the form of the air layer mofified by a city (a) with steady regional airflow (b) in calm condition (Oke 1976).

Figure 2.4: The air pollution index (API) is derived based on 5 air pollutants - SO_2, O_3, CO, NO_2 and PM_{10}. For PM_{10} and SO_2, the mean concentration is averaged for an hour after 24 hours exposure. For CO, the one-hour reading is taken after 8 hours exposure and for O_3 and NO_2 the readings are taken after one hour exposure each. Indices for each of the pollutants are then computed; the highest index recorded is taken as the API reading (Che Asmah 1997).