

XVIII IEA WORLD CONGRESS OF EPIDEMIOLOGY
VII BRAZILIAN CONGRESS OF EPIDEMIOLOGY

EPIDEMIOLOGY IN THE CONSTRUCTION OF HEALTH FOR ALL:
TOOLS FOR A CHANGING WORLD

XVIII CONGRESSO MUNDIAL DE EPIDEMIOLOGIA
VII CONGRESSO BRASILEIRO DE EPIDEMIOLOGIA

EPIDEMIOLOGIA NA CONSTRUÇÃO DA SAÚDE PARA TODOS:
MÉTODOS PARA UM MUNDO EM TRANSFORMAÇÃO

Porto Alegre – 20 to 24 September 2008

Climate change and health

Mudanças climáticas e saúde

Carlos Corvalan - PAHO

Chistovam Barcellos - Fiocruz

Carlos Nobre - INPE

Nelson Gouveia - DMP-FMUSP

Climate change and health

"Energy crisis: health and climate impacts"



Nelson Gouveia
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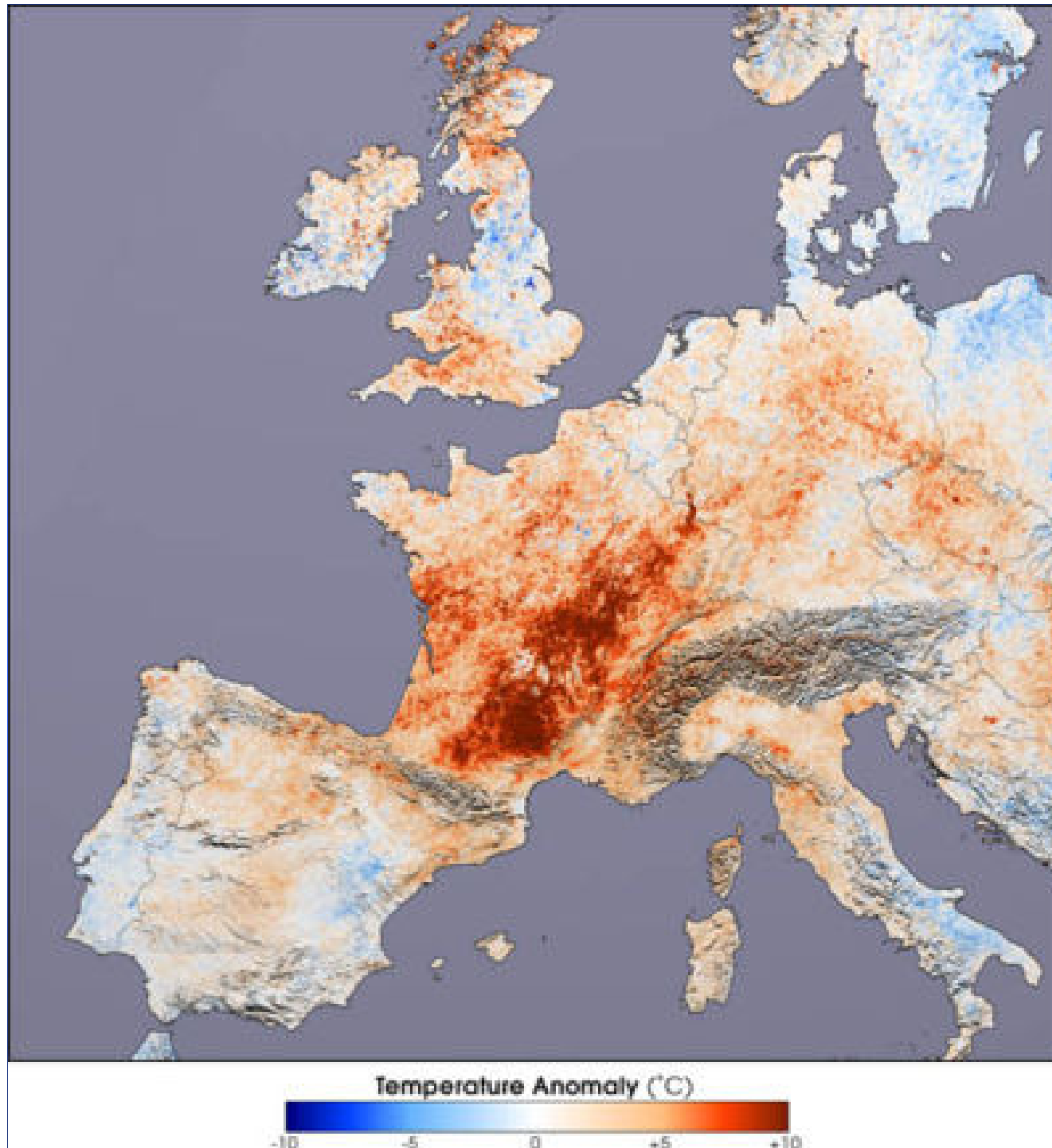
2003 heat wave in Europe

excess deaths:

