Index of Environmental Indicators

The indicators in this report show improvements in many areas of environmental concern including air and water quality, the use of natural resources, and the management of solid waste. This section gives an index that measures improvements or reductions in overall environmental quality for the Canada, the United Kingdom, Mexico, and the United States. The index shows that the relative severity of environmental problems is decreasing in Canada, the United States and the United Kingdom. Environmental quality in these countries, for most indicators, is improving relative to the level of environmental quality in 1980. Data are not complete enough to take the index for Mexico back to a base year of 1980. Relative to 1990 levels, however, overall environmental quality in Mexico is about the same.

Methodology

To aggregate individual environmental indicators such as lead, phosphorus, and soil erosion into a single measure of environmental quality, a common unit of measure is required. To create the index of environmental indicators, annual values within each of the four main categories (air quality, water quality, natural resources, and solid waste) are converted to the base year 1980 (a base year of 1990 is used for Mexico). This makes it possible to compare environmental quality in later years to that in the base year. It is important to recognize that this approach allows a comparison of *relative* values only. The base-80 values do not provide any information about the absolute level of environmental quality. This is unavoidable as assessments of absolute environmental quality are value judgments. Human beliefs about the "state of nature" are social constructions that vary between societies and over time.[1]

Base-80 values are comparable across categories because they are measured in the same units. For the same reason, these values can be averaged. A second technical issue arises when determining the weight assigned to each indicator. For example, it is difficult to quantify the respective weights to be given to air pollution and water pollution. For this reason, no attempt is made to give relative weights to each indicator. For each year, base-80 values are averaged within each of the four environmental categories, air quality, water quality, natural resources, and solid waste. The category averages are then weighted equally to arrive at an overall average for each year.[2] The resulting time series represents the general trend in environmental quality for the United States, Canada, the United Kingdom, and Mexico.

It was necessary to account for missing data in many categories because the available time-series environmental data are often incomplete. Straightforward linear regression techniques are used to estimate missing values. However, in cases where trends are improving, the law of diminishing marginal returns may begin to have a significant effect. This means that future improvements may be more difficult to achieve than past improvements. In such cases, linear projections would overestimate the rate of environmental improvement. For this reason, linear projections are used only to interpolate—to fill gaps between known data points and years without data. Forward projections are conservatively estimated: they use the last known data point as an estimator for later years with missing data. This technique ensures that no additional environmental improvement is assumed where data are missing. In cases where backward projections are necessary, missing data are also conservatively estimated. As a result, the index of environmental indicators likely *underestimates* the actual improvement in environmental quality relative to 1980.

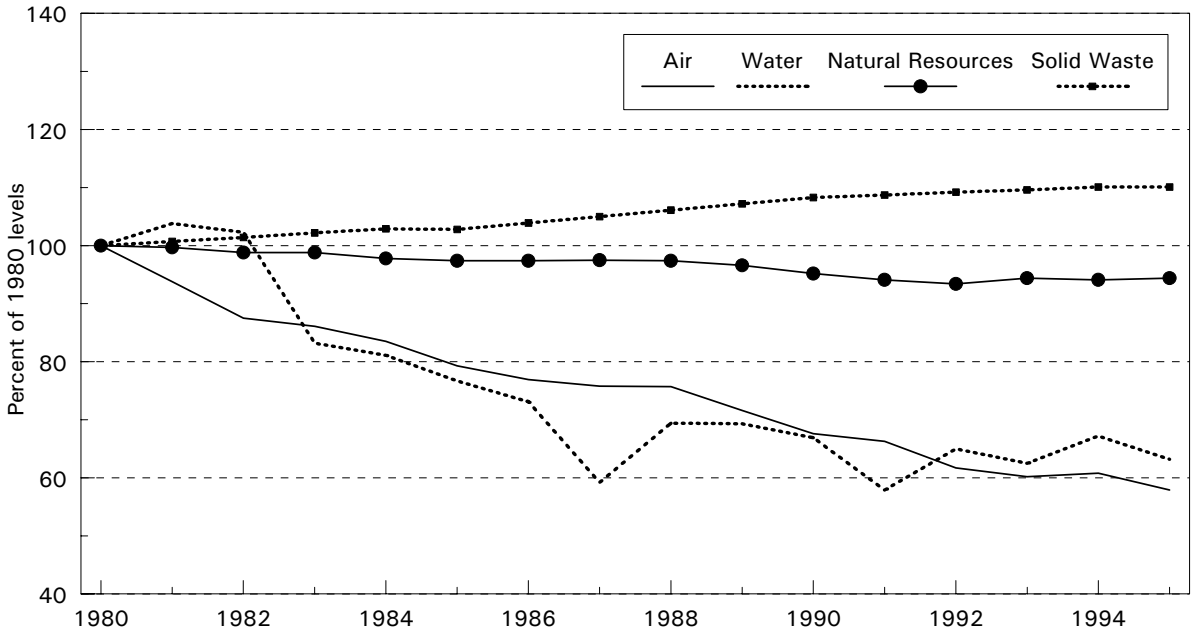
Results

Tables 7, 8, 9 and 10 (pages 86 to 97) show the base-80 values for each primary environmental indicator as well as category and overall averages for the United States and Canada between 1980 and 1995, for the United Kingdom between 1980 and 1996, and for Mexico between 1990 and 1996.[3] The category averages are presented graphically in figures 93 through 96. The trends in Canada, the United States and the United Kingdom are clear: environmental problems are declining in severity in most categories relative to 1980. On average, overall environmental problems in the United States in these categories were 18.6 percent less severe in 1995 than in 1980, and 10.8 percent less severe in Canada over the same time period (figure 97). Overall environmental problems in the United Kingdom were 10.4 percent less severe in 1996 than in 1980. In Mexico, overall environmental quality remained the same between 1990 and 1996 (figure 98).

The greatest improvements in the environment in Canada, the United States, and the United Kingdom were in air and water quality. In Canada, overall ambient air quality improved by 39.3 percent while water quality improved by 27.1 percent between 1980 and 1995. During the same period, American ambient air quality showed a 42.1 percent improvement, while water quality improved by 36.8 percent. In the United Kingdom, overall ambient air quality improved by 38.5 percent and water quality improved 14 percent between 1980 and 1996. Mexico experienced a 16.9 percent improvement in air quality and a 1.5 percent improvement in water quality between 1990 and 1996. The improvements in Mexico, however, should be taken with a note of caution as the available data represent only a limited number of cites.

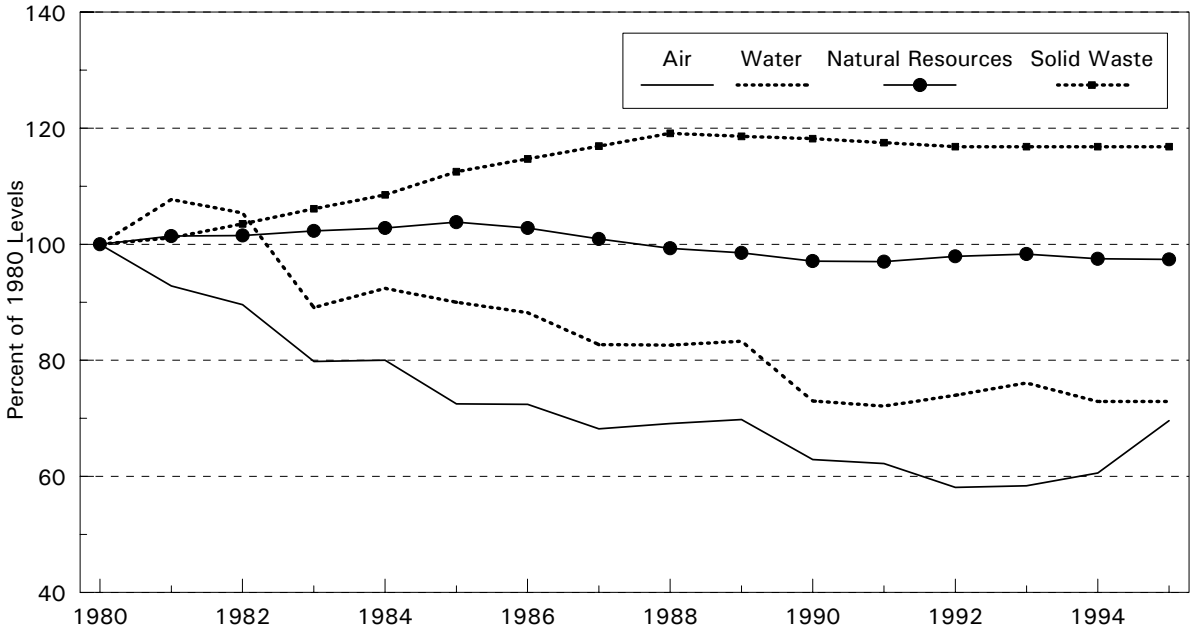
While these trends are encouraging, a few indicators showed a decrease in environmental quality. For ex-

