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Article

Understanding the Land Surface Phenology and Gross Primary Production of Sugarcane Plantations by Eddy Flux Measurements, MODIS Images, and Data-Driven Models

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Supplementary Online materials

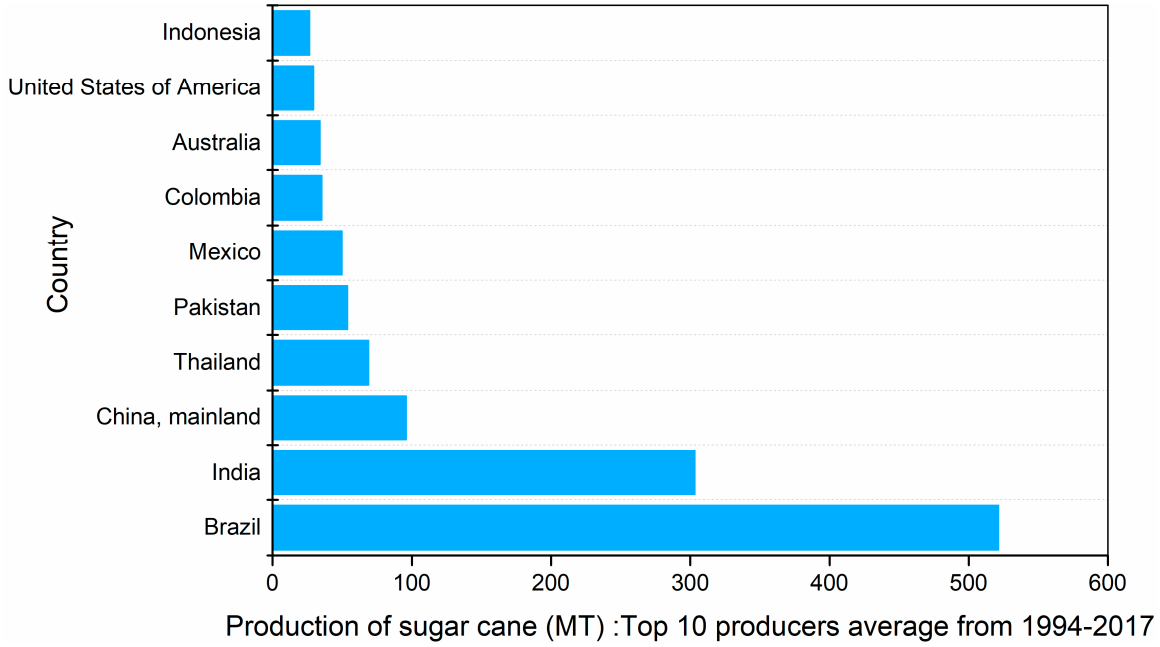


Figure S1. Averaged sugarcane production from the top 10 producer countries in the world (data source: FAO; averaged values over the period of 1994–2017).

