



8.1 Introduction

The quality of the air affects human health, the appearance and value of property, and the vigour of natural communities. Air pollution can be pervasive, and is often unseen and not smelled. These 'undetected' components are often hazardous to human health.

Up until the recent past air pollution was not considered a major concern in Barbados, owing to the relatively low elevation of the island and the continuous sweep of the Northeast Trade winds. In recent years, however, there has been growing concern about ambient air quality as the island has continued to develop and associated activities intensified. Increases in vehicular traffic, industrial activity and the incidence of Sahara dust have become the sources of growing concern about the quality of the air and its possible linkage to certain health problems on the island.

8.2 Sources of Air Pollution

Several types of air pollution have been reported including particulate, odours associated with gaseous emissions, and smoke¹. However, no routine monitoring programmes have been established. One pilot monitoring study was set up in 1994, but has since then been discontinued².

8.2.1 Particulate

A significant contributor to atmospheric pollution is Sahara dust, which has a strong, visible background signature during the spring and summer months. Brought to Barbados by the Trade Winds, this is an area over which there can be no local control and which has not been studied, although a privately managed monitoring station is known to exist at Ragged Point in St. Philip. Areas for which there can be control are: particulate emissions; from construction sites; quarry operations; cane fires; the burning of refuse, including garden waste; vehicular emissions, and certain industrial operations such as auto-body shops and cement works.

8.2.2 Odours

The primary sources of odours have been the Mangrove Landfill; garbage collection trucks; sites of unauthorised disposal of animal and other organ-

ic waste in drainage suckwells, gullies and roadsides; vehicular exhaust, industrial stacks and aircraft, particularly during take-off.

8.2.3 Smoke

This is largely associated with other source problems including cane fires, vehicular exhaust, industrial stacks, aircraft, and the burning of refuse both within and outside landfills. Heavy industry can frequently be a source of air pollution as well.

Stationary sources of air pollution have been measured primarily with respect to the operations of the Barbados Light and Power Company Ltd. (BL&P). The Environmental Management Plan cites a 1994 Pan American Health Organization (PAHO) study which reports that the total BL&P emissions for 1992 were 4 590 tons of sulphur dioxide, 1 716 tons of nitrous oxide, and 373 tons of particulate. The study considered that the oil refinery, and industrial, commercial and residential heating sources were potentially significant contributors to emissions. A number of other concerns were also added, including silicate processing and flour and feed blending plants which emit particulates, as well as asphalt, concrete block and rum production factories, which emit sulphur dioxide, nitrogen dioxide and particulates.

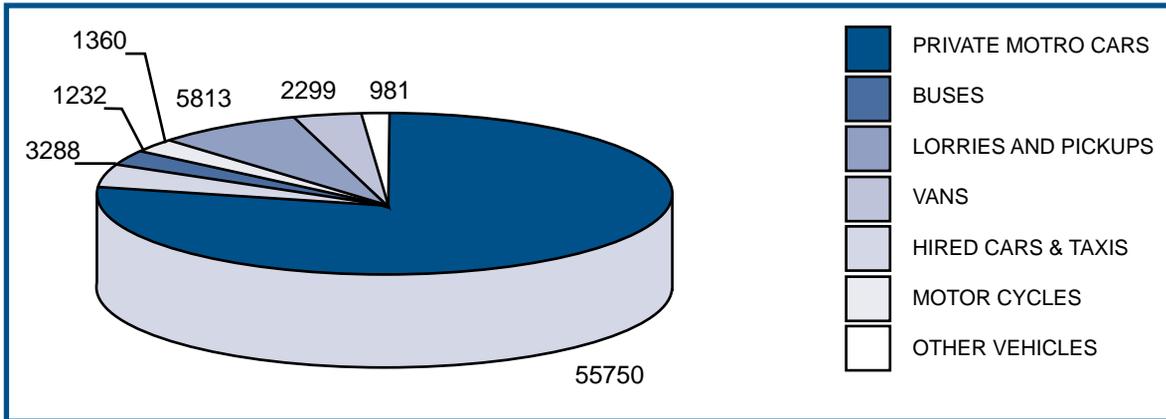
With respect to mobile sources, vehicular traffic on the island has been increasing steadily since the 1960s. Data from the Barbados Licensing Authority shows that the number of registered vehicles increased from around 17 000 in 1967 to approximately 34 000 in 1980, and from just under 40 000 in 1984 to about 57 000 in 1996³. Data for June 1999 gave a total of 73 723 registered motor vehicles on the island, an average of about one per 3.6 persons in the population. Figure 8.1 gives a breakdown of the vehicles by type for 1999⁴.

