

## Full Planet, Empty Plates

### Supporting Data for Chapter 4: Food or Fuel?

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GRAPH: World Fuel Ethanol Production, 1975-2012

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

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

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

## World Fuel Ethanol Production, 1975-2012

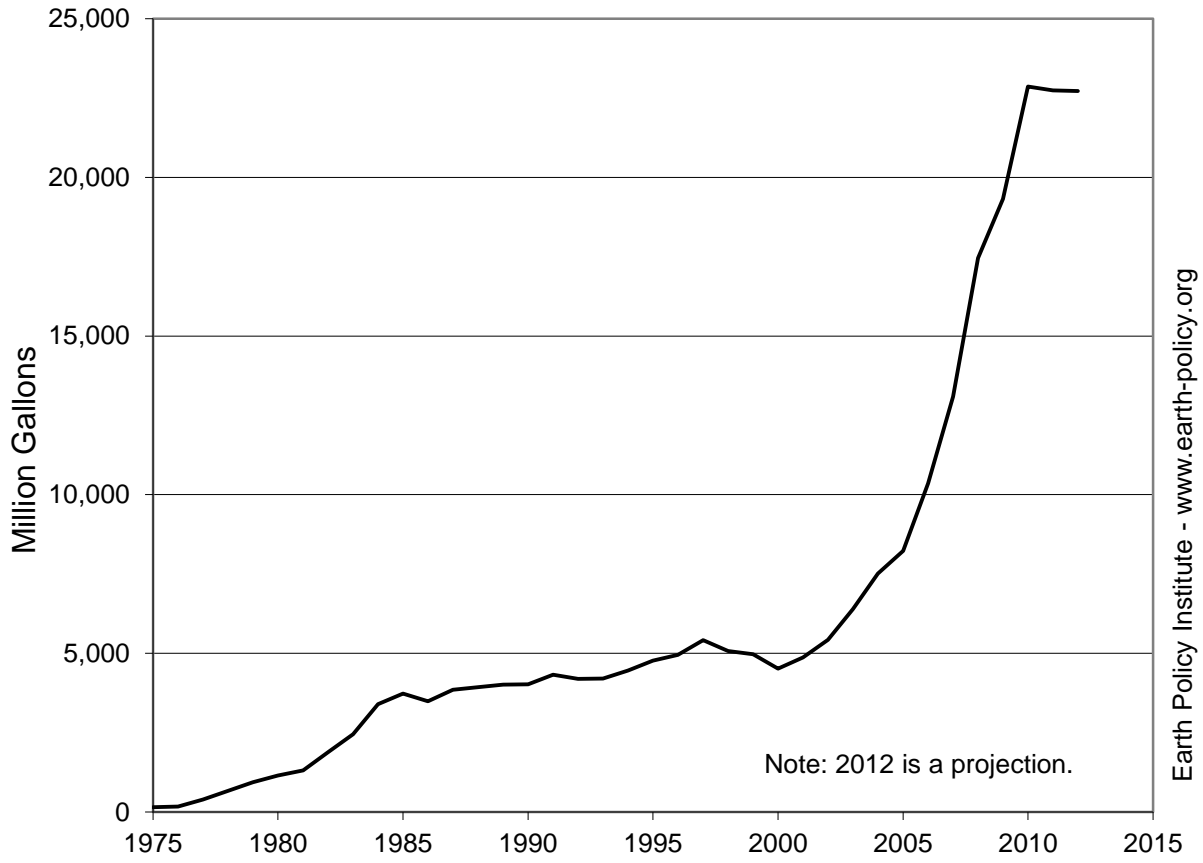
Year	Production Million Gallons
1975	147
1976	175
1977	388
1978	668
1979	933
1980	1,154
1981	1,315
1982	1,889
1983	2,452
1984	3,403
1985	3,732
1986	3,485
1987	3,857
1988	3,937
1989	4,013
1990	4,019
1991	4,325
1992	4,196
1993	4,201
1994	4,458
1995	4,775
1996	4,954
1997	5,420
1998	5,073
1999	4,972
2000	4,519
2001	4,874
2002	5,420
2003	6,394
2004	7,517
2005	8,227
2006	10,353
2007	13,089
2008	17,453
2009	19,317
2010	22,861
2011	22,742
2012 *	22,715

\* Projection.

Source: Compiled by Earth Policy Institute with data for 1975-1998 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 6, no. 4 (23 October 2007), p. 63; 1999-2002 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 18 (26 May 2009), p. 365; 2003-2012 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 16 (24 April 2012), p. 323.

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# World Fuel Ethanol Production, 1975-2012



Note: 2012 is a projection.

Source: F.O. Licht

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

## Fuel Ethanol Production in Ten Leading Countries and the World, 2011

<u>Country</u>	<u>Production</u> Million Gallons
United States	14,319
Brazil	5,553
China	555
Canada	462
France	301
Germany	203
India	147
Thailand	135
Spain	122
Belgium	106
<b><u>World Total</u></b>	<b><u>22,742</u></b>

Source: Compiled by Earth Policy Institute from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 16 (24 April 2012), p. 323.