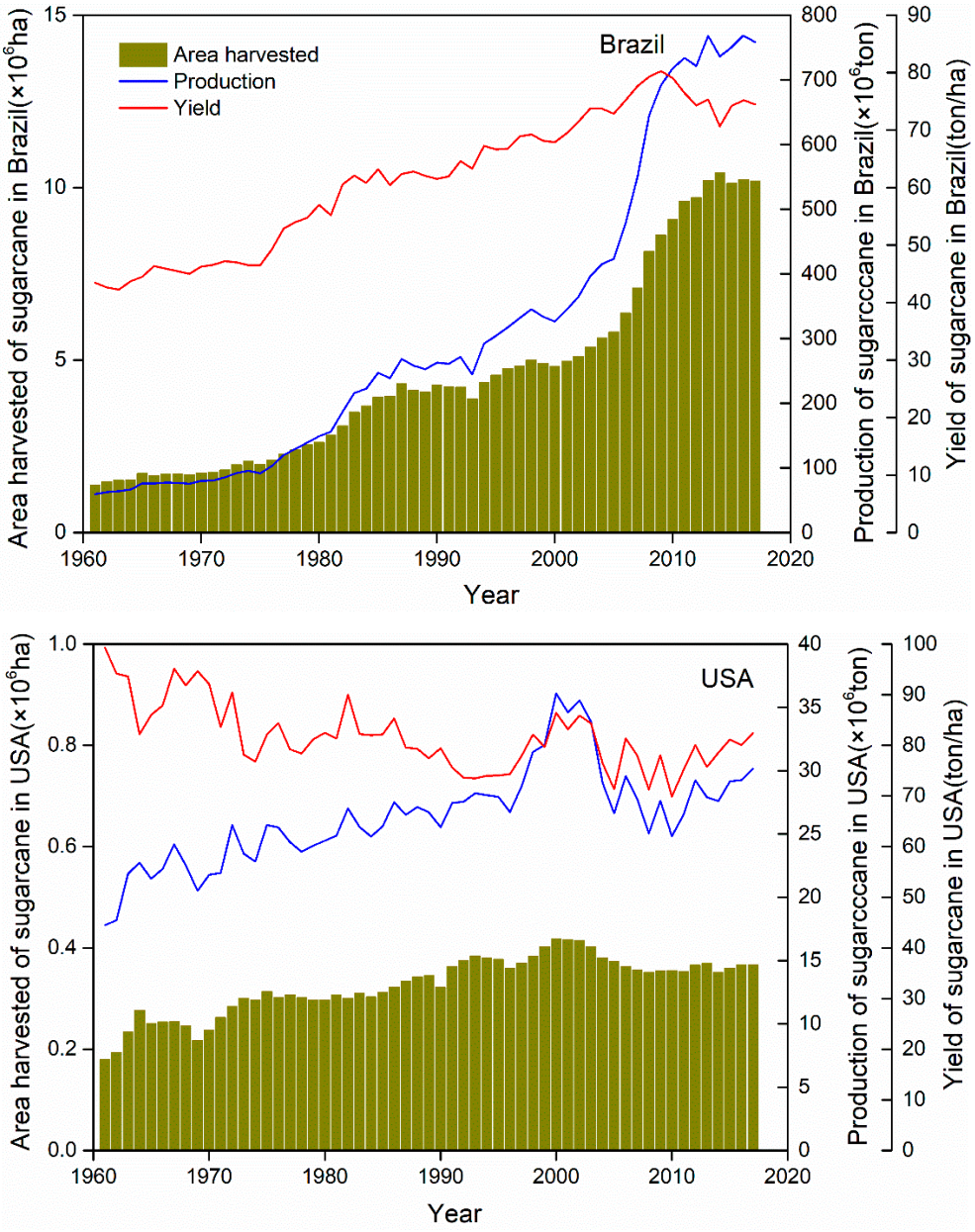


Figure S2. Annual harvested area, production, and yield of sugarcane in Brazil and USA during 1961–2017.

