Supplementary Information for "Consideration of Land Use Change-Induced Surface Albedo Effects in Life-Cycle Analysis of Biofuels"

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Section S1. Challenges for albedo and CDL data processing addressed in the developed geographical pairing methodology.

For each land cover type, we identified and retrieved "clean pixels" that represent "clear-cut areas" of a single specific type of land cover. For this purpose, we managed to overcome three challenges. First, the geographical projection of MODIS albedo data is on a sinusoidal grid, while the CDL data are available in regular latitude/longitude projection. To pair these two datasets geographically, we retrieved the MODIS data (46 eight-day periods in year 2014, covering 10 tiles of data) in a sinusoidal grid and then converted them into the regular latitude/longitude projection using the HDF-EOS to GeoTIFF Conversion Tool [1]. Second, as mentioned above, the geographical resolution is different between the MODIS albedo data and the CDL land cover data, which means a pixel of the MODIS albedo data covers multiple pixels of the CDL land cover data, and thus may represent multiple land cover types expressed by a numerical identifier ranging from 1 to 175, representing 175 types of land cover. Here, we regridded the CDL land cover rectilinear grids from 30-meter resolution to 500-meter resolution in concert with that of the albedo rectilinear grids by interpolation on the basis of local area averaging. With the regridded CDL data that were paired with the albedo data at the same spatial resolution, we were able to identify the types of different land covers and their relative shares within the 500-meter-resolution albedo pixels that the albedo observations represent. Third, some of the regridded CDL land cover pixels may represent mosaics of mixed land cover types within the same pixels; those pixels needed to be detected and discarded, as we had decided to select only those clean pixels representing restrictively one particular land cover type. This was done by applying a geospatial filtering technique developed as part of the National Center for Atmospheric Research Command Language. This way, we were able to retrieve the albedo observations from those 500-meter-resolution clean pixels that represent one particular type of land cover.

Section S2. Physical parameterization, validation, and application of the Monte Carlo Aerosol, Cloud and Radiation (MACR) model

The key element of the Monte Carlo Aerosol, Cloud and Radiation (MACR) model is the Monte Carlo radiative transfer solver combined with the Monte Carlo integration in the multi-dimensional parameter space that includes solar zenith angles, water vapor, aerosol and cloud configurations, and spectral bands. The MACR model uses 25 bands and a total of 3132 pseudo-monochromatic calculations to cover the solar spectrum from 0.25 to 5.0 μm with 50 vertical layers [2].

The advantage of the Monte Carlo approach for solving the radiative transfer equation is that it calculates the atmospheric fluxes more accurately than can be done with two-stream approximations, e.g., [3], for both clear and cloudy skies. The MACR model has been validated extensively [4,5] against *in situ* field data (Ramanathan et al. 2001), the ground-based Baseline Surface Radiation Network (BSRN), the Global Energy Balance Archive, and the Cloud and Earth's Radiant Energy System (CERES) TOA flux measurements. Fig. S2.1 shows the daily mean flux comparison between the BSRN measurements and MACR calculations at the surface and the CERES data and the MACR model at the TOA under clear-sky conditions.

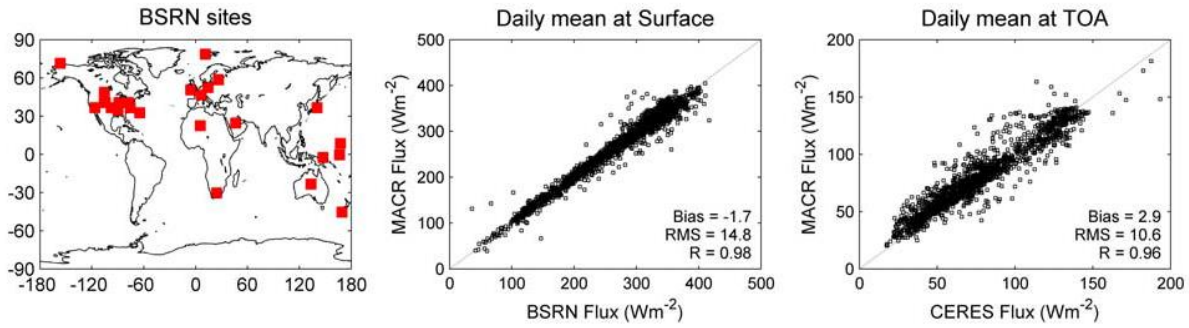


Figure S2.1. (a) Location of BSRN stations. Daily mean flux comparison between (b) the BSRN measurements and MACR model at the surface, and (c) the CERES data and MACR model at the TOA under clear sky conditions from 2000 to 2002 [6].

For each land cover type within each AEZ, the MACR radiation model is deployed daily at the specific latitude and longitude of grid spacing at a resolution of approximately 2.5 by 2.5 degrees. The model runs for all 365 days of the year 2014 to accurately account for the variations in solar zenith angle and declination and eccentricity of the orbit of the Earth around the sun. For each land cover type, each MACR grid that covers a particular AEZ was fed with the respective eight-day albedo observations retrieved from counties within the MACR grid. For each land cover type, the average eight-day satellite observations of surface BSA in each MACR grid was calculated on a pixel-number-weighted basis, and was interpolated to the daily data for the simulated year. Monthly mean cloud cover and optical depth at 2.5-degree resolution were derived from the International Satellite Cloud Climatology Project (ISCCP) satellite data for low, middle, and high clouds and used in calculations of all sky radiative flux [6]. In addition, monthly ozone and daily water vapor data were compiled from various satellite measurements (i.e., Total Ozone Mapping Spectrometer [TOMS], NASA Langley NVAP-NG data products). Daily mean aerosol optical properties were calculated with a global chemical transport model [7] including major aerosol species such as sulfate, black carbon, organic carbon from fossil fuel and biomass burning, and dust and sea salt aerosols. These values were interpolated to each MACR grid and used as input fields in the radiation calculations. Table S2.1 summarizes the radiation calculations performed in the present study and associated input parameters.

Table S2.1. Radiative calculations and associated input parameters

Input Parameter	Value	Reference
Region	6 AEZs	
Time	Daily	
Land cover type	Corn, switchgrass, miscanthus, forest, grass, cropland, shrub, soybean, and winter wheat	[8]
Black-sky surface albedo	Average eight-day values for each land cover type available in each grid within each AEZ (2014)	[9]
Cloud	ISCCP monthly mean (1999–2001)	[6]
Ozone	TOMS monthly mean (2000–2002)	[6]
Water vapor	NVAP-NG daily mean (2000–2001)	[6]
Aerosols	Chemical transport model daily mean (2001)	[7]

Section S3. Calculation of CO_2 equivalent emissions of albedo effects

We adopted the GWP metric according to the IPCC Fifth Assessment Report methodology [10] for direct comparison of albedo-induced radiative forcing with the radiative forcing effects of GHG emissions. The GWP for the albedo effect is the ratio of the Absolute Global Warming Potential (AGWP) due to the albedo effect to the AGWP of CO_2, the reference GHG. The AGWP is calculated by integrating the radiative forcing due to the albedo effect or emission pulses over a chosen time horizon, as shown in Equation (S1):

$$GWP_{albedo}(H) = \frac{\int_0^H RF_{albedo}(t)dt}{\int_0^H RF_{CO_2}(t)dt} = \frac{AGWP_{albedo}(H)}{AGWP_{CO_2}(H)} \quad , \qquad \text{(S1)}$$

where $GWP_{albedo}(H)$ is the albedo-induced GWP on a time horizon of H years; $RF_{albedo}(t)$ and $RF_{CO_2}(t)$ are the annual global average radiative forcing of the albedo effect and the reference gas CO_2, respectively, throughout the time horizon of H years, in W/m^2; and $AGWP_{albedo}(H)$ and $AGWP_{CO_2}(H)$ are the AGWP of the albedo effect and the reference gas CO_2, respectively, throughout the time horizon of H years.

The choice of time horizon influences the GWP values, and thus the CO_2 equivalent (CO_2e) emissions, of the albedo effect. We chose the time horizon of 100 years in this study, which is the typical time horizon chosen in evaluations of the GHG emissions associated with biofuel production. Using the same time horizon ensures a consistent basis for integrating the albedo effect in this study with GHG emissions of biofuels in our previous studies.

For this purpose, we first calculated the annual global average radiative forcing in 2014 due to the albedo effect of land covers *ǰ* and *j*, respectively, which represented the original and converted land covers associated with LUC *n* in AEZ *k*, based on the eight-day local average diurnal net radiative forcing, using Equations (S2):

$$RF_{albedo,j_{LUC_n},k,2014} = \frac{\sum_i^{46} RF_{albedo,i,j_{LUC_n},k,2014}}{46} \times \frac{1}{Earth\ Surface} \qquad \text{(S2-1)}$$

$$RF_{albedo,j_{LUC_n},k,2014} = \frac{\sum_i^{46} RF_{albedo,i,j_{LUC_n},k,2014}}{46} \times \frac{1}{Earth\ Surface} \quad , \qquad \text{(S2-2)}$$

where $RF_{albedo,j_{LUC_n},k,2014}$ and $RF_{albedo,j_{LUC_n},k,2014}$ are the annual global average radiative forcings for land covers *ǰ* and *j*, respectively, associated with LUC *n* in AEZ *k* due to the albedo changes throughout year 2014, in W/m^2; $RF_{albedo,i,j_{LUC_n},k,2014}$ and $RF_{albedo,i,j_{LUC_n},k,2014}$ are the albedo-induced radiative forcings in eight-day period *i* for land covers *ǰ* and *j*, respectively, associated with LUC *n* in AEZ *k*, in W/m^2; and $Earth\ Surface$ is the surface area, in m^2, of the Earth, which is 510 x 10^{12} m^2.

Then, we calculated the 100-year AGWP of an annual albedo effect for land covers *ǰ* and *j* associated with LUC *n* in AEZ *k*, as shown in Equations (S3):

$$AGWP_{Annual\ Albedo,j_{LUC_n},k}(100) = \int_0^{100} RF_{albedo,j_{LUC_n},k}(t)dt = RF_{albedo,j_{LUC_n},k,2014} \qquad \text{(S3-1)}$$

$$AGWP_{Annual\ Albedo,j_{LUC_n},k}(100) = \int_0^{100} RF_{albedo,j_{LUC_n},k}(t)dt = RF_{albedo,j_{LUC_n},k,2014} \qquad \text{(S3-2)}$$

Thus, a 100-year GWP of the albedo effect that is equivalent to an AGWP change on the 100-year time horizon due to the change in annual albedo effects of land covers *ǰ* and *j* associated with LUC *n* in AEZ *k* was calculated, using Equation (S4):

$$GWP_{Annual\ Albedo,LUC_n,k}(100) = \frac{AGWP_{Annual\ Albedo,j_{LUC_n},k}(100) - AGWP_{Annual\ Albedo,j_{LUC_n},k}(100)}{AGWP_{CO_2}(100)} \quad , \qquad \text{(S4)}$$

where $GWP_{Annual\ Albedo,LUC_n,k}(100)$ is the GWP on a 100-year time horizon of the annual albedo effect associated with LUC *n* in AEZ *k*, relative to 1 kg of CO_2 emissions; and $AGWP_{CO_2}(100)$ is a constant, which is 9.17^{-14} W/m^2 year/kg of CO_2 emissions, according to the IPCC [10].

For a LUC, the albedo effect can be translated to CO_2e emissions on the basis of the 100-year GWP calculated by Equation (S4), using Equation (S5):

$$\mathrm{CO_2e}_{Annual\ Albedo,LUC_n,k}(100) = GWP_{Annual\ Albedo,LUC_n,k}(100) \times 1000\ , \quad \text{(S5)}$$

where $\mathrm{CO_2e}_{Annual\ Albedo,LUC_n,k}(100)$ are the CO_2e emissions on a 100-year time horizon, in g CO_2e per m^2 of biomass field, for the annual albedo effect associated with LUC *n* in AEZ *k*; and "1000" is a unit converter for a kilogram to 1000 grams.

Finally, we calculated the $\mathrm{CO_2e}$ emissions of the aggregated albedo effects in various AEZs where multiple types of LUC occur associated with production of corn ethanol, switchgrass ethanol, and miscanthus ethanol, respectively, considering the acreages of biomass feedstock production, as shown in Tables 1–3 in the main text, and the associated annual total ethanol production, which were simulated with the GTAP model [11], using Equations (S6):

$$\mathrm{CO_2e}_{Annual\ Albedo,corn}(100) = \frac{\sum_n \sum_k (\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,corn},k}(100) \times Acreage_{LUC_{n,Corn},k})}{Annual\ Corn\ Ethanol\ Production} \quad \text{(S6-1)}$$

$$\mathrm{CO_2e}_{Annual\ Albedo,switchgrass}(100) = \frac{\sum_n \sum_k (\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Switchgrass},k}(100) \times Acreage_{LUC_{n,Switchgrass},k})}{Annual\ Switchgrass\ Ethanol\ Production} \quad \text{(S6-2)}$$

$$\mathrm{CO_2e}_{Annual\ Albedo,miscanthus}(100) = \frac{\sum_n \sum_k (\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Miscanthus},k}(100) \times Acreage_{LUC_{n,Miscanthus},k})}{Annual\ Miscanthus\ Ethanol\ Production}, \quad \text{(S6-3)}$$

where $\mathrm{CO_2e}_{Annual\ Albedo,corn}(100)$, $\mathrm{CO_2e}_{Annual\ Albedo,switchgrass}(100)$, and $\mathrm{CO_2e}_{Annual\ Albedo,miscanthus}(100)$ are the CO_2e emissions of the annual albedo effects for corn ethanol, switchgrass ethanol, and miscanthus ethanol, respectively, based on a 100-year time horizon for CO_2 AGWP, in g CO_2/MJ; $\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,corn},k}(100)$, $\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Switchgrass},k}(100)$, and $\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Miscanthus},k}(100)$ are the CO_2e emissions of the annual albedo effect associated with LUC *n* in AEZ *k* for corn ethanol, switchgrass ethanol, and miscanthus ethanol, respectively, in g CO_2; $Acreage_{LUC_{n,Corn},k}$, $Acreage_{LUC_{n,Switchgrass},k}$, and $Acreage_{LUC_{n,Miscanthus},k}$ are the annual total LUC areas, in m^2, of corn, switchgrass, and miscanthus, respectively, for LUC *n* in AEZ *k*; and $Annual\ Corn\ Ethanol\ Production$, $Annual\ Switchgrass\ Ethanol\ Production$, and $Annual\ Miscanthus\ Ethanol\ Production$ are the annual total productions of corn ethanol, switchgrass ethanol, and miscanthus ethanol, which are converted to MJ on the basis of the annual volumetric production of 11.6, 7.0 and 7.0 billion gallons of corn, switchgrass, and miscanthus ethanol, respectively, and a lower heating value of 80.5 MJ/gallon for ethanol.