Figure 93: Relative Severity of Environmental Problems with the Primary Indicators in the United States



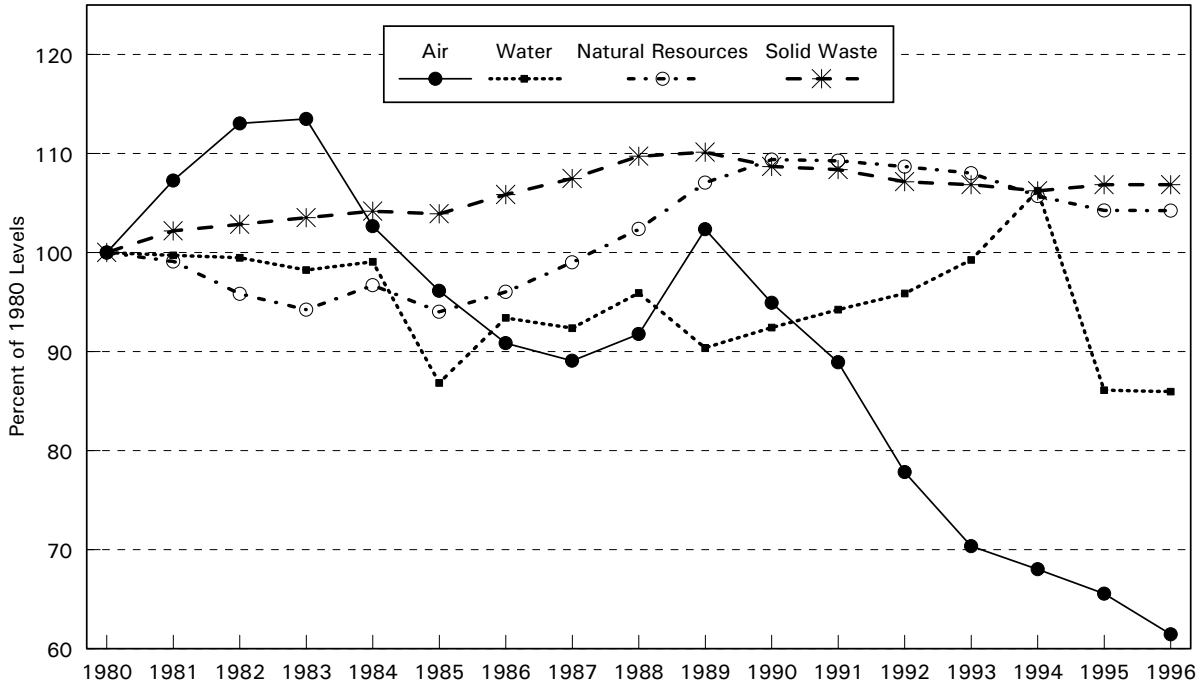
Note: annual values are calculated by averaging "base-80" values of the four primary indicator categories.

Figure 94: Relative Severity of Environmental Problems with the Primary Indicators in Canada



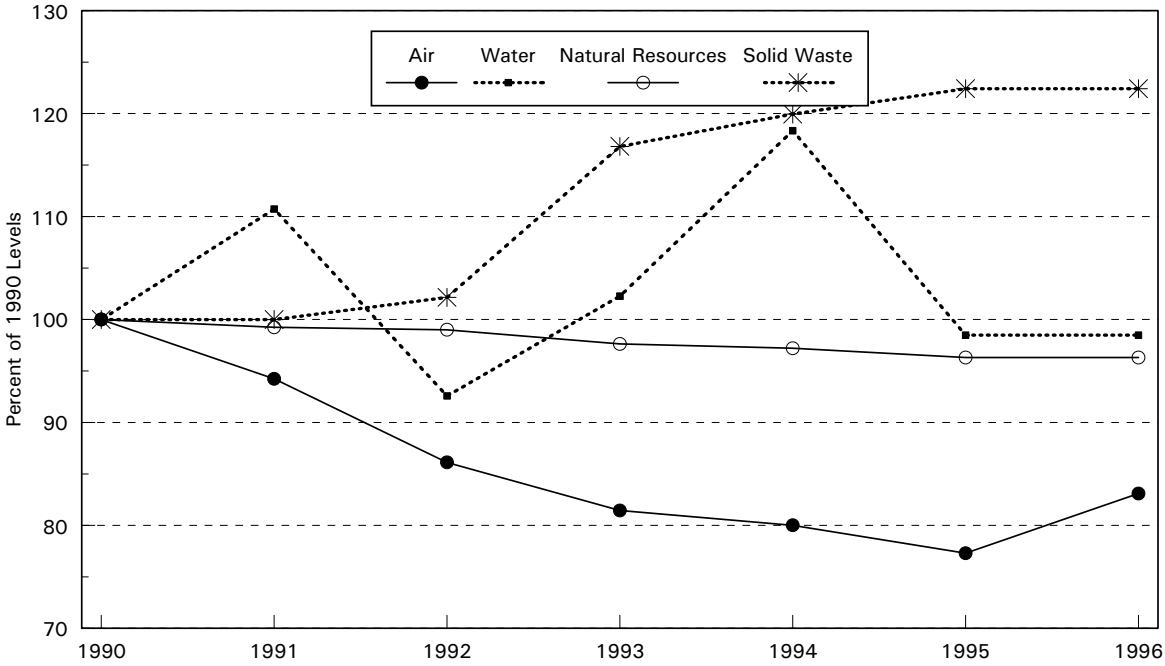
Note: Annual values are calculated by averaging "base-80" values of the four primary indicator categories.

Figure 95: Relative Severity of Environmental Problems with the Primary Indicators in the United Kingdom



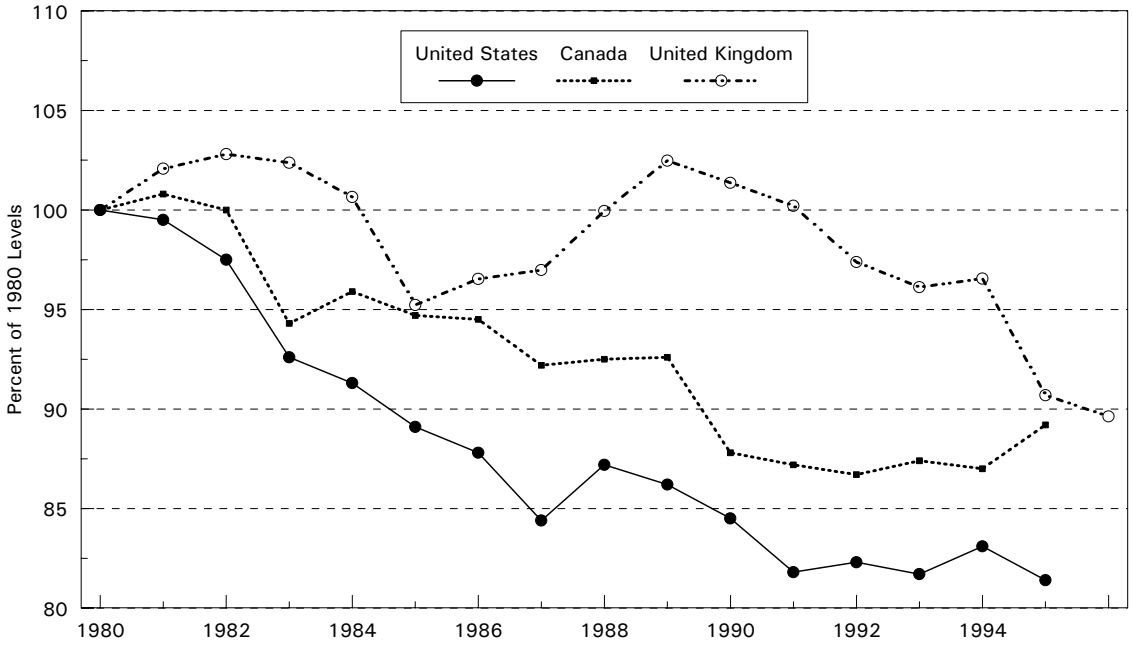
Note: Annual values are calculated by averaging "base-80" values of the four primary indicator categories.