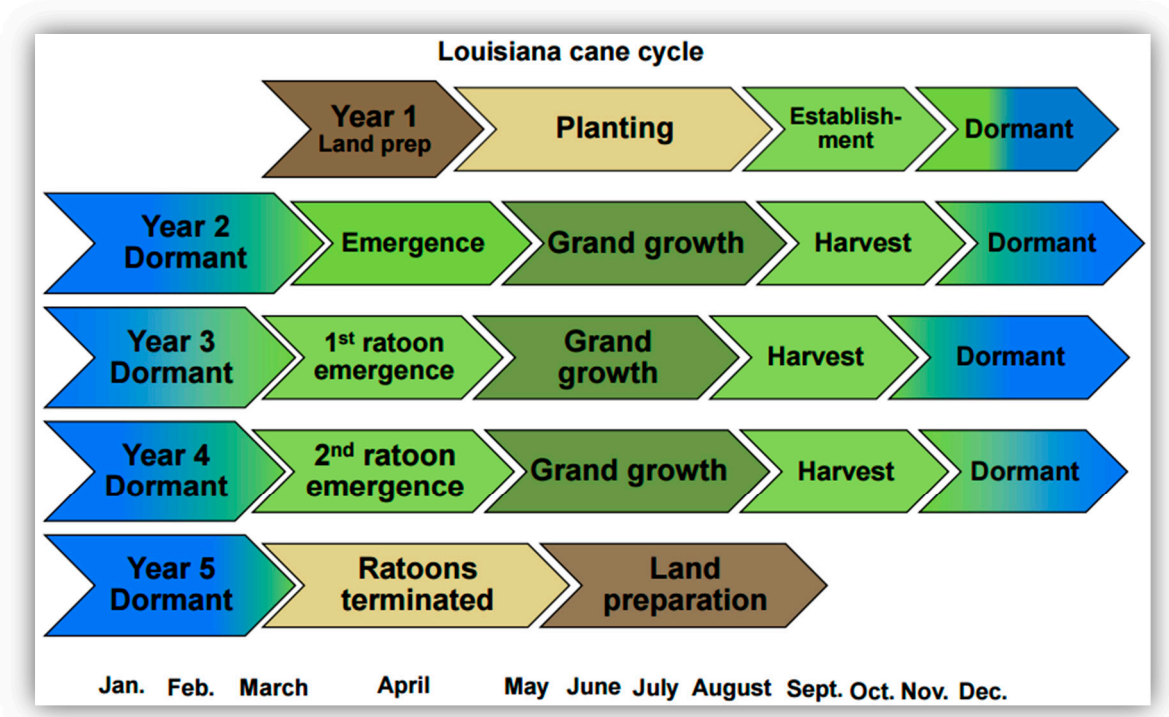


Figure S3. Sugarcane production cycle at the Louisiana site, USA.

