

## World on the Edge - Climate Data - Climate and Weather

[Atmospheric Carbon Dioxide Concentration, 1000-2009](#)

GRAPH: Atmospheric Carbon Dioxide Concentration, 1000-2009

[Global Average Temperature, 1880-2009](#)

GRAPH: Global Average Temperature, 1880-2009

[Average Global Temperature by Decade, 1880-2009](#)

[Natural Disasters with Billion Dollar Insured Losses through 2009](#)

[Countries that Set New High-Temperature Records in 2010](#)

[Selected U.S. Cities with Record-High Summer Average Temperatures in 2010](#)

[MAP: Summer Average Temperatures at U.S. Weather Stations in 2010, Compared with Historical Data from 1895-2010](#)

[World Carbon Dioxide Emissions from Fossil Fuel Combustion in 2006 and 2008, with IEA Projection for 2020](#)

[Net Carbon Emissions from Land Use Change, 1850-2005](#)

GRAPH: Net Carbon Emissions from Land Use Change Worldwide, 1850-2005

GRAPH: Net Carbon Emissions from Land Use Change in Africa and the Middle East, 1850-2005

GRAPH: Net Carbon Emissions from Land Use Change in the Americas, 1850-2005

GRAPH: Net Carbon Emissions from Land Use Change in Asia and the Pacific, 1850-2005

GRAPH: Net Carbon Emissions from Land Use Change in Europe and the Former Soviet Union, 1850-2005

[Plan B Carbon Dioxide Emissions Reductions and Sequestration in 2020](#)

GRAPH: Plan B Carbon Dioxide Emissions Reduction Goals for 2020

A full listing of data for the entire book is on-line at:

[http://www.earth-policy.org/books/wote/wote\\_data](http://www.earth-policy.org/books/wote/wote_data)

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Atmospheric Carbon Dioxide Concentration, 1000-2009

Year	Concentration
	Parts Per Million by Volume
1000	277.0
1001	277.0
1002	277.0
1003	277.0
1004	277.0
1005	277.1
1006	277.1
1007	277.1
1008	277.1
1009	277.1
1010	277.1
1011	277.1
1012	277.1
1013	277.1
1014	277.1
1015	277.2
1016	277.2
1017	277.2
1018	277.2
1019	277.2
1020	277.2
1021	277.2
1022	277.2
1023	277.2
1024	277.2
1025	277.3
1026	277.3
1027	277.3
1028	277.3
1029	277.3
1030	277.3
1031	277.3
1032	277.3
1033	277.3
1034	277.3
1035	277.4
1036	277.4
1037	277.4
1038	277.4
1039	277.4
1040	277.4
1041	277.4
1042	277.4
1043	277.4
1044	277.4
1045	277.5
1046	277.5

1047	277.5
1048	277.5
1049	277.5
1050	277.5
1051	277.5
1052	277.6
1053	277.6
1054	277.6
1055	277.7
1056	277.7
1057	277.7
1058	277.7
1059	277.8
1060	277.8
1061	277.8
1062	277.9
1063	277.9
1064	277.9
1065	278.0
1066	278.0
1067	278.0
1068	278.0
1069	278.1
1070	278.1
1071	278.1
1072	278.2
1073	278.2
1074	278.2
1075	278.3
1076	278.3
1077	278.3
1078	278.3
1079	278.4
1080	278.4
1081	278.4
1082	278.5
1083	278.5
1084	278.5
1085	278.6
1086	278.6
1087	278.6
1088	278.6
1089	278.7
1090	278.7
1091	278.7
1092	278.8
1093	278.8
1094	278.8
1095	278.9
1096	278.9
1097	278.9
1098	278.9

1099	279.0
1100	279.0
1101	279.0
1102	279.0
1103	278.9
1104	278.9
1105	278.9
1106	278.9
1107	278.9
1108	278.8
1109	278.8
1110	278.8
1111	278.8
1112	278.8
1113	278.7
1114	278.7
1115	278.7
1116	278.7
1117	278.7
1118	278.6
1119	278.6
1120	278.6
1121	278.6
1122	278.6
1123	278.5
1124	278.5
1125	278.5
1126	278.5
1127	278.5
1128	278.4
1129	278.4
1130	278.4
1131	278.4
1132	278.4
1133	278.3
1134	278.3
1135	278.3
1136	278.3
1137	278.3
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1140	278.2
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1142	278.2
1143	278.1
1144	278.1
1145	278.1
1146	278.1
1147	278.1
1148	278.0
1149	278.0
1150	278.0

1151	278.0
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1153	277.9
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1155	277.9
1156	277.8
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1165	277.6
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1168	277.5
1169	277.4
1170	277.4
1171	277.4
1172	277.3
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1174	277.3
1175	277.3
1176	277.2
1177	277.2
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1180	277.1
1181	277.1
1182	277.0
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1185	277.0
1186	276.9
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1188	276.9
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1197	276.6
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1205	276.3
1206	276.2
1207	276.2
1208	276.1
1209	276.1
1210	276.0
1211	276.1
1212	276.1
1213	276.2
1214	276.3
1215	276.3
1216	276.4
1217	276.5
1218	276.6
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1220	276.7
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1223	276.9
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1227	277.2
1228	277.2
1229	277.3
1230	277.4
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1233	277.6
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1238	277.9
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1243	278.3
1244	278.4
1245	278.4
1246	278.5
1247	278.6
1248	278.6
1249	278.7
1250	278.8
1251	278.8
1252	278.9
1253	279.0
1254	279.0

1255	279.1
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1257	279.3
1258	279.3
1259	279.4
1260	279.5
1261	279.5
1262	279.6
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1265	279.8
1266	279.9
1267	279.9
1268	280.0
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1270	280.2
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1273	280.4
1274	280.4
1275	280.5
1276	280.6
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1280	280.8
1281	280.9
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1284	281.1
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1297	282.0
1298	282.1
1299	282.2
1300	282.2
1301	282.3
1302	282.4
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1306	282.6

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1310	282.9
1311	283.0
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1313	283.1
1314	283.2
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1322	283.8
1323	283.8
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1325	284.0
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1328	284.2
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1330	284.3
1331	284.4
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1337	284.8
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1356	284.7
1357	284.6
1358	284.5



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1722	279.2

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1798	280.8
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1801	281.3
1802	281.5
1803	281.7
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1841	285.3
1842	286.3
1843	287.4
1844	287.3
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1878	290.3

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1888	292.6
1889	292.9
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1891	293.5
1892	293.8
1893	294.1
1894	294.3
1895	294.6
1896	294.9
1897	295.2
1898	295.5
1899	295.8
1900	295.6
1901	295.3
1902	295.1
1903	294.8
1904	295.9
1905	296.9
1906	297.5
1907	298.1
1908	298.6
1909	299.2
1910	299.4
1911	299.6
1912	299.9
1913	300.1
1914	300.3
1915	300.5
1916	300.7
1917	300.9
1918	301.1
1919	301.2
1920	301.4
1921	301.6
1922	302.3
1923	302.9
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1925	304.2
1926	304.9
1927	305.5
1928	305.6
1929	305.8
1930	305.9

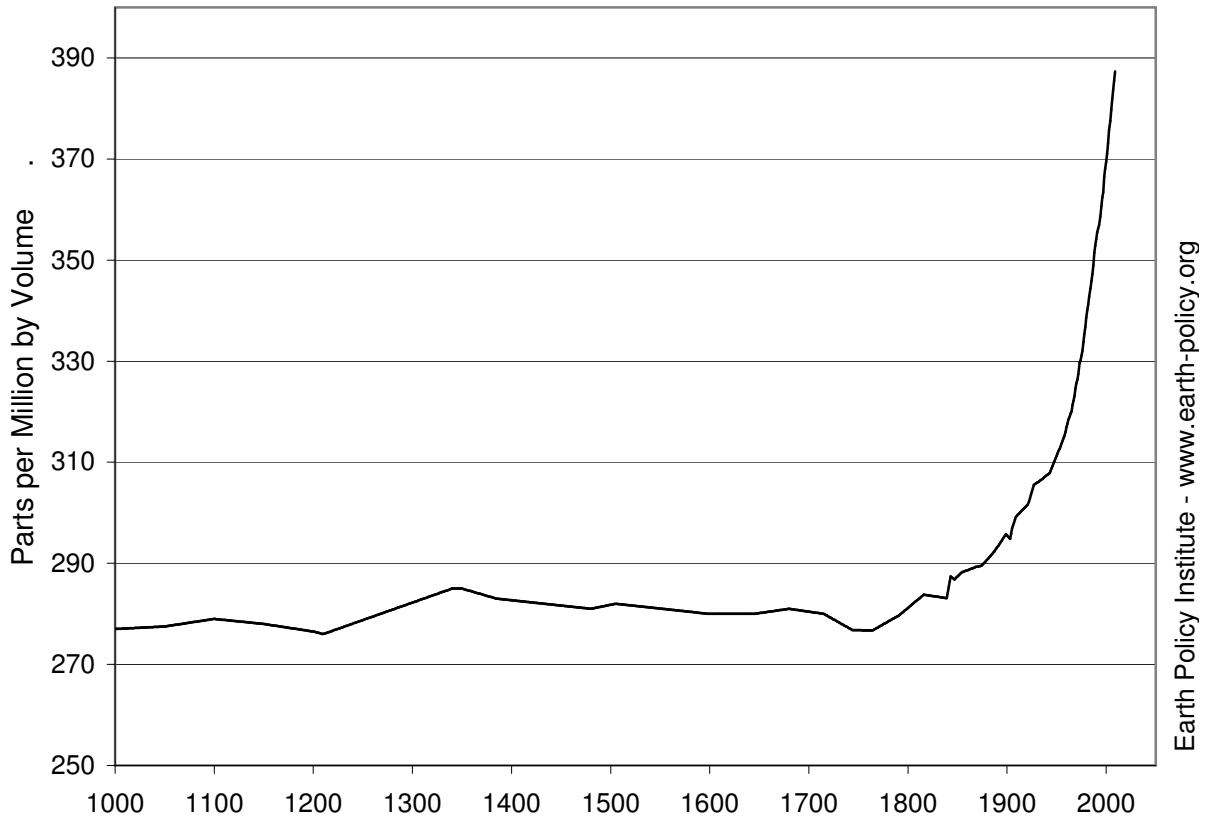
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1932	306.2
1933	306.3
1934	306.5
1935	306.6
1936	306.8
1937	306.9
1938	307.1
1939	307.3
1940	307.4
1941	307.6
1942	307.7
1943	307.9
1944	308.4
1945	308.9
1946	309.3
1947	309.8
1948	310.3
1949	310.8
1950	311.3
1951	311.7
1952	312.2
1953	312.7
1954	313.2
1955	313.7
1956	314.3
1957	314.8
1958	315.3
1959	316.0
1960	316.91
1961	317.64
1962	318.45
1963	318.99
1964	319.62
1965	320.04
1966	321.38
1967	322.16
1968	323.04
1969	324.62
1970	325.68
1971	326.32
1972	327.45
1973	329.68
1974	330.17
1975	331.08
1976	332.05
1977	333.78
1978	335.41
1979	336.78
1980	338.68
1981	340.11
1982	341.22

