

Supporting Information

Burney et al. 10.1073/pnas.0914216107

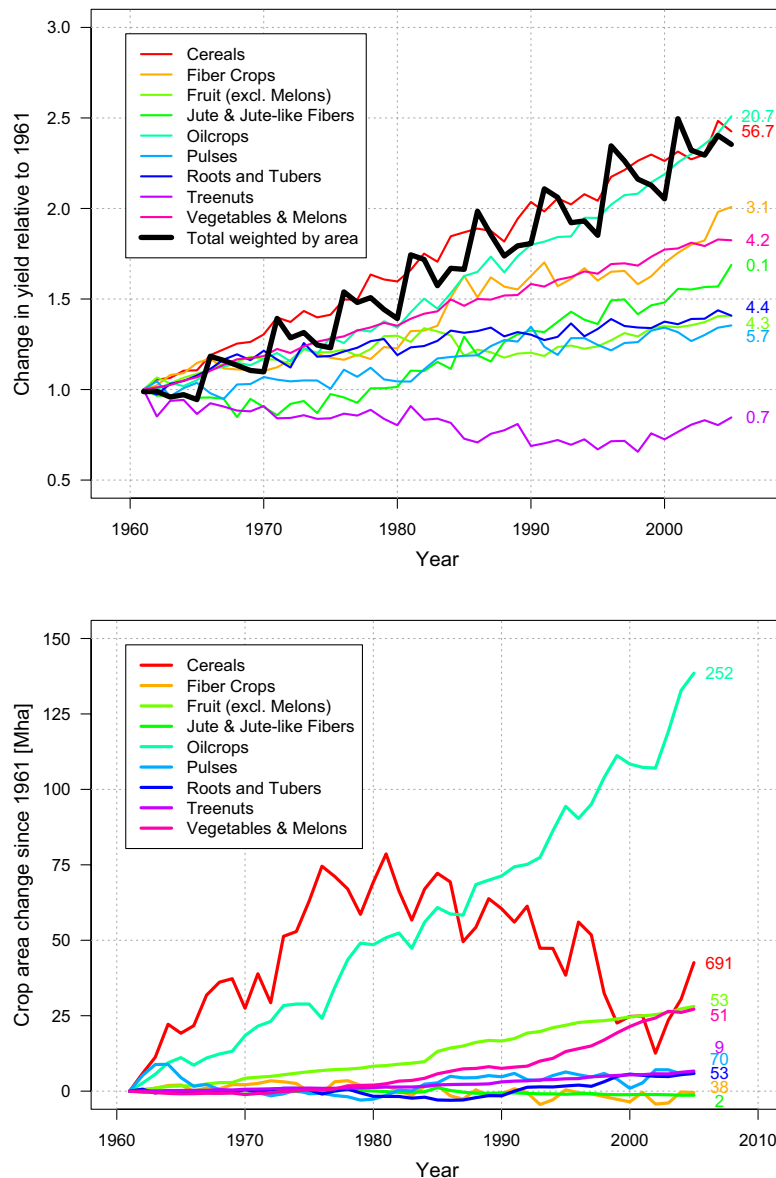


Fig. S1. (Upper) Global crop yield relative to 1961, by crop group. Numbers to right of traces indicate percentage of global cropland in 2005. (Lower) Global crop area expansion since 1961, by crop group. Numbers to right of traces indicate total crop area in 2005.