The albedo effect associated with a LUC lasts for the same time frame as the duration of the LUC, which is typically 30 years. Over the LUC time frame of 30 years for the total biofuel production, the total albedo effect in the same time frame can be calculated from Equations (S7). Given that we assumed that the annual albedo dynamics for a given land cover type in a given AEZ would remain the same each year throughout the LUC time frame as those we have characterized in 2014, a climatically neutral year, the assumption of the time horizon for LUC has no impact on its albedo effect in terms of CO_2e emissions of the biofuel production.

$$\mathrm{CO_2e}_{Albedo_{LUC(30)},corn}(100) = \frac{30\times\sum_n\sum_k(\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,corn},k}(100)\times Acreage_{LUC_{n,Corn},k})}{30\times Annual\ Corn\ Ethanol\ Production} \quad \text{(S7-1)}$$

$$\mathrm{CO_2e}_{Albedo_{LUC(30)},switchgrass}(100) = \frac{30\times\sum_n\sum_k(\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Switchgrass},k}(100)\times Acreage_{LUC_{n,Switchgrass},k})}{30\times Annual\ Switchgrass\ Ethanol\ Production} \quad \text{(S7-2)}$$

$$\mathrm{CO_2e}_{Albedo_{LUC(30)},miscanthus}(100) = \frac{30\times\sum_n\sum_k(\mathrm{CO_2e}_{Annual\ Albedo,LUC_{n,Miscanthus},k}(100)\times Acreage_{LUC_{n,Miscanthus},k})}{30\times Annual\ Miscanthus\ Ethanol\ Production}, \quad \text{(S7-3)}$$

where $\mathrm{CO_2e}_{Albedo_{LUC(30)},corn}(100)$, $\mathrm{CO_2e}_{Albedo_{LUC(30)},switchgrass}(100)$, and $\mathrm{CO_2e}_{Albedo_{LUC(30)},miscanthus}(100)$ are the total albedo effects throughout the 30-year LUC time frame for production of corn ethanol, switchgrass ethanol, and miscanthus ethanol, respectively, in g CO_2e/MJ.

Supplementary Tables

Table S1. Summary of number of counties with albedo observations retrieved and the corresponding number of clean pixels of albedo observations

	Land Cover	AEZ 7	AEZ 8	AEZ 9	AEZ 10	AEZ 11	AEZ 12
Number of counties	Corn	26	55	82	118	147	122
	Cropland	46	61	62	113	180	90
	Forest	56	20	14	120	401	223
	Grassland	64	89	45	41	196	99
	Miscanthus	25	35	19	36	62	38
	Shrubland	40	50	20	25	1	19
	Switchgrass	17	15	24	3	78	37
Number of clean pixels	Corn	3,855	21,171	35,609	57,247	27,936	8,854
	Cropland	6,149	6,575	8,437	8,146	11,288	6,779
	Forest	62,822	65,989	10,310	12,887	147,630	16,021
	Grassland	123,072	139,584	5,794	166	8,391	1,305
	Miscanthus	13,916	20,532	237	149	1,192	236
	Shrubland	337,210	145,677	108,551	1,074	1	67
	Switchgrass	5,219	8,862	2,360	3	3,356	212

Table S2. Weighted annual average diurnal net radiative flux, in W/m^2, for each AEZ for each land cover type

	AEZ 7			AEZ 8			AEZ 9		
	Weighted average	Lower bound	Upper bound	Weighted average	Lower bound	Upper bound	Weighted average	Lower bound	Upper bound
Corn	256.4	247.7	265.1	218.4	196.6	240.2	219.6	196.8	242.3
Switchgrass	257.5	249.7	265.2	234.0	225.5	242.4	248.3	233.1	263.4
Miscanthus	255.0	234.7	275.4	232.0	223.0	240.9	225.5	197.7	253.3
Forest	268.0	241.5	294.5	215.6	202.6	228.6	216.5	210.0	222.9
Grass	253.9	226.2	281.6	220.6	198.0	243.1	237.0	209.8	264.2
Shrub	264.8	225.7	303.9	243.5	186.5	300.4	243.7	217.1	270.4
Cropland for corn	256.2	233.7	278.7	210.5	192.2	228.8	210.3	187.2	233.4
Cropland for switchgrass or miscanthus	256.3	240.7	271.9	214.4	194.4	234.5	214.9	192.0	237.9
Cropland-pasture for corn	255.1	230.0	280.1	215.5	195.1	236.0	223.6	198.5	248.8
Cropland-pasture for switchgrass and miscanthus	128.2	120.3	136.0	107.2	97.2	117.2	107.5	96.0	118.9

	AEZ 10			AEZ 11			AEZ 12		
	Weighted average	Lower bound	Upper bound	Weighted average	Lower bound	Upper bound	Weighted average	Lower bound	Upper bound
Corn	213.8	195.0	232.7	228.7	213.5	243.9	248.7	230.6	266.8
Switchgrass	217.1	204.2	230.0	242.8	217.7	267.9	261.1	243.7	278.6
Miscanthus	218.0	205.7	230.3	229.4	215.4	243.3	257.1	236.6	277.6
Forest	214.9	192.5	237.4	242.6	223.1	262.1	257.2	234.9	279.6
Grass	218.5	206.6	230.5	245.7	219.9	271.5	252.8	234.8	270.7
Shrub	248.0	189.2	306.9	243.7	243.7	243.7	267.6	250.8	284.4
Cropland for corn	212.0	188.3	235.7	235.1	215.4	254.8	252.3	236.9	267.6
Cropland for switchgrass or miscanthus	212.9	191.6	234.2	231.9	214.5	249.4	250.5	233.8	267.2
Cropland-pasture for corn	215.2	197.4	233.1	240.4	217.7	263.2	252.5	235.8	269.2
Cropland-pasture for switchgrass and miscanthus	106.4	95.8	117.1	116.0	107.2	124.7	125.2	116.9	133.6

Table S3. Eight-day pixel number-weighted average albedo and its weighted standard deviation for cornfields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.206685	0.007274	0.57206	0.126467	0.551978	0.084626	0.499605	0.180062	0.183609	0.052913	0.143239	0.005996
2	0.211692	0.005851	0.416384	0.181553	0.380395	0.184524	0.314554	0.214608	0.149644	0.019822	0.146694	0.007623
3	0.212705	0.00931	0.304236	0.182082	0.395246	0.195923	0.568549	0.080133	0.251356	0.159557	0.160612	0.012286
4	0.205765	0.014493	0.505951	0.101576	0.461794	0.172806	0.617031	0.103662	0.339715	0.138825	0.164982	0.011392
5	0.244266	0.053892	0.54239	0.080054	0.502046	0.137325	0.707963	0.051286	0.630758	0.079391	0.136472	0.013446
6	0.217091	0.011321	0.42416	0.109388	0.421506	0.200333	0.674604	0.02351	0.534422	0.137095	0.136988	0.008348
7	0.218479	0.010916	0.475625	0.051732	0.447795	0.170615	0.657529	0.066912	0.163909	0.044339	0.145787	0.005873
8	0.216127	0.010866	0.298566	0.077356	0.436064	0.144021	0.644477	0.082747	0.148974	0.013392	0.145488	0.008126
9	0.215611	0.010482	0.178577	0.032225	0.219464	0.037916	0.245574	0.118883	0.146139	0.012367	0.146196	0.008037
10	0.21765	0.009836	0.187934	0.021675	0.197738	0.031186	0.162163	0.080917	0.155308	0.012152	0.149281	0.007815
11	0.215558	0.009857	0.181473	0.028632	0.159132	0.043455	0.132241	0.025455	0.156709	0.008657	0.147117	0.007827
12	0.211537	0.008909	0.17349	0.027422	0.155841	0.041695	0.131837	0.024166	0.153376	0.006592	0.14768	0.008387
13	0.208447	0.008106	0.174083	0.026305	0.154616	0.040101	0.137898	0.018047	0.160567	0.006174	0.149151	0.012946
14	0.207479	0.007917	0.173205	0.023352	0.157187	0.035835	0.139587	0.018058	0.162113	0.00776	0.153299	0.018917
15	0.204643	0.007546	0.169399	0.023763	0.156264	0.0329	0.146407	0.011146	0.171237	0.008467	0.167542	0.029746
16	0.203841	0.007286	0.166252	0.019869	0.154329	0.028065	0.144299	0.011518	0.171712	0.007893	0.163502	0.024125
17	0.204086	0.006473	0.16798	0.018647	0.155681	0.027839	0.144556	0.013754	0.163355	0.007383	0.15203	0.01446
18	0.196836	0.006257	0.164332	0.018792	0.153041	0.029648	0.14624	0.016044	0.169916	0.010012	0.159184	0.019278
19	0.191112	0.005681	0.15835	0.013644	0.141106	0.022638	0.147172	0.015837	0.171077	0.016081	0.147491	0.00722
20	0.184432	0.007124	0.157972	0.012518	0.142126	0.020679	0.144265	0.011495	0.157717	0.005712	0.156618	0.009177
21	0.181214	0.006	0.151845	0.014419	0.140753	0.022491	0.139361	0.013724	0.162764	0.004477	0.159759	0.00985
22	0.175538	0.004811	0.15031	0.010773	0.142764	0.016334	0.141982	0.016158	0.172711	0.003689	0.161695	0.008446
23	0.175619	0.004173	0.15729	0.007315	0.154175	0.010368	0.161779	0.009245	0.175696	0.004438	0.161603	0.005449
24	0.176084	0.003035	0.162793	0.00568	0.15968	0.008768	0.168254	0.00897	0.178607	0.004881	0.1599	0.004108
25	0.172685	0.002647	0.165858	0.004634	0.166137	0.007497	0.174621	0.008149	0.182649	0.005849	0.15856	0.004304
26	0.171789	0.002763	0.169276	0.002845	0.170901	0.004952	0.180183	0.005388	0.181881	0.005136	0.156131	0.005537

27	0.169974	0.002623	0.168746	0.001595	0.172271	0.002205	0.181202	0.003745	0.179022	0.005425	0.149592	0.005444
28	0.171114	0.001971	0.1647	0.002037	0.169227	0.002129	0.175465	0.004577	0.171495	0.005615	0.141939	0.006251
29	0.172907	0.001861	0.164365	0.001842	0.168934	0.002953	0.172848	0.003122	0.170093	0.006201	0.144048	0.005257
30	0.173157	0.0022	0.16295	0.002486	0.167271	0.002776	0.170217	0.002433	0.164853	0.006344	0.147933	0.004104
31	0.170082	0.002538	0.164407	0.003097	0.166951	0.002803	0.167693	0.003232	0.153618	0.006313	0.147807	0.004152
32	0.164681	0.002006	0.165995	0.003432	0.167285	0.003828	0.166129	0.004862	0.151328	0.006081	0.153467	0.002842
33	0.165131	0.004409	0.166897	0.004107	0.165844	0.003464	0.16619	0.005439	0.155282	0.00634	0.159685	0.004856
34	0.169193	0.005564	0.169078	0.005005	0.16314	0.00438	0.162768	0.005004	0.158312	0.007566	0.159628	0.004326
35	0.173231	0.004622	0.180964	0.004854	0.167377	0.005619	0.160525	0.006437	0.154229	0.008587	0.154626	0.006973
36	0.180003	0.002341	0.194841	0.006335	0.177832	0.006134	0.159428	0.003795	0.148506	0.004486	0.155208	0.002818
37	0.185572	0.001945	0.202659	0.008726	0.18154	0.008421	0.162753	0.00781	0.155677	0.003472	0.160088	0.004154
38	0.193681	0.000768	0.201675	0.009591	0.179869	0.012882	0.168233	0.006119	0.163827	0.002462	0.161868	0.004173
39	0.206593	0.002961	0.271885	0.062773	0.196125	0.016285	0.168919	0.005857	0.171471	0.003495	0.158684	0.004067
40	0.21174	0.004575	0.445185	0.187076	0.504137	0.160824	0.352973	0.164607	0.236954	0.136068	0.145176	0.011201
41	0.215084	0.006063	0.427216	0.177305	0.386694	0.158467	0.372847	0.151002	0.20854	0.123717	0.140134	0.010107
42	0.2139	0.007367	0.322386	0.1443	0.291121	0.142935	0.46258	0.125821	0.16121	0.008067	0.146858	0.006142
43	0.201516	0.006797	0.386946	0.153611	0.396371	0.139418	0.220646	0.145417	0.170342	0.013454	0.150353	0.006632
44	0.19805	0.007338	0.438557	0.162874	0.168311	0.007471	0.155116	0.00755	0.165555	0.014895	0.145593	0.007539
45	0.197833	0.012553	0.564464	0.080064	0.509695	0.090549	0.355153	0.195625	0.158783	0.009366	0.138651	0.006313
46	0.229599	0.035953	0.575284	0.069936	0.492526	0.120743	0.38638	0.169672	0.173478	0.027803	0.140025	0.006903