1983	342.84
1984	344.41
1985	345.87
1986	347.19
1987	348.98
1988	351.45
1989	352.90
1990	354.16
1991	355.48
1992	356.27
1993	356.95
1994	358.64
1995	360.62
1996	362.36
1997	363.47
1998	366.50
1999	368.14
2000	369.40
2001	371.07
2002	373.17
2003	375.78
2004	377.52
2005	379.76
2006	381.85
2007	383.71
2008	385.57
<u>2009</u>	<u>387.35</u>

Source: Compiled by Earth Policy Institute, with long term historical data from Worldwatch Institute, *Signposts 2001*, CD-Rom (Washington, DC: 2001); 1960 to 2009 from NOAA/ESRL, "Atmospheric Carbon Dioxide - Mauna Loa," at [www.esrl.noaa.gov/gmd/ccgg/trends/co2\\_data\\_mlo.html](http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html), updated October 2010.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# Atmospheric Carbon Dioxide Concentration, 1000-2009



Source: NOAA/ESRL; Worldwatch

Earth Policy Institute - [www.earth-policy.org](http://www.earth-policy.org)

## Global Average Temperature, 1880-2009

Year	Temperature Degrees Celsius
1880	13.72
1881	13.79
1882	13.74
1883	13.73
1884	13.68
1885	13.68
1886	13.71
1887	13.64
1888	13.73
1889	13.83
1890	13.61
1891	13.72
1892	13.68
1893	13.67
1894	13.67
1895	13.75
1896	13.86
1897	13.89
1898	13.74
1899	13.84
1900	13.92
1901	13.85
1902	13.75
1903	13.70
1904	13.65
1905	13.76
1906	13.81
1907	13.61
1908	13.67
1909	13.65
1910	13.67
1911	13.66
1912	13.68
1913	13.70
1914	13.85
1915	13.90
1916	13.70
1917	13.61
1918	13.67
1919	13.80
1920	13.81
1921	13.85
1922	13.74
1923	13.78
1924	13.78
1925	13.83
1926	13.98

1927	13.85
1928	13.87
1929	13.74
1930	13.92
1931	13.98
1932	13.92
1933	13.81
1934	13.93
1935	13.88
1936	13.95
1937	14.07
1938	14.10
1939	14.01
1940	14.04
1941	14.10
1942	14.03
1943	14.09
1944	14.19
1945	14.06
1946	13.95
1947	14.00
1948	13.96
1949	13.93
1950	13.84
1951	13.96
1952	14.03
1953	14.11
1954	13.90
1955	13.90
1956	13.83
1957	14.08
1958	14.08
1959	14.06
1960	13.99
1961	14.07
1962	14.04
1963	14.08
1964	13.79
1965	13.89
1966	13.97
1967	13.99
1968	13.96
1969	14.08
1970	14.03
1971	13.90
1972	14.00
1973	14.14



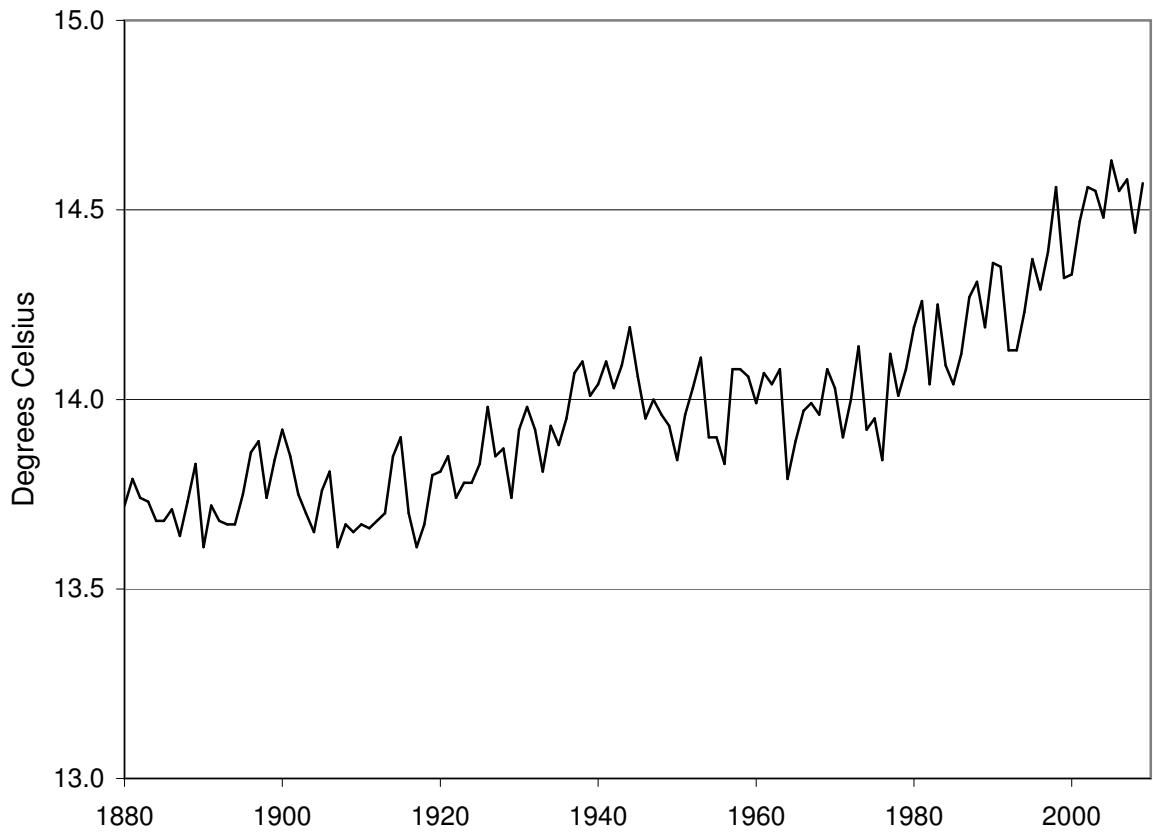
1974	13.92
1975	13.95
1976	13.84
1977	14.12
1978	14.01
1979	14.08
1980	14.19
1981	14.26
1982	14.04
1983	14.25
1984	14.09
1985	14.04
1986	14.12
1987	14.27
1988	14.31
1989	14.19
1990	14.36
1991	14.35
1992	14.13
1993	14.13
1994	14.23
1995	14.37
1996	14.29
1997	14.39
1998	14.56
1999	14.32
2000	14.33
2001	14.47
2002	14.56
2003	14.55
2004	14.48
2005	14.63
2006	14.55
2007	14.58
2008	14.44
2009	14.57

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Source: Compiled by Earth Policy Institute from NASA Goddard Institute for Space Studies, "Global Temperature Anomalies in 0.01 degrees Celsius" at [data.giss.nasa.gov/gistemp/tabledata/GLB.Ts.txt](http://data.giss.nasa.gov/gistemp/tabledata/GLB.Ts.txt), updated December 2010.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# Global Average Temperature, 1880-2009



Source: NASA GISS

Earth Policy Institute - [www.earth-policy.org](http://www.earth-policy.org)

### Average Global Temperature by Decade, 1880-2009

Decade	Average Temperature Degrees Celsius
1880-1889	13.75
1890-1899	13.74
1900-1909	13.73
1910-1919	13.72
1920-1929	13.84
1930-1939	13.97
1940-1949	14.04
1950-1959	13.98
1960-1969	13.99
1970-1979	14.00
1980-1989	14.18
1990-1999	14.32
2000-2009	14.52

Source: Compiled by Earth Policy Institute (EPI) from National Aeronautics and Space Administration (NASA), Goddard Institute for Space Studies (GISS), "Global Land-Ocean Temperature Index in 0.01 Degrees Celsius," at [data.giss.nasa.gov/gistemp/tabledata/GLB.Ts+dSST.txt](http://data.giss.nasa.gov/gistemp/tabledata/GLB.Ts+dSST.txt), updated December 2010.