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## Fuel Ethanol Production in the United States, 1978-2012

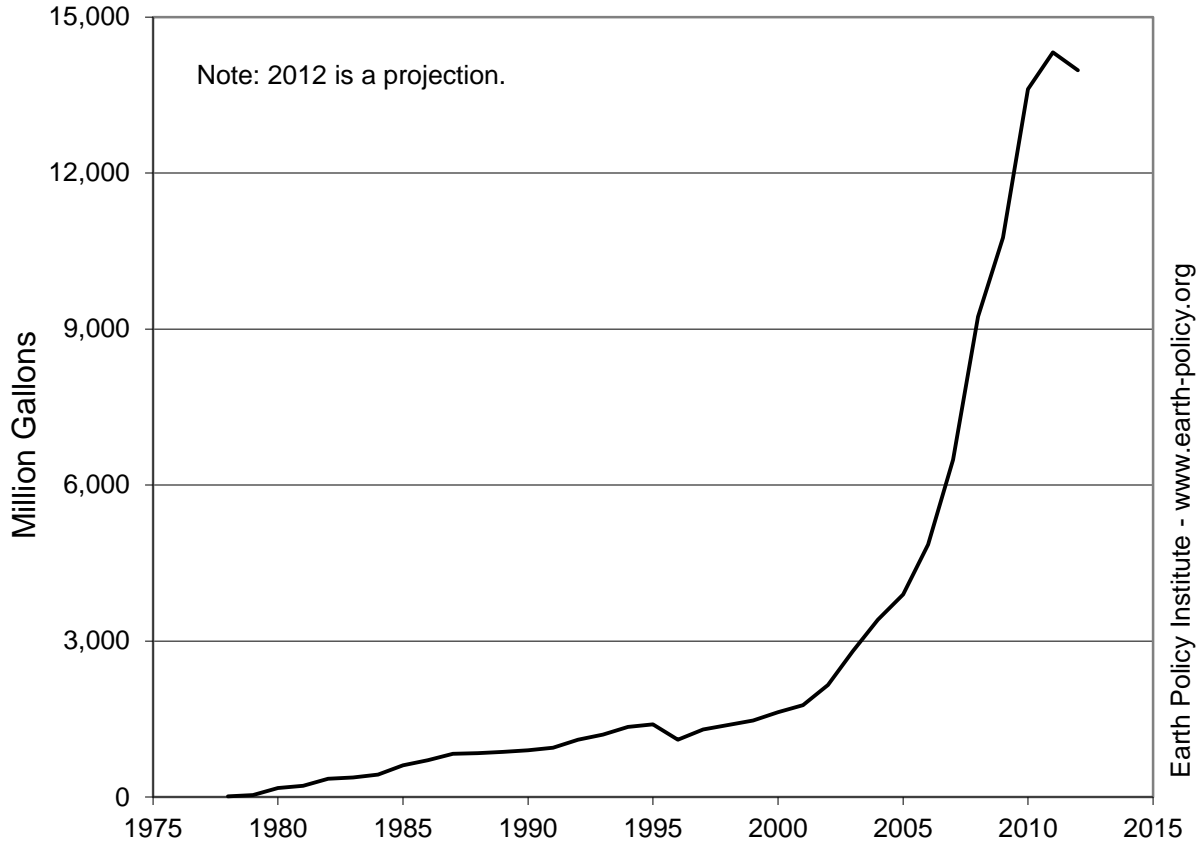
Year	Production Million Gallons
1978	10
1979	40
1980	175
1981	215
1982	350
1983	375
1984	430
1985	610
1986	710
1987	830
1988	845
1989	870
1990	900
1991	950
1992	1,100
1993	1,200
1994	1,350
1995	1,400
1996	1,100
1997	1,300
1998	1,387
1999	1,472
2000	1,630
2001	1,766
2002	2,153
2003	2,805
2004	3,409
2005	3,898
2006	4,856
2007	6,486
2008	9,238
2009	10,759
2010	13,615
2011	14,319
2012 *	13,975

\* Projection.

Source: Compiled by Earth Policy Institute with data for 1978-1998 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 6, no. 4 (23 October 2007), p. 63; 1999-2002 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 18 (26 May 2009), p. 365; 2003-2012 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 16 (24 April 2012), p. 323.

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# Fuel Ethanol Production in the United States, 1978-2012



Source: F.O. Licht

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

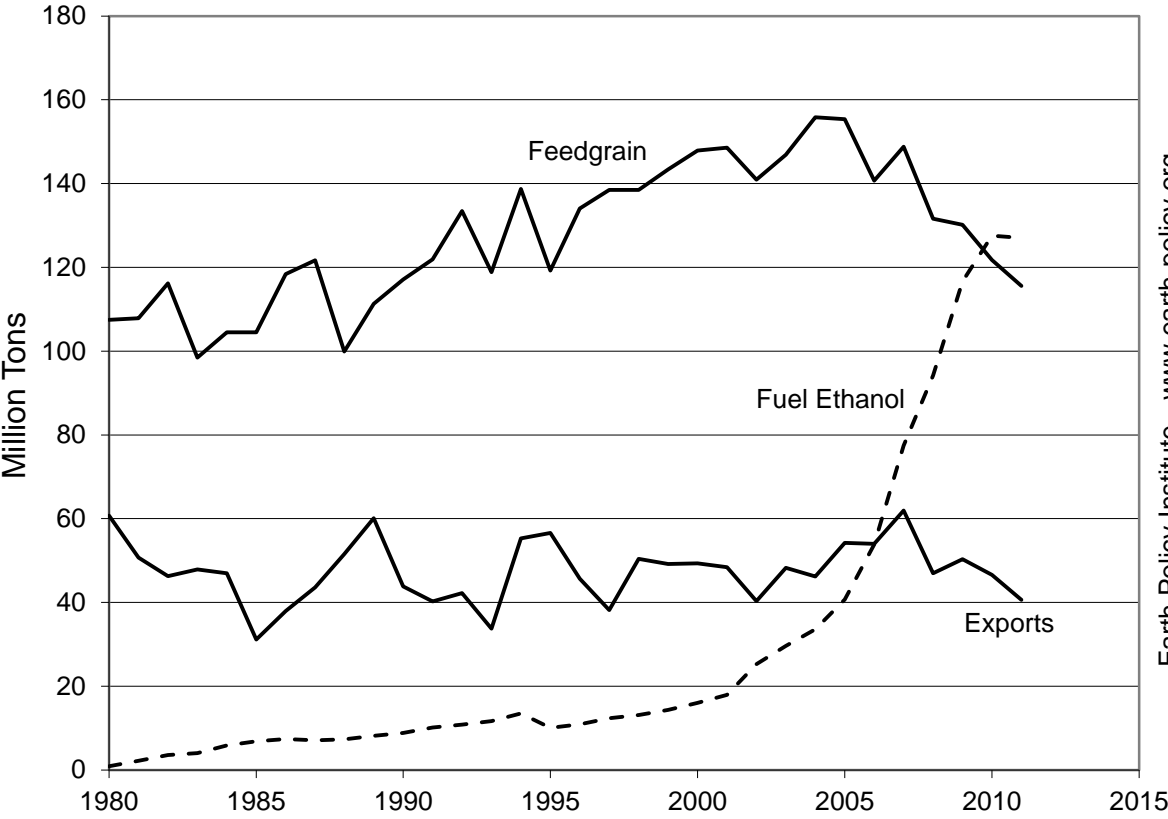
## U.S. Corn Production and Use for Feedgrain, Fuel Ethanol, and Exports, 1980-2011