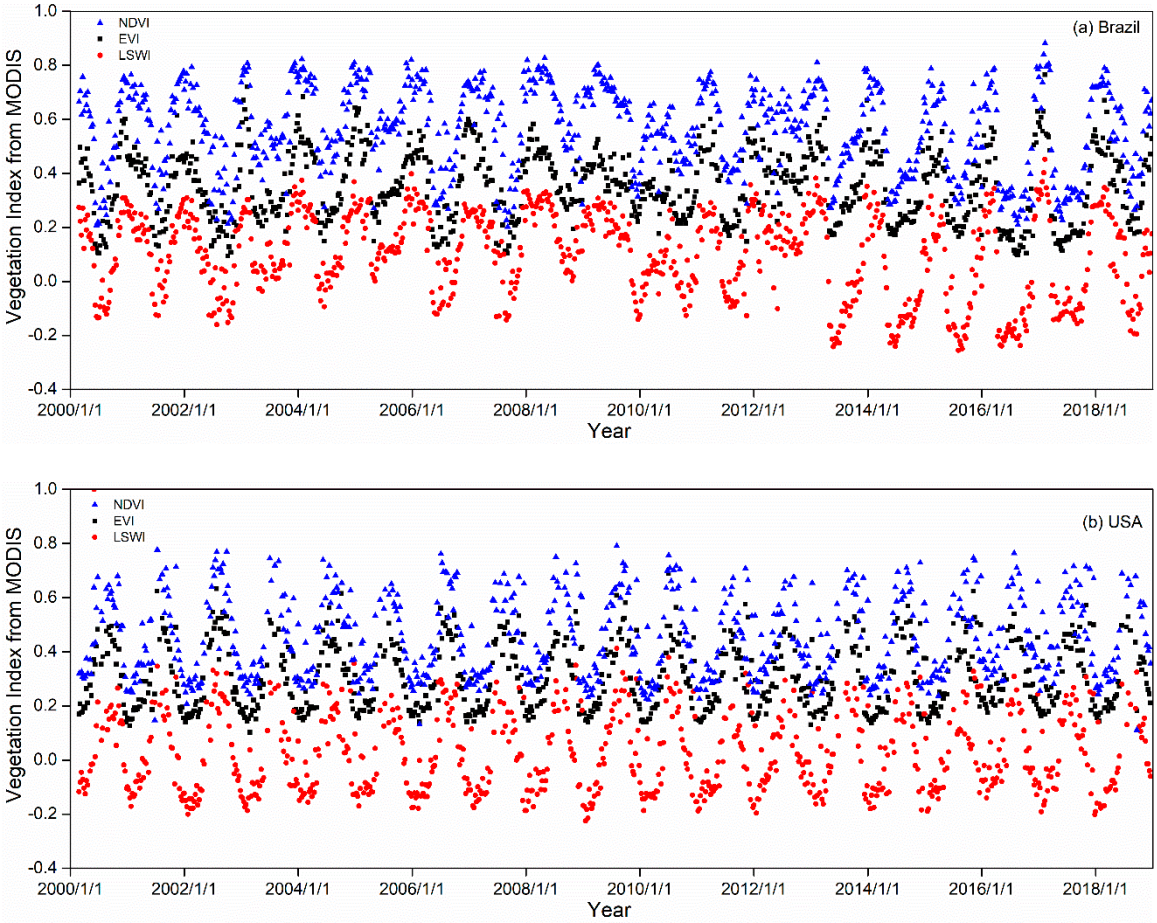


Figure S4. Interannual variation in the three vegetation indices from MODIS during 2000–2018 at the two sugarcane plantation sites. (a) Brazil site; (b) Louisiana site, USA.

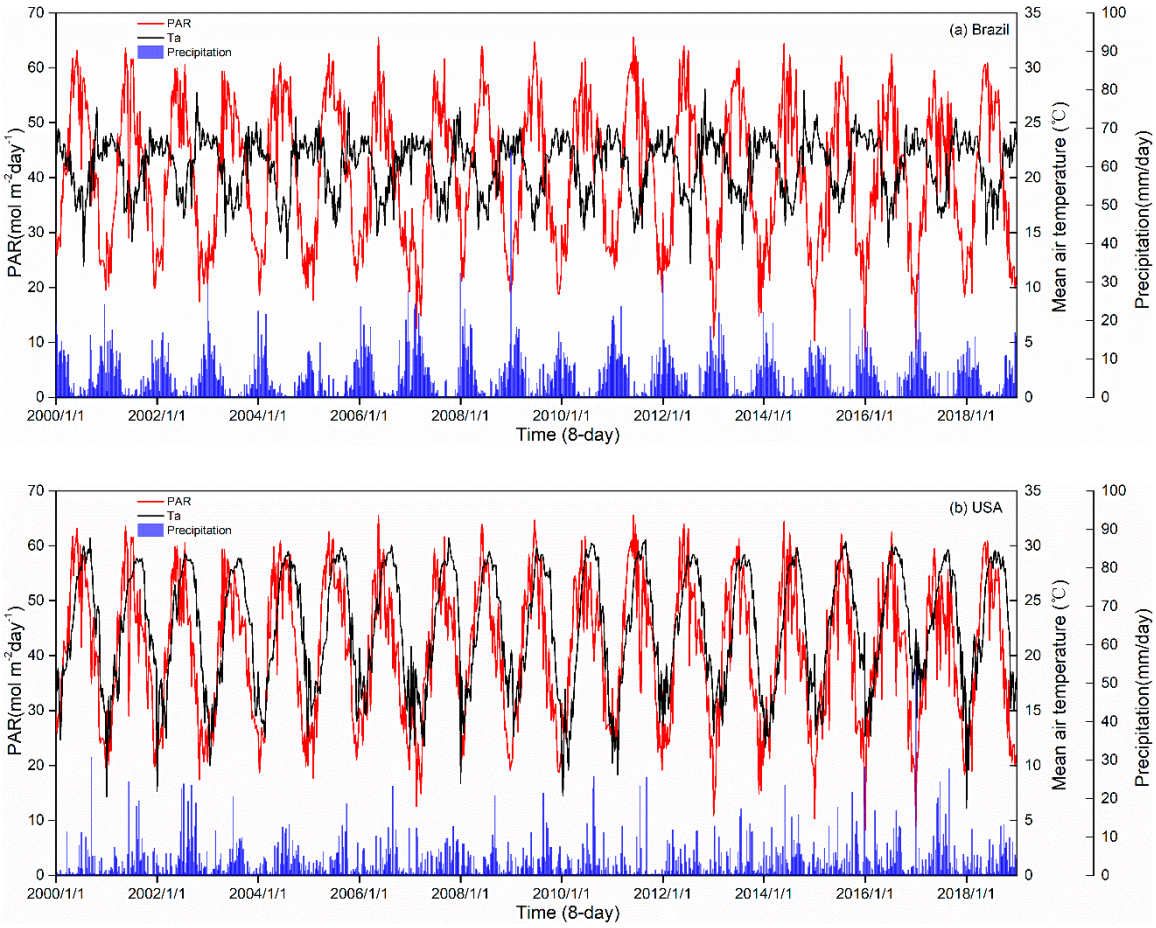
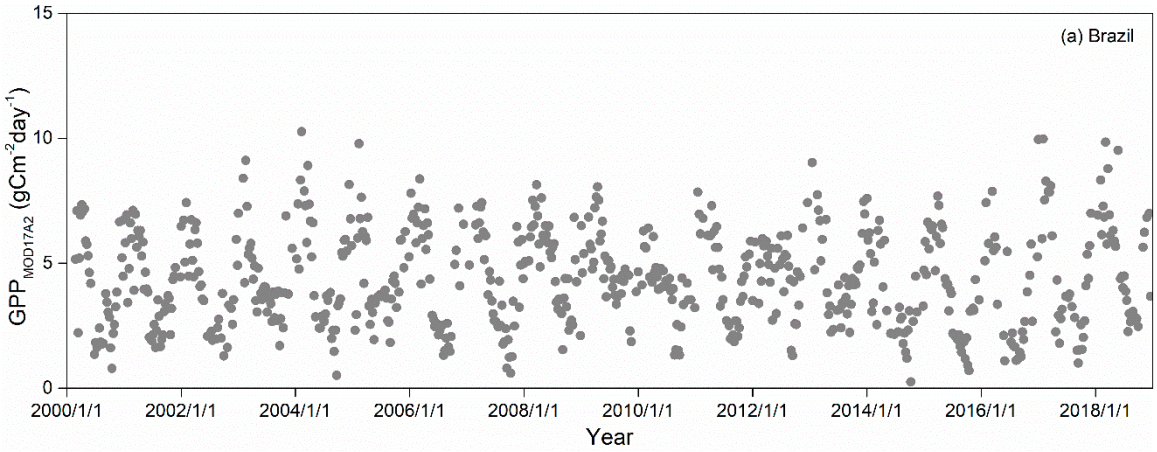