Table S4. Eight-day pixel number-weighted average albedo and its weighted standard deviation for switchgrass fields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.193939	0.009418	0.193008	0.004938	0.195797	0.004701	0	0	0.180632	0.013129	0.153811	0.006572
2	0.194886	0.010159	0.20019	0.002208	0.1942	0.006475	0	0	0.181499	0.013981	0.15596	0.007113
3	0.197932	0.009819	0.203533	0.002067	0.200501	0.006994	0.512	0	0.234587	0.110681	0.159906	0.006171
4	0.193949	0.007987	0.23316	0.004367	0.206824	0.04958	0.5375	98.68946	0.187801	0.011533	0.159853	0.006218
5	0.23436	0.025326	0.406251	0.057624	0.242945	0.117979	0.556	129.9733	0.223425	0.121241	0.154327	0.006803
6	0.189269	0.008188	0.211901	0.000323	0.191091	0.008102	0.572	0	0.185551	0.019234	0.149568	0.008513
7	0.192571	0.009845	0.310511	0.014888	0.19029	0.008205	0.516	0	0.183059	0.012788	0.147574	0.011677
8	0.192921	0.010987	0.215536	0.007285	0.187834	0.012233	0.171	0	0.177979	0.013509	0.149002	0.01198
9	0.19334	0.011139	0.194047	0.002563	0.189586	0.010273	0.166667	253.5737	0.173774	0.012584	0.1522	0.011941
10	0.196074	0.012578	0.196739	0.001152	0.190481	0.008473	0.164167	281.2133	0.170492	0.013172	0.15257	0.01096
11	0.195054	0.012912	0.189647	0.000121	0.186169	0.013907	0.155333	307.6523	0.167817	0.012779	0.149368	0.013533
12	0.190113	0.010893	0.188078	0.000695	0.184396	0.013665	0.155333	331.0985	0.16329	0.011022	0.145134	0.015026
13	0.185966	0.00934	0.186872	0.000461	0.182464	0.016274	0.150333	354.3279	0.160046	0.009536	0.146814	0.012468
14	0.183292	0.009191	0.183313	0.000666	0.180561	0.0182	0.149167	375.6026	0.159017	0.009493	0.149181	0.014047
15	0.181542	0.008808	0.179135	0.000922	0.176726	0.022158	0.148	399.4286	0.159759	0.007973	0.15011	0.012646
16	0.182753	0.010024	0.171665	0.001184	0.175538	0.023441	0.1455	421.8121	0.159875	0.007342	0.147776	0.012286
17	0.186253	0.012136	0.168386	0.001978	0.173267	0.026033	0.151833	439.8372	0.16035	0.00773	0.147024	0.012329
18	0.167105	0.004402	0.158554	0.002967	0.162667	0.038306	0.159333	455.1345	0.160659	0.006325	0.148801	0.011573
19	0.159174	0.00331	0.150426	0.002609	0.14787	0.055408	0.1625	468.6409	0.154089	0.008111	0.16696	0.013264
20	0.156632	0.004049	0.148236	0.003293	0.145805	0.057798	0.160667	480.644	0.156158	0.008041	0.150865	0.010824
21	0.156337	0.004067	0.148641	0.003059	0.147616	0.055714	0.162	489.1058	0.156852	0.007556	0.152467	0.014592
22	0.158986	0.002172	0.148332	0.002588	0.153219	0.049168	0.159333	496.009	0.16061	0.006307	0.149931	0.001445
23	0.159952	0.003263	0.149936	0.002138	0.154956	0.047178	0.161333	498.3872	0.158714	0.004005	0.14932	0.011388
24	0.160693	0.003949	0.151139	0.002364	0.157155	0.044678	0.156167	500.2377	0.158683	0.004025	0.148696	0.012749
25	0.16032	0.003848	0.151253	0.003279	0.157203	0.044603	0.159667	496.676	0.157113	0.005275	0.15076	0.004959
26	0.157593	0.0039	0.153178	0.003148	0.156182	0.045757	0.1645	487.4584	0.156075	0.007117	0.15025	0.008045

27	0.155479	0.003814	0.150783	0.003226	0.154171	0.048074	0.1705	472.9368	0.155459	0.008198	0.147849	0.009141
28	0.156749	0.003588	0.144545	0.003236	0.152141	0.050529	0.165167	458.8984	0.154602	0.00675	0.143461	0.001294
29	0.159102	0.002947	0.144941	0.00274	0.154658	0.047922	0.162667	441.633	0.157256	0.005756	0.142285	0.001774
30	0.159747	0.002687	0.143683	0.002701	0.158407	0.043823	0.159167	422.0628	0.158086	0.005209	0.14475	0.003639
31	0.157475	0.002826	0.145703	0.002648	0.158561	0.043429	0.16	399.339	0.156909	0.005906	0.145821	0.004805
32	0.15558	0.004133	0.148956	0.002453	0.158906	0.043009	0.162667	374.497	0.15602	0.007164	0.143632	0.009692
33	0.163166	0.006821	0.150676	0.002871	0.162474	0.039078	0.157333	350.0094	0.156647	0.007682	0.142287	0.009317
34	0.1682	0.007215	0.152615	0.003024	0.162168	0.03971	0.158	323.9893	0.158191	0.006668	0.143069	0.007181
35	0.168548	0.006662	0.161437	0.002297	0.16033	0.04182	0.152	0	0.156051	0.005762	0.145388	0.007377
36	0.165885	0.004913	0.170545	0.002971	0.163965	0.036932	0.144	274.917	0.157296	0.006396	0.148093	0.009013
37	0.162658	0.002444	0.173293	1.77E-05	0.165625	0.034976	0.148833	249.4421	0.160943	0.00636	0.150247	0.008387
38	0.162783	0.003374	0.176199	0.00095	0.167292	0.033011	0.150667	222.1772	0.162773	0.006963	0.151712	0.007835
39	0.168812	0.005256	0.183253	0.001351	0.174105	0.025203	0.15	197.7782	0.168522	0.007761	0.153516	0.007041
40	0.171736	0.004675	0.195829	0.001638	0.180817	0.017939	0.156	175.7641	0.177116	0.009119	0.155453	0.007245
41	0.175731	0.005986	0.193533	0.001698	0.183467	0.015037	0	0	0.181818	0.010521	0.158371	0.0074
42	0.175979	0.006209	0.196235	0.001553	0.18142	0.018265	0	0	0.181415	0.010155	0.159396	0.007521
43	0.156787	0.006416	0.203969	0.000376	0.173249	0.031542	0	0	0.171619	0.012502	0.158306	0.007895
44	0.157006	0.006341	0.18406	0	0.158487	0.046919	0	0	0.165449	0.016449	0.156248	0.00751
45	0.154413	0.006902	0.505832	12.181	0.164336	0.050521	0.157833	120.3385	0.168007	0.009987	0.147861	0.001613
46	0.161175	0.00559	0.56754	0	0.176457	0.050234	0.161667	122.2135	0.167289	0.011668	0.147452	0.013045

Table S5. Eight-day pixel number-weighted average albedo and its weighted standard deviation for miscanthus fields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.215305	0.086398	0.19594	0.038084	0.516933	0.260494	0.51302	0.000509	0.184432	0.008204	0.153274	0.004923
2	0.215454	0.048233	0.200748	0.03364	0.50611	0.251388	0.5336	0.009235	0.176114	0.001381	0.156031	0.006022
3	0.215473	0.050016	0.203237	0.025034	0.199566	0.009472	0.58459	0.010536	0.411891	0.143091	0.160419	0.006325
4	0.218932	0.077873	0.214875	0.02612	0.542406	0.270248	0.579141	0.012978	0.205759	0.010255	0.160647	0.00828
5	0.237196	0.07516	0.294564	0.040358	0.580474	0.204247	0.603592	0.01788	0.522636	0.020186	0.155142	0.006252
6	0.204871	0.02117	0.205844	0.078155	0.413596	0.270369	0.572761	0.033776	0.240487	0.10545	0.151385	0.00782
7	0.204255	0.01994	0.319623	0.055738	0.42023	0.220765	0.54837	0.051376	0.187352	0.00544	0.149453	0.010057
8	0.2036	0.019584	0.24037	0.07025	0.525375	0.269369	0.537249	0.038359	0.189799	0.00621	0.149841	0.008941
9	0.203414	0.021855	0.189488	0.003185	0.182929	0.01089	0.300811	0.100849	0.18586	0.005285	0.151907	0.006208
10	0.20428	0.0182	0.193046	0.003838	0.183679	0.010606	0.188832	0.080509	0.185952	0.004899	0.151593	0.003715
11	0.202823	0.015138	0.188302	0.005736	0.188895	0.008535	0.16093	0.005063	0.180313	0.005632	0.147074	0.00413
12	0.19944	0.017251	0.185938	0.005135	0.170758	0.015707	0.160679	0.004003	0.173695	0.0049	0.143902	0.004629
13	0.193744	0.016599	0.185767	0.005185	0.170663	0.012183	0.163693	0.005256	0.170376	0.004272	0.145745	0.003399
14	0.191324	0.013586	0.182981	0.004218	0.171593	0.007477	0.163642	0.004809	0.170698	0.005208	0.14718	0.003196
15	0.191659	0.015267	0.179344	0.004945	0.165734	0.006205	0.151494	0.00485	0.169974	0.004695	0.148864	0.002981
16	0.191525	0.014728	0.170635	0.00442	0.1614	0.006491	0.15263	0	0.168498	0.004271	0.146781	0.003687
17	0.191226	0.014089	0.166926	0.003532	0.161193	0.004824	0.159767	0.005238	0.170915	0.004372	0.146136	0.00622
18	0.179724	0.01496	0.159323	0.002379	0.155841	0.005145	0.16054	0.005834	0.169776	0.00408	0.149668	0.005329
19	0.172693	0.014166	0.151862	0.001405	0.148433	0.003472	0.162429	0.005254	0.166767	0.003818	0.157656	0.005363
20	0.171879	0.015941	0.148742	0.001068	0.148217	0.004842	0.162502	0.004175	0.166704	0.006278	0.150172	0.006676
21	0.173798	0.018011	0.149127	0.000906	0.150681	0.004198	0.159161	0.004593	0.167095	0.005708	0.150446	0.005001
22	0.174964	0.016922	0.148274	0.000629	0.151472	0.001056	0.156798	0.006421	0.169066	0.003845	0.152627	0.00467
23	0.173371	0.014625	0.149476	0.000796	0.154031	0.00146	0.158258	0.005226	0.163068	0.00209	0.150025	0.004595
24	0.171051	0.012593	0.151752	0.001022	0.156218	0.000985	0.164183	0.003996	0.161804	0.001144	0.148809	0.004269
25	0.167968	0.010351	0.151078	0.00151	0.158247	0.001497	0.16808	0.003127	0.163818	0.001866	0.151941	0.0045
26	0.163781	0.008922	0.152125	0.001625	0.159609	0.003738	0.171018	0.002805	0.166297	0.00265	0.149944	0.0033

27	0.156809	0.005542	0.148895	0.001907	0.156892	0.004286	0.169843	0.002734	0.167153	0.002502	0.148263	0.004284
28	0.158466	0.005636	0.143616	0.001993	0.153882	0.003319	0.165388	0.00248	0.162862	0.003022	0.146397	0.004736
29	0.16188	0.006005	0.145135	0.00148	0.156245	0.003331	0.162249	0.00312	0.163554	0.002534	0.145385	0.00482
30	0.16525	0.007836	0.144398	0.001957	0.156982	0.003196	0.158563	0.002647	0.164679	0.002173	0.147076	0.005125
31	0.165299	0.009503	0.146784	0.002365	0.158997	0.004782	0.159238	0.002591	0.163758	0.002667	0.147935	0.005856
32	0.163569	0.008511	0.150508	0.002163	0.161842	0.005036	0.160436	0.002495	0.164538	0.003552	0.143515	0.003888
33	0.164053	0.006051	0.151923	0.002356	0.163845	0.004261	0.161923	0.002278	0.165934	0.004053	0.142125	0.003694
34	0.166606	0.005566	0.153111	0.002736	0.163445	0.005672	0.161072	0.002458	0.1656	0.004442	0.143742	0.003516
35	0.168839	0.005578	0.160498	0.002799	0.1654	0.009609	0.162403	0.004454	0.162266	0.004329	0.145324	0.003371
36	0.169382	0.005954	0.16925	0.00282	0.172254	0.011178	0.159574	0.000879	0.162954	0.004131	0.147035	0.002477
37	0.170217	0.00838	0.173101	0.002386	0.178074	0.013815	0.159253	0.003743	0.16501	0.003893	0.149354	0.002483
38	0.172475	0.010125	0.17662	0.002352	0.178415	0.011037	0.162695	0.004113	0.168069	0.003285	0.150854	0.002226
39	0.178612	0.012602	0.184085	0.003267	0.18781	0.012863	0.170736	0.004727	0.173958	0.003837	0.153323	0.003419
40	0.184816	0.020265	0.213022	0.087257	0.17164	0	0.19204	0.082044	0.178965	0.002512	0.156066	0.005303
41	0.186419	0.018092	0.205431	0.082104	0.189488	0.019087	0.382893	0.13654	0.185404	0.006031	0.158831	0.004619
42	0.180502	0.017321	0.191242	0.018095	0.182056	0.012475	0.43386	0	0.174962	0.004508	0.159405	0.005152
43	0.171654	0.014437	0.212367	0.058447	0.15094	0	0.113274	0.007201	0.16811	0	0.157761	0.0061
44	0.16452	0.037012	0.470002	0.046184	0.14233	0	0.03796	0.02591	0.18249	0.003857	0.155901	0.005001
45	0.183176	0.110352	0.566481	0.048708	0.492968	0.18477	0.214824	0.087936	0.179975	0.00469	0.149692	0.004789
46	0.233917	0.163787	0.584901	0.050082	0.495815	0.25649	0.216813	0.089677	0.179457	0.002893	0.146775	0.004627