Year	Production	Feedgrain Use	Fuel Ethanol Use	Exports
Million Tons				
1980	169	108	1	61
1981	206	108	2	51
1982	209	116	4	46
1983	106	98	4	48
1984	195	105	6	47
1985	225	105	7	31
1986	209	118	7	38
1987	181	122	7	44
1988	125	100	7	52
1989	191	111	8	60
1990	202	117	9	44
1991	190	122	10	40
1992	241	133	11	42
1993	161	119	12	34
1994	255	139	14	55
1995	188	119	10	57
1996	235	134	11	46
1997	234	138	12	38
1998	248	138	13	50
1999	240	143	14	49
2000	252	148	16	49
2001	241	149	18	48
2002	228	141	25	40
2003	256	147	30	48
2004	300	156	34	46
2005	282	155	41	54
2006	267	141	54	54
2007	331	149	77	62
2008	307	132	94	47
2009	333	130	117	50
2010	316	122	128	47
2011	314	116	127	41

Source: Compiled by Earth Policy Institute from U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, at [www.fas.usda.gov/psdonline](http://www.fas.usda.gov/psdonline), updated 12 June 2012; corn for ethanol from USDA, *Feed Grains Database*, electronic database, at [www.ers.usda.gov/data-products/feed-grains-database.aspx](http://www.ers.usda.gov/data-products/feed-grains-database.aspx), downloaded 5 June 2012.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# U.S. Corn Use for Feedgrain, Fuel Ethanol, and Exports, 1980-2011



Source: USDA



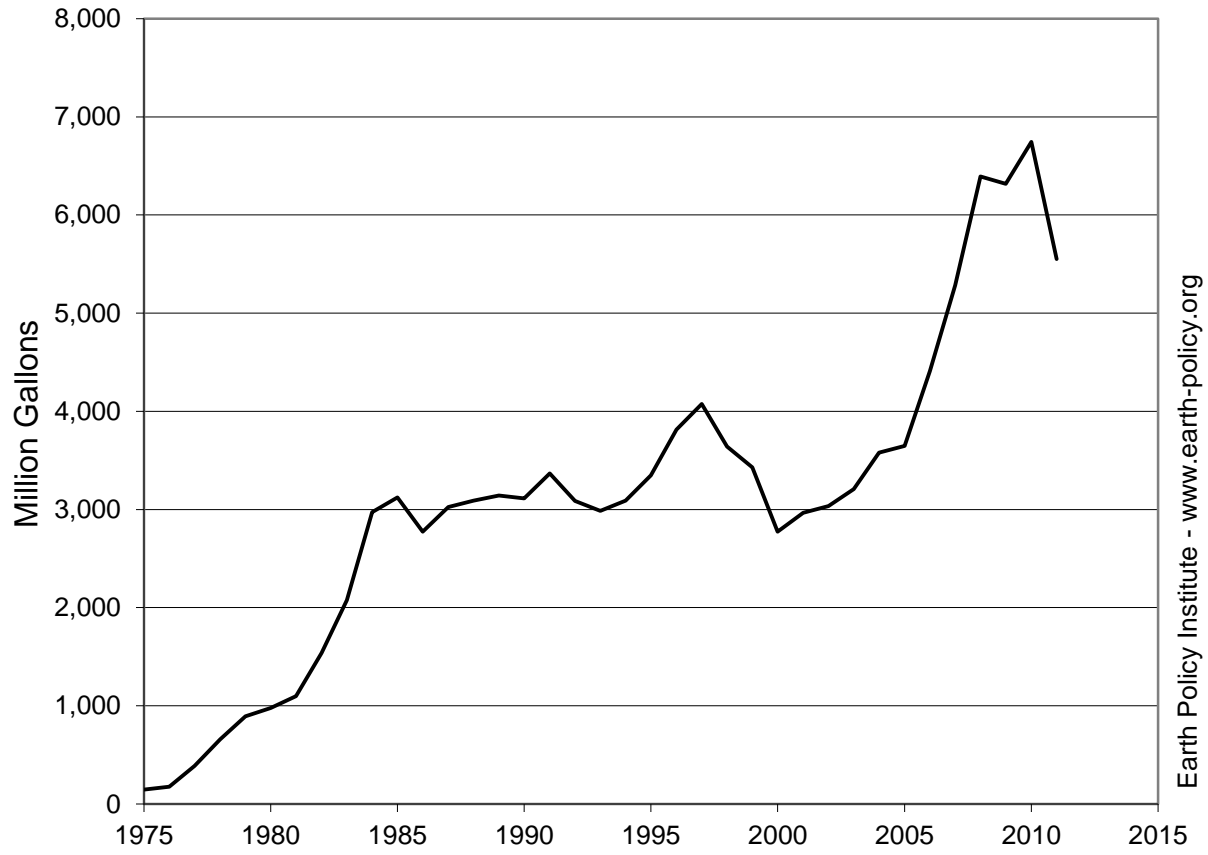
## Fuel Ethanol Production in Brazil, 1975-2011