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### Natural Disasters with Billion Dollar Insured Losses through 2009

Year	Event	Location	Insured Losses	Economic Losses
			Million U.S. Dollars	
1983	Hurricane Alicia	USA	1,500	3,000
1987	Winter storm	West Europe	3,100	3,700
1989	Hurricane Hugo	Caribbean, USA	4,500	9,000
1990	Winter storm Daria	Europe	5,100	6,800
1990	Winter storm Herta	Europe	1,300	1,950
1990	Winter storm Vivian	Europe	2,100	3,200
1990	Winter storm Wiebke	Europe	1,300	2,250
1991	Typhoon Mireille	Japan	5,400	10,000
1991	Wildfire	USA	1,750	2,500
1992	Hurricane Andrew	USA	17,000	30,000
1992	Hurricane Iniki	USA: HI	1,600	3,000
1993	Blizzard	USA	1,750	5,000
1993	Floods	USA	1,270	21,000
1994	Earthquake	USA	15,300	44,000
1995	Earthquake	Japan	3,000	100,000
1995	Hailstorm	USA	1,135	2,000
1995	Hurricane Luis	Caribbean	1,500	2,500
1995	Hurricane Opal	USA	2,100	3,000
1996	Hurricane Fran	USA	1,800	5,200
1997	Ice storm	Canada, USA	1,200	2,500
1998	Floods	China	1,000	30,000
1998	Typhoons Vicki and Waldo	Japan	1,600	3,000
1998	Hailstorm	USA	1,350	1,800
1998	Hurricane Georges	Caribbean, USA	4,000	10,000
1999	Hailstorm	Australia	1,100	1,500
1999	Tornadoes	USA	1,485	2,800
1999	Hurricane Floyd	USA	2,200	4,500
1999	Typhoon Bart	Japan	3,500	5,000
1999	Winter storm Anatol	Europe	2,350	2,900
1999	Winter storm Lothar	Europe	5,900	11,500
1999	Winter storm Martin	Europe	2,500	4,100
2000	Typhoon Saomai	Japan	1,050	1,500
2000	Floods	UK	1,100	1,500
2000	Hailstorm	USA	1,900	2,500
2001	Tropical storm Alison	USA	3,500	6,000
2002	Tornadoes	USA	1,675	2,200
2002	Floods	Europe	3,400	16,000
2002	Winter storm Jeanett	Europe	1,500	2,300
2003	Hailstorm, Tornadoes	USA	1,600	2,100
2003	Tornadoes	USA	3,200	4,000
2003	Hurricane Isabell	USA	1,685	5,000
2003	Wildfires	USA	2,200	3,500
2004	Hurricane Charley	Caribbean, USA	8,000	18,000
2004	Hurricane Frances	Caribbean, USA	6,000	12,000

2004	Typhoon Songda	Japan	3,000	6,000
2004	Hurricane Ivan	Caribbean, USA	11,500	23,000
2004	Hurricane Jeanne	Caribbean, USA	5,000	9,000
2004	Typhoon Tokage	Japan	1,300	2,300
2004	Earthquake, Tsunami	South Asia, East Africa	>1,000	>10,000
2005	Winter storm Erwin	Scandinavia, Baltic Countries	2,500	5,800
2005	Hurricane Dennis	Jamaica, Haiti, Cuba, USA: FL, AL, MS, GA	1,200	3,100
2005	Floods	Germany, Australia, Switzerland	1,700	3,000
2005	Hurricane Katrina	USA: AL, FL, LA, MS	60,000	125,000
2005	Hurricane Rita	USA: FL, LA, TX, MS	11,000	16,000
2005	Hurricane Wilma	Mexico. USA: FL	10,500	18,000
2006	Tornadoes, Hailstorm	USA	1,280	1,600
2006	Tornadoes	USA	1,850	2,600
2006	Drought, Heatwaves, Wildfires	Worldwide	1,500	>4,500
2006	Typhoon Shanshan	Japan, South Korea	1,200	2,500
2007	Winter Storm Kyrill	Europe	5,800	10,000
2007	Winter storm, tornadoes	Atlantic Coast of North America, US Gulf States	1,569	2,000
2007	Floods (June)	UK	3,000	4,000
2007	Floods (July)	UK	3,000	4,000
2007	Wildland Fires	USA: Southern CA	2,300	2,700
2008	Winter damage	China	1,200	21,000
2008	Winter Storm Emma	Europe	1,500	2,000
2008	Severe Storm, Tornadoes	USA, esp: CO, MN	1,325	1,600
2008	Severe Storm Hilal	Germany	1,100	1,500
2008	Hurricane Gustav	Caribbean, USA	3,500	10,000
2008	Hurricane Ike	Caribbean, USA	15,000	38,000
2009	Winter Storm Klaus	France, Spain, Italy	3,000	5,100
2009	Black Saturday wildfires	Australia	770	1,300
2009	Flood	USA, Canada	75	1,000
2009	Earthquake	Italy	260	2,500
2009	Severe Weather, Tornadoes	USA	1,100	2,000
2009	Severe Weather, Hail	Europe	1,200	1,800
2009	Typhoon Morakot	Taiwan, China, Philippines	110	4,600
2009	Earthquake	Indonesia	100	2,200
2009	Typhoon Melor	Japan	625	1,000
2009	Hurricane Ida	Mexico, El Salvador, Nicaragua, USA	250	1,500

Note: Damage values in nominal dollars.

Source: Compiled by Earth Policy Institute from Munich Re, "Natural Disasters: Billion-\$ Insurance Losses," in Louis Perroy, "Impacts of Climate Change on Financial Institutions' Medium to Long Term Assets and Liabilities," presented to the Staple Inn Actuarial Society, 14 June 2005; Munich Re, *Topics Geo: Natural Catastrophes 2004, 2005, 2006, 2007, 2008, and 2009* (Munich: 2005, 2006, 2007, 2008, 2009, and 2010).

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Countries that Set New High-Temperature Records in 2010

Country	Date	Record Temperature		Location
		Degrees Celsius	Degrees Fahrenheit	
Belarus <sup>1</sup>	August 7, 2010	38.9	102.0	Gomel
Ukraine	August 12, 2010	42.0	107.6	Lukhansk
Cyprus	August 1, 2010	46.6	115.9	Lefconica
Finland	July 29, 2010	37.2	99.0	Joensuu
Qatar	July 14, 2010	50.4	122.7	Doha Airport
Russia <sup>2</sup>	July 12, 2010	45.4	113.7	Utta hydrological station, Kalmykia Republic
Sudan	June 22, 2010	49.7	121.5	Dongola
Niger	June 23, 2010	48.2	118.8	Bilma
Saudi Arabia	June 22, 2010	52.0	125.6	Jeddah
Chad	June 22, 2010	47.6	117.7	Faya
Kuwait	June 15, 2010	52.6	126.7	Abdaly
Iraq	June 14, 2010	52.0	125.6	Basra
Pakistan <sup>3</sup>	May 26, 2010	53.5	128.3	Mohenjo-daro
Burma (Myanmar) <sup>4</sup>	May 14, 2010	47.2	117.0	Myinmu
Ascension Island	March 25, 2010	34.9	94.8	Georgetown
The Solomon Islands	February 1, 2010	36.1	97.0	Honiara Airport
Colombia	January 24, 2010	42.3	108.0	Puerto Salgar
Bolivia	October 29, 2010	46.7	116.1	Villamontes
Zambia	October 13, 2010	42.4	108.3	Mfuwe

Notes: Several other countries, including the Azores, Morocco, Estonia, and Latvia came within 1 degree Celsius or less of their previous high-temperature records during 2010. No country set a record for its coldest temperature.

(1) This broke the previous all-time record of 38.7 °C (101.7 °F) set just a day before in Gorky.

(2) This meteorological station is not regulated by the Russian meteorological service and, thus, may not be wholly accurate. If inaccurate, the all-time record is that which was set the previous day: 44.0 °C (111.2 °F) at Yashkul in the Kalmykia Republic.

(3) Pakistan record was also a temperature record for the continent of Asia.

(4) Burma record was also a temperature record for Southeast Asia.