Table S6. Eight-day pixel number-weighted average albedo and its weighted standard deviation for forest in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.129736	0.040568	0.183202	0.033864	0.149744	0.053102	0.368727	0.049205	0.109847	0.008687	0.105704	0.003919
2	0.122791	0.034279	0.140394	0.025295	0.135998	0.046924	0.350972	0.029517	0.11118	0.008052	0.10687	0.004146
3	0.120898	0.031049	0.141904	0.026855	0.153696	0.046975	0.352186	0.021023	0.120168	0.025125	0.108953	0.004488
4	0.150732	0.057596	0.204545	0.018422	0.19139	0.036346	0.342143	0.02272	0.127579	0.034475	0.111137	0.004687
5	0.152902	0.067405	0.214627	0.021094	0.178036	0.040835	0.331832	0.03225	0.141848	0.06474	0.111572	0.005741
6	0.117731	0.035059	0.212072	0.031104	0.171325	0.04462	0.341587	0.01953	0.123841	0.025773	0.108417	0.004353
7	0.116578	0.033939	0.220401	0.024421	0.175915	0.044	0.347248	0.015843	0.118199	0.010617	0.108534	0.00473
8	0.115676	0.031285	0.186839	0.02757	0.130444	0.042116	0.330628	0.015285	0.118606	0.007929	0.108479	0.005822
9	0.113765	0.029581	0.161423	0.034276	0.125752	0.040132	0.312268	0.024994	0.116663	0.007194	0.109261	0.005341
10	0.112363	0.027669	0.150602	0.046172	0.118246	0.045138	0.301164	0.064807	0.116774	0.00734	0.109872	0.004452
11	0.110249	0.024153	0.143693	0.047003	0.115945	0.046168	0.269196	0.062016	0.115669	0.007323	0.10901	0.004738
12	0.106971	0.016092	0.133843	0.027405	0.106472	0.020885	0.231067	0.059855	0.114691	0.007062	0.109448	0.005501
13	0.106865	0.014918	0.124043	0.020272	0.102045	0.018632	0.17681	0.069459	0.114737	0.006778	0.111104	0.004992
14	0.104681	0.00708	0.10939	0.019938	0.094768	0.024095	0.144983	0.055378	0.115054	0.007255	0.114918	0.005781
15	0.101616	0.007578	0.109854	0.019812	0.096302	0.006613	0.122426	0.003297	0.121524	0.008576	0.121879	0.009162
16	0.101782	0.0083	0.106266	0.014817	0.09778	0.005639	0.119986	0.003331	0.129596	0.007072	0.124417	0.011001
17	0.100703	0.007517	0.099106	0.003246	0.097559	0.004483	0.116608	0.009438	0.143093	0.006284	0.131867	0.015313
18	0.099659	0.007257	0.093675	0.002141	0.09604	0.005573	0.123953	0.009874	0.148926	0.003325	0.134564	0.014588
19	0.099275	0.007197	0.091225	0.002165	0.09336	0.007907	0.136922	0.007654	0.154369	0.004932	0.144718	0.015364
20	0.100421	0.007871	0.092122	0.002983	0.092515	0.010714	0.147459	0.004295	0.152033	0.00516	0.138604	0.01682
21	0.101722	0.007875	0.088737	0.004667	0.093916	0.010115	0.149047	0.004665	0.15166	0.003779	0.136833	0.014771
22	0.10114	0.007285	0.083844	0.005817	0.088783	0.012155	0.152507	0.005443	0.156608	0.006729	0.133979	0.014385
23	0.101018	0.007484	0.083149	0.005668	0.088757	0.012291	0.151174	0.003107	0.1487	0.003507	0.128468	0.013567
24	0.102927	0.007587	0.084866	0.005402	0.090042	0.012691	0.152747	0.003092	0.148254	0.003007	0.127263	0.01369
25	0.10158	0.008671	0.084838	0.005091	0.092102	0.011762	0.15281	0.004915	0.151399	0.006055	0.129482	0.013633
26	0.102454	0.008564	0.084295	0.005008	0.090155	0.012655	0.153492	0.004528	0.149693	0.006019	0.12668	0.012267

27	0.103141	0.00877	0.085767	0.005112	0.09056	0.012816	0.152769	0.003704	0.151676	0.008073	0.126907	0.012357
28	0.100578	0.008184	0.08696	0.004804	0.093245	0.011141	0.148168	0.003311	0.144802	0.004793	0.125749	0.012709
29	0.100194	0.008566	0.085799	0.005237	0.091939	0.011128	0.144554	0.002484	0.138021	0.003522	0.121866	0.011283
30	0.098637	0.008147	0.083108	0.005043	0.090671	0.009758	0.140994	0.003874	0.13595	0.003926	0.121747	0.010675
31	0.098584	0.007621	0.082159	0.00448	0.089375	0.009778	0.136966	0.003152	0.136595	0.005278	0.124777	0.011029
32	0.099881	0.007523	0.082218	0.004696	0.089214	0.009987	0.137817	0.003272	0.133862	0.004692	0.119034	0.009902
33	0.098776	0.007014	0.083699	0.005125	0.090637	0.009486	0.139891	0.005669	0.129106	0.003117	0.114585	0.009984
34	0.096565	0.007673	0.084322	0.00508	0.091012	0.008807	0.138238	0.006151	0.128307	0.003046	0.113839	0.009856
35	0.097426	0.008109	0.084805	0.004331	0.091668	0.007164	0.12991	0.004401	0.128327	0.003741	0.114971	0.010197
36	0.099286	0.008747	0.08549	0.004732	0.093844	0.006077	0.121575	0.005115	0.121995	0.00258	0.112059	0.007717
37	0.099182	0.008983	0.084563	0.005374	0.093437	0.005056	0.115445	0.007072	0.120827	0.003233	0.112727	0.007865
38	0.099143	0.008508	0.083024	0.005671	0.084884	0.006572	0.112792	0.005431	0.119942	0.004042	0.11324	0.007809
39	0.100516	0.00815	0.115978	0.018373	0.091724	0.00478	0.118963	0.00852	0.116491	0.00636	0.11352	0.007296
40	0.10504	0.011313	0.135503	0.046761	0.092306	0.000815	0.123039	0.020381	0.115315	0.006732	0.113328	0.006111
41	0.109074	0.01174	0.149383	0.026686	0.10495	0.026796	0.165653	0.045579	0.11767	0.005791	0.11282	0.004861
42	0.103598	0.008585	0.165986	0.023315	0.115003	0.01505	0.132191	0.059459	0.115355	0.006393	0.111976	0.004873
43	0.102789	0.00744	0.1211	0.0171	0.098332	0.021789	0.111928	0.007776	0.1059	0.005723	0.109245	0.004123
44	0.129164	0.036499	0.12062	0.031511	0.10969	0	0.049759	0.031928	0.110267	0.009373	0.109002	0.005228
45	0.18434	0.063156	0.214386	0.021648	0.150823	0.015913	0.124104	0.036503	0.110228	0.006162	0.105907	0.004459
46	0.177965	0.052098	0.218831	0.017577	0.186173	0.013003	0.282168	0.052361	0.109995	0.005938	0.104358	0.003461

Table S7. Eight-day pixel number-weighted average albedo and its weighted standard deviation for grassland in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.250977	0.066935	0.33939	0.152299	0.293174	0.213542	0.51266	0	0.175716	0.009517	0.154149	0.005139
2	0.234215	0.030717	0.301633	0.126642	0.244567	0.152067	0.556587	0.016149	0.174556	0.00801	0.156297	0.005232
3	0.237673	0.038056	0.230935	0.079516	0.23966	0.138572	0.584016	0.014892	0.183291	0.021985	0.161373	0.005776
4	0.283855	0.13051	0.344332	0.103737	0.27279	0.147119	0.577978	0.012264	0.188689	0.010338	0.163903	0.006268
5	0.293035	0.130515	0.449125	0.10766	0.410172	0.13972	0.599773	0.017835	0.222431	0.110234	0.157765	0.009589
6	0.218777	0.011211	0.323995	0.106545	0.236914	0.142891	0.574296	0.02941	0.190111	0.039711	0.155276	0.006796
7	0.219557	0.010886	0.467329	0.092115	0.282832	0.126091	0.552784	0.048952	0.181978	0.012045	0.154657	0.007632
8	0.217922	0.010388	0.295623	0.11005	0.227911	0.126468	0.53563	0.04627	0.176695	0.011446	0.15144	0.007526
9	0.217517	0.010154	0.179359	0.050154	0.19059	0.054237	0.31643	0.109809	0.172587	0.010437	0.150842	0.006637
10	0.219629	0.010355	0.181341	0.049511	0.191636	0.024367	0.167016	0.005289	0.169578	0.010642	0.149514	0.005774
11	0.218947	0.010113	0.201825	0.040138	0.185818	0.004234	0.16081	0.004863	0.166801	0.009798	0.147043	0.006559
12	0.215413	0.010454	0.177249	0.02314	0.182538	0.005905	0.160884	0.003712	0.162094	0.008454	0.145882	0.006795
13	0.210035	0.010442	0.170852	0.013903	0.18244	0.00493	0.161292	0.008064	0.159066	0.007255	0.146805	0.005762
14	0.209455	0.010647	0.169604	0.012979	0.181008	0.005448	0.161404	0.007518	0.157805	0.007033	0.149261	0.006344
15	0.210525	0.011282	0.166767	0.012529	0.17725	0.005773	0.151038	0.004068	0.158616	0.0061	0.151781	0.005635
16	0.2104	0.011471	0.160682	0.011124	0.173898	0.005079	0.151293	0.004797	0.158875	0.005711	0.149307	0.00536
17	0.20816	0.011857	0.158044	0.009865	0.171105	0.004216	0.15803	0.006675	0.159142	0.00586	0.148418	0.006146
18	0.198736	0.011206	0.152435	0.007128	0.161289	0.002204	0.158844	0.007346	0.159668	0.00473	0.153228	0.005765
19	0.193705	0.011961	0.145252	0.005803	0.15098	0.00369	0.160628	0.006486	0.154249	0.006732	0.150105	0.005687
20	0.192988	0.012779	0.143056	0.006478	0.148361	0.003139	0.16079	0.00498	0.154409	0.006671	0.14712	0.00675
21	0.193954	0.012729	0.144378	0.00725	0.150312	0.003622	0.158099	0.005447	0.15542	0.006344	0.149627	0.006868
22	0.194211	0.012492	0.145118	0.006569	0.152511	0.002031	0.156012	0.006588	0.158935	0.005152	0.155116	0.004118
23	0.193033	0.011655	0.147612	0.006129	0.154116	0.001353	0.157212	0.005259	0.157826	0.003664	0.152102	0.0054
24	0.189275	0.010404	0.149481	0.005305	0.156343	0.001622	0.162936	0.004169	0.15804	0.00388	0.150454	0.00563
25	0.182721	0.010253	0.149223	0.00392	0.154161	0.003428	0.166439	0.004125	0.156205	0.004551	0.151482	0.003091
26	0.180303	0.010943	0.150757	0.003993	0.154088	0.002923	0.169371	0.003408	0.155064	0.005932	0.150329	0.004127

27	0.172547	0.011866	0.148584	0.0062	0.152207	0.002762	0.168402	0.003294	0.154356	0.007266	0.149226	0.004532
28	0.173333	0.010609	0.144651	0.007431	0.149204	0.004255	0.164242	0.002926	0.153286	0.006199	0.148667	0.004247
29	0.17563	0.009568	0.142787	0.007515	0.150556	0.006006	0.16094	0.003907	0.155478	0.004969	0.148865	0.004453
30	0.178972	0.010097	0.13925	0.007602	0.150842	0.008922	0.157422	0.003499	0.15618	0.004719	0.149252	0.004173
31	0.179093	0.010315	0.141025	0.00708	0.151804	0.00818	0.157959	0.003823	0.154627	0.005377	0.14836	0.003654
32	0.173017	0.008839	0.14456	0.006642	0.153937	0.007286	0.159027	0.003749	0.154689	0.006408	0.145767	0.004707
33	0.169251	0.012746	0.148757	0.00584	0.156294	0.008537	0.160442	0.003549	0.153845	0.007184	0.145272	0.004908
34	0.172878	0.012327	0.15103	0.005495	0.157167	0.008251	0.159655	0.003697	0.155756	0.005969	0.147754	0.004358
35	0.173904	0.009545	0.153121	0.007564	0.160193	0.005947	0.161096	0.005631	0.154415	0.004939	0.148002	0.004072
36	0.174941	0.008559	0.161427	0.007938	0.166989	0.004082	0.158435	0.003292	0.155455	0.005217	0.148752	0.004211
37	0.177763	0.011007	0.167715	0.006628	0.17075	0.006323	0.158279	0.0039	0.159209	0.00513	0.151694	0.004112
38	0.18062	0.011722	0.169709	0.006867	0.173265	0.0075	0.161442	0.004228	0.161177	0.00568	0.152649	0.003545
39	0.186026	0.012487	0.194654	0.057691	0.179583	0.013621	0.173176	0.008965	0.166703	0.006578	0.155134	0.003497
40	0.19645	0.023273	0.363079	0.145817	0.214068	0.11563	0.156	0.0045	0.175251	0.008007	0.158335	0.004597
41	0.192009	0.008914	0.252593	0.091132	0.213581	0.109682	0.25132	0	0.179167	0.00989	0.161027	0.005059
42	0.191862	0.010816	0.22209	0.079188	0.214872	0.113349	0.164935	0.024488	0.17719	0.008761	0.161303	0.005537
43	0.190868	0.012973	0.201716	0.041812	0.214312	0.107677	0.113274	0.007201	0.167156	0.013	0.155484	0.005824
44	0.205005	0.022733	0.290623	0.123551	0.281805	0	0.039288	0.020561	0.158763	0.013862	0.154155	0.006098
45	0.292081	0.099565	0.544711	0.08172	0.374467	0.19376	0.216186	0.071155	0.162706	0.012179	0.152336	0.00426
46	0.336361	0.113805	0.60793	0.033084	0.39998	0.207641	0.219315	0.074258	0.163508	0.010162	0.14911	0.006165