France - 14,802

UK - 2,139

Italy - 1,094

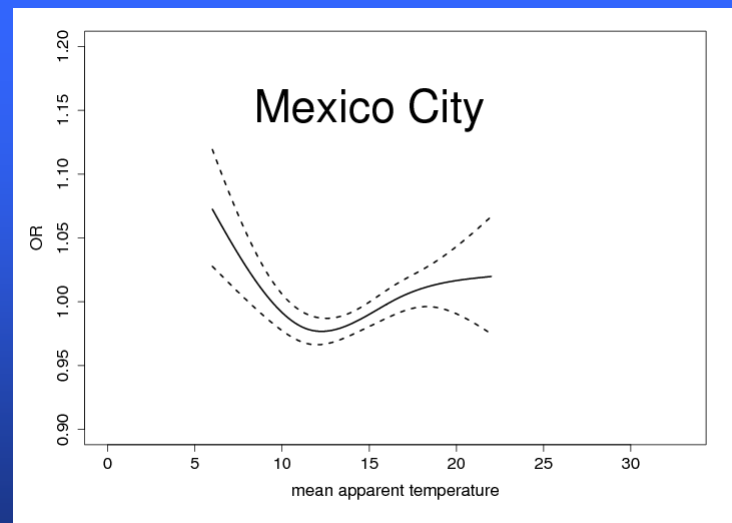
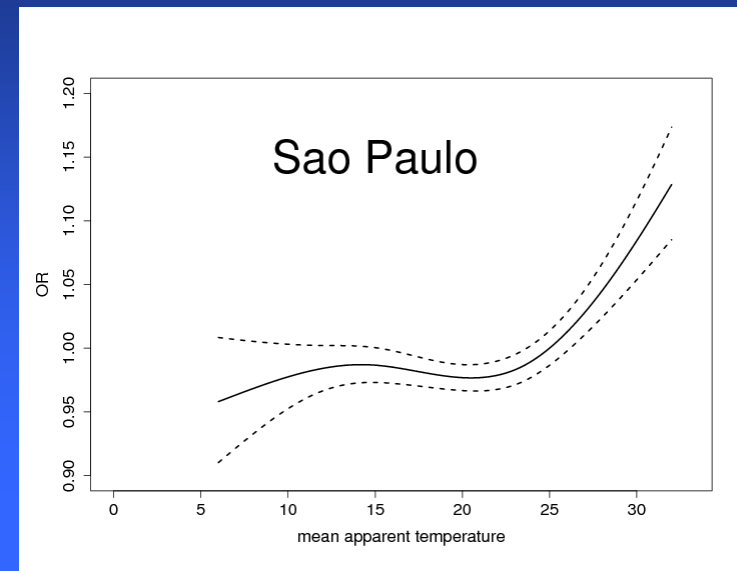
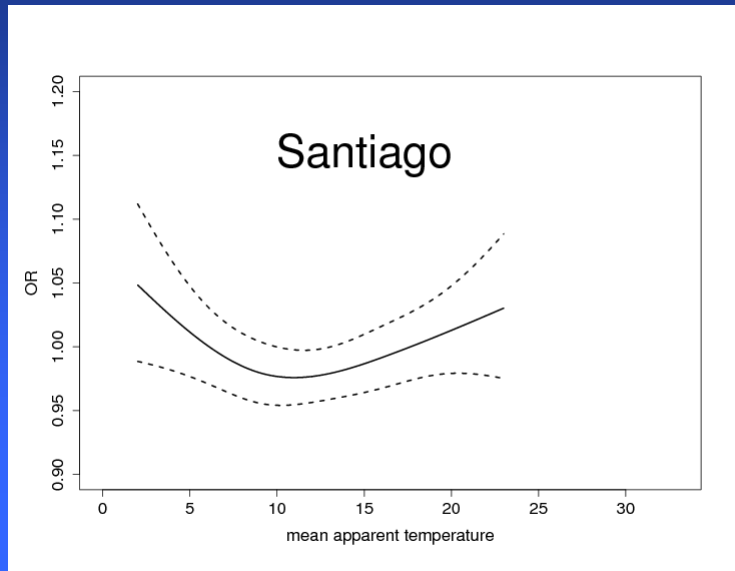


- Understand differences in population susceptibility
- Assess population adaptation to climate change
- Understand the nature of vulnerable populations

Table 2 Threshold and slopes of temperature-mortality relationships

City	Threshold (°C) with 95% CI		Percentage increase in mortality for each °C decrease in temperature below 'cold threshold' (95% CI) ^c	Percentage increase in mortality for each °C increase in temperature above 'heat threshold' (95% CI) ^c
	Lower (cold ^a)	Upper (heat ^b)		
Ljubljana	17 (7–20)	17 (7–20)	0.43 (–0.78 to 1.65)	3.12 (1.26–5.02)
Bucharest	22 (20–22)	22 (20–22)	0.85 (0.44–1.25)	3.30 (2.35–4.26)
Sofia	16 (15–17)	16 (15–17)	0.93 (0.37–1.49)	2.88 (2.11–3.65)
Delhi	19 (–39) ^d	29 (8–30)	2.78 (0.66–4.94)	3.94 (2.80–5.08)
Monterrey	17 (13–19)	31 (31–33)	4.70 (3.04–6.40)	18.8 (13.0–25.0) ^e
Mexico City	15 (14–15)	18 (8–21)	6.90 (5.70–8.11)	0.77 (0.14–1.39)
Chiang Mai	19 (–20) ^d	28 (17–) ^d	84.3 (48.1–129) ^e	2.39 (–0.49 to 5.35)
Bangkok	29 (29–30)	29 (29–30)	4.09 (1.27–6.98)	5.78 (3.52–8.09)
Salvador	23 (–30) ^d	23 (20–27)	–12.8 (–34.7 to 16.4)	2.48 (0.93–4.05)
São Paulo	21 (18–22)	23 (19–23)	2.47 (1.78–3.16)	3.46 (2.62–4.31)
Santiago	16 (14–20)	16 (14–20)	2.53 (1.44–3.62)	1.04 (0.28–1.81)
Cape Town	17 (15–22)	17 (15–22)	3.82 (2.08–5.60)	0.47 (–0.31 to 1.24)