Figure 96: Relative Severity of Environmental Problems with the Primary Indicators in Mexico



Note: Annual values are calculated by averaging "base-90" values of the four primary indicator categories.

Figure 97: Relative Severity of Environmental Problems in the United States, Canada, and the United Kingdom



Note: Annual values are calculated by averaging "base-90" values of the four primary indicator categories.

Figure 98: Relative Severity of Environmental Problems in Mexico

Note: Annual values are calculated by averaging "base-90" values of the four primary indicator categories.

ample, ground-level ozone levels increased in Canada in the 1980s. Because ground-level ozone is the result of many factors, its reduction remains a particularly difficult regulatory problem. In addition, freshwater consumption in Canada increased relative to renewable freshwater resources. However, since Canada has abundant water resources and since freshwater consumption could be drastically reduced by simply allowing it to be sold at a market value, this trend may not be of great concern.

In the United States, Canada, the United Kingdom, and Mexico municipal waste generation increased substantially since 1980 although recycling rates increased in Canada, the United States, and the United Kingdom. While more refuse was being produced, fewer economically valuable resources were being sent to landfills and incinerators. In addition, using the total amount of waste generated as an indicator of environmental quality may actually overstate the waste problem as there is no shortage of landfill space.

It will be interesting to monitor Mexico's environmental quality over the coming years. While overall environmental quality in Mexico remained the same between 1990 and 1996, several categories showed slight improvements. If environmental quality does indeed improve with economic growth, the improvements should continue. There have been many recent initiatives in Mexico such as new facilities for sewage treatment and stricter air-quality guidelines that suggest that the expected improvements in environmental quality will materialize.

Conclusion

The Index of environmental indicators developed by The Fraser Institute, the Pacific Research Institute and the Institute of Economic Affairs shows that fears about increasing environmental degradation in North America and the United Kingdom are unfounded. Environmental quality is getting better, not worse. While it is impossible to determine the exact magnitude of the improvement in the environment due to the difficulty in determining how overall environmental quality should be measured as well as the lack of data for some important categories, the direction of the change in quality is clear. While there are still some serious environmental problems that need to be addressed, according to most measures available, environmental quality is improving, not becoming worse.

Table 7: Relative Severity of Environmental Problems in the United States (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Net change[B]
Air quality[C]																	
SO_2	1.00	0.94	0.86	0.84	0.84	0.84	0.83	0.81	0.82	0.79	0.73	0.72	0.67	0.65	0.62	0.52	–0.477
NO_2	1.00	0.98	0.96	0.94	0.95	0.94	0.95	0.94	0.95	0.92	0.88	0.88	0.83	0.81	0.86	0.83	–0.168
Ozone	1.00	0.92	0.89	1.00	0.89	0.88	0.85	0.89	0.96	0.82	0.80	0.81	0.76	0.77	0.77	0.80	–0.199
CO	1.00	0.97	0.88	0.88	0.87	0.79	0.76	0.72	0.69	0.68	0.63	0.60	0.56	0.53	0.54	0.48	–0.516
PM-10s[D]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.91	0.90	0.82	0.79	0.80	0.78	–0.220
Pb	1.00	0.83	0.65	0.51	0.45	0.32	0.22	0.20	0.13	0.10	0.10	0.07	0.06	0.06	0.05	0.05	–0.949
Average	1.00	0.94	0.88	0.86	0.84	0.80	0.77	0.76	0.76	0.72	0.68	0.66	0.62	0.60	0.61	0.58	–0.421
Water quality																	
"Exceedances"[E]	1.00	0.92	0.94	0.88	0.77	0.75	0.71	0.55	0.70	0.69	0.66	0.46	0.60	0.57	0.68	0.68	–0.322
Phosphorus (Gr. Lakes)	1.00	0.96	0.91	0.87	0.83	0.78	0.78	0.87	0.80	0.74	0.78	0.74	0.74	0.78	0.61	0.61	–0.391
Nitrogen (Gr. Lakes)	1.00	1.03	1.06	1.08	1.11	1.14	1.15	1.18	1.13	1.12	1.13	1.18	1.19	1.19	1.19	1.19	0.194
DDE (Gr. Lakes)	1.00	1.32	1.36	0.67	0.78	0.75	0.68	0.42	0.54	0.58	0.62	0.75	0.67	0.77	0.69	0.48	–0.523
PCB (Gr. Lakes)	1.00	1.24	1.23	0.73	0.80	0.67	0.55	0.37	0.45	0.57	0.50	0.48	0.44	0.34	0.48	0.39	–0.610
HCB (Gr. Lakes)	1.00	1.22	0.98	0.56	0.72	0.58	0.60	0.34	0.50	0.48	0.34	0.34	0.46	0.33	0.36	0.26	–0.740
Average (Great Lakes)[F]	1.00	1.15	1.11	0.78	0.85	0.78	0.75	0.64	0.69	0.70	0.67	0.70	0.70	0.68	0.67	0.59	–0.414
Average[G]	1.00	1.04	1.02	0.83	0.81	0.77	0.73	0.59	0.69	0.69	0.70	0.58	0.65	0.63	0.67	0.63	–0.368
Natural resources																	
Forests[H]	1.00	1.01	1.02	1.02	1.03	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.07	1.07	1.07	1.07	0.071
Water[I]	1.00	0.98	0.96	0.94	0.92	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	–0.100
Energy[J]	1.00	1.00	0.96	0.99	0.97	0.97	0.98	0.99	1.02	1.00	0.96	0.94	0.95	1.00	0.98	1.00	0.000
Development sprawl[K]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.004
Soil erosion	1.00	1.00	1.00	0.99	0.97	0.96	0.95	0.93	0.90	0.86	0.83	0.79	0.76	0.76	0.76	0.76	–0.243
Average	1.00	1.00	0.99	0.99	0.98	0.97	0.97	0.98	0.97	0.97	0.95	0.94	0.93	0.94	0.94	0.94	–0.056

Table 7: Relative Severity of Environmental Problems in the United States (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Net change[B]
Solid waste																	
Waste generation	1.00	1.02	1.03	1.05	1.07	1.09	1.13	1.17	1.21	1.25	1.29	1.32	1.34	1.36	1.38	1.38	0.381
Recycling rate[L]	1.00	1.00	0.99	0.99	0.99	0.97	0.95	0.93	0.91	0.89	0.87	0.86	0.85	0.83	0.82	0.82	–0.179
Average	1.00	1.01	1.01	1.02	1.03	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.09	1.10	1.10	1.10	0.101
Overall average[M]	1.00	1.00	0.98	0.93	0.91	0.89	0.88	0.84	0.87	0.86	0.85	0.82	0.82	0.82	0.83	0.81	–0.186

A Except where otherwise noted, missing data were either extrapolated backward using the earliest available data point or extrapolated forward using the last available data point. See text for explanation.

B Net change equals the 1995 base-80 value minus the 1980 base-80 value; multiply by 100 to obtain a percentage change. Any slight discrepancies between the net change column and the difference between the 1995 and 1980 columns are due to rounding-off.