Year	Production Million Gallons
1975	147
1976	175
1977	388
1978	658
1979	894
1980	979
1981	1,100
1982	1,539
1983	2,077
1984	2,972
1985	3,123
1986	2,775
1987	3,027
1988	3,092
1989	3,143
1990	3,113
1991	3,369
1992	3,087
1993	2,984
1994	3,089
1995	3,347
1996	3,814
1997	4,074
1998	3,642
1999	3,428
2000	2,773
2001	2,968
2002	3,035
2003	3,207
2004	3,578
2005	3,649
2006	4,412
2007	5,283
2008	6,393
2009	6,319
2010	6,744
2011	5,553

Source: Compiled by Earth Policy Institute with data for 1975-1998 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 6, no. 4 (23 October 2007), p. 63; 1999-2002 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 18 (26 May 2009), p. 365; 2003-2012 from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 16 (24 April 2012), p. 323.

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### Fuel Ethanol Production in Brazil, 1975-2011



Source: F.O. Licht

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

## World Biodiesel Production, 1991-2012

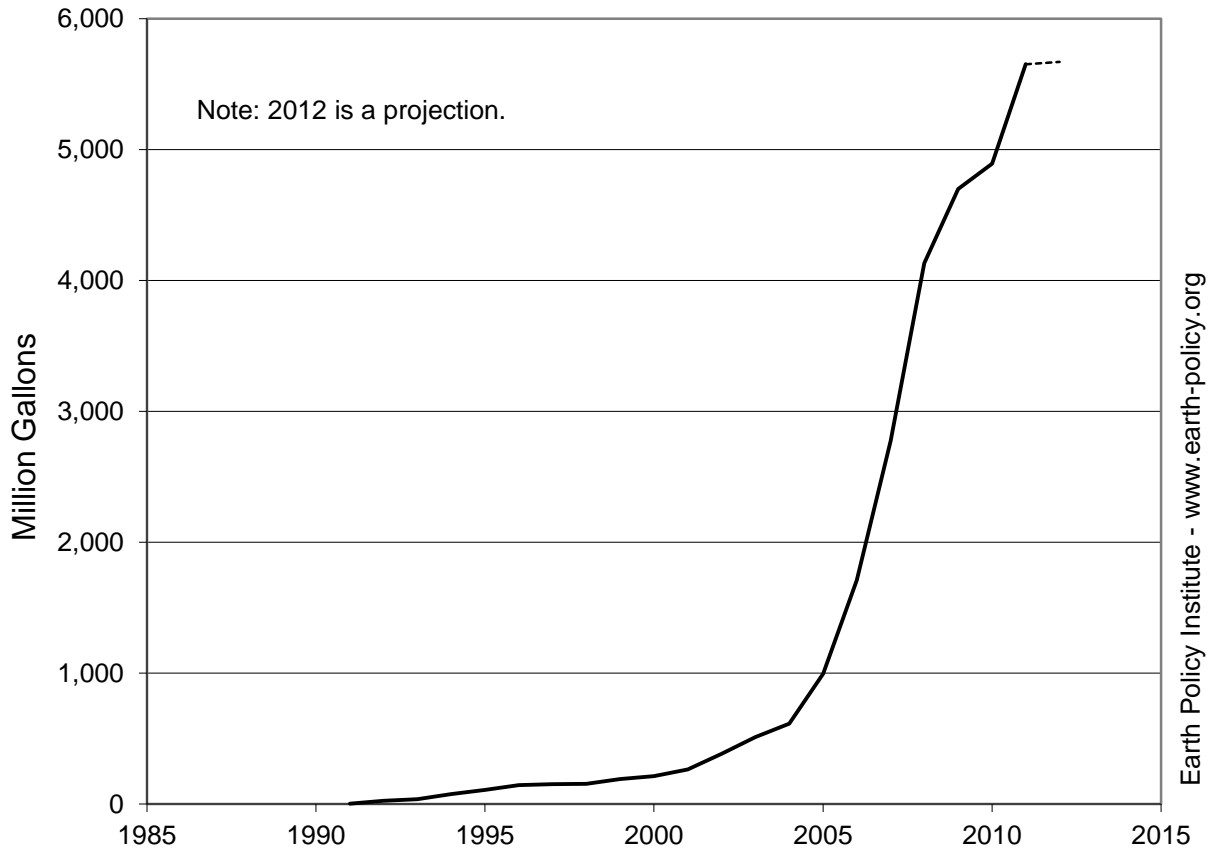
Year	Production Million Gallons
1991	3
1992	23
1993	38
1994	75
1995	108
1996	144
1997	151
1998	155
1999	190
2000	213
2001	265
2002	383
2003	510
2004	614
2005	995
2006	1,710
2007	2,775
2008	4,132
2009	4,699
2010	4,893
2011	5,651
2012 *	5,670

\* Projection.