Sources: Jeff Masters, "Paula Dying; Zambia Records its Hottest Temperature in History," *Dr. Jeff Masters' WunderBlog, Weather Underground*, at [www.wunderground.com/blog/JeffMasters](http://www.wunderground.com/blog/JeffMasters), 15 October 2010; Jeff Masters, e-mails to Alexandra Giese, Earth Policy Institute, 19 November 2010 and 3 December 2010.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Selected U.S. Cities with Record-High Summer Average Temperatures in 2010

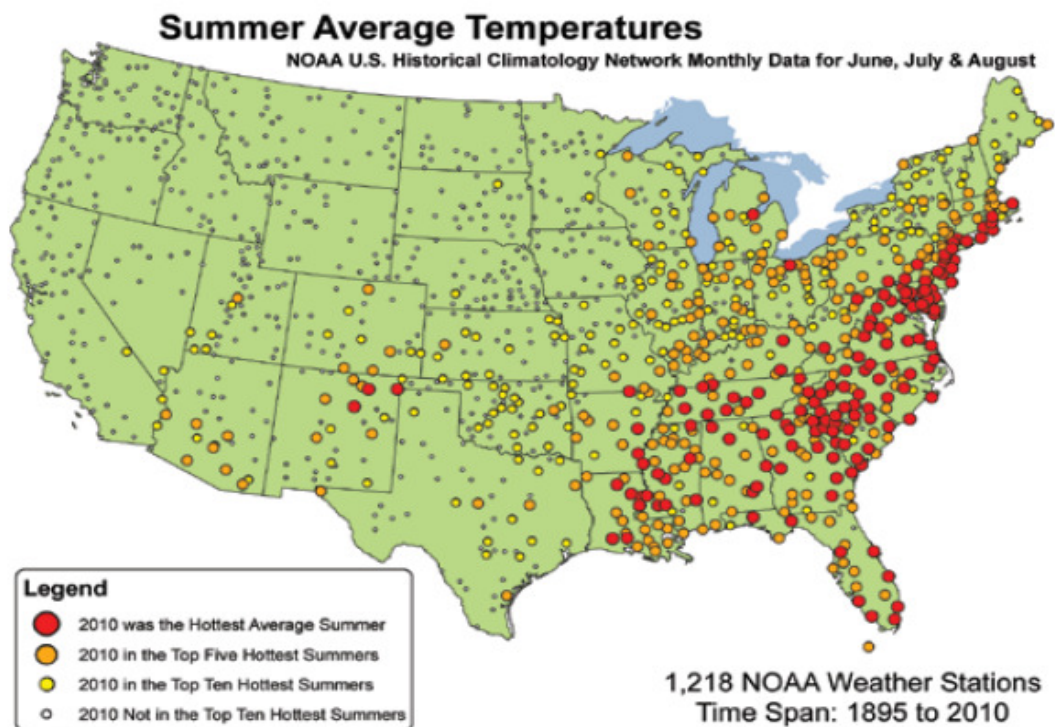
City	Temperature
	Degrees Fahrenheit
New York, NY	77.8
Washington, DC	81.3
Dulles, VA	77.8
Richmond, VA	81.3
Atlantic City, NJ	77.5
Philadelphia, PA	79.6
Trenton, NJ	77.7
Wilmington, DE	77.8
Baltimore, MD	79.2
Norfolk, VA	81.1
Tampa, FL	84.5
Lakeland, FL	84.6
St. Petersburg, FL	85.6
Asheville, NC	75.4
Greenville, SC	81.0

Note: Temperatures are June - August temperatures.

Source: Christopher C. Burt, "The Remarkable Summer of 2010," *Weather Extremes Blog, Weather Underground*, at [www.wunderground.com/blog/weatherhistorian](http://www.wunderground.com/blog/weatherhistorian), 22 September 2010.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Summer Average Temperatures at U.S. Weather Stations in 2010, Compared with Historical Data from 1895-2010



Note: 153 of 1,218 weather stations maintained by the National Oceanic and Atmospheric Administration experienced all-time record summer (June-August) temperatures. This number differs from the number of cities that experienced record hot summers because the weather stations are often located in rural areas.

Source: National Resources Defense Council, "The Worst Summer Ever? Record Temperatures Heat Up in the United States," *Climate Facts*, September 2010, at [www.nrdc.org/globalWarming/hottestsummer/default.asp](http://www.nrdc.org/globalWarming/hottestsummer/default.asp).

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).



## World Carbon Dioxide Emissions from Fossil Fuel Combustion in 2006 and 2008, with IEA Projection for 2020

Emissions	Growth Rate,	Growth Rate,	CO <sub>2</sub> Emissions,	CO <sub>2</sub> Emissions,	CO <sub>2</sub> Emissions,
	2006-2015	2015-2020	2006	2008	2020
	Percent		Million Tons Carbon		
By Fuel:					
Coal	3.1	1.6	3,185	3,431	4,555
Oil	1.3	0.9	2,937	2,947	3,454
Gas	2.0	1.5	1,484	1,602	1,918
By Sector:					
Power Generation	2.9	1.6	3,119	3,250	4,365
Coal	3.2	1.7	2,273	2,365	3,300
Oil	-0.4	-1.9	241	236	211
Gas	2.8	2.0	605	650	853
Total Final Consumption	1.7	1.1	4,123	4,323	5,090
Coal	2.7	1.1	855	990	1,150
Oil	1.5	1.2	2,515	2,527	3,033
<i>of which transport</i>	1.7	1.3	1,708	1,746	2,126
<i>of which marine bunkers</i>	1.0	1.0	159	158	326
<i>of which international aviation</i>	2.2	1.8	108	124	145
Gas	1.4	1.2	754	807	907
Other Energy Sector			364	406	472
<b>Total CO<sub>2</sub> Emissions</b>	<b>2.2</b>	<b>1.4</b>	<b>7,606</b>	<b>7,980</b>	<b>9,927</b>

Notes: Power Generation refers to fuel use in electricity plants, heat plants, and combined heat and power, including both public plants and small plants that produce fuel for their own use. Total Final Consumption includes industry (e.g. construction, mining, manufacturing, and petrochemical feedstocks), transport, agriculture, residential, and non-energy use. Other Energy Sector includes transformation and transmission losses. Growth rates and 2020 projection are for the International Energy Agency Reference Scenario, which is "based on established trends and policies, without new initiatives by governments on energy security or climate change."

Source: Calculated by Earth Policy Institute with rates, 2006 data, and 2020 projection from International Energy Agency (IEA), *World Energy Outlook 2008* (Paris: 2008), p. 507; 2008 data from International Energy Agency (IEA), *World Energy Outlook 2010* (Paris: 2010), p. 620, with bunker data from Michael Chen, e-mail to Alexandra Giese, Earth Policy Institute, 30 November 2010.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Net Carbon Emissions from Land Use Change, 1850-2005

Year	United States	Canada	S. and C. America	Europe	N. Africa and Mid. East	Tropical Africa	Former USSR	China	S. and S. E. Asia	Developing Pacific	World
Million Tons of Carbon											
1850	164.1	5.5	23.5	55.0	4.0	-1.3	58.6	101.8	87.3	2.0	500.6
1851	165.7	5.4	23.2	55.0	4.0	-1.1	58.6	93.1	86.9	2.0	492.7
1852	230.7	5.3	22.9	55.0	4.0	-1.0	58.9	83.8	86.9	2.0	548.5
1853	238.5	5.3	22.6	55.0	4.0	-1.1	59.2	74.2	87.0	2.0	546.8
1854	246.2	5.3	22.4	54.9	4.0	-1.0	59.6	64.3	87.1	2.0	544.8
1855	253.6	5.3	22.2	54.9	4.0	-1.1	60.0	54.2	87.1	2.0	542.1
1856	260.5	5.2	22.0	54.9	4.0	-1.1	60.3	52.6	87.2	2.0	547.7
1857	267.2	5.2	21.8	54.8	4.0	-1.1	60.7	51.3	87.3	2.0	553.3
1858	273.6	5.2	21.7	54.8	4.0	-1.4	61.1	50.2	87.4	2.0	558.6
1859	279.7	5.2	21.5	54.8	4.0	-1.6	61.5	49.4	87.5	2.0	564.0
1860	285.7	5.2	21.1	54.8	4.0	-1.8	61.9	48.7	87.6	2.0	569.0
1861	290.7	5.1	21.9	54.8	9.0	-2.1	62.2	48.1	87.7	2.1	579.6
1862	237.7	6.8	22.1	54.9	10.0	-1.9	53.7	47.8	87.8	2.2	520.9
1863	236.8	7.3	22.2	55.0	10.8	-1.7	53.7	46.6	87.9	2.3	521.1
1864	236.0	7.8	22.3	55.1	11.3	-1.2	53.8	46.2	88.0	2.4	521.6
1865	235.2	8.4	22.3	55.2	11.6	-0.7	53.9	45.8	88.1	2.6	522.4
1866	234.8	8.9	21.9	55.3	12.0	-0.5	53.7	45.4	88.2	2.7	522.5
1867	232.5	9.4	21.5	55.5	12.3	-0.2	53.6	45.2	88.2	2.8	520.8
1868	230.6	9.9	21.1	55.6	12.6	-0.2	53.5	44.9	88.3	3.0	519.2
1869	228.6	10.4	20.7	55.8	12.9	-0.4	53.4	44.7	88.4	3.1	517.5
1870	226.8	10.8	20.7	56.0	13.2	-0.6	53.3	44.5	88.4	3.2	516.3
1871	224.2	11.3	20.6	50.5	13.4	-0.8	53.2	44.3	110.0	9.9	536.7
1872	303.9	11.8	20.5	49.6	13.6	-1.0	53.5	44.2	115.2	11.9	623.2
1873	309.3	12.3	20.4	48.8	13.9	-0.8	53.7	44.1	118.9	13.7	634.1
1874	314.4	12.7	20.3	47.9	14.1	-0.4	54.0	42.0	121.7	14.3	641.1
1875	319.3	13.2	20.3	47.2	14.3	-0.3	54.3	41.4	123.9	14.9	648.4
1876	324.1	13.6	20.4	46.5	14.5	-0.1	54.9	40.9	125.2	15.4	655.5
1877	330.1	13.3	20.9	45.9	14.6	0.0	55.0	40.4	126.4	15.8	662.4
1878	335.8	13.2	21.3	45.4	14.8	0.0	55.1	40.3	127.4	16.1	669.5
1879	341.3	13.1	21.7	44.9	14.9	0.0	55.2	40.4	128.3	16.4	676.4
1880	346.7	13.1	22.1	44.4	15.1	-0.2	55.3	40.6	129.1	16.7	682.9