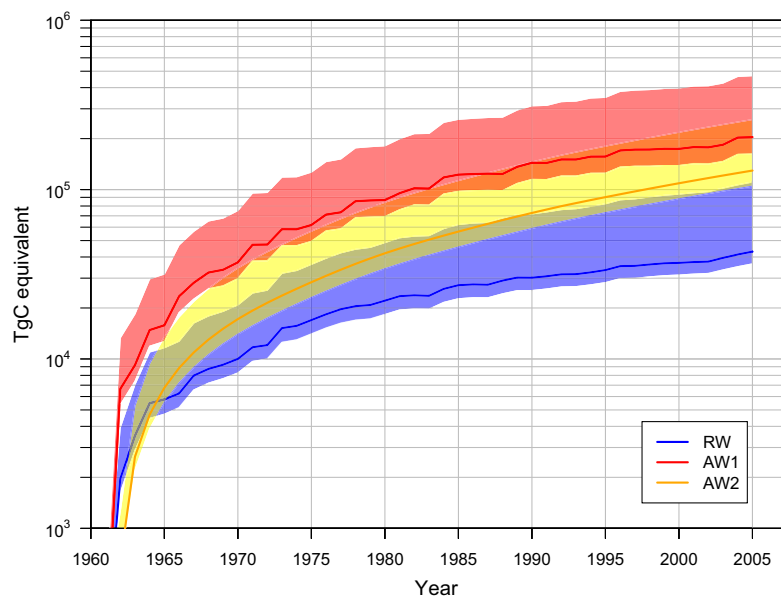


Table S1. Percentage of global crop area by biome, 1961–2005 (1993–2005 values set to percentages calculated from 2000)

	Tropical			Temperate			Temperate			Boreal			Evergreen			Grassland/			Open			Tundra			Polar desert/ rock/ ice
	evergreen	deciduous	forest	broadleaf	needleleaf	deciduous	forest	deciduous	forest	evergreen	deciduous	forest	deciduous	forest	mixed	Savanna	steppe	shrubland	shrubland	Open	shrubland	Tundra	Desert	Desert	
1961	9.34	9.81	9.81	3.06	7.02	13.14	1.24	0.67	11.76	16.72	16.53	5.58	3.77	0.79	0.55	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1962	9.37	9.87	9.87	3.05	6.99	13.06	1.24	0.67	11.72	16.78	16.49	5.61	3.79	0.78	0.56	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1963	9.45	9.88	9.88	3.06	6.92	12.99	1.23	0.66	11.65	16.83	16.52	5.66	3.80	0.78	0.56	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1964	9.50	9.91	9.91	3.05	6.86	12.91	1.22	0.65	11.59	16.90	16.46	5.71	3.86	0.78	0.58	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1965	9.52	9.91	9.91	3.04	6.85	12.85	1.22	0.65	11.55	16.98	16.43	5.74	3.88	0.78	0.59	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1966	9.55	9.93	9.93	3.04	6.81	12.81	1.20	0.64	11.47	17.05	16.45	5.78	3.88	0.77	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1967	9.57	9.97	9.97	3.03	6.80	12.73	1.20	0.64	11.40	17.11	16.48	5.81	3.87	0.77	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1968	9.58	10.00	10.00	3.02	6.79	12.66	1.19	0.63	11.32	17.16	16.59	5.82	3.86	0.77	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1969	9.58	10.00	10.00	3.02	6.79	12.60	1.18	0.63	11.25	17.28	16.55	5.87	3.87	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1970	9.64	10.08	10.08	3.03	6.79	12.57	1.18	0.63	11.24	17.33	16.38	5.85	3.89	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1971	9.71	10.06	10.06	3.03	6.79	12.52	1.18	0.63	11.13	17.40	16.39	5.90	3.90	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1972	9.79	10.12	10.12	3.01	6.76	12.42	1.17	0.63	11.05	17.45	16.40	5.92	3.91	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1973	9.86	10.21	10.21	3.00	6.74	12.35	1.16	0.63	11.01	17.48	16.34	5.93	3.92	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1974	9.92	10.27	10.27	2.99	6.73	12.30	1.16	0.62	10.98	17.51	16.29	5.93	3.92	0.76	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1975	10.00	10.33	10.33	2.97	6.73	12.24	1.16	0.62	10.95	17.59	16.17	5.91	3.94	0.75	0.61	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1976	10.09	10.37	10.37	2.95	6.72	12.18	1.15	0.62	10.91	17.65	16.12	5.93	3.94	0.75	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1977	10.18	10.39	10.39	2.94	6.70	12.14	1.15	0.62	10.88	17.70	16.05	5.94	3.94	0.75	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1978	10.24	10.44	10.44	2.92	6.69	12.10	1.15	0.61	10.85	17.76	16.00	5.95	3.93	0.75	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1979	10.30	10.42	10.42	2.92	6.65	11.99	1.15	0.61	10.65	17.78	16.17	6.06	3.96	0.74	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1980	10.39	10.45	10.45	2.92	6.62	11.92	1.15	0.61	10.64	17.85	16.11	6.06	3.93	0.75	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1981	10.41	10.48	10.48	2.92	6.60	11.86	1.15	0.61	10.62	17.87	16.10	6.11	3.93	0.74	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1982	10.45	10.54	10.54	2.89	6.56	11.81	1.15	0.60	10.59	17.88	16.08	6.15	3.93	0.74	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1983	10.50	10.59	10.59	2.88	6.53	11.76	1.14	0.60	10.57	17.93	16.09	6.13	3.92	0.74	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1984	10.54	10.62	10.62	2.87	6.50	11.73	1.14	0.60	10.52	17.98	16.07	6.15	3.91	0.74	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1985	10.68	10.67	10.67	2.85	6.45	11.67	1.14	0.60	10.47	18.02	16.01	6.16	3.92	0.73	0.60	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1986	10.79	10.72	10.72	2.84	6.40	11.61	1.14	0.60	10.42	18.04	15.99	6.16	3.92	0.73	0.61	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1987	10.91	10.77	10.77	2.84	6.37	11.56	1.14	0.60	10.38	18.01	15.96	6.19	3.93	0.73	0.61	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1988	10.98	10.78	10.78	2.84	6.35	11.52	1.14	0.60	10.35	18.02	15.94	6.18	3.95	0.73	0.62	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1989	11.00	10.80	10.80	2.84	6.33	11.49	1.13	0.59	10.35	18.01	15.93	6.21	3.95	0.73	0.62	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1990	11.09	10.81	10.81	2.84	6.32	11.48	1.13	0.59	10.34	17.98	15.91	6.18	3.96	0.73	0.62	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1991	10.98	10.85	10.85	2.85	6.34	11.45	1.13	0.59	10.36	18.01	15.94	6.18	3.96	0.73	0.62	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1992	11.23	10.83	10.83	2.84	6.33	11.35	1.13	0.59	10.32	17.99	15.90	6.16	3.95	0.73	0.63	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1993	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1994	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1995	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1996	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1997	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1998	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1999	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2000	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2001	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2002	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2003	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2004	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2005	12.06	10.55	10.55	1.83	4.82	9.69	0.60	0.26	7.70	20.09	18.25	7.16	5.83	0.29	0.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table S2. Biomass and soil organic carbon values by biome