Table S8. Eight-day pixel number-weighted average albedo and its weighted standard deviation for shrubland in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.211751	0.064214	0.22409	0.143475	0.183111	0.016633	0.12674	0.01461	0.119	0	0.117885	0.00353
2	0.205939	0.053983	0.207389	0.121623	0.18295	0.016965	0.131224	0.020765	0.116	0	0.119175	0.003804
3	0.20361	0.052762	0.204273	0.115666	0.182091	0.016505	0.131765	0.021411	0.119	0	0.120032	0.004543
4	0.209816	0.072254	0.210109	0.110275	0.182621	0.018211	0.131914	0.024974	0.121	0	0.119236	0.004867
5	0.208545	0.073566	0.220393	0.12001	0.19217	0.03433	0.1264	0.030584	0.118	0	0.118128	0.003523
6	0.194308	0.03489	0.210938	0.129389	0.188146	0.020098	0.125378	0.03333	0.118	0	0.116328	0.004243
7	0.193352	0.03857	0.210512	0.12682	0.186312	0.019444	0.123888	0.031876	0.117	0	0.114881	0.005551
8	0.190977	0.03714	0.168551	0.07774	0.182112	0.015489	0.11646	0.030708	0.115	0	0.11347	0.006197
9	0.191474	0.03255	0.153287	0.062585	0.179566	0.018347	0.11853	0.02805	0.116	0	0.115363	0.005892
10	0.189312	0.032465	0.142627	0.040677	0.179337	0.019134	0.117907	0.025755	0.118	0	0.117243	0.005334
11	0.189629	0.031738	0.141635	0.032172	0.179886	0.019013	0.117092	0.021908	0.117	0	0.115568	0.006637
12	0.190377	0.031421	0.142102	0.02714	0.179706	0.018689	0.114915	0.02157	0.118	0	0.114073	0.006498
13	0.18697	0.029494	0.142582	0.026179	0.179979	0.01832	0.115806	0.020335	0.121	0	0.114767	0.006305
14	0.186636	0.029936	0.140442	0.02421	0.179686	0.01797	0.114035	0.017614	0.11	0	0.116696	0.006404
15	0.18736	0.03033	0.139933	0.023657	0.179392	0.01796	0.114519	0.018368	0.117	0	0.119227	0.00544
16	0.188022	0.029794	0.139832	0.022604	0.180054	0.018414	0.115691	0.017454	0.123	0	0.118021	0.005302
17	0.188936	0.029911	0.140693	0.022801	0.181019	0.018433	0.116118	0.01687	0.122	0	0.120603	0.004134
18	0.186385	0.028893	0.140566	0.023274	0.179573	0.017972	0.117523	0.017164	0.117	0	0.124257	0.004411
19	0.185959	0.028572	0.140586	0.023664	0.179062	0.017688	0.117822	0.016546	0.119	0	0.135608	0.007522
20	0.188018	0.027688	0.143558	0.023042	0.180177	0.017202	0.117488	0.013295	0.119	0	0.125528	0.006178
21	0.188473	0.027328	0.143937	0.022952	0.180597	0.017357	0.118531	0.013817	0.113	0	0.124606	0.005861
22	0.188072	0.026958	0.144574	0.022269	0.180434	0.01715	0.122213	0.018187	0.108	0	0.12386	0.00398
23	0.188564	0.025499	0.146844	0.020378	0.178972	0.016874	0.121161	0.016269	0.115	0	0.118183	0.004735
24	0.186769	0.025613	0.144961	0.0214	0.177719	0.016813	0.122341	0.017588	0.118	0	0.117243	0.005254
25	0.187203	0.025703	0.143868	0.021521	0.177676	0.016679	0.121523	0.015736	0.118	0	0.125794	0.004271
26	0.187746	0.024874	0.144941	0.021247	0.176446	0.016322	0.121844	0.016482	0.113	0	0.124681	0.002962

27	0.187013	0.02436	0.145803	0.021305	0.173801	0.015459	0.121916	0.016301	0.116	0	0.121579	0.00362
28	0.184611	0.023465	0.146088	0.019435	0.173984	0.015799	0.120661	0.014336	0.129	0	0.11793	0.002795
29	0.183496	0.021949	0.145522	0.018482	0.174286	0.01586	0.120875	0.013565	0.124	0	0.116569	0.00486
30	0.184958	0.022516	0.144925	0.019257	0.176064	0.016409	0.121608	0.013487	0.123	0	0.121064	0.004696
31	0.185035	0.02177	0.145451	0.019368	0.176709	0.016557	0.120255	0.011219	0.126	0	0.124039	0.004862
32	0.181214	0.019068	0.146202	0.019504	0.176328	0.016238	0.120217	0.010165	0.119	0	0.116989	0.004252
33	0.175312	0.016449	0.146718	0.017418	0.177349	0.015999	0.121137	0.010942	0.118	0	0.113602	0.005544
34	0.177708	0.016515	0.148132	0.015884	0.179166	0.016134	0.119142	0.010438	0.106	0	0.112319	0.003747
35	0.180568	0.017668	0.149179	0.016944	0.181	0.016905	0.119256	0.011066	0.116	0	0.114438	0.004093
36	0.180541	0.020137	0.148481	0.018985	0.182045	0.017459	0.120084	0.011736	0.115	0	0.114376	0.00441
37	0.179473	0.01885	0.150505	0.018718	0.182957	0.017331	0.121327	0.013301	0.115	0	0.114321	0.0042
38	0.17812	0.01735	0.152608	0.018277	0.183178	0.01739	0.120031	0.012834	0.119	0	0.115063	0.00423
39	0.177188	0.01925	0.151333	0.018657	0.18343	0.018103	0.118631	0.012596	0.117	0	0.116893	0.004163
40	0.18699	0.05308	0.150452	0.037095	0.183798	0.019402	0.119774	0.014531	0.118	0	0.118576	0.004862
41	0.189526	0.043704	0.153102	0.037046	0.184082	0.019658	0.118528	0.017323	0.117	0	0.119373	0.004071
42	0.191706	0.013763	0.193581	0.067366	0.181804	0.019117	0.11943	0.016883	0.119	0	0.119473	0.00354
43	0.185308	0.015363	0.186424	0.07267	0.167874	0.014645	0.121726	0.02085	0.123	0	0.119243	0.003847
44	0.185548	0.067875	0.140712	0.03154	0.168735	0.016717	0.110077	0.022731	0.123	0	0.119297	0.004074
45	0.200319	0.095771	0.173901	0.106954	0.171395	0.019032	0.108248	0.016301	0.12	0	0.115688	0.004619
46	0.198434	0.088885	0.194223	0.112639	0.173012	0.019351	0.110572	0.015961	0.125	0	0.11394	0.005072

Table S9. Eight-day pixel number-weighted average albedo and its weighted standard deviation for cropland/pasture land that is converted to cornfields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.227863	0.057705	0.473787	0.081152	0.457386	0.15008	0.517567	0.106853	0.163643	0.023003	0.143368	0.004419
2	0.216811	0.020511	0.418018	0.13243	0.395909	0.171917	0.54691	0.074775	0.159346	0.007236	0.14609	0.004361
3	0.219074	0.023915	0.37997	0.133216	0.402498	0.17084	0.582399	0.068417	0.202422	0.081565	0.156275	0.004806
4	0.247995	0.112615	0.450167	0.106307	0.432205	0.159805	0.60215	0.056353	0.235173	0.082567	0.159051	0.006009
5	0.25651	0.112207	0.50308	0.095245	0.532126	0.096586	0.650884	0.032468	0.350201	0.177597	0.139618	0.011751
6	0.208681	0.012241	0.421515	0.106136	0.40648	0.153581	0.625463	0.026056	0.275969	0.132688	0.138726	0.006945
7	0.210311	0.01306	0.499267	0.0618	0.433222	0.130126	0.598019	0.064006	0.17309	0.031245	0.143086	0.006595
8	0.209465	0.012428	0.322998	0.08984	0.376372	0.113471	0.567405	0.09155	0.162678	0.011164	0.142657	0.006286
9	0.209765	0.012088	0.184068	0.046062	0.255817	0.082952	0.288835	0.128438	0.157416	0.011717	0.143871	0.005261
10	0.212198	0.011945	0.186093	0.035688	0.229723	0.055892	0.171117	0.058931	0.161419	0.010056	0.145577	0.004506
11	0.210048	0.011639	0.219634	0.061486	0.217335	0.051918	0.160109	0.055241	0.160325	0.008666	0.142117	0.005074
12	0.205528	0.011511	0.173762	0.023827	0.182396	0.023122	0.158641	0.048989	0.155114	0.008412	0.141184	0.005104
13	0.200798	0.011388	0.165805	0.018906	0.1569	0.019852	0.15197	0.014533	0.156932	0.007279	0.144464	0.004106
14	0.19992	0.011469	0.165523	0.018143	0.157488	0.019899	0.153389	0.014682	0.158032	0.006802	0.147951	0.004465
15	0.201245	0.01235	0.161821	0.018248	0.153204	0.020951	0.151235	0.011209	0.164462	0.006966	0.157785	0.007237
16	0.202173	0.012265	0.159066	0.014373	0.153255	0.017056	0.150697	0.011858	0.162199	0.006957	0.15402	0.00657
17	0.201182	0.010644	0.158436	0.013204	0.153628	0.014969	0.152639	0.012918	0.155208	0.009113	0.149145	0.005683
18	0.192803	0.01383	0.153872	0.011649	0.147083	0.014348	0.153842	0.014845	0.159873	0.007897	0.15885	0.006673
19	0.187813	0.016693	0.14871	0.009102	0.139487	0.011478	0.155163	0.014396	0.158465	0.01285	0.148531	0.006052
20	0.18911	0.016338	0.147821	0.009882	0.13855	0.011407	0.152928	0.010585	0.153325	0.007592	0.150306	0.006329
21	0.189923	0.015846	0.145457	0.01017	0.138056	0.013029	0.150137	0.012313	0.155438	0.008017	0.154081	0.006551
22	0.191216	0.013473	0.145776	0.008147	0.140963	0.009983	0.148973	0.011466	0.160064	0.009158	0.16118	0.004676
23	0.191891	0.013261	0.150089	0.005855	0.147975	0.007205	0.157197	0.008637	0.16112	0.00787	0.159008	0.004542
24	0.190127	0.011898	0.153728	0.005426	0.152294	0.006714	0.163086	0.008195	0.164924	0.006467	0.157863	0.00426
25	0.183936	0.00965	0.154822	0.005351	0.153788	0.008517	0.168763	0.008768	0.167474	0.008029	0.160168	0.002546
26	0.182056	0.010625	0.158024	0.00488	0.157156	0.007722	0.173882	0.007631	0.168286	0.007461	0.160233	0.003281

27	0.176582	0.010563	0.159236	0.004174	0.16033	0.005032	0.175436	0.005901	0.168025	0.007743	0.1578	0.004159
28	0.17776	0.009389	0.157341	0.00489	0.159404	0.005117	0.171962	0.004761	0.165921	0.006126	0.155261	0.003989
29	0.179802	0.00886	0.158215	0.005356	0.160343	0.006692	0.170196	0.005163	0.16665	0.005372	0.15361	0.004868
30	0.182206	0.009471	0.155185	0.004824	0.160108	0.007923	0.16805	0.004691	0.165624	0.004837	0.152182	0.005166
31	0.181025	0.010132	0.156472	0.004691	0.160417	0.007206	0.166369	0.004314	0.160643	0.005541	0.146415	0.004756
32	0.173692	0.008461	0.15857	0.004466	0.161514	0.006041	0.164869	0.004241	0.158452	0.005854	0.145523	0.004827
33	0.174018	0.009573	0.160042	0.004535	0.160159	0.007213	0.163732	0.005103	0.157519	0.006333	0.148933	0.004801
34	0.176898	0.009795	0.161045	0.004819	0.158504	0.007337	0.161541	0.0058	0.158429	0.006824	0.149423	0.004705
35	0.177698	0.007486	0.165098	0.008052	0.158889	0.008521	0.159406	0.006897	0.155294	0.006963	0.14421	0.005325
36	0.180178	0.006996	0.173407	0.010113	0.163246	0.010917	0.156969	0.005542	0.149758	0.004476	0.145299	0.003707
37	0.182611	0.008318	0.178112	0.011094	0.162649	0.014839	0.158195	0.007011	0.154698	0.004178	0.149167	0.003463
38	0.184154	0.009452	0.176867	0.011039	0.161488	0.016331	0.161066	0.008131	0.157865	0.006875	0.148525	0.004068
39	0.189004	0.011655	0.22269	0.054688	0.170677	0.019036	0.168055	0.010537	0.162211	0.01049	0.147559	0.004446
40	0.196167	0.028048	0.441416	0.139193	0.309247	0.115774	0.256325	0.089191	0.183283	0.061617	0.14032	0.006735
41	0.192349	0.008286	0.391775	0.109752	0.319021	0.109863	0.321031	0.091642	0.187937	0.076984	0.139393	0.007105
42	0.193838	0.009047	0.349881	0.113921	0.292679	0.108899	0.280054	0.081242	0.16042	0.008436	0.145004	0.005995
43	0.190654	0.01083	0.348612	0.058213	0.316086	0.071656	0.139904	0.011778	0.153437	0.006781	0.14376	0.006185
44	0.196656	0.014648	0.359781	0.119906	0.294207	0.072637	0.094379	0.013546	0.154056	0.012721	0.14159	0.006437
45	0.252234	0.082732	0.554623	0.083377	0.383326	0.173217	0.276455	0.135691	0.153905	0.010802	0.13768	0.005272
46	0.312199	0.125733	0.584353	0.058722	0.410867	0.167701	0.290631	0.131185	0.158791	0.016932	0.135682	0.00635