1881	350.7	13.0	54.1	43.9	15.2	-0.3	55.4	40.3	129.5	17.0	718.9
1882	295.6	12.9	63.0	43.5	15.4	-0.5	55.5	40.1	129.9	17.3	672.7
1883	294.0	12.8	70.2	43.1	15.5	-0.7	55.6	39.9	130.2	17.6	678.3
1884	292.7	12.7	76.1	42.7	15.6	-0.4	55.8	39.7	130.5	17.9	683.4
1885	291.6	12.6	81.2	42.4	15.8	-0.2	55.9	39.6	130.7	18.2	687.7
1886	290.3	12.5	84.1	42.6	15.9	0.0	56.0	39.4	131.0	18.5	690.4
1887	286.8	12.4	86.2	42.7	16.0	0.1	56.2	39.2	131.2	18.8	689.8
1888	283.3	12.3	87.9	42.9	16.2	0.0	56.3	39.1	131.4	19.1	688.6
1889	279.9	12.2	89.4	43.1	16.3	-0.2	56.4	39.0	131.6	19.4	687.2
1890	276.6	12.1	90.6	43.3	16.4	-0.2	56.6	39.0	131.8	19.6	685.9
1891	272.6	12.0	73.4	43.5	16.5	-0.4	56.7	39.0	148.3	19.8	681.5
1892	285.2	11.9	70.0	43.7	16.7	-0.7	56.8	39.0	152.3	20.1	695.0
1893	285.6	11.8	67.3	43.9	16.8	-1.1	57.0	39.1	155.2	20.3	695.8
1894	287.1	11.7	65.2	44.1	16.9	-1.4	57.1	54.6	157.4	20.5	713.3
1895	288.7	11.7	63.6	44.3	17.0	-1.3	57.2	56.4	159.2	20.7	717.5
1896	288.3	11.6	62.6	44.5	17.1	-1.3	57.3	58.1	160.2	20.9	719.4
1897	289.2	11.5	61.7	44.7	17.2	-1.0	57.5	59.8	161.1	21.1	723.0
1898	288.2	11.4	61.1	44.9	17.3	-0.6	57.6	61.4	161.9	21.3	724.5
1899	287.2	11.3	60.6	45.0	17.4	-0.6	57.7	62.9	162.6	21.6	725.8
1900	286.3	11.3	60.3	45.2	17.6	-0.7	57.8	64.4	163.1	21.7	726.9
1901	285.9	11.2	121.8	45.4	20.1	-0.8	57.9	65.8	163.5	22.0	792.8
1902	240.4	24.0	139.4	45.7	20.6	-0.3	58.0	82.7	163.8	22.3	796.8
1903	231.8	26.8	153.8	46.0	21.0	1.0	58.2	100.6	164.1	22.7	825.9
1904	222.2	29.5	165.8	46.3	21.3	2.7	58.3	119.0	164.4	23.0	852.4
1905	213.1	32.1	176.1	46.6	21.5	4.8	58.5	137.9	164.6	23.3	878.5
1906	205.9	34.6	180.8	46.9	21.7	7.4	58.6	157.1	172.8	23.6	909.5
1907	198.5	37.1	184.7	47.3	21.9	10.2	58.6	161.6	174.9	23.9	918.6
1908	193.3	39.4	187.9	47.6	22.1	12.9	58.6	165.5	176.4	24.3	927.9
1909	188.2	41.8	190.5	48.0	22.2	15.5	58.6	168.4	177.5	24.6	935.3
1910	183.0	44.1	192.6	48.3	22.3	17.9	58.5	170.9	178.4	24.9	941.0
1911	178.8	46.3	130.5	48.7	22.5	20.2	58.5	173.2	179.0	25.1	882.9
1912	153.5	48.6	112.6	49.1	22.6	22.7	58.5	173.6	179.6	25.4	846.2
1913	147.6	50.8	98.0	49.5	22.7	25.0	63.7	173.8	159.2	25.7	815.9
1914	142.9	52.9	85.5	49.8	22.8	27.2	65.2	177.8	154.7	25.9	804.8
1915	138.3	55.1	74.6	50.2	22.9	29.4	66.6	178.4	151.4	26.2	793.0
1916	133.5	57.2	70.5	50.7	22.9	31.5	67.9	178.8	155.8	26.4	795.1
1917	130.0	57.8	67.2	51.1	23.0	34.1	69.2	183.7	155.5	26.6	798.2

1918	126.1	58.4	64.5	51.5	23.0	36.4	70.5	188.8	155.4	26.8	801.4
1919	124.4	58.9	62.2	51.9	23.0	38.7	71.8	193.9	155.2	27.1	807.1
1920	118.6	59.5	60.0	52.3	23.0	41.1	73.1	199.0	154.9	27.3	808.8
1921	112.5	60.0	104.8	52.8	23.1	43.0	74.4	204.1	154.6	27.6	856.7
1922	85.5	60.6	117.3	53.2	23.1	44.9	75.7	206.7	154.3	27.8	849.1
1923	76.4	61.1	127.4	53.6	23.1	46.7	77.1	209.2	154.4	28.0	857.0
1924	67.2	61.6	135.9	54.0	23.1	48.2	78.4	211.6	154.5	28.2	862.7
1925	56.5	62.1	143.3	54.4	23.1	49.6	79.8	213.8	154.6	28.3	865.6
1926	49.8	62.6	145.4	54.1	31.7	51.0	81.2	216.0	150.1	28.6	870.5
1927	93.2	52.6	147.0	53.6	33.6	52.3	82.5	216.9	149.2	28.8	909.7
1928	92.9	51.0	148.1	53.0	35.4	54.1	83.1	217.8	148.6	29.1	913.0
1929	117.0	49.4	149.0	52.4	35.8	55.8	83.7	219.5	148.2	29.3	940.0
1930	191.7	47.8	150.1	51.6	36.1	57.4	84.3	221.6	148.0	29.5	1,018.1
1931	187.6	46.3	161.8	50.7	36.7	59.1	84.9	223.7	148.0	29.8	1,028.7
1932	85.0	44.9	165.0	49.7	37.3	60.8	85.5	224.6	148.0	30.0	930.8
1933	77.4	43.5	167.5	48.6	37.8	62.8	86.1	225.4	148.1	30.3	927.6
1934	70.2	42.1	169.5	47.4	38.3	64.7	84.6	220.0	148.2	30.5	915.3
1935	67.8	40.8	171.1	46.1	38.8	67.5	82.8	219.8	148.3	30.8	913.7
1936	59.4	39.5	172.8	44.8	39.2	69.2	80.9	219.8	165.5	31.0	922.0
1937	32.8	38.2	174.6	43.4	39.6	71.1	78.8	219.7	169.7	31.3	899.3
1938	33.4	36.9	176.3	42.0	40.0	73.0	76.7	219.8	172.8	31.5	902.4
1939	29.5	35.6	177.8	40.6	40.3	75.3	74.5	219.8	175.2	31.7	900.5
1940	16.5	34.4	179.2	39.1	40.7	77.6	71.1	219.8	177.1	32.0	887.5
1941	15.0	33.1	177.8	37.7	41.0	79.5	54.4	219.8	179.6	32.2	870.2
1942	27.6	33.1	177.3	36.2	41.3	81.7	47.5	231.9	182.2	32.4	891.3
1943	13.2	33.1	176.9	34.8	41.7	84.0	40.8	244.6	184.7	32.6	886.4
1944	9.0	33.1	176.6	33.3	41.9	86.3	34.4	257.7	187.2	32.8	892.3
1945	0.1	33.1	176.4	31.9	42.1	88.6	28.0	271.2	189.6	33.0	894.1
1946	-4.8	33.1	179.4	30.4	42.3	91.2	24.0	284.9	263.1	33.2	976.9
1947	5.9	32.9	182.5	29.0	42.6	93.5	20.4	286.9	281.7	33.4	1,008.9
1948	-5.2	32.7	185.8	27.5	42.8	97.3	17.2	288.7	295.4	33.6	1,015.8
1949	-10.6	32.5	189.2	26.1	43.0	101.2	14.3	290.2	305.1	33.8	1,024.9
1950	-11.4	32.4	192.8	24.7	43.2	105.2	13.1	290.1	313.4	34.0	1,037.3
1951	3.2	32.2	251.7	23.5	34.4	109.3	126.9	289.8	319.8	67.5	1,258.3
1952	-42.0	32.9	270.4	22.5	32.6	105.9	149.6	308.1	327.8	76.9	1,284.7
1953	-66.3	32.6	285.8	21.7	30.8	108.9	171.5	327.0	284.3	84.5	1,280.9
1954	-64.4	32.4	298.7	21.0	28.6	112.0	192.7	346.5	281.0	86.6	1,335.0