Source: Compiled by Earth Policy Institute with 1991-1999 data from F.O. Licht data, cited in Suzanne Hunt and Peter Stair, "Biofuels Hit a Gusher," *Vital Signs 2006-2007* (Washington, DC: Worldwatch Institute, 2006), pp. 40-41; 2000-2004 data from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 2 (23 September 2008), p. 29; 2005-2012 data from F.O.Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 14 (27 March 2012), p. 281.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# World Biodiesel Production, 1991-2012



Source: F.O. Licht; Worldwatch

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

## **Biodiesel Production in Ten Leading Countries and the World, 2011**

<u>Country</u>	<u>Production</u> Million Gallons
United States	841
Germany	835
Argentina	729
Brazil	698
France	420
Indonesia	360
Spain	188
Italy	156
Thailand	156
Netherlands	117
<b><u>World Total</u></b>	<b>5,651</b>

Source: Compiled by Earth Policy Institute from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 14 (27 March 2012), p. 281.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

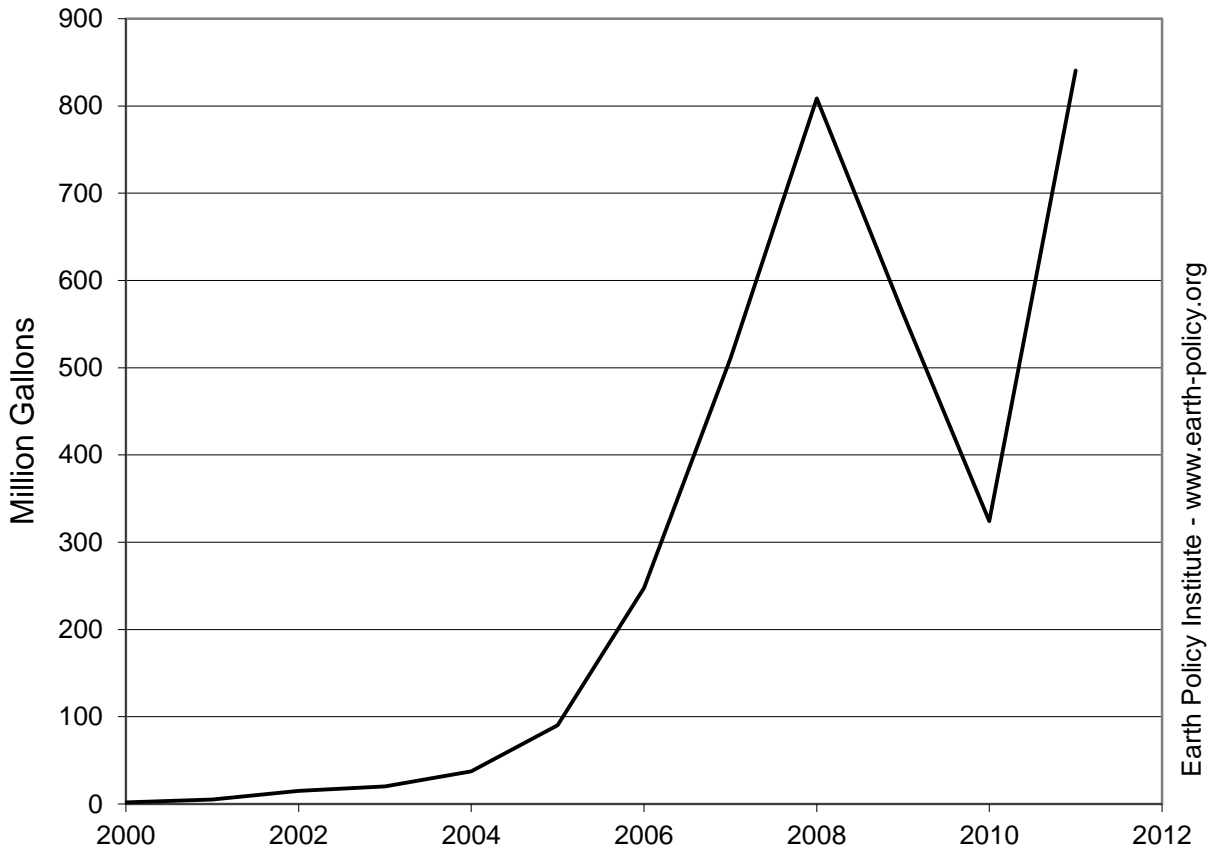
## Biodiesel Production in the United States, 2000-2011

<u>Year</u>	<u>Production</u> Million Gallons
2000	2
2001	5
2002	15
2003	20
2004	37
2005	90
2006	248
2007	511
2008	809
2009	563
2010	324
<u>2011</u>	<u>841</u>

Source: Compiled by Earth Policy Institute with 2000-2004 data from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 2 (23 September 2008), p. 29; 2005-2011 data from F.O.Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 14 (27 March 2012), p. 281.

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# Biodiesel Production in the United States, 2000-2011