Exposure-response curves for mean apparent temperature and risk of mortality



Percent increase in risk of mortality at the 95th percentile of mean apparent temperature compared to the 75th percentile (95% confidence interval) by sex, age, and educational attainment

	Santiago	São Paulo	Mexico City
<i>Sex</i>			
Male	1.98 (-3.42, 7.68)	4.59 (1.76, 7.50)	0.78 (-1.54, 3.15)
Female	1.65 (-3.90, 7.50)	4.25 (1.25, 7.34)	1.75 (-0.57, 4.13)
<i>Education (>21 years)</i>			
None	0.58 (-16.00, 20.34)	7.45 (0.78, 14.56)	1.30(-2.86, 5.64)
Primary	2.15 (-3.16, 7.76)	6.01 (2.70, 9.43)	1.81 (-1.50, 5.23)
Secondary	7.11 (-4.25, 19.83)	4.67 (-2.29, 12.13)	1.29 (-1.34, 3.98)
University	1.04 (-6.64, 9.36)	5.28 (-3.16, 14.45)	5.50 (-0.82, 12.21)
<i>Age</i>			
0 to 15 years	-7.65 (-23.92, 12.10)	-0.82 (-6.44, 5.13)	-2.53 (-7.17, 2.33)
16 to 64 years	1.10 (-5.80, 8.53)	3.32 (-0.05, 6.80)	-0.34 (-3.06, 2.46)
≥65 years	2.69 (-2.06, 7.88)	6.51 (3.57, 9.52)	3.22 (0.93, 5.57)