Table S10. Eight-day pixel number-weighted average albedo and its weighted standard deviation for cropland/pasture land that is converted to switchgrass or miscanthus fields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	0.228347	0.047405	0.464756	0.110267	0.439981	0.149582	0.51185	0.098442	0.171653	0.027109	0.146031	0.004993
2	0.219882	0.019398	0.388513	0.143264	0.354195	0.170106	0.49124	0.095077	0.160723	0.010576	0.148793	0.005394
3	0.222132	0.023799	0.323778	0.132007	0.359975	0.169044	0.579341	0.057965	0.209873	0.086168	0.158634	0.006918
4	0.246402	0.092559	0.437654	0.104482	0.399748	0.159884	0.599827	0.057158	0.249687	0.078574	0.161747	0.00742
5	0.26258	0.102206	0.499419	0.094551	0.494117	0.117554	0.652376	0.033515	0.388398	0.136204	0.143368	0.011634
6	0.213307	0.011754	0.397796	0.107051	0.367845	0.162596	0.624956	0.026258	0.319118	0.110545	0.142429	0.007259
7	0.214664	0.01198	0.485372	0.066862	0.399268	0.13924	0.601588	0.060969	0.173017	0.029719	0.146654	0.006674
8	0.213245	0.011527	0.310046	0.091772	0.35418	0.124358	0.578729	0.078029	0.162756	0.011791	0.14556	0.007056
9	0.213164	0.011203	0.181518	0.043625	0.230422	0.064514	0.284919	0.121392	0.158389	0.01156	0.146195	0.006299
10	0.215419	0.01102	0.185365	0.035641	0.212205	0.041834	0.167853	0.051017	0.161931	0.010727	0.147488	0.00565
11	0.21365	0.010812	0.205642	0.047936	0.194905	0.037881	0.153317	0.0352	0.16104	0.008946	0.144598	0.006133
12	0.209502	0.010596	0.174566	0.024554	0.175793	0.023461	0.152501	0.031464	0.156425	0.007968	0.143983	0.006347
13	0.205019	0.010331	0.169136	0.019505	0.162714	0.021184	0.150782	0.013795	0.158374	0.006997	0.146221	0.00673
14	0.204193	0.010375	0.168464	0.018154	0.163293	0.02027	0.151943	0.013735	0.158996	0.007099	0.149616	0.008548
15	0.204415	0.010882	0.164952	0.018197	0.159981	0.020144	0.149978	0.009408	0.164694	0.007124	0.158723	0.012464
16	0.204647	0.010822	0.161266	0.014935	0.158684	0.016814	0.149247	0.010008	0.163746	0.00688	0.155212	0.010656
17	0.203652	0.009904	0.160724	0.01373	0.158511	0.015498	0.151966	0.011566	0.158229	0.007867	0.149684	0.007993
18	0.195294	0.011281	0.156128	0.012304	0.152124	0.015137	0.153192	0.01327	0.162333	0.007634	0.157528	0.009597
19	0.190111	0.012757	0.150256	0.009413	0.142765	0.012321	0.154532	0.012779	0.160564	0.012128	0.148664	0.006253
20	0.18891	0.013145	0.149168	0.00969	0.141897	0.011658	0.152728	0.009411	0.154694	0.006892	0.151088	0.007146
21	0.188753	0.012605	0.146785	0.010502	0.141794	0.013043	0.149433	0.010949	0.157265	0.006714	0.154387	0.007455
22	0.188045	0.011062	0.146745	0.008409	0.1443	0.009583	0.148985	0.01142	0.162944	0.006789	0.159793	0.005479
23	0.188108	0.010587	0.15127	0.006289	0.15106	0.006533	0.158346	0.007944	0.163941	0.00596	0.15793	0.004984
24	0.186403	0.009309	0.154932	0.005459	0.155153	0.005954	0.164341	0.007382	0.166624	0.005424	0.15652	0.004564
25	0.180819	0.00805	0.156181	0.004814	0.156969	0.00699	0.169646	0.007453	0.168451	0.006614	0.157594	0.003122

26	0.179051	0.008739	0.15902	0.004149	0.159825	0.00583	0.17433	0.006015	0.168379	0.006497	0.156732	0.004057
27	0.173921	0.008904	0.15895	0.004036	0.161285	0.003758	0.175119	0.00471	0.167357	0.007044	0.153605	0.004574
28	0.174992	0.00784	0.156008	0.004812	0.159309	0.004154	0.170908	0.004256	0.164156	0.006017	0.150282	0.004619
29	0.177035	0.007288	0.155896	0.005017	0.160044	0.005586	0.168545	0.004339	0.164718	0.005478	0.150033	0.004861
30	0.179135	0.007809	0.153142	0.004934	0.159582	0.006886	0.165935	0.003829	0.16307	0.005184	0.150387	0.004652
31	0.177806	0.00828	0.154594	0.00489	0.159897	0.006349	0.164598	0.003921	0.157383	0.005693	0.147249	0.004329
32	0.17127	0.006942	0.156924	0.004751	0.161063	0.005799	0.163723	0.004274	0.15573	0.00605	0.14757	0.004301
33	0.170604	0.009075	0.158935	0.004754	0.160614	0.006607	0.163524	0.004799	0.156041	0.006547	0.150706	0.004841
34	0.173967	0.00937	0.160549	0.005034	0.159329	0.006826	0.161376	0.005075	0.157731	0.006796	0.151557	0.004524
35	0.175633	0.007285	0.16607	0.007131	0.161337	0.007152	0.160108	0.006465	0.154808	0.006863	0.147762	0.005424
36	0.178825	0.006223	0.17577	0.008625	0.167828	0.008012	0.15795	0.004543	0.150869	0.004664	0.14864	0.003611
37	0.182139	0.007397	0.181649	0.009385	0.169397	0.011105	0.159356	0.006433	0.15607	0.00424	0.152529	0.003798
38	0.185652	0.007849	0.18128	0.009634	0.169028	0.013261	0.162952	0.006652	0.160183	0.005473	0.152892	0.003964
39	0.192657	0.00969	0.22798	0.05746	0.179265	0.016995	0.169551	0.008974	0.165649	0.007763	0.152234	0.004114
40	0.200131	0.020986	0.422774	0.15282	0.334175	0.127	0.255406	0.086872	0.194693	0.066828	0.146038	0.007317
41	0.197948	0.007887	0.36584	0.121985	0.309579	0.121969	0.316557	0.083572	0.190895	0.071894	0.144987	0.007344
42	0.19836	0.00907	0.31106	0.112833	0.272838	0.118521	0.296906	0.078198	0.16481	0.008425	0.149542	0.005917
43	0.193423	0.010357	0.321472	0.077962	0.310713	0.097602	0.153432	0.044044	0.161093	0.010004	0.148339	0.006207
44	0.199092	0.014842	0.362186	0.131559	0.259633	0.038186	0.09579	0.013801	0.158108	0.01355	0.145732	0.006628
45	0.248595	0.069395	0.554605	0.082134	0.412704	0.157686	0.281062	0.13454	0.157325	0.010787	0.141587	0.005279
46	0.297589	0.100306	0.58798	0.055116	0.42856	0.165946	0.29674	0.126575	0.163642	0.017957	0.140125	0.006442

Table S11. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for cornfields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	129.5	5.3	61.5	15.0	60.8	11.4	67.2	16.4	105.8	7.4	129.8	7.2
2	133.4	5.4	79.4	20.7	82.0	20.8	86.9	17.2	111.2	7.1	133.8	7.3
3	140.2	5.8	96.7	23.7	87.0	22.5	73.9	7.4	106.3	11.3	139.4	7.6
4	151.8	6.0	87.1	15.2	88.0	20.5	77.6	10.4	109.1	11.8	148.3	8.4
5	160.6	9.9	89.6	11.8	92.9	18.5	75.3	3.8	96.4	11.0	161.7	8.9
6	178.4	5.5	109.3	17.9	109.6	25.4	87.9	5.3	113.7	16.1	174.7	9.2
7	192.8	5.8	116.7	11.3	119.6	24.7	99.1	10.0	155.8	7.5	187.2	9.5
8	206.7	6.2	149.1	12.8	135.6	23.2	112.7	11.0	173.1	7.1	200.3	9.5
9	220.8	6.5	180.3	6.8	177.0	12.5	171.9	15.5	190.4	6.6	213.8	9.4
10	234.5	7.0	200.1	5.7	202.6	7.3	201.9	12.8	207.2	6.0	227.1	9.5
11	251.7	6.6	219.2	8.1	224.2	9.1	224.3	8.4	223.8	6.9	243.6	9.6
12	269.9	5.8	237.1	4.6	241.2	5.1	241.3	9.2	240.3	7.7	260.6	9.9
13	287.3	4.9	253.1	5.7	257.2	5.2	256.6	10.1	254.9	8.6	277.0	10.6
14	303.2	3.9	268.2	7.5	271.4	6.3	271.2	11.5	269.3	9.3	292.1	11.6
15	318.7	3.7	286.5	6.6	288.6	5.3	285.2	10.7	284.2	8.6	305.2	11.5
16	332.5	3.5	303.4	6.1	304.5	5.1	298.9	10.2	299.1	8.5	319.9	11.0
17	344.3	3.3	317.8	5.3	318.1	4.7	310.7	10.1	314.0	8.4	334.8	10.0
18	356.1	3.2	331.4	4.5	330.7	4.6	320.9	10.1	324.7	8.1	344.5	9.6
19	363.0	2.2	344.1	5.4	344.2	4.4	329.4	8.4	338.3	12.2	351.1	9.3
20	368.6	1.3	353.7	5.9	353.2	3.9	341.7	8.4	340.3	6.5	349.1	6.6
21	371.7	1.3	362.3	5.8	360.4	3.3	349.8	8.2	343.5	5.5	348.3	5.6
22	374.7	1.2	367.8	6.4	365.1	3.6	354.6	8.4	345.4	5.0	350.8	6.5
23	375.9	1.5	369.0	6.0	365.8	3.9	354.2	6.8	348.4	5.1	351.1	7.9
24	375.6	2.5	368.1	5.8	365.5	3.7	354.1	6.6	349.8	5.6	352.7	10.8
25	374.5	3.8	365.6	5.8	362.8	4.2	351.9	6.3	349.0	6.5	352.9	13.7
26	370.1	4.3	359.5	6.0	356.7	4.8	346.1	5.5	346.3	7.0	351.2	14.2

27	363.1	3.9	350.6	6.1	347.7	5.6	337.6	5.3	341.1	6.5	348.0	12.8
28	353.6	3.7	340.4	6.2	337.6	6.0	328.6	5.5	334.9	6.1	343.6	11.7
29	342.5	3.6	327.3	6.3	324.9	6.2	316.9	5.7	325.8	6.0	335.7	9.9
30	330.6	3.5	310.6	5.9	308.7	7.2	301.9	5.7	313.1	5.7	322.6	9.2
31	317.8	3.4	290.8	8.6	289.8	8.9	284.7	5.9	298.3	5.2	307.0	9.8
32	304.3	3.6	270.0	10.2	269.9	10.8	266.3	6.4	280.9	4.6	289.4	9.8
33	288.4	4.0	248.8	11.7	249.6	12.4	247.0	6.8	261.9	4.2	270.9	10.2
34	268.1	4.1	227.8	12.7	229.8	13.4	228.5	7.2	243.9	4.7	257.0	9.2
35	247.2	4.3	205.8	13.0	209.2	14.1	209.9	7.5	226.9	5.3	243.8	8.9
36	226.2	4.4	184.3	13.1	188.3	13.8	191.7	7.9	210.2	6.6	229.6	7.8
37	206.3	4.7	164.9	13.8	169.4	13.9	173.9	8.1	192.5	7.6	215.0	7.4
38	191.8	4.7	148.1	13.2	152.3	13.7	154.7	8.1	172.8	7.1	197.4	7.2
39	177.8	4.6	127.2	16.7	135.5	14.5	138.0	8.2	155.4	6.7	181.9	6.9
40	166.2	4.6	101.2	25.3	91.8	22.3	107.7	17.8	140.2	14.1	169.2	7.1
41	155.5	4.4	93.2	23.6	97.8	23.4	95.1	15.0	126.0	11.2	157.5	7.3
42	144.8	4.4	95.1	22.0	97.6	21.8	74.8	7.9	123.9	6.7	145.8	7.1
43	137.3	4.5	81.8	20.4	80.0	20.4	93.3	19.3	124.2	8.2	136.9	6.9
44	131.3	4.8	74.8	17.3	116.7	5.9	91.5	12.3	108.1	7.1	131.0	7.0
45	128.1	5.1	63.8	10.3	69.8	13.4	74.8	12.5	100.6	6.8	128.2	7.2
46	125.9	4.4	63.6	8.2	69.1	12.0	74.3	11.6	100.0	7.0	128.5	7.3