Source: F.O. Licht

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

## Biodiesel Production in the European Union, 2000-2011

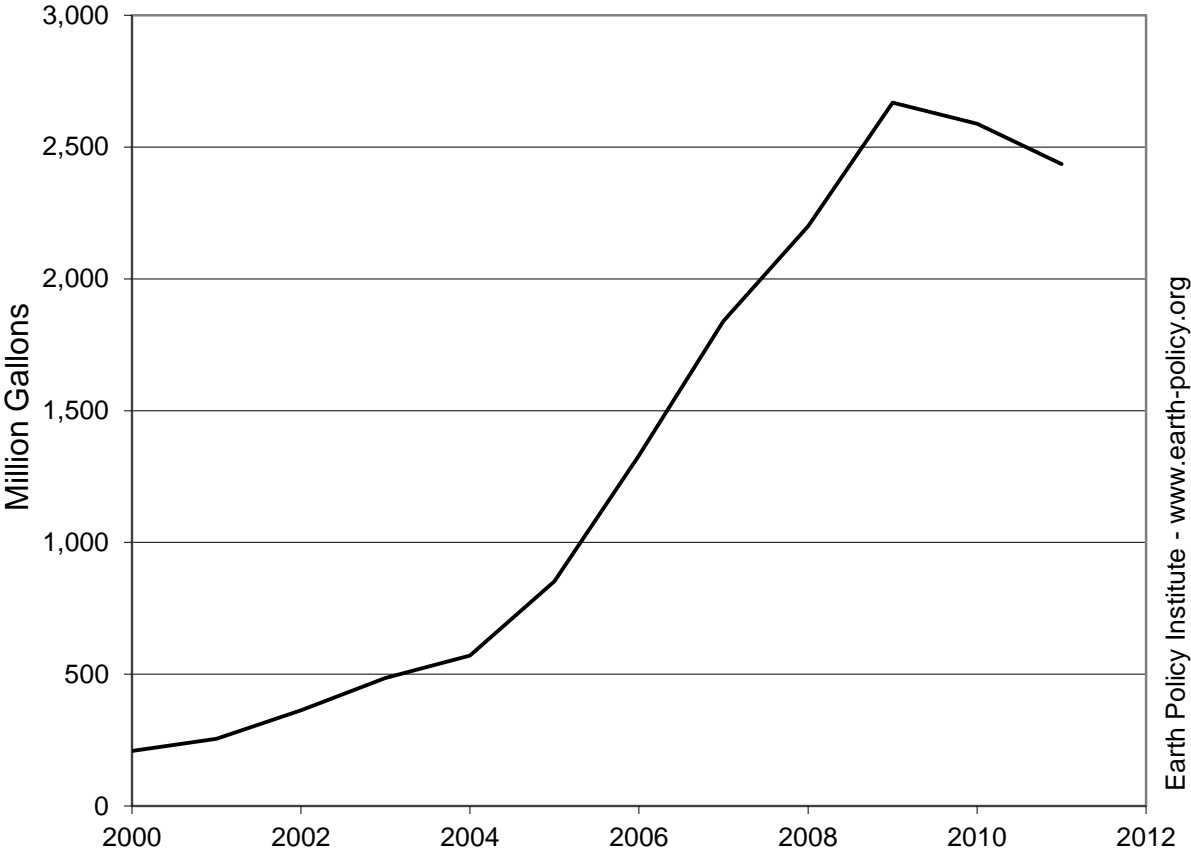
<u>Year</u>	<u>Production</u> Million Gallons
2000	209
2001	255
2002	363
2003	485
2004	570
2005	852
2006	1,329
2007	1,840
2008	2,200
2009	2,668
2010	2,589
<u>2011</u>	<u>2,435</u>

Source: Compiled by Earth Policy Institute with 2000-2004 data from F.O. Licht, *World Ethanol and Biofuels Report*, vol. 7, no. 2 (23 September 2008), p. 29; 2005-2011 data from F.O.Licht, *World Ethanol and Biofuels Report*, vol. 10, no. 14 (27 March 2012), p. 281.

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### Biodiesel Production in the European Union, 2000-2011



Source: F.O. Licht

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

## Biofuel Yields by Feedstock and Location

Crop	Country/Region	Biofuel Type	Biofuel Yield	
			Liters Per Hectare	Gallons Per Acre
Cassava	World	Ethanol	2,070	221
Cassava	Brazil	Ethanol	1,863	199
Cassava	Nigeria	Ethanol	1,480	158
Corn	World	Ethanol	1,960	210
Corn	United States	Ethanol	3,751	401
Corn	China	Ethanol	1,995	213
Oil Palm	Malaysia	Biodiesel	4,736	506
Oil Palm	Indonesia	Biodiesel	4,092	438
Rice	World	Ethanol	1,806	193
Sorghum	World	Ethanol	494	53
Soybean	United States	Biodiesel	552	59
Soybean	Brazil	Biodiesel	491	52
Sugar Beet	World	Ethanol	5,060	541
Sugarcane	World	Ethanol	4,550	486
Sugarcane	Brazil	Ethanol	5,476	585
Sugarcane	India	Ethanol	4,522	483
Wheat	World	Ethanol	952	102

Source: Compiled by U.N. Food and Agriculture Organization (FAO) from D. Rajagopal et al., "Challenge of Biofuel: Filling the Tank without Emptying the Stomach?" *Environmental Research Letters*, vol. 2 (2007); and from Rosamond L. Naylor et al., "The Ripple Effect: Biofuels, Food Security, and the Environment," *Environment*, vol. 49, no. 9 (November 2007), pp. 30–43, in FAO, *The State of Food and Agriculture 2008 - Biofuels: Prospects, Risks and Opportunities* (Rome: 2008), p. 16.

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## Biofuel Net Energy Ratio for Selected Crops

Crop	Biofuel Type	Net Energy Return*
Corn	Ethanol	1.2 – 1.8
Sugar Beet	Ethanol	1.2 – 2.2
Wheat	Ethanol	1.2 – 4.2
Sugarcane	Ethanol	2.2 – 8.4
Rapeseed	Biodiesel	1.2 – 3.6
Soybean	Biodiesel	1.4 – 3.4
Oil Palm	Biodiesel	8.6 – 9.6

\* Net energy return is calculated by dividing the usable energy embodied in ethanol or biodiesel by the amount of energy required to produce it. For example, a gallon of sugarcane-based ethanol can yield up to 8.4 times the energy required to produce that gallon.

Source: D. J. Connor and C. G. Hernandez, "Crops for Biofuel: Current Status and Prospects for the Future," in R. W. Howarth and S. Bringezu, eds., *Biofuels: Environmental Consequences and Interactions with Changing Land Use* (Ithaca, NY: Scientific Committee on Problems of the Environment, Cornell University, 2009), p. 70.