C Ambient levels.

D For Canada the TSP measure was used; for the United States, the narrower category of PM-10 is monitored and has thus been included in the study.

E An "exceedance" is an instance of a reported failure to comply with a standard. This line shows the percentage of readings failing to meet local standards. In table 15, this is an average of fecal coliform, dissolved oxygen, and phosphorus; in table 16, this is an average of responses from British Columbia, Alberta, Saskatchewan, Manitoba, and New Brunswick.

F Average of phosphorus, nitrogen, DDE, PCB, and HCB.

G Average of the line "Exceedances" and the line "Average (Great Lakes)."

H In table 15, this is the ratio of harvest to growth; in table 16 this is the ratio of annual allowable cut (AAC) to growth.

I Ratio of withdrawals to renewable resources.

J Ratio of consumption to production.

K Developed land (urban + agricultural) as a proportion of total land base.

L Recycling rate is an average of the rate of recycling of paper and cardboard and of glass. The rates are inverted to express the proportion of waste *not* recycled.

M Overall average is the average of the lines "Average (air quality)," "Average (water quality)," "Average (natural resources)," and "Average (solid waste)."

Table 8: Relative Severity of Environmental Problems in Canada (base year 1980).[A]
Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Net change[B]
Air quality[C]																	
SO_2	1.00	0.89	0.89	0.67	0.78	0.67	0.67	0.56	0.67	0.67	0.67	0.56	0.56	0.56	0.56	0.56	–0.444
NO_2	1.00	0.92	0.92	0.88	0.96	0.87	0.87	0.83	0.85	0.91	0.85	0.78	0.72	0.74	0.74	0.74	–0.261
Ozone	1.00	0.94	1.00	1.00	1.00	1.00	1.06	1.06	1.19	1.19	1.06	1.25	1.13	1.13	1.31	1.31	0.313
CO	1.00	1.01	0.86	0.79	0.70	0.65	0.62	0.63	0.60	0.63	0.54	0.50	0.48	0.49	0.43	0.43	–0.572
TSP[D]	1.00	0.87	0.77	0.71	0.69	0.64	0.64	0.72	0.65	0.65	0.58	0.58	0.54	0.54	0.54	0.54	–0.462
Pb	1.00	0.94	0.94	0.74	0.68	0.52	0.48	0.30	0.18	0.14	0.07	0.06	0.06	0.06	0.06	0.06	–0.940
Average	1.00	0.93	0.90	0.80	0.80	0.73	0.72	0.68	0.69	0.70	0.63	0.62	0.58	0.58	0.61	0.61	–0.393
Water quality																	
"Exceedances"[E]	1.00	1.00	1.00	1.00	1.00	1.02	1.01	1.02	0.97	0.97	0.79	0.74	0.78	0.84	0.79	0.87	–0.129
Phosphorus (Gr. Lakes)	1.00	0.96	0.91	0.87	0.83	0.78	0.78	0.87	0.80	0.74	0.78	0.74	0.74	0.78	0.61	0.61	–0.391
Nitrogen (Gr. Lakes)	1.00	1.03	1.06	1.08	1.11	1.14	1.15	1.18	1.13	1.12	1.13	1.18	1.19	1.19	1.19	1.19	0.194
DDE (Gr. Lakes)	1.00	1.32	1.36	0.67	0.78	0.75	0.68	0.42	0.54	0.58	0.62	0.75	0.67	0.77	0.69	0.48	–0.523
PCB (Gr. Lakes)	1.00	1.24	1.23	0.73	0.80	0.67	0.55	0.37	0.45	0.57	0.50	0.48	0.44	0.34	0.48	0.39	–0.610
HCB (Gr. Lakes)	1.00	1.22	0.98	0.56	0.72	0.58	0.60	0.34	0.50	0.48	0.34	0.34	0.46	0.33	0.36	0.26	–0.740
Average (Great Lakes)[F]	1.00	1.15	1.11	0.78	0.85	0.78	0.75	0.64	0.69	0.70	0.67	0.70	0.70	0.68	0.67	0.59	–0.414
Average[G]	1.00	1.08	1.05	0.89	0.92	0.90	0.88	0.83	0.83	0.83	0.73	0.72	0.74	0.76	0.73	0.73	–0.271
Natural resources																	
Forests[H]	1.00	1.04	1.08	1.12	1.16	1.21	1.14	1.08	1.03	0.98	0.94	0.99	1.05	1.11	1.11	1.11	0.110
Water[I]	1.00	1.03	1.06	1.09	1.12	1.15	1.17	1.19	1.20	1.22	1.23	1.23	1.23	1.23	1.23	1.23	0.231
Energy[J]	1.00	1.00	0.94	0.91	0.86	0.84	0.84	0.81	0.79	0.80	0.78	0.74	0.74	0.70	0.68	0.67	–0.331
Development sprawl[K]	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.91	–0.087
Soil erosion	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.97	0.97	0.96	0.95	0.95	0.95	0.95	0.95	–0.053
Average	1.00	1.01	1.02	1.02	1.03	1.04	1.03	1.01	0.99	0.99	0.97	0.97	0.98	0.98	0.98	0.97	–0.026

Table 8: Relative Severity of Environmental Problems in Canada (base year 1980).[A]
Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Net change[B]
Solid waste																	
Waste generation	1.00	1.05	1.11	1.16	1.21	1.27	1.32	1.38	1.43	1.43	1.43	1.44	1.44	1.44	1.44	1.44	0.437
Recycling rate[L]	1.00	0.97	0.96	0.96	0.96	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.90	0.90	0.90	0.90	–0.101
Average	1.00	1.01	1.04	1.06	1.09	1.13	1.15	1.17	1.19	1.19	1.18	1.18	1.17	1.17	1.17	1.17	0.168
Overall average[M]	1.00	1.01	1.00	0.94	0.96	0.95	0.95	0.92	0.93	0.93	0.88	0.87	0.87	0.87	0.87	0.89	–0.108

A Except where otherwise noted, missing data were either extrapolated backward using the earliest available data point or extrapolated forward using the last available data point. See text for explanation.

B Net change equals the 1995 base-80 value minus the 1980 base-80 value; multiply by 100 to obtain a percentage change. Any slight discrepancies between the net change column and the difference between the 1995 and 1980 columns are due to rounding-off.

C Ambient levels.

D For Canada the TSP measure was used; for the United States, the narrower category of PM-10 is monitored and has thus been included in the study.

E An "exceedance" is an instance of a reported failure to comply with a standard. This line shows the percentage of readings failing to meet local standards. In table 15, this is an average of fecal coliform, dissolved oxygen, and phosphorus; in table 16, this is an average of responses from British Columbia, Alberta, Saskatchewan, Manitoba, and New Brunswick.

F Average of phosphorus, nitrogen, DDE, PCB, and HCB.

G Average of the line "Exceedances" and the line "Average (Great Lakes)."

H In table 15, this is the ratio of harvest to growth; in table 16 this is the ratio of annual allowable cut (AAC) to growth.

I Ratio of withdrawals to renewable resources.

J Ratio of consumption to production.

K Developed land (urban + agricultural) as a proportion of total land base.

L Recycling rate is an average of the rate of recycling of paper and cardboard and of glass. The rates are inverted to express the proportion of waste *not* recycled.

M Overall average is the average of the lines "Average (air quality)," "Average (water quality)," "Average (natural resources)," and "Average (solid waste)."