1955	-73.6	32.1	309.8	20.4	26.4	115.3	213.7	366.3	281.0	87.9	1,379.5
1956	-65.5	31.9	316.5	20.0	25.7	118.6	236.1	386.5	280.4	88.8	1,438.9
1957	-68.0	31.6	322.0	19.7	25.0	122.0	258.2	388.6	280.7	89.3	1,469.1
1958	-33.0	31.4	326.7	19.5	24.4	124.8	280.0	381.7	275.9	89.5	1,520.8
1959	-71.8	31.1	330.7	19.4	23.8	127.6	208.3	362.1	276.8	89.6	1,397.8
1960	-74.9	30.9	334.3	19.4	23.2	130.5	210.9	343.1	278.9	89.6	1,385.8
1961	-88.5	30.6	449.6	16.7	22.6	132.7	205.2	323.1	282.4	89.5	1,463.9
1962	-86.2	30.7	484.4	16.3	22.1	133.6	201.9	296.2	271.8	89.3	1,460.0
1963	-92.3	30.8	512.0	16.0	21.5	138.9	198.8	285.6	274.4	89.1	1,474.9
1964	-95.4	30.9	534.4	15.8	21.0	140.7	196.2	285.0	269.7	88.8	1,487.1
1965	-99.9	31.1	553.7	15.6	20.5	143.4	192.9	284.3	274.8	88.6	1,505.0
1966	-67.9	31.2	563.7	15.5	21.6	142.5	181.2	283.1	280.1	88.3	1,539.3
1967	-63.8	31.2	572.4	15.4	21.8	143.6	169.5	282.2	285.6	87.9	1,545.8
1968	-62.8	31.2	580.3	15.3	22.0	139.4	157.9	281.7	225.0	87.6	1,477.7
1969	-51.6	31.1	587.0	15.3	21.7	146.5	147.8	281.2	216.9	87.0	1,483.1
1970	-53.0	31.1	593.1	13.6	21.5	139.8	114.5	280.8	212.0	86.5	1,439.7
1971	-89.3	31.1	536.8	11.2	21.5	143.1	100.1	280.7	206.4	50.2	1,291.7
1972	-80.9	30.1	524.9	8.6	21.6	146.8	85.4	282.8	205.7	39.1	1,264.2
1973	-92.9	30.2	515.6	6.0	21.6	150.8	71.3	284.7	231.8	29.7	1,248.7
1974	-92.1	30.2	508.3	3.2	21.7	154.7	64.9	287.2	250.4	26.1	1,254.5
1975	-81.5	30.3	502.6	0.2	21.7	144.5	58.8	291.3	254.0	23.2	1,245.1
1976	-64.8	30.4	503.0	-2.6	21.8	159.0	55.9	303.4	284.9	20.8	1,311.9
1977	-60.2	30.5	504.2	-5.6	21.8	142.4	50.4	306.4	306.6	18.8	1,315.1
1978	-54.4	30.6	505.3	-8.8	21.8	149.0	44.8	285.3	321.2	16.9	1,311.9
1979	-51.7	30.7	506.2	-12.1	21.8	150.3	39.5	248.1	335.7	15.3	1,283.8
1980	-53.9	30.9	507.8	-14.1	21.9	144.6	35.4	209.5	344.1	13.7	1,239.9
1981	-50.2	31.0	510.0	-15.3	17.0	166.7	33.4	168.8	386.5	15.6	1,263.4
1982	-38.0	27.8	729.4	-16.4	16.6	181.9	30.7	122.9	393.3	14.9	1,463.0
1983	-38.8	27.0	787.5	-17.2	16.4	195.3	28.8	101.5	398.2	14.1	1,512.9
1984	-42.5	26.2	833.6	-17.9	18.0	205.5	27.2	93.8	403.4	12.7	1,560.1
1985	-39.4	25.5	873.0	-18.3	19.8	197.1	25.8	82.7	405.9	11.3	1,583.2
1986	-34.3	24.7	902.5	-18.6	20.4	193.4	23.4	76.8	403.1	9.8	1,601.1
1987	-31.1	24.2	917.0	-18.7	21.0	193.3	22.6	71.0	403.6	8.2	1,611.1
1988	-21.6	23.7	926.4	-18.7	21.7	202.8	21.8	64.8	410.7	6.6	1,638.5
1989	-21.8	23.2	932.6	-18.4	22.5	197.1	21.2	66.6	418.6	5.3	1,647.0
1990	-31.9	22.8	936.8	-18.1	23.2	201.4	20.1	61.1	424.5	3.9	1,643.7
1991	-31.9	22.3	938.6	-18.1	23.2	195.5	20.1	50.9	508.0	3.9	1,712.5

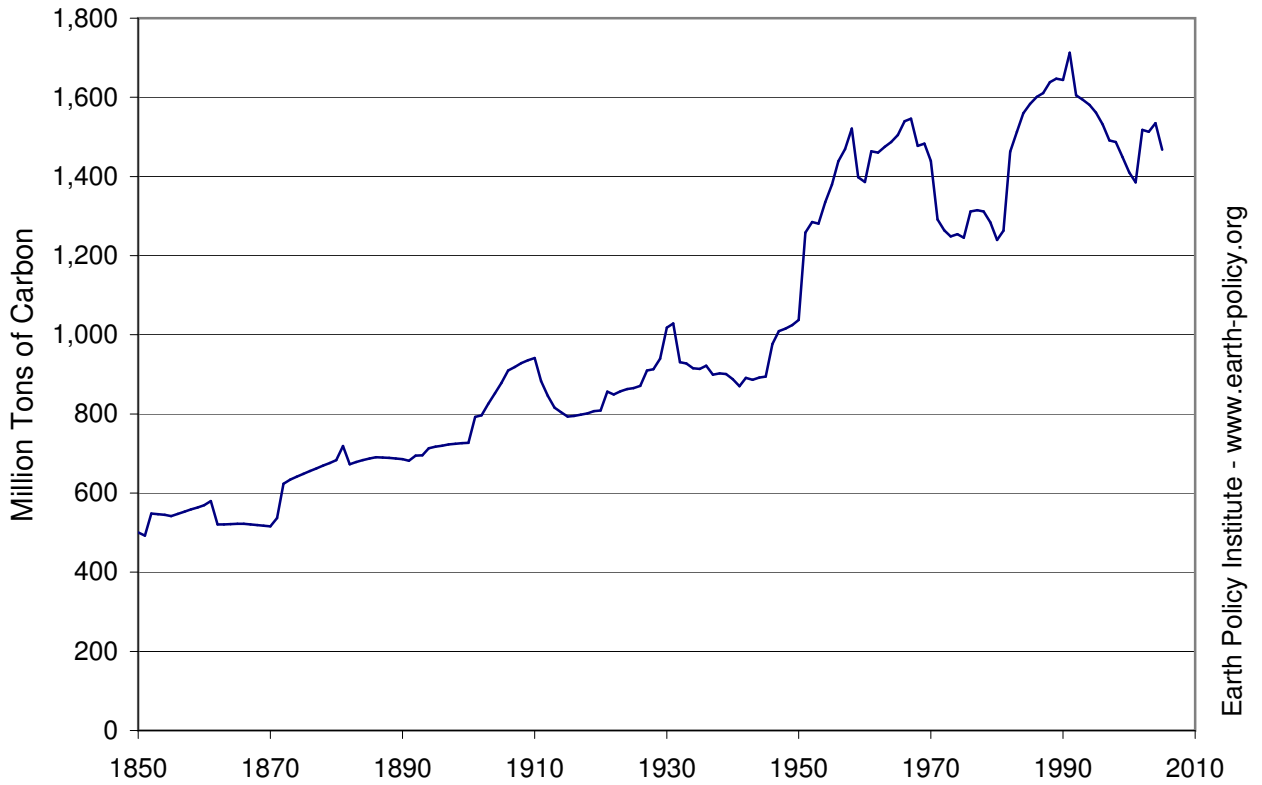
1992	-31.9	21.6	803.7	-18.1	23.2	214.3	20.1	39.8	528.4	3.9	1,605.0
1993	-31.9	20.9	767.5	-18.1	23.2	224.9	20.1	39.5	543.7	3.9	1,593.8
1994	-31.9	20.1	737.3	-18.1	23.2	243.7	20.1	43.0	539.2	3.9	1,580.5
1995	-31.9	19.4	713.4	-18.1	23.2	262.8	20.1	31.1	537.7	3.9	1,561.6
1996	-31.9	18.7	692.1	-18.1	23.2	260.9	20.1	27.3	535.0	3.9	1,531.3
1997	-31.9	18.4	678.5	-18.1	23.2	247.5	20.1	21.1	528.5	3.9	1,491.3
1998	-31.9	18.2	667.1	-18.1	23.2	269.4	20.1	12.1	523.2	3.9	1,487.2
1999	-31.9	17.9	656.4	-18.1	23.2	263.9	20.1	5.0	508.7	3.9	1,449.2
2000	-31.9	17.6	649.6	-18.1	23.2	260.9	20.1	-12.9	497.5	3.9	1,409.9
2001	-31.9	17.6	643.2	-18.1	23.2	261.7	20.1	-12.9	478.5	3.9	1,385.4
2002	-31.9	17.6	625.5	-18.1	23.2	258.5	20.1	-12.9	631.7	3.9	1,517.7
2003	-31.9	17.6	616.5	-18.1	23.2	225.5	20.1	-12.9	669.3	3.9	1,513.2
2004	-31.9	17.6	609.4	-18.1	23.2	225.8	20.1	-12.9	697.8	3.9	1,534.9
2005	-31.9	17.6	606.4	-18.1	23.2	239.2	20.1	-12.9	619.7	3.9	1,467.3

Note: Figures after 1990 for regions outside of the tropics are estimations. Negative values indicate net carbon uptake.