The PAHO (1994) report on air quality estimated that emissions from vehicular traffic annually contributed 9,302 tonnes of hydro-carbons, 49,680 tonnes of carbon monoxide, 2,413 tonnes of nitrogen oxides and 50 tonnes of lead to the atmosphere.

8.3 Impacts of Air Pollution

The impacts of air pollution depend on local factors relative to sources. It is recognized that in many areas of the island the persistent easterly

Figure 8.1: Registered Motor Vehicles 1999



Source: Barbados Licensing Authority.

trade winds tend to assist in the rapid dispersion of pollutants⁵. It should be noted, however, that the trade winds can also spread smoke and particulate matter from cane fires and quarry operations westward to the more densely populated areas.

The central Bridgetown area, with its dense road and housing systems and the confounding effects of buildings, is considered to be an area of high ambient concentrations of pollution, especially from vehicular traffic⁶. In addition, except for the incinerator at the Queen Elizabeth Hospital, the large stationary sources of stack emissions are generally located on the windward coast, where advantage is taken of the offshore breeze. However, calm or onshore winds are known to retain and bring pollution from such sources onshore⁷.

While studies worldwide have linked the types of pollutants mentioned to human health problems, no studies have been conducted or data exist to establish such linkages locally. Anecdotal reports suggest that the incidence of respiratory symptoms has increased in recent years. The rate of asthma, for example, is believed to be high by international standards. Establishing causes, however, is complicated by the range of factors that might be involved, including pollen, seasonal Sahara dust and indoor pollutants⁸.

8.4 The Policy Response

There is clearly a dire need for reliable information in this area and on ambient air quality parameters in

general, so that appropriate policies and management procedures can be developed.

The agency with the general mandate to monitor and control air quality in Barbados is the Environmental Engineering Division (EED) of the Ministry of Physical Development and Environment. In 1993 the Division conducted air pollution monitoring at the Grantley Adams Airport and in the vicinity of the Barbados Light and Power Plant. It also set up a pilot monitoring study in 1994, which has since then been discontinued. The Division has been directed to implement a systematic and ongoing programme of air quality monitoring, but has suffered from the persistent problem of insufficient capacity.

The 1992 Coastal Conservation Institutional Strengthening study and the more recent 1998 EMLUP study both made recommendations for capacity building of the EED to enable it to carry out this important work in area of air quality management and control. The EMLUP study recommends its restructuring to become the Environmental Protection Unit (EPU) within the Ministry responsible for environmental management, and supporting legislation has been prepared within the Draft Environmental Management Act.

The draft Environmental Management Plan also details an air quality monitoring programme to be implemented by the EED or proposed EPU. The programme is designed to provide data on ambient air quality that could be used to⁹:

- Determine the nature, extent and trends of air pollution in Barbados;
- Assist in determining appropriate standards for air quality and emissions;
- Support research on effects of air pollution on health, property and vegetation, and
- Provide a measure of the effectiveness of air pollution abatement activities, including the phase out of lead in the environment.

Several sites have been proposed for the initial phase of the programme, which also allows for expansion to include additional sites, including specific sources such as factories and emission stacks, utilities, quarries and landfill sites. Implementation was envisaged to occur throughout 1998, but it appears not yet to have started.

It seems at this point that strengthening of the EED is a necessary prerequisite for addressing air quality issues in Barbados.