Table 9: Relative Severity of Environmental Problems in the United Kingdom (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Air quality[C]																		
SO_2	1.00	0.78	0.70	0.63	0.59	0.59	0.70	0.52	0.37	0.63	0.52	0.52	0.41	0.37	0.30	0.26	0.22	–0.778
NO_2*	1.00	1.07	1.23	1.40	1.30	1.17	1.07	1.03	0.97	1.07	1.00	0.80	0.80	0.80	0.80	0.77	0.77	–0.233
Ozone	1.00	1.17	1.50	1.92	1.67	1.75	1.75	1.75	2.00	2.00	2.08	2.00	1.92	1.75	1.83	1.83	1.58	0.583
CO	1.00	1.29	1.35	0.87	0.80	0.51	0.51	0.65	0.80	1.29	1.02	1.07	0.72	0.56	0.50	0.46	0.50	–0.499
TSP	1.00	1.19	1.10	1.14	1.00	1.00	1.00	0.95	0.90	0.81	0.81	0.76	0.67	0.62	0.52	0.52	0.52	–0.480
Pb	1.00	0.95	0.90	0.85	0.80	0.75	0.42	0.44	0.47	0.34	0.27	0.19	0.15	0.12	0.13	0.09	0.09	–0.906
Average	1.00	1.07	1.13	1.13	1.03	0.96	0.91	0.89	0.92	1.02	0.95	0.89	0.78	0.70	0.68	0.66	0.61	–0.385
Water quality																		
Heavy Metals in Rivers–Cadmium																		
Thames	1.00	0.96	0.92	0.88	0.84	0.80	0.50	0.50	0.40	0.20	0.10	0.30	0.50	0.50	0.20	0.10	0.10	–0.900
Severn	1.00	0.80	0.61	0.41	0.22	0.02	0.03	0.02	0.02	0.04	0.05	0.04	0.02	0.01	0.02	0.01	0.01	–0.990
Clyde	1.00	0.95	0.89	0.84	0.78	0.73	0.55	0.45	0.45	0.45	0.18	0.18	0.36	0.27	0.27	1.09	1.09	0.091
Mersey	1.00	0.85	0.70	0.55	0.40	0.25	0.38	0.25	0.25	0.25	0.38	0.38	0.38	0.13	0.13	0.13	0.13	–0.875
Average[D]	1.00	0.89	0.78	0.67	0.56	0.45	0.36	0.31	0.28	0.24	0.18	0.22	0.31	0.23	0.15	0.33	0.33	–0.669
Heavy Metals in Rivers–Chromium																		
Thames	1.00	0.99	0.97	0.96	0.95	0.93	0.84	0.93	0.78	0.47	0.47	0.79	0.93	0.93	0.16	0.15	0.15	–0.850
Severn	1.00	0.87	0.75	0.62	0.50	0.37	0.35	0.21	0.10	0.07	0.07	0.07	0.04	0.05	0.06	0.05	0.05	–0.947
Clyde	1.00	0.97	0.94	0.91	0.88	0.85	1.28	1.21	0.97	1.26	1.06	0.89	0.78	0.83	0.69	0.68	0.68	–0.316
Mersey	1.00	0.92	0.85	0.77	0.70	0.62	0.72	0.60	0.48	0.55	0.53	0.43	0.28	0.30	0.24	0.25	0.25	–0.750
Average[E]	1.00	0.94	0.88	0.82	0.75	0.69	0.80	0.74	0.58	0.59	0.53	0.55	0.51	0.53	0.29	0.28	0.28	–0.716
Heavy Metals in Rivers–Copper																		
Thames	1.00	1.01	1.02	1.03	1.04	1.05	1.12	1.10	0.83	0.54	0.84	0.79	0.67	0.62	0.51	0.68	0.68	–0.320
Severn	1.00	0.92	0.83	0.75	0.66	0.58	0.54	0.41	0.28	0.29	0.46	0.26	0.23	0.25	0.25	0.25	0.25	–0.755
Clyde	1.00	0.91	0.83	0.74	0.65	0.57	0.55	0.41	0.41	0.26	0.53	0.30	0.34	0.55	0.40	0.90	0.90	–0.098

Table 9: Relative Severity of Environmental Problems in the United Kingdom (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Mersey	1.00	0.90	0.80	0.69	0.59	0.49	0.54	0.51	0.49	0.58	0.41	0.44	0.46	0.44	0.37	0.36	0.36	–0.640
Average[F]	1.00	0.93	0.87	0.80	0.74	0.67	0.69	0.61	0.50	0.42	0.56	0.45	0.43	0.47	0.38	0.55	0.55	–0.453
Metal Average[G]	1.00	0.92	0.84	0.76	0.68	0.60	0.62	0.55	0.46	0.41	0.42	0.41	0.42	0.41	0.28	0.39	0.39	–0.612
Nutrients in Lakes–Phosphorus																		
Neagh	1.00	1.01	1.03	1.04	1.06	1.06	1.00	0.87	0.83	0.98	0.89	0.93	0.93	1.04	0.62	1.11	1.11	0.111
Lomond	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.56	0.33	1.67	2.11	2.11	2.56	1.67	1.00	1.00	1.00	0.000
Bewl Water	1.00	1.00	1.00	1.00	1.00	1.00	3.26	3.37	3.48	3.52	3.65	3.78	3.91	5.78	10.43	1.30	1.30	0.304
Average[H]	1.00	1.00	1.01	1.01	1.02	1.02	1.72	1.60	1.55	2.06	2.22	2.27	2.46	2.83	4.02	1.14	1.14	0.138
Nutrients in Lakes–Nitrogen																		
Neagh	1.00	1.00	1.00	1.00	1.00	1.00	0.71	0.63	1.31	0.54	1.60	1.21	0.79	0.85	0.85	0.88	0.88	–0.125
Lomond	1.00	1.00	1.00	0.97	0.97	0.97	0.90	0.77	0.70	0.53	0.43	0.67	1.20	0.50	0.73	1.30	1.30	0.300
Bewl Water	1.00	0.97	0.93	0.91	0.88	0.85	1.07	1.46	0.86	0.88	1.23	1.99	1.60	1.54	0.67	0.62	0.62	–0.385
Average[I]	1.00	0.99	0.98	0.96	0.95	0.94	0.89	0.95	0.96	0.65	1.09	1.29	1.20	0.96	0.75	0.93	0.93	–0.070
Nutrient Average[J]	1.00	1.00	0.99	0.99	0.98	0.98	1.30	1.27	1.25	1.35	1.65	1.78	1.83	1.90	2.39	1.03	1.03	0.034
Biological Quality of Rivers and Canals[K]																		
England and Wales	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.82	0.72	0.63	0.54	0.54	–0.462
Scotland	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.87	0.80	0.73	0.67	0.67	–0.333
Northern Ireland	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.000
Average[L]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.89	0.84	0.79	0.74	0.74	–0.265
Chemical Quality of Rivers and Canals[M]																		
England and Wales	1.00	1.00	1.00	1.00	1.00	1.00	1.04	1.08	1.12	1.16	1.20	1.14	1.08	1.02	0.96	0.90	0.90	–0.100
Scotland	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.000
Northern Ireland	1.00	1.20	1.40	1.60	1.80	2.00	1.93	1.87	1.80	1.73	1.67	2.13	2.60	3.07	3.53	4.00	4.00	3.000
Average[N]	1.00	1.07	1.13	1.20	1.27	1.33	1.32	1.32	1.31	1.30	1.29	1.42	1.56	1.70	1.83	1.97	1.97	0.967

