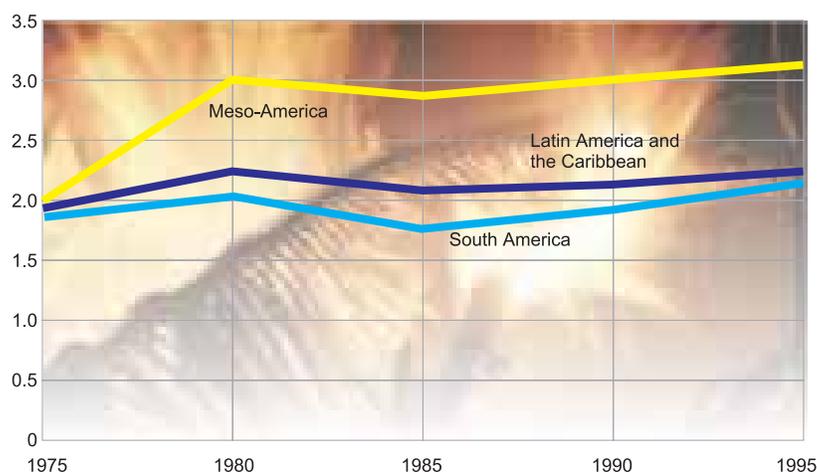


Upper air and ozone

Internationally there is now a much greater understanding of the interconnections between atmospheric issues such as local air pollution, acid rain, global climate change and atmospheric ozone depletion. It is also now understood that an isolated response to one environmental issue may, in fact, exacerbate others.

In Latin America and the Caribbean, the main source of atmospheric emissions is deforestation, particularly in the Amazon Basin (UNEP 1999a). Some parts of the region also face air pollution problems as result of industrial development and urban growth. This, in fact, could worsen as a result of the deregulation and privatization of the power sector. For example, in countries like Argentina, Brazil and Colombia, this could lead to reduced use of biomass and hydroelectric power, and to increased use of fossil fuels (Rosa *et al.* 1996).

Carbon dioxide emissions per capita 1975 - 1995 (tonnes/year)



Note: data for the Caribbean are unreliable

Source: compiled by UNEP GRID Geneva, from WRI, UNEP, UNDP, and WB 1998 and CDIAC 1998.

Greenhouse effect gases

Reliable information with which to prepare inventories of greenhouse gas emissions is difficult to obtain in most countries of the region. Few specific emission factors have been identified for specific regions or systems; the forest status and land use changes are difficult to characterize; and data are either totally non-existent or derived from related statistics or even from anecdotal evidence. There is also a general absence of monitoring infrastructure, except in some large metropolitan areas.

Per capita emissions of carbon dioxide are well below the 12 tonnes estimated for the high-income economies, and also below the world average of 4.0 tonnes.

Trends depicted by existing inventories, either complete (Argentina, Virgin Islands,

Air pollution due to energy use in Chile

Man-made air pollution is caused mainly by the use of fossil fuels to generate electrical power, by changes in land use, deforestation and agriculture, and by diverse industrial activities. At the global scale, carbon dioxide is one of the main pollutants – estimated to be responsible for around 60 per cent of the global warming attributable to the 'greenhouse effect' caused by human activities. Some estimates indicate that 85 per cent of anthropogenic emissions of this gas come from industrial processes while the rest is due to changes in land use.

Even though it is estimated that in South America as a whole the main source of carbon dioxide emissions is deforestation, there are no data available to support this statement in the case of Chile. However, a recent study carried out in that country sheds some light on the emission of pollutants from combustion of fossil materials. As shown in the accompanying graphs, based on 1994 data, combustion of crude oil is responsible for 64 per cent of carbon dioxide emissions originating from energy use. In relation to the role of the energy consumer sector, it is estimated that transportation generates 36 per cent of carbon dioxide emissions, followed by the manufacturing and construction industries and the energy industry (26 per cent and 24 per cent of emissions respectively).

Total carbon dioxide emissions due to the burning of fossil fuels in Chile are similar to those of countries such as Estonia, Lithuania and Norway, which oscillate –according to 1990 estimates– between 35 and 39 million tonnes per year. However, per capita emissions are considerably lower: 2.45 tonnes per year for Chile compared to 8.26 tonnes per year for Norway, for example. As an average, yearly per capita emissions for 1995 were higher in North America (19.93 tonnes) and Europe and Central Asia (7.93 tonnes), than for Latin America and the Caribbean (2.55 tonnes.)

Air pollutant emissions from energy use by emission sectors (in thousands of tonnes)

Sector	Carbon dioxide (CO ₂)	Carbon monoxide (CO)	Methane (CH ₄)	Nitrogen oxides (NO _x)	Nitrous oxides (N ₂ O)	Non-methane volatile organic compounds (NMVOC)	Sulphur dioxide (SO ₂)
Energy industry	8 439.8	3.0	0.2	25.7	0.1	0.6	58.8
Manufacturing and construction industries	9 255.2	32.8	1.6	38.8	0.2	2.7	48.5
Transportation	12 695.3	378.3	2.1	77.7	1.1	74.2	6.1
Commercial, institutional and residential	4049.6	464.5	28.9	14.9	0.4	55.7	27.8
Agriculture, forestry and fisheries	787.1	6.0	0.7	4.6	0.0	1.1	5.0
Fugitive sources	0.7	40.7	0.4		13.2	6.8	
Total	35 227.0	885.2	74.1	161.9	1.7	147.5	153.0

Source: UNFCCC Secretariat 2000; PRIEN-CONAMA 1999; UNEP 1999a.