8.5 Climate Change

The term "climate" is used in this section to refer to the phenomenon of climate change caused by accelerated warming of the earth's atmosphere due to increased concentrations of greenhouse gases. It encompasses the implications of climate change on the natural and built environment both as a result of natural fluctuations in climatic parameters such as the intensity, duration and frequency of weather phenomena, and through changes brought by human activity.

The international scientific consensus is that human beings have changed, and continue to change the balance of gases that form the atmosphere, particularly the "greenhouse gases" which include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These greenhouse gases are vital to maintaining life on the earth, because they act as a blanket that prevents excessive cooling of the earth's atmosphere. The problem is that human activity such as the burning of fossil fuels and the destruction of forests, releases huge amounts of carbon dioxide into the air. Such human activity has increased dramatically since the industrial revolution. The result is a warming of

the earth's atmosphere at a rate never before experienced in the history of the planet. This is expected to change wind and rainfall patterns that have prevailed for thousands of years, thereby affecting weather patterns and agriculture, and cause sea-level to rise.

Barbados and other small island developing countries are very concerned about the potential impacts of climate change, which include:

- Acceleration in the rate of change of mean sea level with associated possibilities for increased coastal flooding and shoreline instability; and
- Possible changes in weather patterns, including the potential for increases in the intensity and frequency of tropical storms and hurricanes, and in precipitation patterns, with potential impacts on agriculture and on groundwater recharge and public water supply.

It is widely postulated that some effects could be quite dislocating for the inhabitants of many small islands. Various socio-economic sectors, including tourism, infrastructure, agriculture, water resources, and human health - all of which are sensitive to fluctuations in rainfall, temperature, and sea level - could also be negatively affected¹⁰.

8.6 Policy Response to Climate Change

Response to the problem of climate change takes the form of mitigation and/or adaptation strategies. There is very little that small island countries can do by way of mitigation, since their contribution to global greenhouse gas emissions is quite small. Barbados' per capita CO₂ emissions trends since 1970 are shown in figure 8.2 . In fact, in 1996 the average per capita emissions for 32 island countries that are members of the Alliance of Small Island States (AOSIS), was 0.9 metric tons of CO₂ equivalent, compared to 6 tons per capita for most developed countries and over 19 tons per capita in the case of the USA.

The emphasis for island countries with respect to domestic policy has to be adaptation. In this regard, Barbados is already well advanced in terms of both the analysis of coastal impacts and in the preparation of an institutional and planning frame-

work for Coastal Zone Management. In the last two decades Barbados has undertaken three major coastal zone management projects - 1983-84, 1991-95 and 1996-98 - with assistance from the Inter-American Development Bank. These projects, which have included coastal vulnerability analyses, have culminated in a Coastal Zone Management Plan for the entire coastline. Design standards for coastal structures and setbacks have been developed, taking into account assumed future changes in sea level, flooding associated with 50-year and 100-year storm events and, in the case of setbacks, projections for shoreline erosion. Setback policies are also incorporated into the Physical Development Plan (1998)¹².

In addition, at the regional level Barbados is participating in the GEF-funded project: Caribbean Planning for Adaptation to Climate Change. Barbados is the site of a pilot study on Coastal Vulnerability and Risk Assessment, in which the Coastal Management Unit (CZMU) is responsible for monitoring sea level changes around the island. Three tidal gauges digitally record tidal data which is analysed by the CZMU. This data is also regularly submitted to the Permanent Service for Mean Sea level (PMSL) and the Tropical Ocean Global Atmospheric Project (TOGA).