Table 9: Relative Severity of Environmental Problems in the United Kingdom (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Contaminants in Fish in the Irish Sea–Whiting																		
Mercury	1.00	1.00	1.00	1.21	0.86	0.93	0.93	0.86	0.86	0.93	0.93	0.79	0.86	0.93	0.93	0.93	0.93	–0.071
PCBs	1.00	1.00	1.00	1.05	1.11	1.21	1.04	0.87	1.16	0.92	0.66	0.74	0.62	0.50	0.50	0.50	0.50	–0.500
DDT	1.00	1.00	1.00	0.83	0.67	0.44	0.61	0.78	0.78	0.44	0.33	0.44	0.44	0.44	0.44	0.44	0.44	–0.556
Contaminants in Fish in the Irish Sea–Plaice																		
Mercury	1.00	1.00	1.00	1.17	0.92	0.75	0.92	0.92	1.00	0.83	0.83	0.83	0.83	0.75	0.75	0.75	0.75	–0.250
PCBs	1.00	1.00	1.00	1.00	1.75	1.00	0.75	1.00	1.25	1.25	1.08	0.92	0.75	1.00	0.88	0.75	0.75	–0.250
DDT	1.00	1.00	1.00	1.00	1.18	0.27	0.64	0.64	0.55	0.55	0.48	0.42	0.36	0.64	0.50	0.36	0.36	–0.636
Average[O]	1.00	1.00	1.00	1.04	1.08	0.77	0.81	0.84	0.93	0.82	0.72	0.69	0.64	0.71	0.67	0.62	0.62	–0.377
Contaminants in Fish in the North Sea–Cod																		
Mercury	1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.89	0.89	1.11	1.00	0.67	0.72	0.78	0.78	0.78	0.78	–0.222
PCBs	1.00	1.00	1.00	0.86	0.62	0.38	0.32	0.35	0.44	0.33	0.32	0.32	0.27	0.21	0.35	0.30	0.24	–0.758
DDT	1.00	1.00	1.00	0.40	0.35	0.30	0.30	0.20	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	–0.800
Contaminants in Fish in the North Sea–Plaice																		
Mercury	1.00	1.00	1.00	1.14	0.86	0.71	0.57	0.71	0.86	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	–0.286
PCBs	1.00	1.00	1.00	1.00	1.20	0.20	0.20	0.20	0.60	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	–0.800
DDT	1.00	1.00	1.00	1.00	1.67	0.67	1.00	1.00	1.67	0.67	0.33	0.33	0.33	0.33	0.33	0.33	0.33	–0.667
Average[P]	1.00	1.00	1.00	0.90	0.93	0.52	0.55	0.56	0.81	0.54	0.46	0.41	0.41	0.41	0.43	0.42	0.41	–0.589
Water quality average[Q]	1.00	1.00	0.99	0.98	0.99	0.87	0.93	0.92	0.96	0.90	0.92	0.94	0.96	0.99	1.06	0.86	0.86	–0.140
Natural Resources																		
Forests[R]	1.00	1.01	1.03	1.04	1.05	1.06	1.14	1.22	1.30	1.38	1.46	1.49	1.52	1.55	1.58	1.60	1.60	0.605
Water[S]	1.00	0.97	0.94	0.91	0.88	0.85	0.86	0.87	0.88	0.89	0.89	0.85	0.81	0.77	0.73	0.69	0.69	–0.308
Energy[T]	1.00	0.98	0.87	0.82	0.94	0.85	0.84	0.87	0.92	1.02	1.03	1.04	1.03	1.01	0.93	0.88	0.88	–0.117
Development Sprawl[U]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	–0.010
Average	1.00	0.99	0.96	0.94	0.97	0.94	0.96	0.99	1.02	1.07	1.09	1.09	1.09	1.08	1.06	1.04	1.04	0.042

Table 9: Relative Severity of Environmental Problems in the United Kingdom (base year 1980).[A] Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Solid Waste																		
Waste Generation	1.00	1.02	1.04	1.06	1.08	1.10	1.14	1.17	1.21	1.25	1.29	1.29	1.29	1.29	1.29	1.29	1.29	0.290
Recycling Rate[V]	1.00	1.02	1.02	1.01	1.01	0.98	0.98	0.98	0.98	0.95	0.88	0.88	0.85	0.85	0.83	0.85	0.85	–0.153
Average	1.00	1.02	1.03	1.04	1.04	1.04	1.06	1.07	1.10	1.10	1.09	1.08	1.07	1.07	1.06	1.07	1.07	0.068
Overall Average[W]	1.00	1.02	1.03	1.02	1.01	0.95	0.97	0.97	1.00	1.02	1.01	1.00	0.97	0.96	0.97	0.91	0.90	–0.104

A Except where otherwise noted, missing data were either extrapolated backward using the earliest available data point or extrapolated forward using the last available data point. See text for explanation.

B Net change equals the 1996 base-80 value minus the 1980 base-80 value; multiply by 100 to obtain a percentage change. Any slight discrepancies between the net change column and the difference between the 1996 and 1980 columns are due to rounding off.

C Ambient levels. NO_2 was measured at Central London, Cromwell Rd, and Stevenage sites only until 1987. In 1987, more sites were measured.

D Average of cadmium in the Thames, Severn, Clyde, and Mersey Rivers.

E Average of chromium in the Thames, Severn, Clyde, and Mersey Rivers.

F Average of copper in the Thames, Severn, Clyde, and Mersey Rivers.

G Average of the "Average" lines for cadmium, chromium, and copper.

H Average of phosphorus in the Neagh, Lomond, and Bewl Water.

I Average of nitrogen in the Neagh, Lomond, and Bewl Water.

J Average of the "Average" lines for phosphorus and nitrogen.

K This expresses the percent of rivers and canals not considered Fair or Good.

L Average of the biological quality of rivers and canals in England and Wales, Scotland, and Northern Ireland.

M This expresses the percent of rivers and canals not considered Fair or Good.

N Average of the chemical quality of rivers and canals in England and Wales, Scotland, and Northern Ireland.

O Average of the levels of mercury, PCBs, and DDT found in whiting and plaice in the Irish Sea.

P Average of the levels of mercury, PCBs, and DDT found in cod and plaice in the Irish Sea.

Q Average of the lines "Metal Average" and "Nutrient Average," and the Averages for "Biological Quality of Rivers and Canals," "Chemical Quality of Rivers and Canals," "Contaminants in Fish in the Irish Sea," and "Contaminants in Fish in the North Sea.

R This is the ratio of harvest to growth.

S Ratio of withdrawals to renewable resources.

T Ratio of consumption to production.

U Developed land (urban + agricultural) as a proportion of total land base.

V Recycling rate is an average of the rate of recycling of paper and cardboard and of glass; rates are inverted to express the proportion of waste *not* recycled.

W Overall average is the average of the lines "Average (air quality)," "Average (water quality)," "Average (natural resources)," and "Average (solid waste).

Table 10: Relative Severity of Environmental Problems in Mexico (base year 1990).[A]
Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Air Quality[C]								
SO_2								
Mexico City	1.00	1.07	0.89	0.56	0.41	0.56	0.56	–0.444
Guadalajara	1.00	1.00	1.00	1.00	1.00	0.77	0.70	–0.300
Monterrey	1.00	1.00	1.00	1.00	1.06	0.94	1.18	0.176
Average[D]	1.00	1.02	0.96	0.85	0.82	0.75	0.81	–0.189
NO_2								
Mexico City	1.00	0.93	0.87	1.00	1.03	0.95	1.15	0.148
Guadalajara	1.00	1.00	1.00	1.00	1.00	1.09	1.11	0.114
Monterrey	1.00	1.00	1.00	1.00	1.00	0.89	0.96	–0.036
Average[E]	1.00	0.98	0.96	1.00	1.01	0.98	1.08	0.075
Ozone								
Mexico City	1.00	1.12	1.06	0.96	1.02	1.00	0.95	–0.047
Toluca	1.00	1.00	1.00	1.00	1.00	0.97	1.43	0.434
Monterrey	1.00	1.00	1.00	1.00	0.82	0.79	0.91	–0.091
Average[F]	1.00	1.04	1.02	0.99	0.95	0.92	1.10	0.099
CO								
Mexico City	1.00	1.11	0.86	0.54	0.53	0.76	0.78	–0.224
Guadalajara	1.00	1.00	1.00	1.00	1.00	0.88	0.90	–0.098
Monterrey	1.00	1.00	1.00	1.00	0.96	0.80	0.84	–0.160
Average[G]	1.00	1.04	0.95	0.85	0.83	0.82	0.84	–0.161
TSP								
Mexico City	1.00	0.73	0.69	0.89	0.81	1.10	1.25	0.250
Guadalajara	1.00	1.00	1.00	1.00	1.00	1.05	0.83	–0.175
Monterrey	1.00	1.00	1.00	1.00	1.17	0.84	0.88	–0.116
Average[H]	1.00	0.91	0.90	0.96	1.00	1.00	0.99	–0.014