Source: R. A. Houghton, "Carbon Flux to the Atmosphere from Land-Use Changes: 1850-2005," in Carbon Dioxide Information Analysis Center, *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Oak Ridge National Laboratory, 2008 and 2010), at [cdiac.ornl.gov/trends/trends.htm](http://cdiac.ornl.gov/trends/trends.htm).

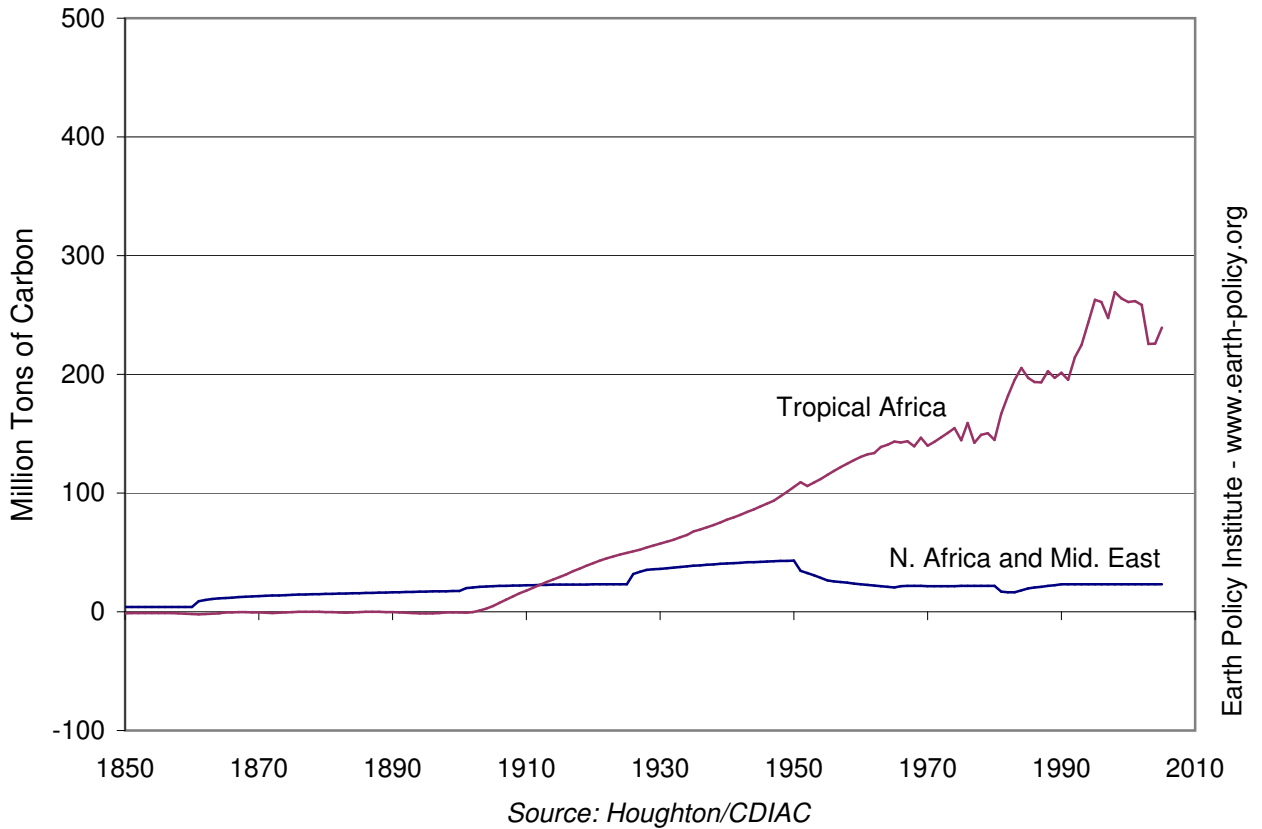
This is part of a supporting dataset for Lester R. Brown, **World on the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2011). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# Net Carbon Emissions from Land Use Change Worldwide, 1850-2005