Table S12. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for switchgrass fields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	126.6	6.6	99.6	4.8	118.4	11.2	82.5	0.0	118.1	14.3	140.4	8.1
2	131.6	6.5	103.5	5.0	121.5	10.2	80.4	0.0	122.0	14.4	144.7	8.9
3	138.8	6.3	109.5	4.9	127.1	10.0	78.3	0.0	124.5	18.7	151.3	9.7
4	149.3	5.6	114.8	5.2	135.6	12.6	86.0	3.5	141.6	12.6	161.8	10.8
5	157.3	6.8	110.0	0.7	153.4	18.5	92.5	4.4	147.9	22.1	174.8	11.6
6	176.1	4.3	136.6	6.3	160.8	13.9	96.4	0.0	160.9	15.7	189.6	12.5
7	189.9	4.0	141.3	7.2	174.9	13.7	112.8	0.0	174.0	15.0	203.7	13.5
8	203.7	3.7	166.4	6.3	190.1	12.3	152.2	0.0	187.0	14.4	215.9	13.6
9	217.9	3.4	186.3	4.4	205.4	10.1	179.5	8.5	200.3	13.5	228.3	13.6
10	231.8	3.3	204.6	3.4	221.1	7.6	199.0	8.1	213.7	13.0	241.0	13.4
11	249.2	3.3	224.3	3.6	240.1	6.7	217.7	9.8	230.6	13.1	259.0	14.1
12	268.0	3.2	243.1	4.2	257.8	6.4	234.3	11.2	248.8	13.3	279.0	14.9
13	286.1	3.0	261.4	4.7	275.5	6.5	250.7	12.0	266.5	13.4	297.8	15.3
14	302.9	2.7	279.2	5.3	292.2	6.3	265.7	13.4	283.0	13.7	315.9	15.6
15	318.6	2.7	296.5	5.1	309.0	5.7	282.6	13.0	298.2	12.8	329.2	15.0
16	332.0	2.6	313.2	4.4	324.0	5.4	298.4	13.2	312.2	12.0	341.8	14.2
17	343.6	2.3	327.4	3.9	337.7	4.9	311.2	11.2	325.1	11.1	352.7	13.0
18	358.2	3.1	341.6	3.4	351.0	4.5	322.0	10.2	336.1	9.9	361.1	11.4
19	365.5	3.3	355.2	2.6	359.5	3.1	331.5	10.7	342.9	9.5	349.9	9.9
20	369.9	3.1	365.6	1.8	363.5	1.4	340.0	11.0	346.0	8.3	362.5	9.7
21	372.1	3.0	373.6	1.1	364.7	1.8	346.0	10.4	347.9	7.5	360.7	8.5
22	374.4	3.1	378.8	0.9	366.2	2.7	350.9	11.0	350.7	6.7	361.5	4.6
23	379.0	2.9	380.0	1.4	371.6	1.4	352.6	9.6	358.0	7.1	361.6	4.3
24	382.3	3.2	379.4	1.9	375.1	1.5	353.9	9.3	363.1	10.3	361.9	3.6
25	383.7	3.7	377.1	2.1	377.1	3.3	351.4	9.0	366.8	12.4	360.7	2.2
26	380.8	4.1	370.7	2.5	374.6	4.9	344.8	7.2	365.4	13.9	357.3	4.7
27	373.5	3.4	361.8	2.7	367.4	5.4	334.6	6.0	359.2	13.5	352.3	5.1

28	362.9	3.1	351.7	2.9	358.5	5.1	324.7	5.7	351.5	12.8	346.8	4.0
29	350.9	2.6	338.3	3.3	346.7	5.2	312.4	5.3	341.4	12.1	338.9	3.7
30	337.9	2.2	322.2	3.8	331.2	5.7	298.6	5.3	327.2	11.6	327.9	2.8
31	324.2	2.3	303.3	4.4	314.0	6.6	282.5	5.5	310.8	11.5	315.2	2.1
32	309.1	2.9	283.2	5.0	295.9	7.1	265.0	5.9	292.3	12.2	301.7	4.2
33	291.2	4.1	262.7	5.5	276.5	7.3	247.7	6.2	273.1	12.7	287.4	6.1
34	268.7	4.3	242.7	5.3	257.0	6.9	229.3	7.2	254.7	11.5	273.2	6.4
35	246.5	4.4	221.8	5.0	237.5	6.7	215.5	0.0	236.7	10.5	258.5	6.7
36	225.0	4.4	201.3	4.5	217.6	7.2	194.5	9.9	218.5	9.9	243.5	6.8
37	204.4	4.4	182.5	4.6	198.5	6.8	176.5	9.5	200.5	9.5	228.8	7.2
38	191.4	3.8	164.9	5.6	183.0	7.6	157.3	8.6	183.9	10.3	210.8	7.6
39	178.7	3.5	148.5	6.4	168.4	8.4	140.0	7.3	168.6	11.2	194.4	8.1
40	167.7	3.2	133.9	6.9	155.5	9.2	124.4	6.2	155.1	11.9	180.0	8.5
41	156.9	3.3	122.5	6.7	144.3	9.8	109.1	0.0	143.5	12.8	167.4	8.4
42	144.9	4.0	112.3	6.2	134.3	10.2	101.3	0.0	133.4	13.2	156.1	7.9
43	137.1	4.5	104.3	5.9	126.9	11.4	95.6	0.0	129.5	12.2	147.4	7.4
44	129.7	5.5	115.0	0.0	122.4	11.3	92.2	0.0	121.0	20.4	140.9	6.8
45	126.4	6.1	77.5	12.2	118.7	12.3	85.3	5.8	117.9	14.7	137.7	6.8
46	127.1	6.1	72.9	0.0	118.2	11.8	86.6	5.7	117.8	14.5	139.1	7.4

Table S13. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for miscanthus fields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	138.4	16.6	64.5	6.4	62.6	0.6	108.1	37.7	122.7	8.3	135.5	10.2
2	142.0	17.0	70.1	6.8	67.5	3.9	76.4	10.3	125.2	9.2	139.4	10.9
3	147.7	17.7	76.3	6.8	73.3	3.8	79.0	9.9	130.6	9.9	145.7	11.6
4	154.4	20.9	82.2	7.0	80.2	3.7	87.4	8.7	139.5	11.2	155.7	12.1
5	165.5	22.4	92.0	7.2	91.1	3.7	96.7	7.8	154.3	15.8	168.0	12.8
6	182.2	20.2	104.5	8.5	103.8	3.7	106.2	8.4	162.7	13.8	182.2	13.1
7	198.2	20.1	118.6	7.2	118.6	3.9	119.8	9.1	174.3	12.7	196.1	13.4
8	216.2	18.5	138.3	6.7	139.7	3.5	137.1	8.5	189.3	12.3	209.2	13.4
9	235.3	16.9	160.3	6.3	161.0	3.8	156.3	11.0	205.6	11.9	222.6	13.3
10	254.9	15.5	183.6	5.6	185.4	4.4	176.7	16.2	222.1	11.8	236.2	13.2
11	273.4	15.1	205.3	5.3	207.8	5.3	199.8	14.0	239.3	11.7	253.4	13.9
12	291.3	14.6	226.7	4.1	230.4	3.3	222.0	14.7	256.3	11.5	271.8	15.0
13	307.6	14.9	247.7	4.4	251.9	3.6	245.7	16.7	272.5	11.3	289.5	16.1
14	323.0	14.2	268.6	4.2	273.2	5.2	266.1	15.2	287.8	11.0	306.3	17.3
15	340.4	12.8	288.1	4.9	293.1	3.2	286.3	8.1	303.5	10.9	320.3	16.4
16	355.7	11.6	307.0	5.2	311.9	3.1	299.5	6.0	317.6	10.5	333.6	15.4
17	369.4	10.0	324.8	5.8	329.2	3.0	313.7	4.8	329.1	9.8	344.8	14.3
18	380.9	8.8	340.4	6.5	344.6	3.3	323.8	4.4	339.8	9.3	354.6	12.7
19	387.3	7.6	350.1	6.6	353.6	3.0	332.8	4.0	345.2	8.2	357.0	12.1
20	391.5	7.2	356.8	7.0	359.7	2.8	340.0	4.1	348.2	6.7	357.0	10.7
21	393.9	7.9	361.7	7.2	363.0	2.0	346.3	4.4	350.3	5.8	356.5	9.6
22	393.5	9.2	367.1	7.4	367.9	2.3	350.7	4.4	350.7	5.3	358.3	8.9
23	388.6	10.3	373.0	6.7	374.6	3.0	354.7	4.0	353.6	5.9	361.2	7.8
24	381.6	11.4	375.8	6.3	378.1	3.9	355.8	3.7	353.5	7.9	363.1	7.8
25	373.7	12.7	376.0	6.1	378.4	4.3	354.8	4.0	351.0	11.0	362.9	8.8
26	365.5	13.0	370.5	6.2	373.7	4.5	349.5	4.1	348.2	11.9	361.0	9.2

27	357.4	11.9	359.0	6.2	362.8	4.0	340.6	4.1	343.5	11.4	355.3	8.8
28	348.4	12.0	345.6	6.1	349.2	3.1	330.2	4.5	338.6	10.1	348.5	8.9
29	337.3	12.2	330.6	5.8	334.3	2.5	317.6	4.8	331.9	9.3	340.8	8.9
30	328.5	11.2	312.6	5.7	315.3	2.4	301.0	5.8	319.1	8.9	328.7	8.9
31	319.8	10.0	292.0	5.8	293.8	2.8	281.7	7.5	302.3	8.5	313.5	9.5
32	309.0	9.1	270.3	5.8	270.7	3.3	260.6	9.3	284.8	8.2	298.9	10.2
33	297.2	9.1	247.7	6.1	246.9	3.6	238.8	11.3	266.8	7.8	282.5	11.6
34	280.5	9.3	224.1	6.3	222.8	3.5	218.7	12.5	252.0	7.7	268.8	10.5
35	262.0	9.6	200.9	6.7	199.3	3.4	199.6	13.1	237.4	8.0	254.7	9.5
36	243.4	9.9	178.7	7.2	176.9	3.4	181.0	13.7	222.9	8.6	240.8	9.0
37	225.4	10.2	158.1	7.5	156.4	3.4	163.2	14.2	208.2	9.2	226.6	9.2
38	209.2	11.2	136.1	8.1	134.3	3.6	144.1	14.3	188.6	9.2	207.3	9.7
39	194.0	12.2	114.9	8.4	114.0	3.9	125.5	15.0	171.1	9.4	190.0	10.1
40	180.2	13.3	97.6	6.1	96.9	0.5	132.4	13.5	156.2	9.1	174.8	10.5
41	168.0	13.8	84.7	7.7	83.8	4.2	134.1	35.8	143.1	9.9	161.8	10.7
42	158.0	13.7	75.3	8.4	74.4	4.0	97.9	27.5	133.1	9.8	151.1	10.3
43	150.0	13.9	70.3	7.7	67.8	0.8	91.4	29.9	134.8	8.3	142.8	9.8
44	142.1	15.2	66.0	7.4	62.8	0.0	81.0	10.9	125.1	8.7	136.8	9.3
45	134.1	18.0	61.4	6.8	60.3	2.9	87.7	15.0	114.5	10.8	133.7	9.1
46	133.4	16.6	62.0	6.7	60.4	2.9	74.5	9.6	114.9	10.1	134.3	9.8

Table S14. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for miscanthus in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	138.4	16.6	64.5	6.4	62.6	0.6	108.1	37.7	122.7	8.3	135.5	10.2
2	142.0	17.0	70.1	6.8	67.5	3.9	76.4	10.3	125.2	9.2	139.4	10.9
3	147.7	17.7	76.3	6.8	73.3	3.8	79.0	9.9	130.6	9.9	145.7	11.6
4	154.4	20.9	82.2	7.0	80.2	3.7	87.4	8.7	139.5	11.2	155.7	12.1
5	165.5	22.4	92.0	7.2	91.1	3.7	96.7	7.8	154.3	15.8	168.0	12.8
6	182.2	20.2	104.5	8.5	103.8	3.7	106.2	8.4	162.7	13.8	182.2	13.1
7	198.2	20.1	118.6	7.2	118.6	3.9	119.8	9.1	174.3	12.7	196.1	13.4
8	216.2	18.5	138.3	6.7	139.7	3.5	137.1	8.5	189.3	12.3	209.2	13.4
9	235.3	16.9	160.3	6.3	161.0	3.8	156.3	11.0	205.6	11.9	222.6	13.3
10	254.9	15.5	183.6	5.6	185.4	4.4	176.7	16.2	222.1	11.8	236.2	13.2
11	273.4	15.1	205.3	5.3	207.8	5.3	199.8	14.0	239.3	11.7	253.4	13.9
12	291.3	14.6	226.7	4.1	230.4	3.3	222.0	14.7	256.3	11.5	271.8	15.0
13	307.6	14.9	247.7	4.4	251.9	3.6	245.7	16.7	272.5	11.3	289.5	16.1
14	323.0	14.2	268.6	4.2	273.2	5.2	266.1	15.2	287.8	11.0	306.3	17.3
15	340.4	12.8	288.1	4.9	293.1	3.2	286.3	8.1	303.5	10.9	320.3	16.4
16	355.7	11.6	307.0	5.2	311.9	3.1	299.5	6.0	317.6	10.5	333.6	15.4
17	369.4	10.0	324.8	5.8	329.2	3.0	313.7	4.8	329.1	9.8	344.8	14.3
18	380.9	8.8	340.4	6.5	344.6	3.3	323.8	4.4	339.8	9.3	354.6	12.7
19	387.3	7.6	350.1	6.6	353.6	3.0	332.8	4.0	345.2	8.2	357.0	12.1
20	391.5	7.2	356.8	7.0	359.7	2.8	340.0	4.1	348.2	6.7	357.0	10.7
21	393.9	7.9	361.7	7.2	363.0	2.0	346.3	4.4	350.3	5.8	356.5	9.6
22	393.5	9.2	367.1	7.4	367.9	2.3	350.7	4.4	350.7	5.3	358.3	8.9
23	388.6	10.3	373.0	6.7	374.6	3.0	354.7	4.0	353.6	5.9	361.2	7.8
24	381.6	11.4	375.8	6.3	378.1	3.9	355.8	3.7	353.5	7.9	363.1	7.8
25	373.7	12.7	376.0	6.1	378.4	4.3	354.8	4.0	351.0	11.0	362.9	8.8
26	365.5	13.0	370.5	6.2	373.7	4.5	349.5	4.1	348.2	11.9	361.0	9.2