Figure S5. Interannual variation in climate data (air temperature, PAR, and precipitation) during 2000–2018 at the two sugarcane plantation sites, derived from the NCEP-DOE Reanalysis 2. (a) Brazil site; (b) Louisiana site, USA.



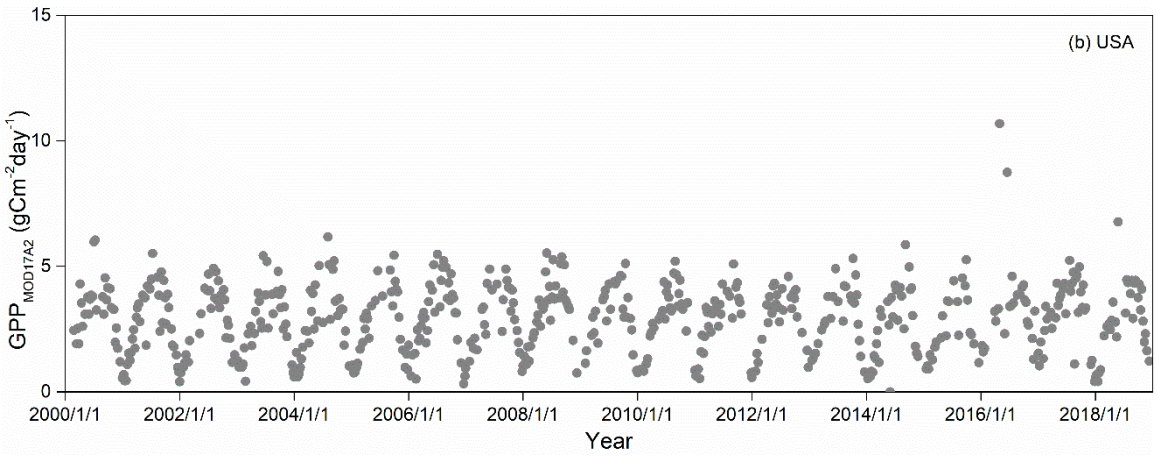


Figure S6. Interannual variation in the GPP data from the MODIS MOD17A2 product during 2000–2018 at the two sugarcane plantation sites. (a) Brazil site; (b) Louisiana site, USA.