Biome	Biomass carbon, t/ha	Soil organic carbon, t/ha	Source
Tropical evergreen forest	210	72	Gibbs et al. (1)
Tropical deciduous forest	132	72	Gibbs et al. (1)
Temperate broadleaf evergreen forest	100	101	Houghton (2)
Temperate needleleaf evergreen forest	160	101	Houghton (2)
Temperate deciduous forest	135	101	Houghton (2)
Boreal evergreen forest	90	155	Houghton (2)
Boreal deciduous forest	90	155	Houghton (2)
Evergreen/deciduous mixed forest	145	101	Houghton (2), estimate
Savanna	43	55	Gibbs et al. (1)
Grassland/steppe	8	59	Gibbs et al. (1)
Dense shrubland	69	59	Gibbs et al. (1)
Open shrubland	31	59	Gibbs et al. (1)
Tundra	1	1	Estimate
Desert	1	1	Estimate
Polar desert/rock/ice	1	1	Estimate

1. Gibbs HK, et al. (2008) Carbon payback times for crop-based biofuel expansion in the tropics: The effects of changing yield and technology. *Environ Res Lett* 3:034001.
2. Houghton RA (1999) The annual net flux of carbon to the atmosphere from changes in land use, 1850–1990. *Tellus B* 51:298–313.