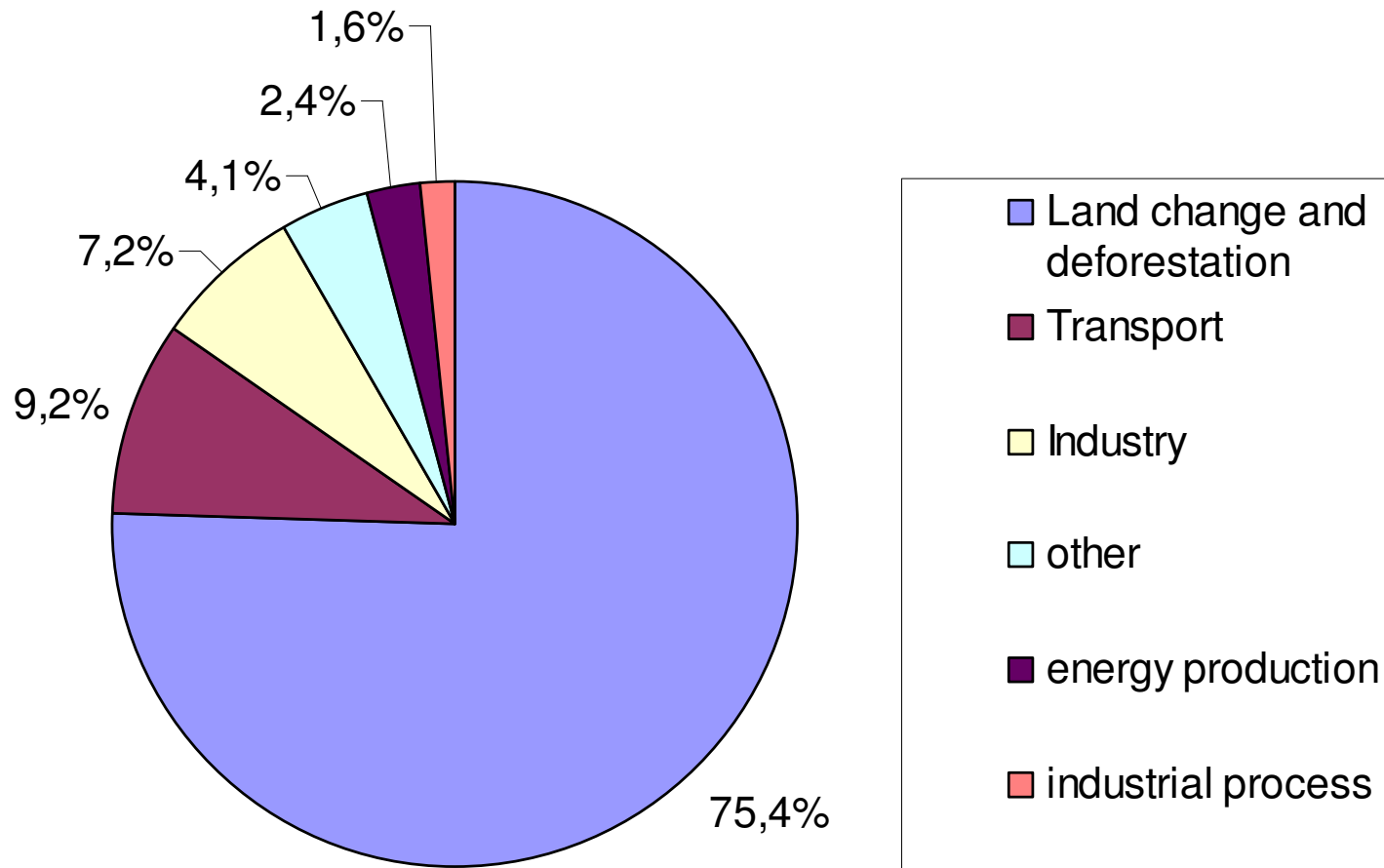
Total GHG Emissions in 2000

(includes land use change)

country	BillionTCO ₂	% of world total
USA	5.4	15.9
European Union (25 countries)	3.8	11.3
China	3.4	9.9
Indonesia	2.9	8.4
Brazil	1.7	5.0
Russian Federation	1.6	4.7
Japan	1.3	3.7
India	1.0	2.9
Germany	0.86	2.5
Malaysia	0.82	2.4

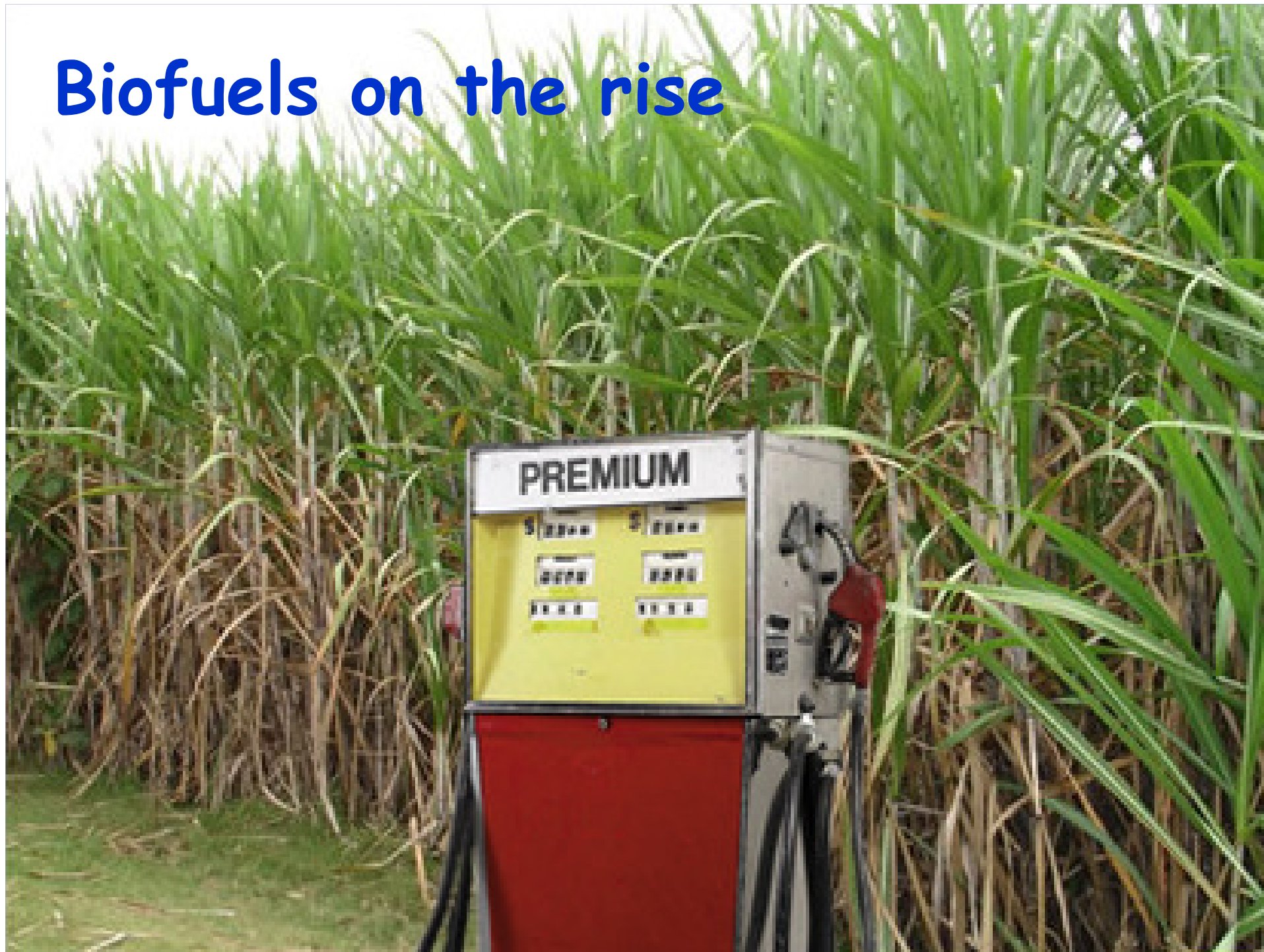
Source: The Climate Analysis Indicators Tool - CAIT
World Resources Institute