Table 10: Relative Severity of Environmental Problems in Mexico (base year 1990).[A]
Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Pb (Mexico national)	1.00	0.67	0.38	0.24	0.20	0.17	0.18	–0.825
Average[I]	1.00	0.94	0.86	0.81	0.80	0.77	0.83	–0.169
Water Quality								
Nitrates in Rivers								
Bravo	1.00	2.02	1.34	0.93	1.11	0.89	0.89	–0.107
Lema	1.00	1.25	2.66	3.86	1.11	1.11	1.11	0.114
Panuco	1.00	1.20	2.70	1.70	2.60	1.50	1.50	0.500
Grijalva	1.00	2.21	0.58	0.43	0.21	0.32	0.32	–0.683
Average[J]	1.00	1.67	1.82	1.73	1.26	0.96	0.96	–0.044
Phosphorus in Rivers								
Lema	1.00	0.50	0.60	0.70	2.12	2.12	2.12	1.125
Panuco	1.00	0.93	0.39	0.67	0.83	0.87	0.87	–0.130
Grijalva	1.00	0.10	0.09	0.32	0.07	0.21	0.21	–0.789
Balsas	1.00	1.05	0.94	1.02	1.72	1.72	1.72	0.719
Average[K]	1.00	0.65	0.51	0.68	1.18	1.23	1.23	0.231
Ammonium in Rivers								
Bravo	1.00	2.60	0.72	1.08	1.24	0.12	0.12	–0.884
Lema	1.00	0.83	1.25	2.75	7.06	7.06	7.06	6.057
Panuco	1.00	0.80	0.60	0.40	0.50	0.30	0.30	–0.700
Grijalva	1.00	0.20	0.10	0.05	0.05	0.10	0.10	–0.900
Average[L]	1.00	1.11	0.67	1.07	2.21	1.89	1.89	0.893
Copper in Rivers								
Panuco	1.00	0.75	0.50	0.50	0.50	0.50	0.50	–0.500
Biochemical Oxygen Demand in Rivers								
Bravo	1.00	0.89	0.86	1.00	1.22	0.86	0.86	–0.139
Lema	1.00	0.21	1.13	1.19	0.71	0.71	0.71	–0.289

Table 10: Relative Severity of Environmental Problems in Mexico (base year 1990).[A]
Values > 1 represent an increase in environmental degradation; values < 1 represent a decrease

	1990	1991	1992	1993	1994	1995	1996	Net Change[B]
Panuco	1.00	1.04	1.08	1.12	0.92	0.86	0.86	–0.145
Grijalva	1.00	1.05	1.36	1.68	1.73	0.91	0.91	–0.091
Average[M]	1.00	0.80	1.11	1.25	1.15	0.83	0.83	–0.166
Phosphorus in Lakes								
Chapala	1.00	1.17	1.13	1.23	1.33	1.33	1.33	0.333
Patzcuaro	1.00	1.33	1.66	0.84	0.01	0.01	0.01	–0.989
Catemaco	1.00	0.56	0.11	0.08	0.06	0.04	0.04	–0.956
Average[N]	1.00	1.02	0.97	0.72	0.47	0.46	0.46	–0.537
Nitrogen in Lakes								
Chapala	1.00	2.40	1.20	1.37	1.53	1.53	1.53	0.533
Catemaco	1.00	1.13	0.63	1.06	1.50	0.50	0.50	–0.500
Average[O]	1.00	1.76	0.91	1.21	1.52	1.02	1.02	0.017
Average[P]	1.00	1.11	0.93	1.02	1.18	0.98	0.98	–0.015
Natural Resources								
Forests[Q]	1.00	0.94	0.88	0.82	0.76	0.70	0.70	–0.298
Water[R]	1.00	1.02	1.03	1.05	1.07	1.09	1.09	0.088
Energy[S]	1.00	1.00	1.02	1.01	1.04	1.04	1.04	0.043
Development Sprawl[T]	1.00	1.01	1.02	1.02	1.02	1.02	1.02	0.020
Average	1.00	0.99	0.99	0.98	0.97	0.96	0.96	–0.037
Solid Waste								
Waste Generation	1.00	1.00	1.04	1.33	1.40	1.45	1.45	0.449
Recycling Rate[U]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.000
Average	1.00	1.00	1.02	1.17	1.20	1.22	1.22	0.224
Overall Average[V]	1.00	1.01	0.95	1.00	1.04	0.99	1.00	0.001

A Except where otherwise noted, missing data were either extrapolated backward using the earliest available data point or extrapolated forward using the last available data point. See text for explanation.

B Net change equals the 1996 base-90 value minus the 1990 base-90 value; multiply by 100 to obtain a percentage change. Any slight discrepancies between the net change column and the difference between and the 1996 and 1990 columns are due to rounding off.

C Ambient levels.

D Average of sulphur dioxide levels in Mexico City, Guadalajara, and Monterrey.

E Average of nitrogen dioxide levels in Mexico City, Guadalajara, and Monterrey.

F Average of ozone levels in Mexico City, Toluca, and Monterrey.

G Average of carbon monoxide levels in Mexico City, Guadalajara, and Monterrey.

H Average of total suspended particulate levels in Mexico City, Guadalajara, and Monterrey.

I Average of the "Average" lines for sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide, and TSP, and line for Pb (Mexico national).

J Average of nitrates in the Bravo, Lema, Panuco, and Grijalva Rivers.

K Average of phosphorus in the Lema, Panuco, Grijalva, and Balsas Rivers.

L Average of ammonium in the Bravo, Lema, Panuco, and Grijalva Rivers.

M Average of biochemical oxygen demand in the Bravo, Lema, Panuco, and Grijalva Rivers.

N Average of phosphorus in the Chapala, Patzcuaro, and Catemaco Lakes.

O Average of nitrogen in the Chapala and Catemaco Lakes.

P Average of the "Average" lines for nitrates, phosphorus, ammonium, B.O.D., and the Copper line in rivers, and the "Average" lines for phosphorus and nitrogen in lakes.

Q This is the ratio of harvest to growth.

R Ratio of withdrawals to renewable resources.

S Ratio of consumption to production.

T Developed land (urban + agricultural) as a proportion of total land base.

U Recycling rate is an average of the rate of recycling of paper and cardboard and of glass. The rates are inverted to express the proportion of waste *not* recycled.

V Overall average is the average of the lines "Average (air quality)," "Average (water quality)," "Average (natural resources)," and "Average (solid waste)."

Notes

Primary Indicators

1 USEPA 1996a: 1. Cities from 50,000–100,000 have a class-two station and cities with populations over 250 000 are required to have a class-one monitoring station according to the NAPS.

2 Canada has a unique three-tiered system of objectives defining maximum desirable, maximum acceptable and maximum tolerable air pollution levels over periods of one year, 24 hours, eight hours and one hour. Each table in this section gives the corresponding levels explicitly in parts per million (ppm) or micrograms per cubic metre (μg/m3). "Good" means an ambient pollution level lower than the maximum desirable objective, "Fair" lies between the maximum desirable and maximum acceptable objectives, "Poor" lies between the maximum acceptable and maximum tolerable objectives, and "Very Poor" means an ambient pollution level higher than the maximum tolerable objective.

3 SO_2 converts to sulphuric acid when it combines with oxygen and water in intense sunlight.

4 Individual stations may exceed these objectives; a 1990 Canadian study showed, however, that 98 percent of stations met annual "fair" objectives, 88 percent met 24-hr "fair" objectives and 82 percent met 1-hr "fair" objectives. See Environment Canada 1994: 12–17.

5 For a more complete analysis, see Ackerman and Hassler 1981. This regulation carries with it an enormous cost as well. Scrubbers on coal-fired plants can cost as much as US$200 million to install. See Portney 1990: 76.

6 These targets are set by the United Nations Economic Commission for Europe's (UNECE) Second Sulphur Protocol.

7 Working Assets Long Distance, a San Francisco-based long distance phone company, bought and retired US$74,000 worth of permits in 1992; this represents 336 metric tonnes of emissions.