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### U.S. Motor Gasoline Consumption, 1950-2012

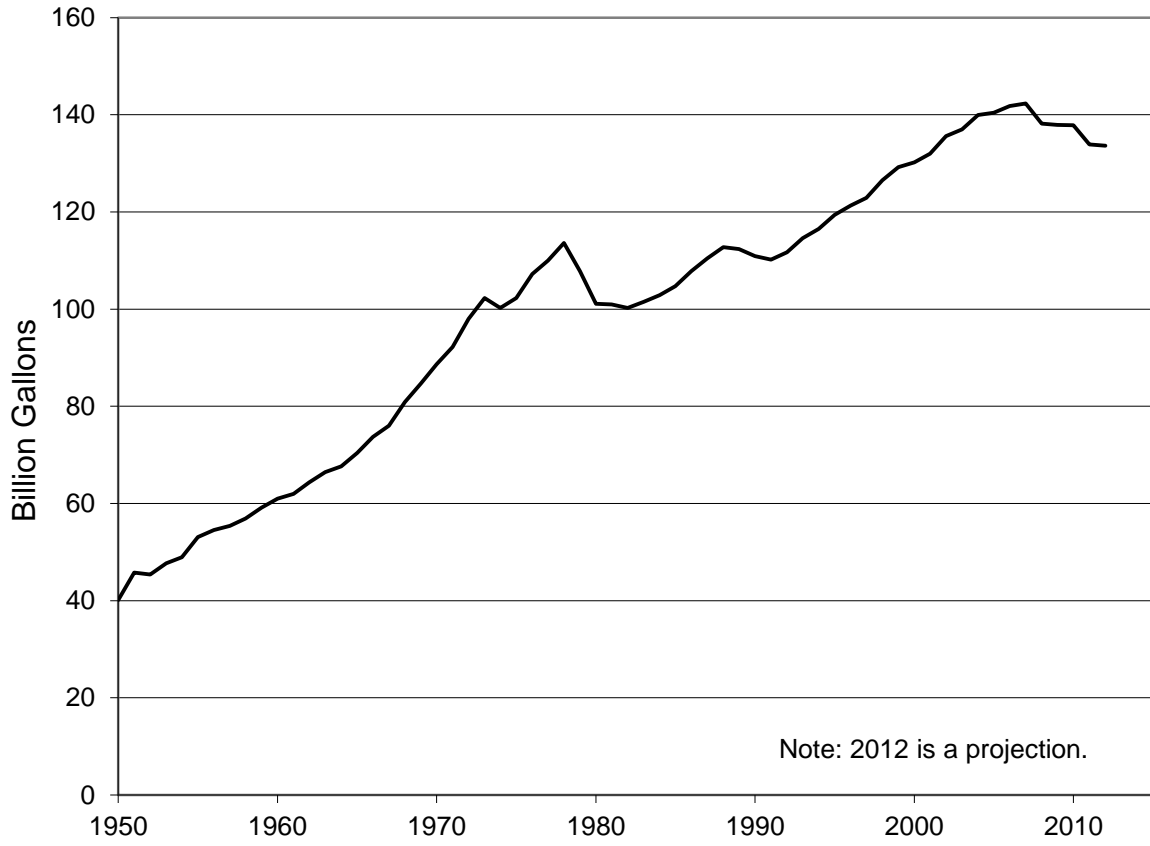
Year	Consumption	
	Million Barrels	Billion Gallons
1950	955	40.1
1951	1,090	45.8
1952	1,081	45.4
1953	1,135	47.7
1954	1,166	49.0
1955	1,264	53.1
1956	1,298	54.5
1957	1,320	55.4
1958	1,354	56.9
1959	1,409	59.2
1960	1,453	61.0
1961	1,476	62.0
1962	1,533	64.4
1963	1,582	66.4
1964	1,611	67.7
1965	1,676	70.4
1966	1,755	73.7
1967	1,810	76.0
1968	1,925	80.9
1969	2,017	84.7
1970	2,111	88.7
1971	2,195	92.2
1972	2,334	98.0
1973	2,436	102.3
1974	2,386	100.2
1975	2,436	102.3
1976	2,554	107.3
1977	2,620	110.0
1978	2,705	113.6
1979	2,568	107.8
1980	2,408	101.1
1981	2,404	101.0
1982	2,387	100.2
1983	2,417	101.5
1984	2,449	102.9
1985	2,493	104.7
1986	2,567	107.8
1987	2,630	110.5
1988	2,685	112.8
1989	2,675	112.3
1990	2,641	110.9
1991	2,623	110.2
1992	2,660	111.7
1993	2,729	114.6
1994	2,774	116.5
1995	2,843	119.4
1996	2,888	121.3
1997	2,926	122.9
1998	3,012	126.5
1999	3,077	129.2
2000	3,101	130.2
2001	3,143	132.0
2002	3,229	135.6
2003	3,261	137.0
2004	3,333	140.0
2005	3,343	140.4
2006	3,377	141.8
2007	3,389	142.3
2008	3,290	138.2
2009	3,284	137.9
2010	3,282	137.9
2011	3,189	133.9
2012 *	3,182	133.7

\* Projection.

Source: Compiled by Earth Policy Institute with 1950-2007 from U.S. Department of Energy (DOE), Energy Information Administration (EIA), "U.S. Product Supplied of Finished Motor Gasoline," at [tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=pets&s=mgfupus1&f=a](http://tonto.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=pets&s=mgfupus1&f=a), updated 30 July 2012; and 2008-2012 from DOE, EIA, "Short Term Energy Outlook," at [www.eia.gov/forecasts/steo/data.cfm](http://www.eia.gov/forecasts/steo/data.cfm), updated 7 August 2012.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# U.S. Motor Gasoline Consumption, 1950-2012



Note: 2012 is a projection.