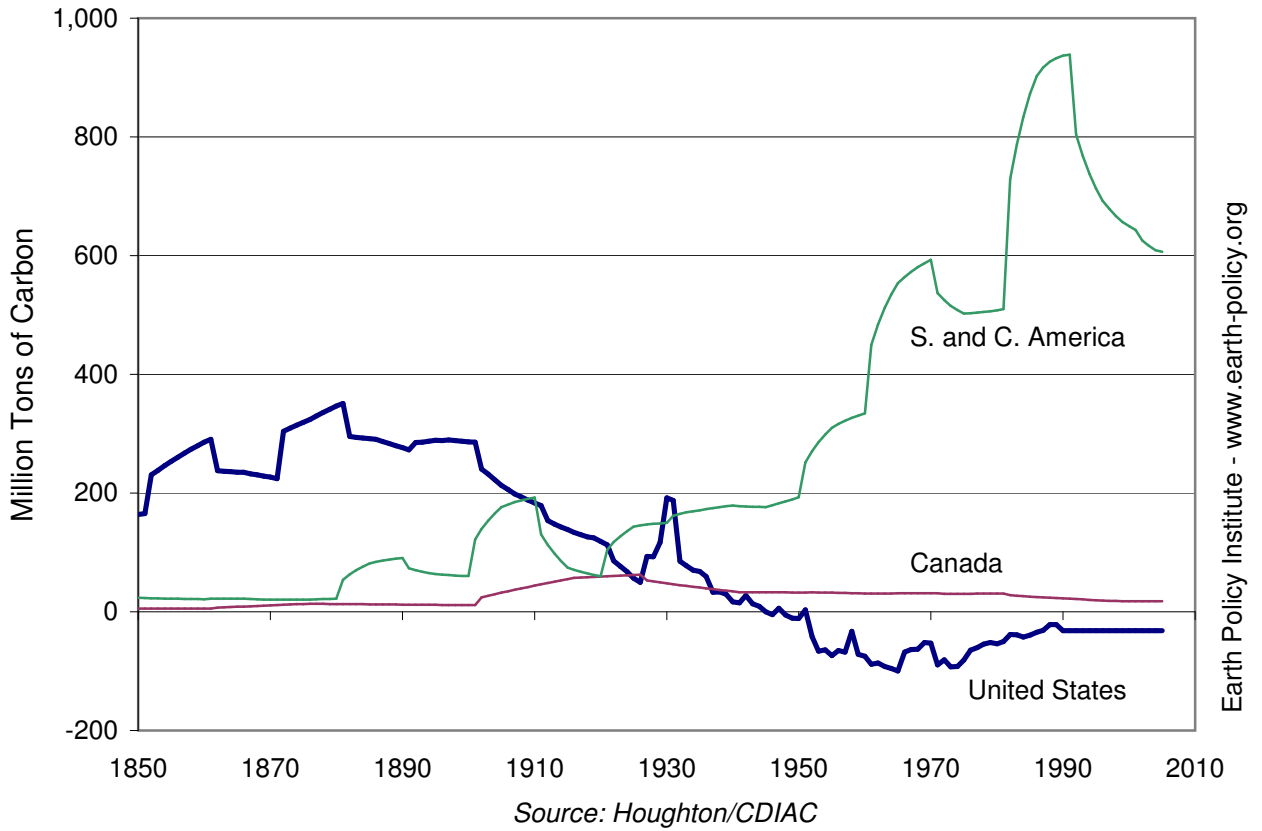
Source: Houghton/CDIAC

# Net Carbon Emissions from Land Use Change in Africa and the Middle East, 1850-2005

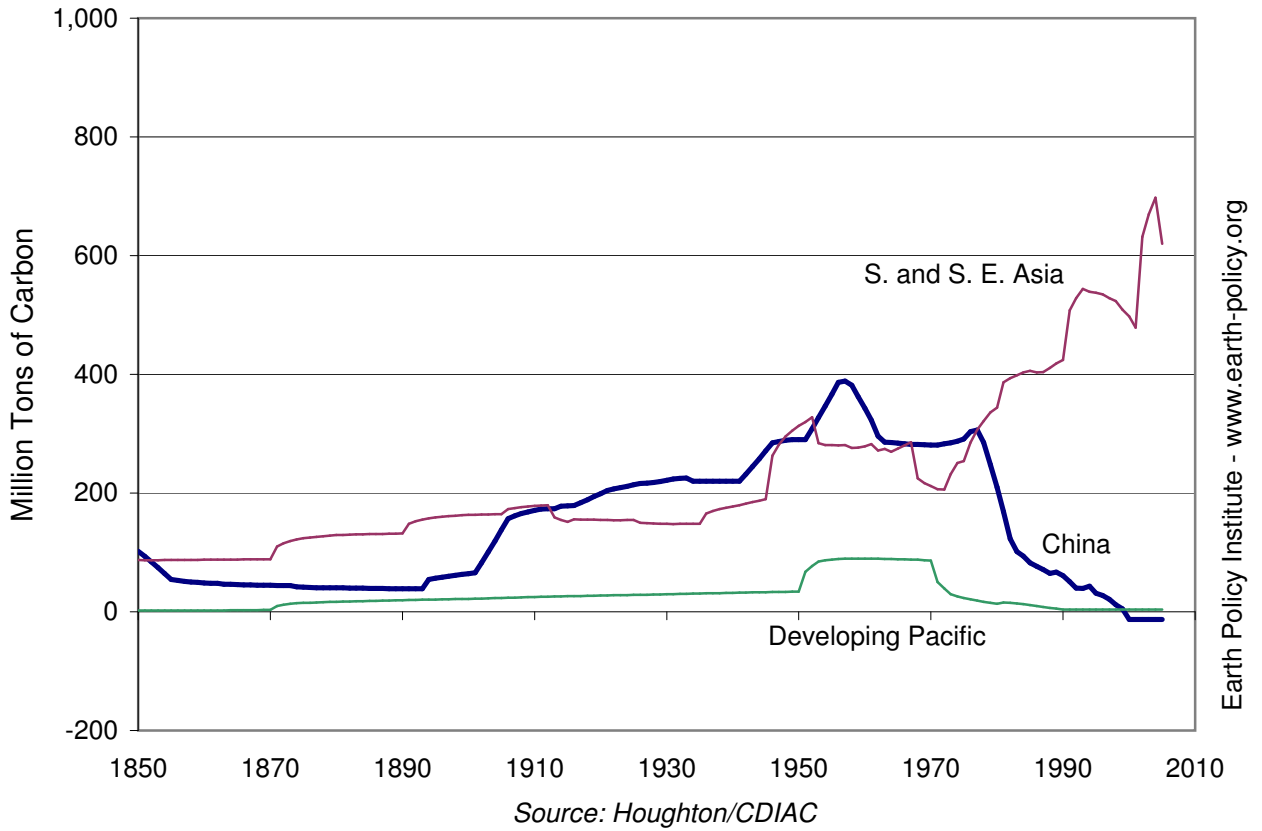




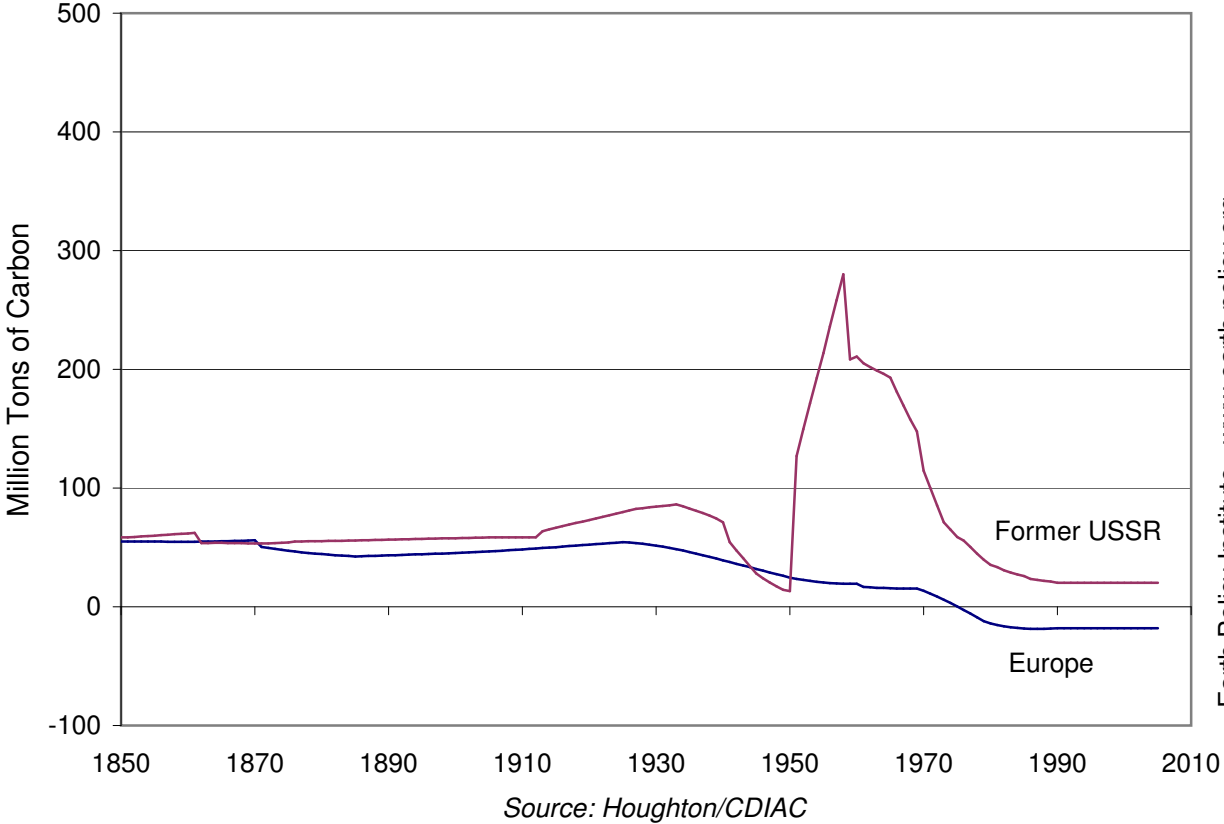
# Net Carbon Emissions from Land Use Change in the Americas, 1850-2005



# Net Carbon Emissions from Land Use Change in Asia and the Pacific, 1850-2005



# Net Carbon Emissions from Land Use Change in Europe and the Former Soviet Union, 1850-2005



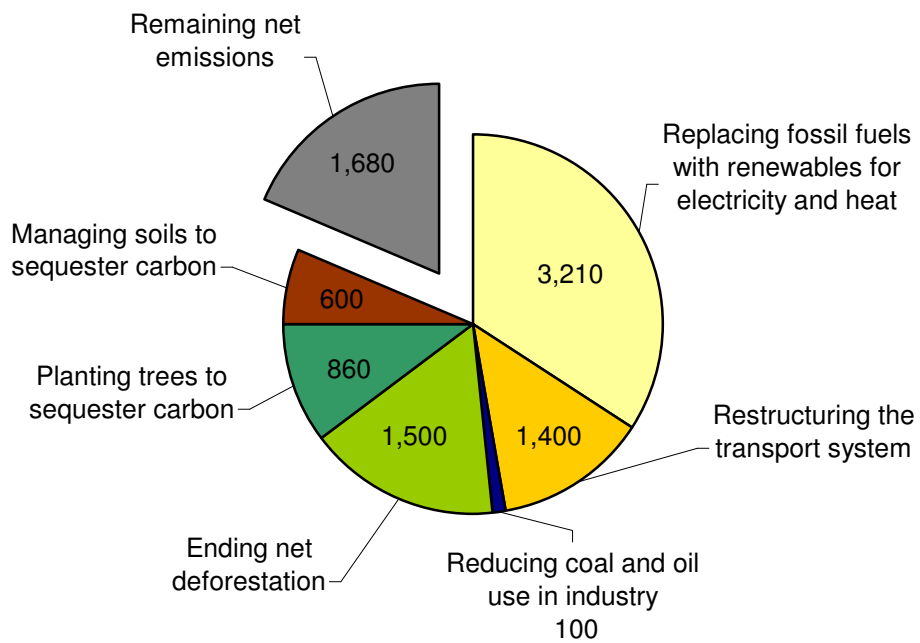
## Plan B Carbon Dioxide Emissions Reductions and Sequestration in 2020

Action	Amount
	Million Tons of Carbon
<b>Energy Restructuring</b>	
Replacing fossil fuels with renewables for electricity and heat	3,210
Restructuring the transport system	1,400
Reducing coal and oil use in industry	100
<b>Biological Carbon Sequestration</b>	
Ending net deforestation	1,500
Planting trees to sequester carbon	860
Managing soils to sequester carbon	600
<b>Total Carbon Dioxide Reductions in 2020</b>	<b>7,670</b>
Carbon Dioxide Emissions in 2006	9,350
<b>Percent Reduction from 2006 Baseline</b>	<b>82.0</b>

Source: Calculated by Earth Policy Institute using International Energy Agency (IEA), *World Energy Outlook 2008* (Paris: 2008), p. 507; IEA, *Tracking Industrial Energy Efficiency and CO2 Emissions* (Paris: 2007); Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press, 2007), pp. 543, 559; and Rattan Lal, "Soil Carbon Sequestration Impacts on Global Climate Change and Food Security," *Science*, vol. 304 (11 June 2004), pp. 1,623–27.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## Plan B Carbon Dioxide Emissions Reduction Goals for 2020 (Million Tons of Carbon)



Baseline Emissions (2006) = 9,350 Million Tons of Carbon

Source: EPI