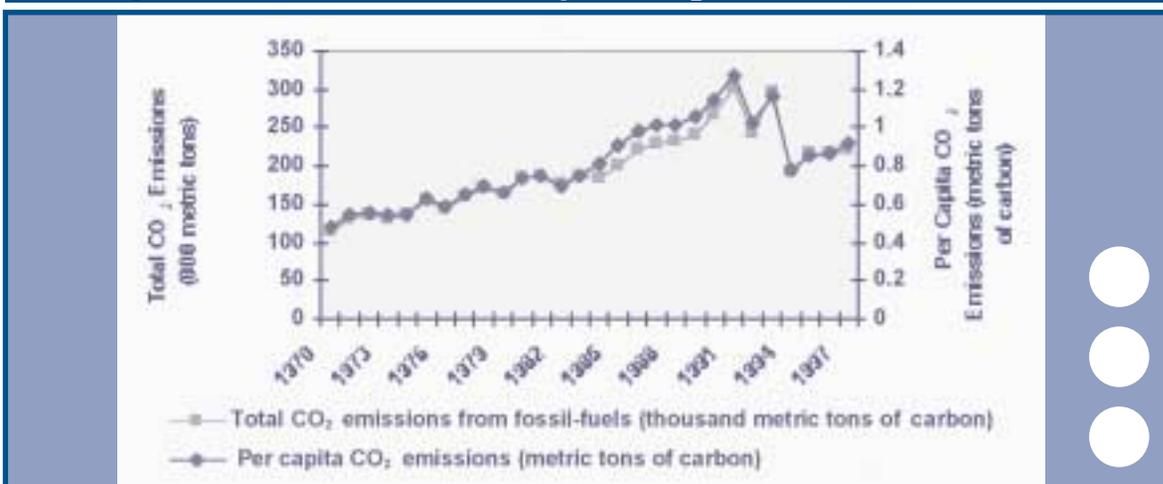
A Global Positioning System (GPS) has also been installed and calibrated at the CZMU headquarters. As a participant in the Global Level of Sea Surface (GLOSS) programme which coordinates global monitoring of the sea surface, the GPS data is submitted to the US National Oceanic and Atmospheric Association (NOAA) for processing.

At the international level, Barbados has ratified the United Nations Framework Convention on Climate Change (FCCC), and is an active member of the Intergovernmental Panel on Climate Change (IPCC). Barbados participates regularly in the Conferences of the Parties to the FCCC and its subsidiary bodies, and does its part to keep the international community focused on adopting policies that lead to the real and concrete reduction of global greenhouse gas emissions.

8.7 Conclusion

The subject of atmosphere and climate change is, logically, a two-level one: a local issue - atmospheric pollution, and a global issue - climate change. On the former it is clear that, given the pace of physical and socio-economic development of the country, clean air can no longer be assured by natural processes alone. It is timely that implementation of the recommendations of studies on the subject be actively considered. On the global

Figure 8.2: Total and Per Capita CO₂ Emissions 1970 - 1997



Source: Oak Ridge National Laboratory, Carbon Dioxide Data Analysis Center, 1999.

issue of climate change, the key challenge for island countries like Barbados is to devise a strategy to pressure larger emitters to effectively reduce their emissions. For, with the large emitters so heavily focused on least-cost, market-based approaches to stemming global warming due to climate change, actions that will halt the impacts of sea level rise are, in effect, delayed. This means that Barbados must plan to raise funds to meet adaptation costs, which at present are estimated to be beyond the capacity of the national budgets of island countries.



Notes

1. Willms and Shier, 1998a: *Environmental and Natural Resources Management Plan*. Prepared for the Government of Barbados as part of the EMLUP studies.
2. Caribbean Development Bank, 1996: "Environmental Indicators for Barbados". A pilot study conducted as part of the UN Commission on Sustainable Development's Environmental Indicators Programme.
3. Ibid.
4. Barbados Licensing Authority
5. See 1 above.
6. Willms and Shier, 1998a: *Environmental and Natural Resources Management Plan*, citing PAHO 1994.
7. See 1 above.
8. See 2 above.
9. See 1 above.
10. IPCC 2001. *Special Report on The Regional Impacts of Climate Change: An Assessment of Vulnerability*. Chapter (9) on Small Island States.
11. Source: Oak Ridge National Laboratory, Carbon Dioxide Data Analysis Center. 1999. "National CO2 Emissions from Fossil-fuel Burning, Cement Manufacturing [omitted for this report], and Gas Flaring." Available at <http://cdiac.esd.ornl.gov/ftp/ndp030/nation96.ems>.
12. see 1 above