CO₂ Emissions in Brazil, by sector



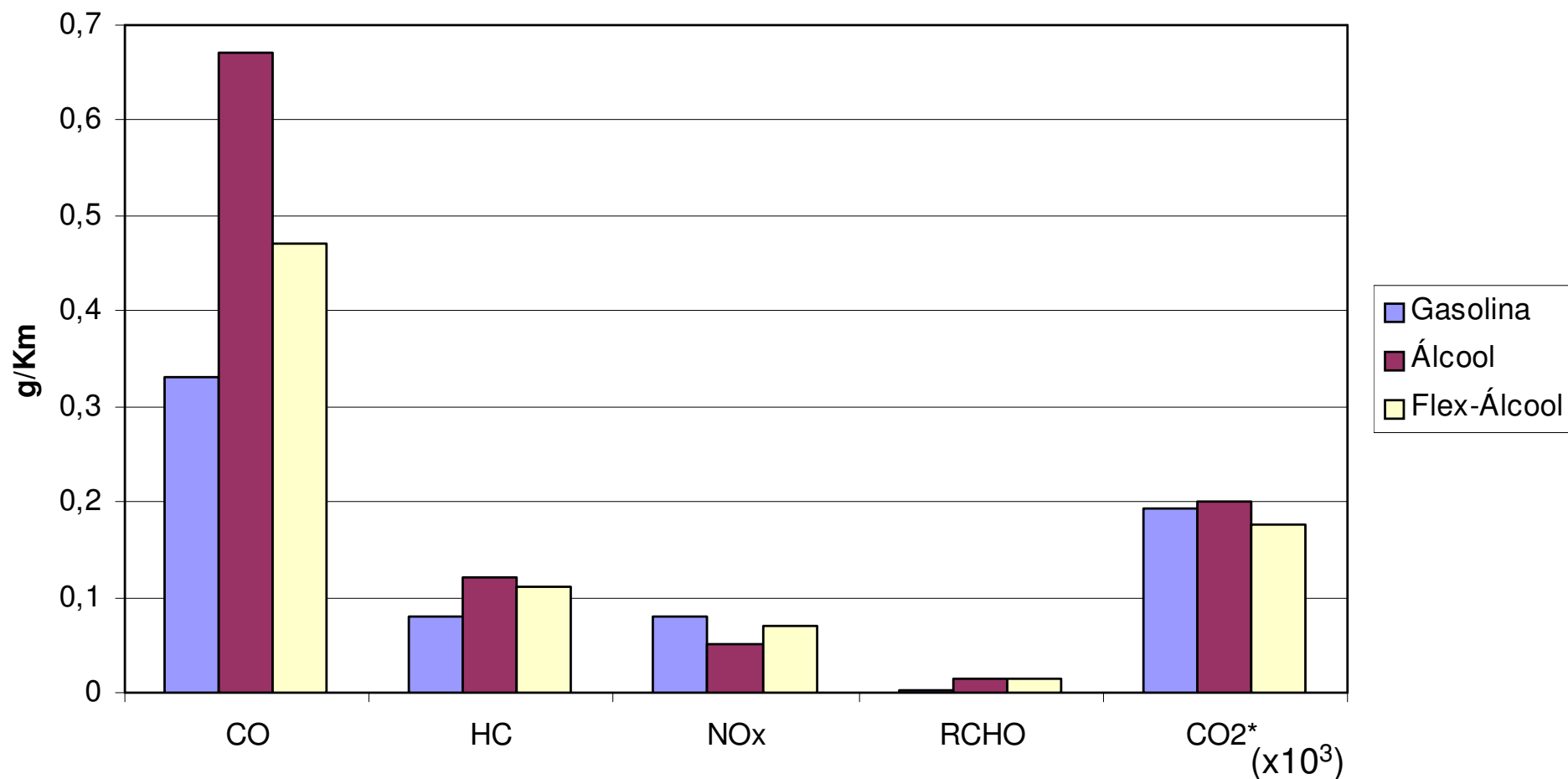
Source: Inventário de Emissões, Ministério de Ciência e Tecnologia, 2006