8 In the 1990 survey of individual stations, 100 percent of stations met annual, 24–hr and 1–hr "fair" objectives. Environment Canada 1994: 18–22.

9 In 1990, 38 percent of stations met annual "Fair" objectives and 31 percent met 1–hr "Fair" objectives, although no station exceeded the "Poor" 1–hr level. Environment Canada 1994: 28–34.

10 Although there are no annual objectives, in the 1990 study of Canadian stations, 98 percent of stations met the 8–hr and 1–hr Fair objectives. Environment Canada 1994: 23–27.

11 Dr. Donald Stedman, a chemistry professor at the University of Denver, has developed a device that can measure and test the exhaust of moving vehicles, thus isolating the heaviest polluters. For more on this see Bast, Hill, and Rue 1994: 115–6. Also, if power plants were to add chemical or isometric "labels" to their emissions, lasimetric technology could map chemical concentrations from orbit. See Smith 1995: 390.

12 In Mexico, 57 percent of the gasoline sold is unleaded. However, there is considerable variation among cities. For example, 97 percent of gasoline sold is unleaded in the northern border regions while only 63 percent of gasoline in Guadalajara and Monterrey is unleaded and only 46 percent of gasoline in Mexico City is unleaded.

13 It should be noted that the Canadian ozone standard (.082 ppm) is stricter than that of the United States (.120 ppm).

14 Even measures at Canada's worst sites are relatively low. A recent study shows that the lake-shore sites around the Great Lakes record an average of 150 hours (20 days) annually that exceed the .082 ozone standard. Recorded levels greater than .120 ppm are

rare in most regions and very infrequent in southern Ontario with only 0.14 percent of measures exceeding this level. See Dann 1996: 1–27.

15 Point versus non-point sources of water pollution could be compared to stationary versus mobile sources of air pollution.

16 Eutrophication, or nutrient enrichment, is the oversupply of inorganic nutrients that cause algae and plants to multiply rapidly; when they die and decompose, the water's dissolved oxygen content is depleted. Dissolved oxygen, which is derived from photosynthesis by aquatic plants and atmospheric exchange, is essential to ensure the maintenance of aquatic life and self-purification processes in natural water systems.

17 Bioaccumulation in aquatic organisms occurs when a persistent, fat-soluble, contaminant enters the organism's body through the skin or by ingestion. If consumption exceeds the organism's ability to metabolize or eliminate the contaminant, over time it accumulates in tissues.

18 Phosphorus targets: Lake Michigan, 5,600 tonnes; Lake Superior, 3,400 tonnes; Lake Huron, 4,360 tonnes; Lake Erie, 11,000 tonnes; Lake Ontario, 7,000 tonnes.

19 DDT (dichloro-diphenyl-trichloro-ethane) is a persistent, bioaccumulative, synthetic insecticide. Its use was heavily restricted in the 1970s and prohibited after 1990. The breakdown product, DDE (dichloro-diphenyl-dichloro-ethylene), is most easily measured in the fat of animals or in the eggs of birds. Most other pesticides in use today are not as persistent and hence are not transported to the same degree as DDT.

20 PCBs were once used extensively in many parts of the electrical and transmission industry, in flame retardants, water-proofing agents, printing inks, adhesives; they were also spread on roads to prevent airborne dust. In the 1980s, tight restrictions allowed PCBs to be used only in closed electrical equipment, and safe incineration technologies now are used to destroy those currently in storage. They have been associated with declining fish populations in some locations.

21 HCBs are used in fungicides, dye manufacturing, and wood preservatives; they are also produced as a waste by-product of chemical manufacturing. The Great Lakes region is at risk from HCB contamination since numerous chlorine plants are located near the Lakes on both sides of the border.

22 Organisation for Economic Cooperation and Development (OECD), Environmental Data Compendium, 1997, p. 120. Production for each nation as a percentage of global production: wood pulp—US, 19.8%; Can., 34.7%; sawnwood and sleepers—US, 10.2%; Can., 33.0%; industrial roundwood—US, 26.3%; Can., 2.0%; paper and cardboard—US, 10.2%; Can., 15.6%; wood-based panels—US, 5.96%; Can., 9.2%.

23 Environment Canada 1991b: 74. Conversion based on 1989 exchange rate of CDN$1.184 per US$1, from Statistics Canada 1995: 89. Prices are quoted in US dollars.

24 Calculations of Canadian and American figures are based on data from OECD 1997: 67–70.

25 One measure of energy efficiency is the ratio of energy use to the size of the national economy. See OECD 1995: 205.

26 Brookes 1991: 104–112. This estimate excludes Alaska, which is 90 percent wetland area and 90 percent government owned.

27 Comparable data do not exist after this period because the Canada Land Use Monitoring Program ended in 1986. Statistics Canada is attempting to derive comparable data for 1991 (Trant 1996).

28 Whatever happened to the Mobro garbage barge? After wandering up and down the Atlantic seaboard for several weeks, the trash it carried was placed in a landfill in New York, just a few miles from where it had started its journey.

29 The Canadian Council of Ministers of the Environment (CCME) has set a nation-wide goal of 50 percent reduction per capita from 1988 level, by the year 2000. A second initiative, the National Packaging Protocol (NAPP), targets the 35 to 40 percent of solid waste that is composed of discarded packaging, and aims to reduce the level of discarded packaging to 50 percent of the 1988 level by the year 2000. See Environment Canada 1991c: (25)4.

30 In the United States, municipal waste is waste collected by, or on the order of, municipalities. It includes waste originating in households, commercial activities, office buildings, institutions like schools and government buildings, and small businesses that dispose of waste at the same facilities used for municipally collected wastes. In Canada, municipal waste is all waste that is not construction and demolition debris. See OECD 1997: 153.

31 According to OECD data the United Kingdom disposes of 70 percent of its waste in landfills. DETR data

indicate that a higher percentage, 84 percent, is disposed of in landfills in the United Kingdom.

32 Imperial measures are 44 square miles and 120 feet deep. See Wiseman 1990.

33 Canadian data are based on apparent consumption (a proxy for waste generated derived from consumption) using figures from domestic consumption of the respective product + imports – exports. American data are based on amounts of waste generated. OECD 1995: 153.

34 Canada's glass recycling figure includes the reuse of refillable money-back bottles. OECD 1997: 164.

Secondary Indicators

1 The atmosphere contains 750 billion tonnes of carbon dioxide; living plants contain 560 billion tonnes, soils 1,400 billion tonnes, ocean sediments 11,000 billion tonnes and the oceans themselves 38,000 billion tonnes. See Environment Canada 1991c: (22) 7.

2 Scientists do not dispute that the increase in equivalent CO_2 has occurred. Since the Industrial Revolution, equivalent CO_2 levels have risen from approximately 290 ppm to nearly 440 ppm in 1994 (Bailey 1995: 87). Humans do not, however, contribute to the main absorbers of infrared light in the atmosphere. Water vapour and clouds are responsible for over 98 percent of the current greenhouse effect (Lindzen 1992: 2).

3 Extinct: a species no longer existing; extirpated: a species no longer existing in the wild in Canada but existing elsewhere; endangered: a species facing imminent extirpation or extinction; threatened: a species likely to become endangered if limiting factors are not reversed; vulnerable: a species of special concern because it has characteristics that make it particularly sensitive to human activities or natural events. From COSEWIC 1995: 1.

4 "Threatened" means species that are thought to be at risk of extinction if present deterioration of habitat continues; "rare" indicates species with a small population or a restricted habitat; "needing special protection" indicates species for which regulations exist to prevent over-exploitation or to ensure conservation.

5 Easterbrook 1994. Easterbrook argues that the number of spotted owls has been badly underestimated, that it does not differ genetically from the spotted owl populations in California, that it thrives in more kinds of habitat than is claimed, and, therefore, that it is not endangered.

Index

1 For a comprehensive discussion of the wide variety of beliefs about nature in this century alone, see Bramwell 1989.

2 This two-stage averaging process is necessary to avoid giving exaggerated weight to categories that include a larger number of sub-categories.

3 This is the time period for which the data are most complete across all categories.

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