Source: DOE

## U.S. Vehicle Sales, 1931-2011

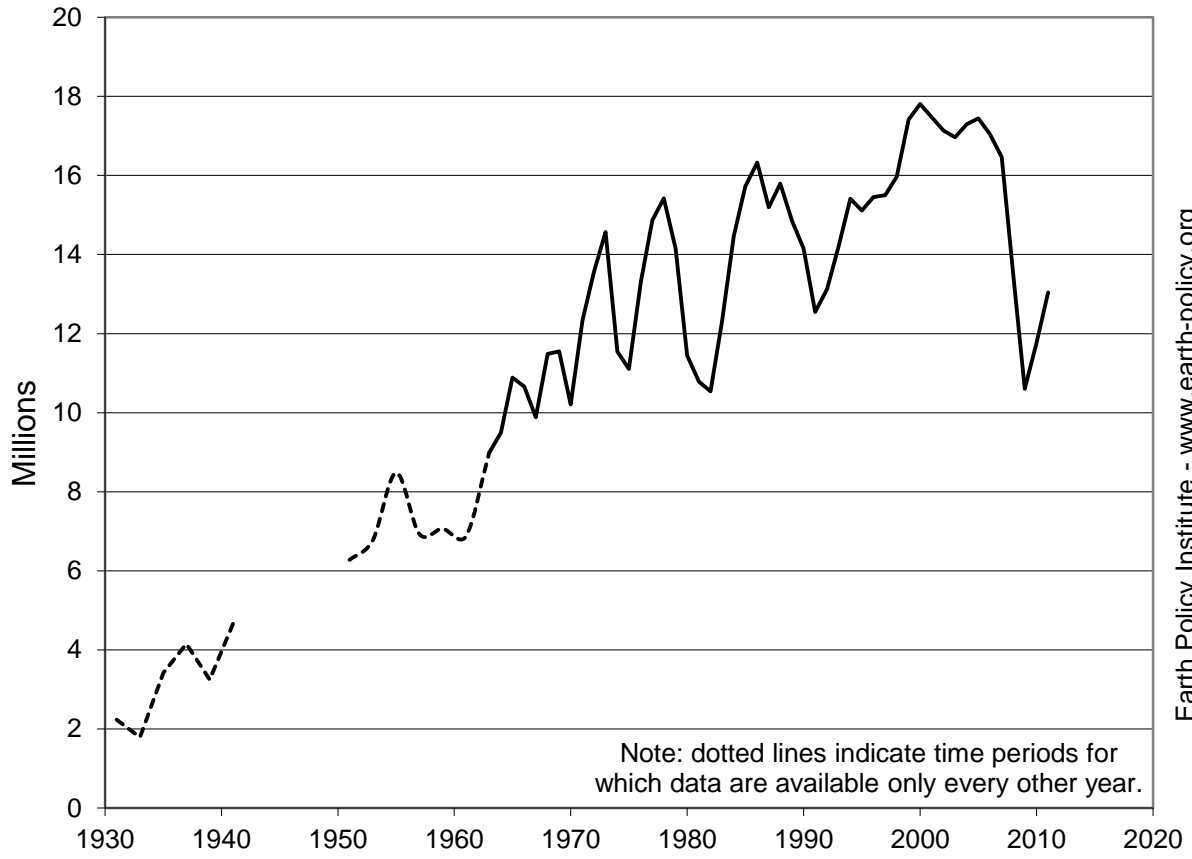
Year	Total Millions
1931	2.2
1933	1.8
1935	3.4
1937	4.2
1939	3.2
1941	4.7
...	...
1951	6.3
1953	6.8
1955	8.5
1957	6.9
1959	7.1
1961	6.9
1963	9.0
1964	9.5
1965	10.9
1966	10.7
1967	9.9
1968	11.5
1969	11.6
1970	10.2
1971	12.3
1972	13.6
1973	14.6
1974	11.5
1975	11.1
1976	13.3
1977	14.9
1978	15.4
1979	14.2
1980	11.4
1981	10.8
1982	10.5
1983	12.3
1984	14.5
1985	15.7
1986	16.3
1987	15.2
1988	15.8
1989	14.8
1990	14.1
1991	12.5
1992	13.1
1993	14.2
1994	15.4
1995	15.1
1996	15.5
1997	15.5
1998	16.0
1999	17.4
2000	17.8
2001	17.5
2002	17.1
2003	17.0
2004	17.3
2005	17.4
2006	17.0
2007	16.5
2008	13.5
2009	10.6
2010	11.8
2011	13.0

Note: 1942-1950 data unavailable.

Source: Ward's Automotive Group, "U.S. Car and Truck Sales, 1931-2011," at [wardsauto.com/public-data](http://wardsauto.com/public-data), updated 2012.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).

# U.S. Vehicle Sales, 1931-2011



Source: Ward's

### U.S. Vehicle Registrations and Scrappage, 2001-2011

Year	New Vehicle Registrations	Scrappage	Scrappage Share of Registrations
	Millions		Percent
2001	17.5	14.1	80.7
2002	17.6	13.3	75.4
2003	16.9	12.1	71.3
2004	17.4	11.1	63.9
2005	17.3	10.1	58.3
2006	17.3	12.1	69.7
2007	16.8	12.7	75.8
2008	15.1	14.0	92.7
2009	9.6	10.4	108.8
2010	10.6	10.6	100.5
2011	12.7	12.0	94.5

Source: R.L. Polk & Company data cited in National Automobile Dealers Association, *NADA DATA 2012* (McLean, VA: 2012), p.16

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).



## Vehicles in Operation in the United States, 2001-2011

<u>Year</u>	<u>Total Vehicles</u> Millions
2001	216.7
2002	221.0
2003	225.9
2004	232.2
2005	239.4
2006	244.6
2007	248.7
2008	249.8
2009	249.0
2010	248.2
<u>2011</u>	<u>248.9</u>

Source: R.L. Polk & Company data cited in National Automobile Dealers Association, *NADA DATA 2012* (McLean, VA: 2012), p. 16.

This is part of a supporting dataset for Lester R. Brown, **Full Planet, Empty Plates: The New Geopolitics of Food Scarcity** (New York: W.W. Norton & Company, 2012). For more information, see Earth Policy Institute on-line at [www.earth-policy.org](http://www.earth-policy.org).