Table S1. A detailed information on sugarcane planting history at the two sugarcane sites during 2000–2018.

Year	USR site, Brazil	Louisiana site, USA
2000		
2001		
2002		fallow-cane planted
2003	Re-planted	plant cane
2004	First ratoon	First ratoon
2005	Second ratoon	Second ratoon
2006	Third ratoon	Third ratoon
2007	Re-planted	fallow-cane planted
2008	First ratoon	plant cane
2009	Second ratoon	First ratoon
2010	Third ratoon	Second ratoon
2011	Fourth ratoon	fallow-cane planted
2012	Re-planted	plant cane
2013	First ratoon	First ratoon
2014	Second ratoon	fallow-flux tower erected
2015	Third ratoon	fallow - cane planted on remainder of field
2016	Fourth ratoon	plant cane
2017	Re-planted	First ratoon
2018	First ratoon	Second ratoon

Table S2. A summary of the annual precipitation, mean annual air temperature, and annual PAR from NCEP Reanalysis-2 climate data, and GPP estimated from the VPM model with the NCEP Reanalysis-2 climate data ($GPP_{VPM\text{-}NCEP}$) within the entire sugarcane growing seasons at the two sugarcane EC tower locations..

Brazil Site				
Year	**Precipitation (mm/yr)**	**Mean annual temperature (°C)**	**Annual PAR ($mmol/m^2/yr$)**	**Sum $GPP_{VPM\text{-}NCEP}$ ($g\ C/m^2/yr$)**
2003/2004	1545.60	21.72	1498.85	2943.97
2004/2005	1383.98	21.94	1655.65	3176.36
2005/2006	1952.58	21.00	1722.28	3103.04
2006/2007	2736.75	21.36	1495.27	2913.43
2007/2008	1923.71	21.52	1330.87	2434.51
2008/2009	2421.29	21.30	1692.71	2582.64
2009/2010	1853.27	21.60	1702.06	2090.12

2010/2011	2380.32	21.00	1946.98	2719.20
2011/2012	2041.90	20.74	2001.78	2525.79
2012/2013	2110.13	21.63	1731.95	3141.78
2013/2014	1825.61	21.10	1935.79	2857.62
2014/2015	1800.68	21.31	1512.91	2165.94
2015/2016	1923.54	22.85	1503.85	2160.32
2016/2017	1884.26	22.38	1206.73	2268.17
2017/2018	1579.73	21.72	1331.79	2436.67

USA Site

Year	Precipitation (mm/yr)	Mean annual temperature (°C)	Annual PAR ($mmol/m^2/yr$)	Sum $GPP_{VPM-NCEP}$ ($g\ C/m^2/yr$)
2002	1806.67	23.46	1310.91	3051.76
2003	1089.97	23.75	1300.13	2688.76
2004	1311.74	23.82	1375.41	3326.88
2005	1036.66	24.46	1324.56	2814.65
2006	1061.67	24.58	1262.53	2807.23
2007	1095.52	24.22	1243.92	2942.97
2008	967.41	23.36	1386.94	2907.08
2009	1304.36	23.06	1371.33	3013.24
2010	1240.97	24.24	1292.87	2879.03
2011	825.80	24.20	1394.45	2607.32
2012	1049.14	23.81	1422.50	2923.90
2013	1234.58	23.10	1370.38	2954.33
2014	1456.69	23.38	1270.61	2799.15
2015	1361.77	23.87	1345.60	2760.70
2016	1309.64	24.78	1270.99	2819.41
2017	1723.17	23.94	1339.42	2812.34
2018	1185.24	24.37	1297.55	2843.59