Carbon dioxide emissions from energy use by type of fuel (in thousands of tonnes)

Fuel	Emissions*
Liquid fossil fuels:	23 673.1
Crude oil:	22 630.1
Others:	1 043.0
Solid fossil fuels:	7 788.4
Gaseous fossil fuels: (natural gas)	3 930.7
Total	35 392.2

* In thousands of tonnes.

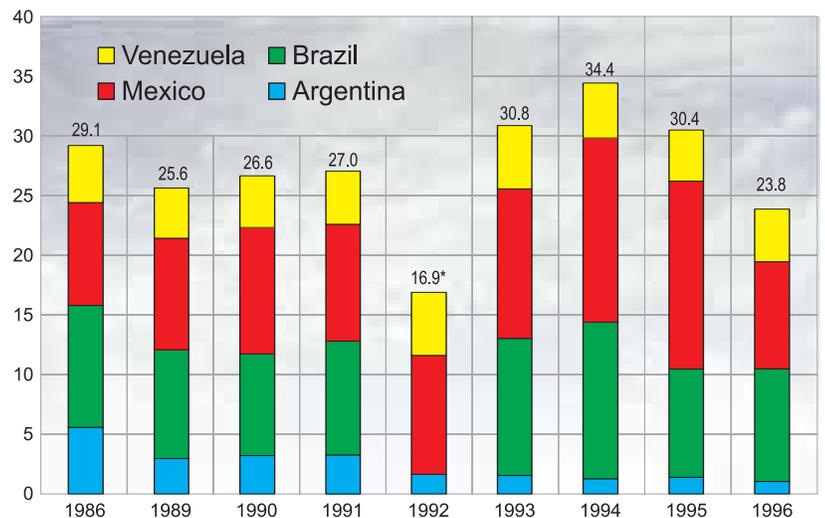
Puerto Rico, Uruguay) or preliminary (Chile, Costa Rica, Mexico, Trinidad, Venezuela), suggest that more than 50 per cent of the emissions result from industrial production and power generation. In the Caribbean, emissions are caused mainly by oil refineries, but also significant are those resulting from mining activities. Transcontinental dispersion of suspended particles between Africa and the Caribbean has also been recorded. However, in Brazil and Chile the gross emission of greenhouse gases due to power generation is considerably lower than that caused by deforestation, changes in land use and agriculture (Bonduki *et al.* 1995).

The region is responsible for 4.3 per cent of the total global emissions of carbon dioxide by industrial processes, and for 48.3 per cent of emissions caused by land use changes. Anthropogenic methane emissions represent 9.3 per cent of the world total. The mean per capita carbon dioxide emission in 1995 was 2.55 tonnes – way below the 11.9 tonnes calculated for high-income economies (19.93 tonnes for North America, 7.93 for Europe and Central Asia, 7.35 for West Asia) and also below the world average of 4.0 tonnes (CDIAC 1998).

The main cause of anthropogenic emissions is deforestation, and the Amazon region is an important source of methane and nitrogen oxides. The conversion of primary tropical forests to agriculture and to secondary growth has produced great changes around the globe. In the Amazon Basin, encompassing almost 7 million square kilometres, biomass combustion and the introduction of new types of green cover will have significant ecological implications for the region, the continent and the whole planet (LBA 1996).

Because of the renewable energy sources in the region, and the potential of many forest conservation and reforestation programmes to provide valuable carbon sinks, many countries might be able to decrease their carbon emissions. Using ethanol as a gasoline substitute, for example, can reduce carbon dioxide emissions. However, although a significant proportion of the power in the region is hydroelectric (see ‘Energy’ section), the deregulation and privatization of power generation could increase emissions since market forces will most likely not favour biomass and water power.

CFC production in Latin America and the Caribbean, for the four main producing countries, 1986-1996
(thousands of tonnes multiplied by the ozone depleting potential)



Source: UNEP Ozone Secretariat, 1999.

* There are no 1992 data for Brazil.

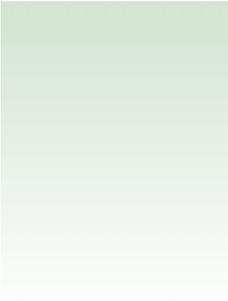
For the Caribbean specifically it is worth noting that despite its small contribution to regional carbon emissions, and even smaller contribution to global emissions, this sub-region will probably experience the consequences of climate change before many other regions. A rise in sea level, for example, will profoundly affect the small island states.

CFCs production in the region is around 14.9 per cent of global production.

Ozone-depleting substances

Global consumption of chlorofluorocarbons (CFCs) – the most widespread ozone-depleting substances (ODSs) – dropped from 1.1 million tonnes in 1986 to 160 000 tonnes in 1996 thanks to their almost complete elimination in industrialized nations (UNEP 1999a). If the reductions foreseen in the Montreal Protocol continue, the concentration of these substances in the atmosphere will have reached its highest point in 1997 and 1999, and will decrease during the next century (as is already occurring in mid latitudes).

Reducing production of these substances is now an important task for developing nations, where production more than doubled in the period 1986 to 1996 and where consumption increased by 10 per cent. At the same time, the virtual elimination of CFCs in industrialized countries is now being compromised by a rise in the illegal trade in these substances, estimated to be running at 20 000 to 30 000 tonnes per year (UNEP 1999a).



Among the developing countries that produce CFCs are Brazil, China, India, Republic of Korea, Mexico and Venezuela. In Latin America and the Caribbean, production represented 14.9 per cent of world production in 1996.