Biofuels on the rise



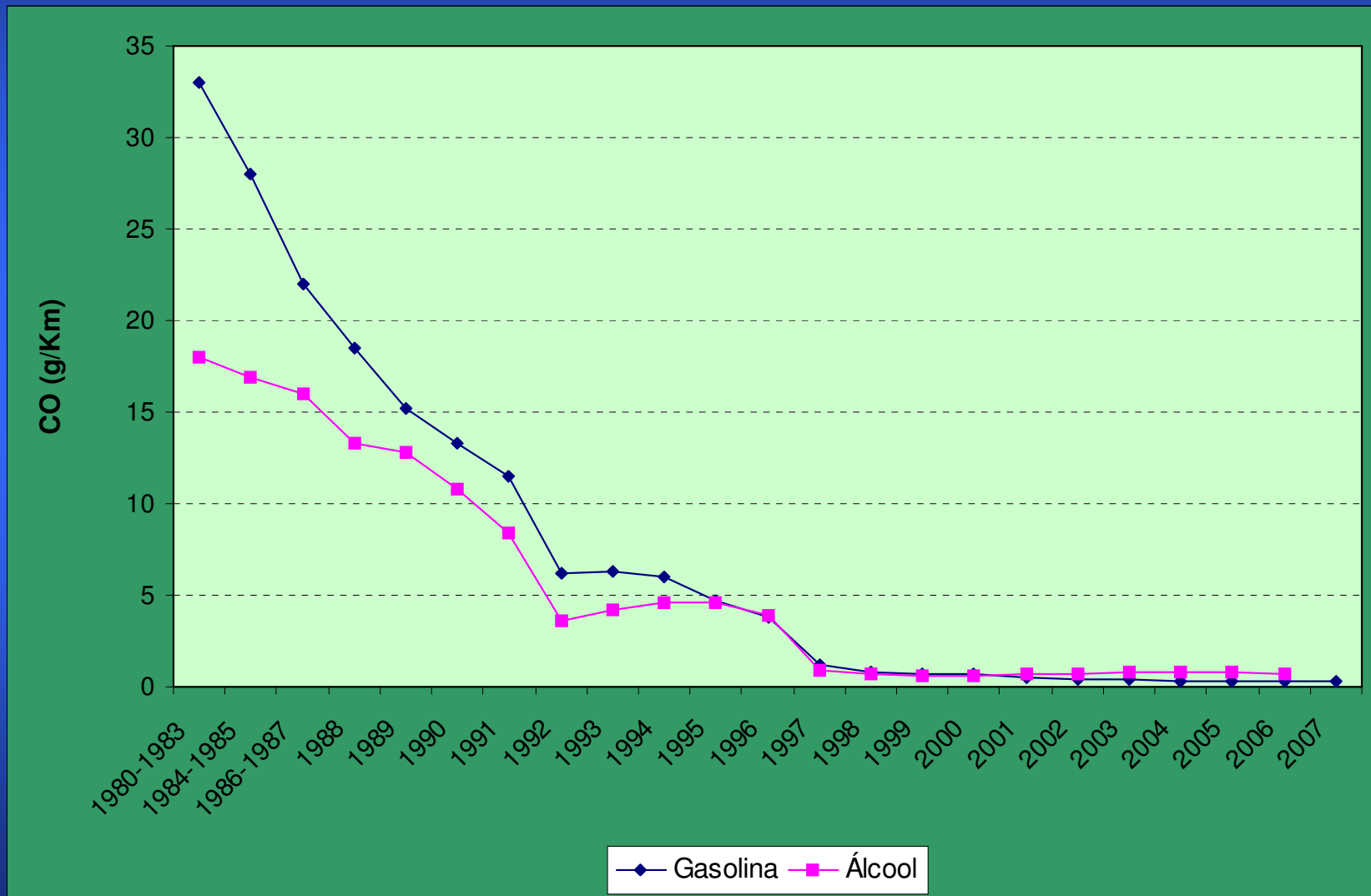


Emission factors for new vehicles, Brazil, 2006



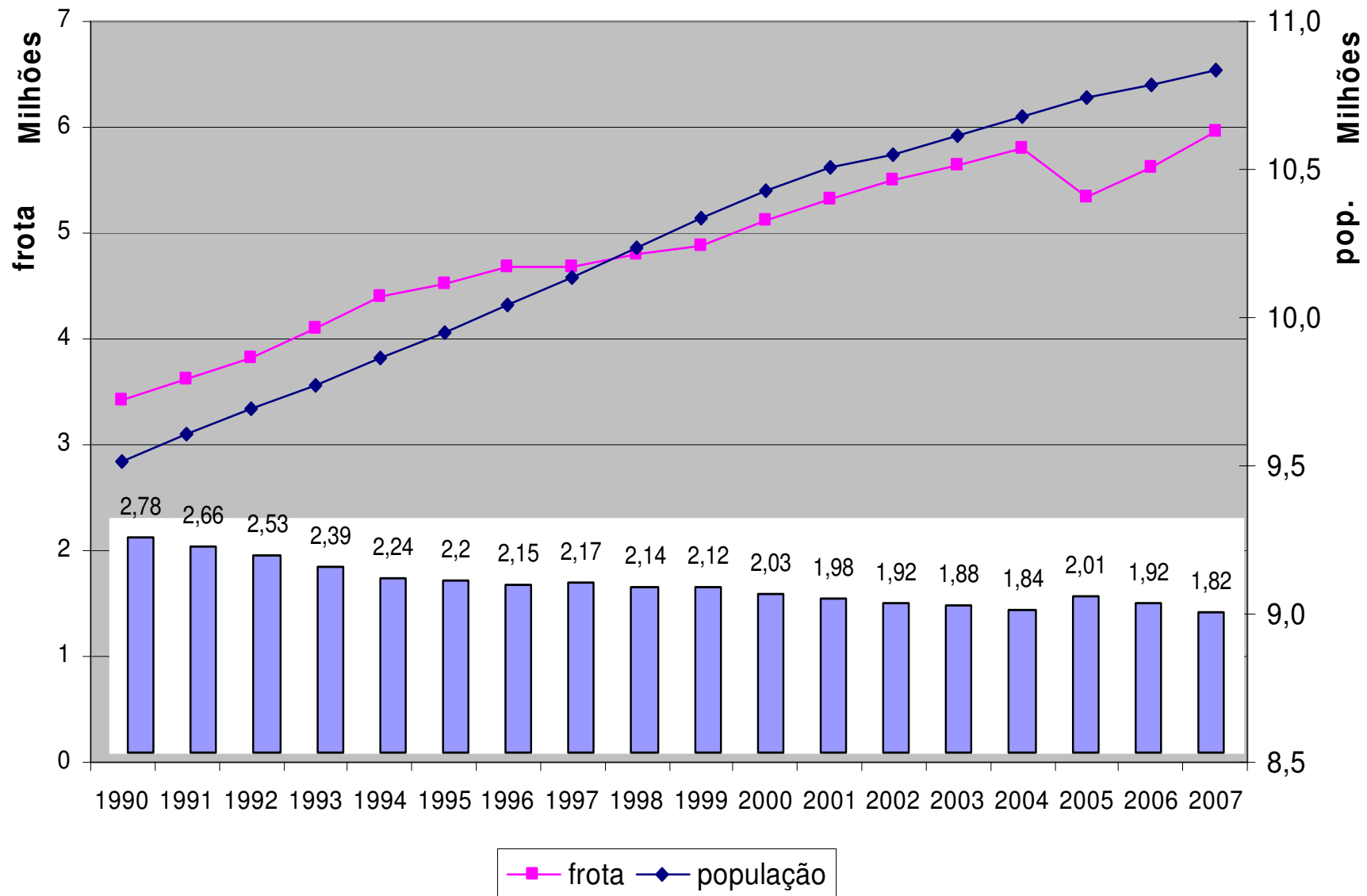
Source: CETESB, 2008

Emission factors for new vehicles, Brazil, 1980-2007



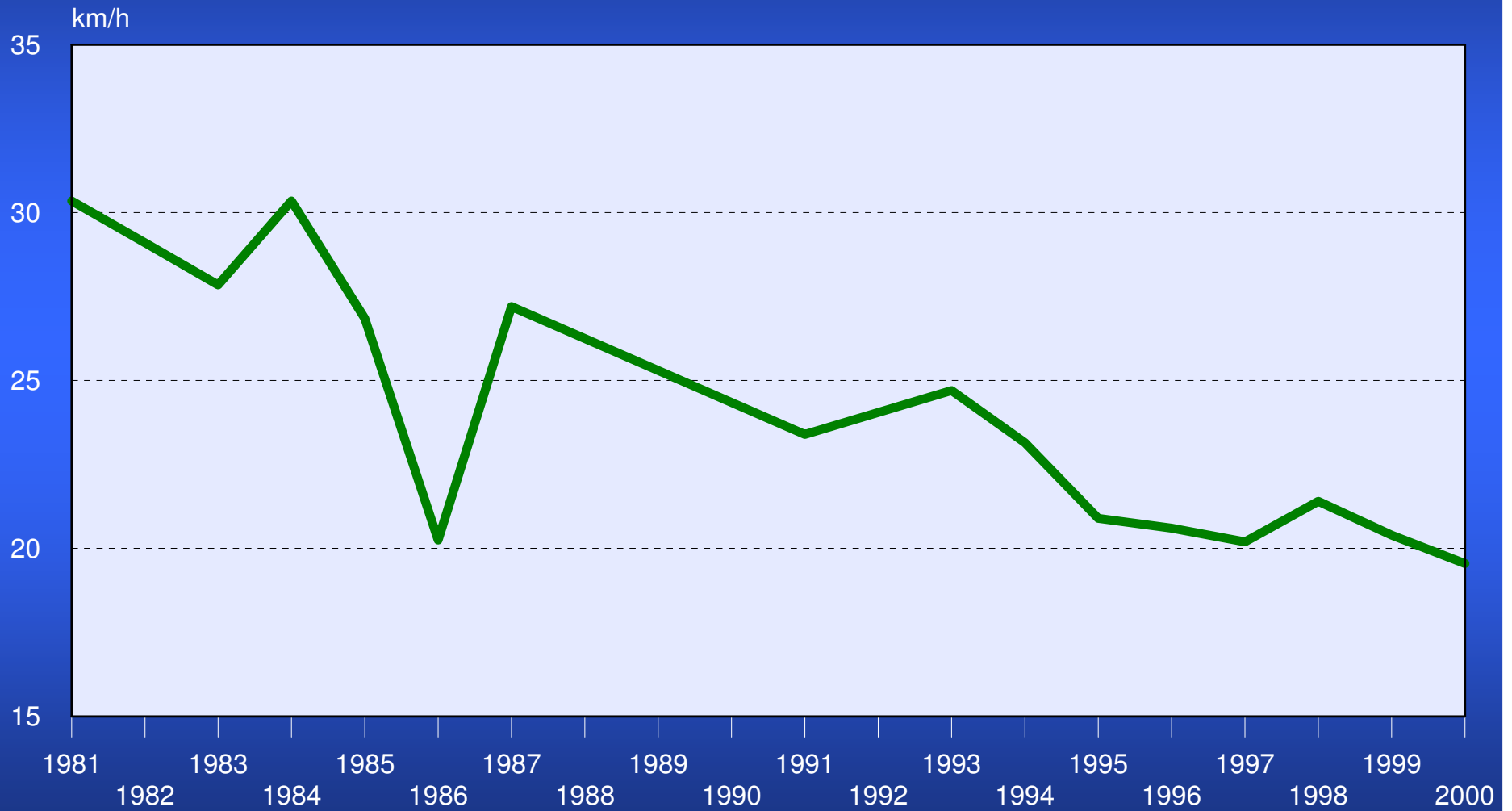
Fonte: Cetesb, 2008

Vehicle fleet and motorization index, São Paulo, 1990-2007

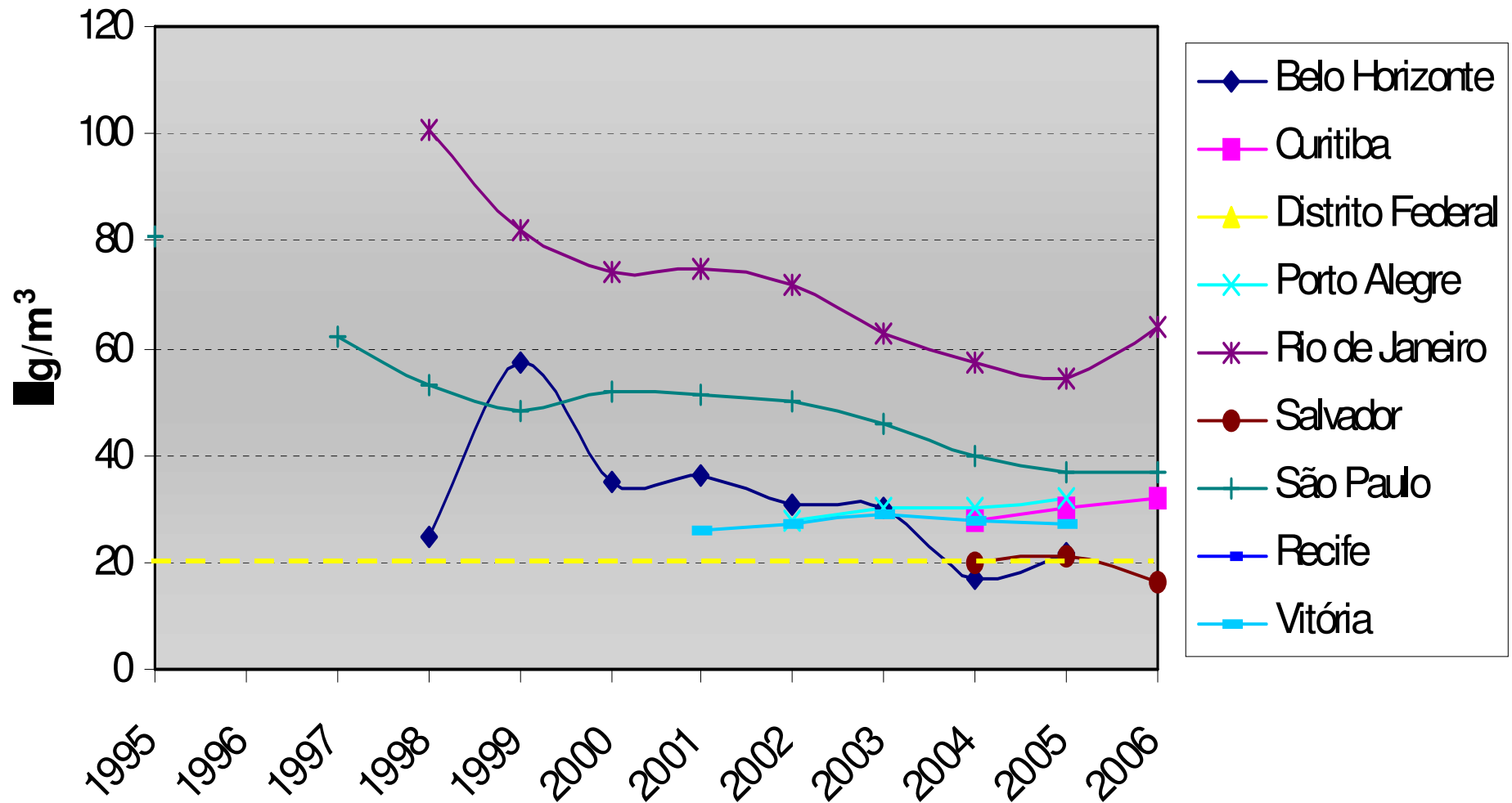


Source: CET; SEADE; DETRAN-SP

Average speed of the vehicle fleet in São Paulo, 1981-2000



PM₁₀ concentration (annual mean) in selected metropolitan regions in Brazil, 1997-2006



Climate change and health

Mudanças climáticas e saúde

1- Carlos Corvalan - PAHO

Environmenta change - new threats to public health

2- Chistovam Barcellos -Fiocruz

Climate change and health inequalities

3- Carlos Nobre - INPE

Climate change and its impacts in Brazil