27	357.4	11.9	359.0	6.2	362.8	4.0	340.6	4.1	343.5	11.4	355.3	8.8
28	348.4	12.0	345.6	6.1	349.2	3.1	330.2	4.5	338.6	10.1	348.5	8.9
29	337.3	12.2	330.6	5.8	334.3	2.5	317.6	4.8	331.9	9.3	340.8	8.9
30	328.5	11.2	312.6	5.7	315.3	2.4	301.0	5.8	319.1	8.9	328.7	8.9
31	319.8	10.0	292.0	5.8	293.8	2.8	281.7	7.5	302.3	8.5	313.5	9.5
32	309.0	9.1	270.3	5.8	270.7	3.3	260.6	9.3	284.8	8.2	298.9	10.2
33	297.2	9.1	247.7	6.1	246.9	3.6	238.8	11.3	266.8	7.8	282.5	11.6
34	280.5	9.3	224.1	6.3	222.8	3.5	218.7	12.5	252.0	7.7	268.8	10.5
35	262.0	9.6	200.9	6.7	199.3	3.4	199.6	13.1	237.4	8.0	254.7	9.5
36	243.4	9.9	178.7	7.2	176.9	3.4	181.0	13.7	222.9	8.6	240.8	9.0
37	225.4	10.2	158.1	7.5	156.4	3.4	163.2	14.2	208.2	9.2	226.6	9.2
38	209.2	11.2	136.1	8.1	134.3	3.6	144.1	14.3	188.6	9.2	207.3	9.7
39	194.0	12.2	114.9	8.4	114.0	3.9	125.5	15.0	171.1	9.4	190.0	10.1
40	180.2	13.3	97.6	6.1	96.9	0.5	132.4	13.5	156.2	9.1	174.8	10.5
41	168.0	13.8	84.7	7.7	83.8	4.2	134.1	35.8	143.1	9.9	161.8	10.7
42	158.0	13.7	75.3	8.4	74.4	4.0	97.9	27.5	133.1	9.8	151.1	10.3
43	150.0	13.9	70.3	7.7	67.8	0.8	91.4	29.9	134.8	8.3	142.8	9.8
44	142.1	15.2	66.0	7.4	62.8	0.0	81.0	10.9	125.1	8.7	136.8	9.3
45	134.1	18.0	61.4	6.8	60.3	2.9	87.7	15.0	114.5	10.8	133.7	9.1
46	133.4	16.6	62.0	6.7	60.4	2.9	74.5	9.6	114.9	10.1	134.3	9.8

Table S15. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for grassland in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	129.4	19.6	79.7	19.0	105.3	29.8	68.9	0.0	124.2	12.2	132.3	8.2
2	134.7	16.7	84.7	16.1	105.9	20.9	66.2	4.8	127.9	12.7	135.9	8.7
3	141.0	17.6	94.9	14.2	112.5	20.1	69.5	3.6	133.1	13.6	141.6	9.3
4	146.9	25.7	95.9	14.9	117.7	23.2	82.4	5.0	142.7	13.7	150.9	9.8
5	157.7	27.1	97.2	15.2	114.4	27.6	88.4	4.4	150.3	21.6	162.8	10.4
6	179.6	14.5	117.4	16.2	141.6	24.7	99.6	6.9	163.3	17.2	176.2	10.9
7	194.0	14.5	117.2	14.5	151.0	26.2	112.7	9.3	176.9	15.9	189.0	11.5
8	208.3	15.0	149.1	15.9	171.9	24.6	127.8	8.3	189.9	15.6	201.0	11.7
9	222.9	15.3	179.4	11.2	193.0	15.7	169.2	17.0	203.3	15.1	213.3	11.7
10	237.1	15.8	199.0	10.9	210.6	12.0	207.5	4.6	216.7	14.9	225.6	11.9
11	253.7	15.2	214.4	10.7	234.8	12.5	227.0	5.4	233.6	14.9	243.1	12.4
12	271.1	14.1	234.6	8.5	248.0	10.0	243.2	6.5	251.9	15.0	262.0	12.9
13	288.2	13.3	251.8	8.0	265.5	10.5	259.9	6.9	269.4	14.9	280.3	13.3
14	303.1	12.3	267.2	9.1	282.2	10.7	275.4	7.7	286.0	14.9	297.8	13.8
15	317.3	11.3	285.4	8.6	299.6	10.0	280.3	13.6	301.1	14.3	311.3	13.2
16	330.1	10.3	302.9	8.3	315.5	9.0	287.5	8.1	315.0	13.6	324.7	12.7
17	341.9	9.0	318.3	8.1	329.7	8.3	314.4	7.2	327.8	12.9	336.9	12.0
18	353.6	8.7	332.6	8.3	343.6	7.8	324.0	7.0	338.7	11.9	346.3	11.1
19	360.0	6.5	345.9	8.8	355.0	5.5	334.4	6.2	345.7	11.4	347.6	6.0
20	363.7	5.1	356.2	9.1	362.9	3.8	343.0	5.5	348.1	10.0	352.9	8.2
21	365.3	4.6	363.6	9.1	367.7	4.9	350.2	4.8	349.7	9.1	353.0	7.1
22	365.6	5.9	368.5	8.9	371.5	6.4	355.3	4.4	352.4	8.1	353.9	5.9
23	364.8	8.3	370.2	8.0	374.5	4.8	357.8	4.2	359.8	8.4	359.4	4.4
24	363.0	10.7	369.7	7.5	375.5	3.7	357.4	3.6	365.1	9.7	363.4	4.9
25	360.2	17.5	367.4	7.4	375.5	4.6	355.3	3.4	369.0	12.1	365.5	6.6
26	355.1	14.7	361.1	7.5	370.9	5.8	350.1	2.9	367.6	13.2	364.4	7.5

27	349.9	14.5	352.2	8.3	362.7	6.3	342.2	3.1	361.5	12.8	358.3	7.5
28	341.3	14.1	341.5	9.2	352.8	6.8	333.1	3.6	353.6	12.2	351.3	7.0
29	330.8	14.1	328.4	9.0	340.1	7.5	321.9	4.0	343.5	11.5	342.5	6.7
30	320.0	13.0	312.1	9.1	324.1	8.0	307.1	4.3	329.4	11.3	330.1	6.3
31	308.9	11.6	292.5	9.8	305.7	9.4	289.4	4.5	313.3	11.5	315.6	6.0
32	297.6	11.6	271.7	10.5	286.2	10.9	270.7	5.0	290.8	9.0	299.4	6.8
33	284.6	12.6	250.2	11.4	266.0	12.5	251.2	5.4	275.7	13.7	282.0	8.0
34	266.3	12.3	229.2	11.9	246.1	12.4	232.3	5.8	257.1	12.4	265.5	7.8
35	247.7	11.7	208.4	11.9	225.8	13.1	213.4	6.3	238.8	11.2	249.2	8.1
36	229.2	11.7	187.6	12.1	205.4	13.6	195.3	6.8	220.3	10.4	232.8	8.8
37	210.9	12.5	168.1	12.5	186.3	13.8	178.0	7.0	202.2	9.9	216.5	9.9
38	196.9	13.3	150.1	12.8	169.4	14.9	159.2	7.4	185.8	10.6	199.0	9.3
39	183.6	14.0	132.5	15.6	153.9	15.9	141.6	8.2	170.7	11.4	183.3	8.9
40	171.1	15.4	106.3	21.8	138.7	22.2	124.5	6.2	157.3	12.1	169.4	8.8
41	161.1	14.0	104.3	16.7	127.5	21.0	113.3	0.0	147.9	11.0	157.5	8.6
42	150.2	14.3	96.9	15.4	117.7	21.0	103.6	8.4	139.2	10.6	147.2	8.3
43	141.8	14.8	90.5	12.7	110.2	20.6	100.6	3.9	133.8	11.6	139.6	7.8
44	134.2	16.7	74.4	8.5	102.4	0.0	96.8	7.1	128.4	18.7	134.0	7.5
45	124.0	22.6	64.0	8.2	91.9	26.0	85.1	8.4	123.6	19.8	131.1	7.7
46	120.4	22.8	60.9	7.4	90.7	26.7	85.8	8.6	120.5	14.6	131.4	7.9

Table S16. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for shrubland in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	147.3	29.4	103.5	41.2	144.3	18.9	135.1	29.7	124.2	0.0	145.8	6.7
2	151.8	30.0	108.0	41.6	146.0	18.7	132.1	36.3	129.3	0.0	150.5	6.9
3	158.3	31.3	118.4	41.8	150.1	18.5	137.3	37.9	136.7	0.0	157.8	7.0
4	166.2	32.8	120.8	42.0	158.3	18.5	145.3	37.5	145.6	0.0	169.0	9.1
5	176.5	33.2	129.7	42.5	167.9	19.8	155.7	37.4	156.9	0.0	180.9	8.4
6	189.8	31.3	142.1	43.7	179.8	18.9	167.8	37.5	169.8	0.0	195.5	9.3
7	204.4	30.7	156.4	43.8	193.4	18.5	184.9	36.4	184.0	0.0	209.7	9.7
8	221.7	28.4	178.2	41.6	208.1	17.1	208.2	30.4	199.1	0.0	222.6	9.4
9	239.3	25.3	199.7	40.0	222.4	14.5	220.6	33.6	214.6	0.0	235.6	8.9
10	257.8	22.1	222.2	37.4	236.6	12.4	237.6	32.6	230.1	0.0	248.4	8.7
11	274.1	20.4	242.3	35.2	252.1	10.9	255.7	29.6	245.1	0.0	266.9	9.2
12	289.0	19.0	261.3	32.9	268.3	9.7	272.7	26.3	259.2	0.0	287.1	10.7
13	303.6	17.0	279.7	30.5	283.0	8.0	288.7	23.1	271.9	0.0	306.5	12.2
14	316.4	15.6	297.6	27.6	296.9	6.4	303.7	18.7	285.5	0.0	325.1	13.8
15	330.5	13.2	315.4	25.5	304.7	3.9	318.2	17.6	302.1	0.0	338.3	12.4
16	343.1	11.1	331.6	23.4	310.8	2.9	331.1	17.3	317.5	0.0	350.8	11.2
17	354.0	9.5	345.9	21.2	314.2	5.2	342.6	17.0	332.9	0.0	361.1	9.8
18	363.8	8.2	358.4	18.9	317.2	8.0	351.9	16.6	346.2	0.0	369.0	8.6
19	367.9	8.1	366.6	21.9	322.2	8.1	356.0	15.2	348.4	0.0	368.9	7.7
20	369.7	9.7	372.1	14.9	325.9	8.1	358.5	14.0	349.1	0.0	369.9	6.7
21	370.4	12.0	376.2	13.5	328.3	8.0	358.9	13.5	349.1	0.0	368.3	6.7
22	369.9	13.9	378.8	11.2	330.0	7.8	357.3	15.0	348.2	0.0	367.0	6.7
23	367.6	14.7	380.1	7.7	329.8	18.9	355.1	22.1	345.4	0.0	368.3	7.9
24	364.5	15.8	380.1	5.8	328.4	11.4	350.8	29.1	342.0	0.0	367.6	8.9
25	359.3	16.8	377.7	6.2	325.6	13.5	345.2	36.7	337.6	0.0	363.9	9.3
26	353.7	16.2	371.1	6.7	322.3	13.8	339.7	38.5	335.6	0.0	361.1	9.4

27	347.9	14.1	361.1	7.3	318.5	12.1	334.7	35.6	334.3	0.0	356.0	8.3
28	341.0	12.7	349.4	8.7	312.5	10.4	328.3	33.7	329.5	0.0	350.5	7.9
29	332.4	11.7	336.3	10.7	305.1	8.8	319.9	31.8	325.8	0.0	342.4	7.4
30	323.0	10.8	322.8	13.2	295.9	8.0	308.8	31.6	314.2	0.0	331.6	7.7
31	313.2	10.5	308.3	16.7	285.7	8.3	296.0	32.7	297.5	0.0	319.4	8.2
32	302.7	10.9	292.4	20.3	274.3	9.0	279.3	32.8	281.3	0.0	307.7	9.2
33	291.4	12.0	275.5	23.9	261.9	10.2	266.5	33.9	263.5	0.0	294.4	10.4
34	274.9	13.8	254.5	27.9	248.3	11.1	251.0	31.3	252.2	0.0	280.3	8.9
35	257.5	15.6	233.2	31.5	234.0	12.2	234.8	29.5	238.3	0.0	265.1	7.8
36	240.5	17.0	212.6	34.2	219.8	13.5	218.8	28.7	225.5	0.0	250.1	7.1
37	224.0	18.7	192.6	36.3	205.6	14.6	202.9	28.9	212.6	0.0	235.2	6.8
38	209.4	21.4	172.9	38.1	195.1	16.6	187.4	31.3	194.8	0.0	216.9	6.7
39	195.7	23.7	155.5	39.1	185.2	18.3	173.1	33.0	179.2	0.0	200.2	6.6
40	182.1	26.3	140.3	39.8	176.2	19.7	160.7	34.3	165.1	0.0	185.5	6.7
41	171.0	26.4	127.9	40.3	168.3	20.7	150.0	34.9	152.6	0.0	172.7	6.7
42	161.6	26.1	117.4	41.5	159.8	20.4	141.3	33.9	140.6	0.0	161.4	6.6
43	155.2	25.7	112.0	41.6	155.0	20.5	143.8	37.3	131.1	0.0	152.5	6.5
44	150.7	26.4	110.7	40.1	150.6	20.0	135.8	32.6	124.3	0.0	145.8	6.5
45	147.1	29.2	105.8	40.0	147.3	19.5	133.4	32.0	121.2	0.0	142.9	8.6
46	147.4	30.2	104.6	40.6	145.2	19.1	131.9	33.2	121.9	0.0	144.2	6.8

Table S17. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for cropland/pasture that is converted to cornfields in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	131.3	16.3	64.8	10.0	78.9	20.6	65.5	10.4	120.6	9.9	132.5	7.4
2	136.5	14.2	74.7	16.6	84.8	21.4	66.7	8.3	123.4	10.6	136.1	7.8
3	143.3	14.9	81.7	18.9	90.0	21.9	70.8	7.3	123.9	14.2	141.5	8.4
4	151.0	21.7	84.7	15.9	94.3	22.3	79.7	8.0	131.0	15.7	150.8	9.1
5	162.2	23.0	89.8	14.0	92.5	19.1	82.3	5.5	131.7	24.6	163.5	9.6
6	179.8	14.2	106.1	16.3	114.9	23.6	93.6	7.0	148.4	21.7	176.9	10.3
7	194.1	14.3	111.2	13.5	124.8	23.8	106.8	11.2	169.8	13.7	189.4	11.0
8	208.3	14.7	143.4	14.4	145.0	21.7	122.6	13.6	184.4	12.5	201.4	11.2
9	222.8	15.1	176.3	10.6	175.3	18.7	169.6	19.0	199.3	11.7	213.8	11.1
10	236.9	15.6	196.9	9.3	197.5	15.3	203.2	11.8	213.6	10.9	224.0	7.0
11	253.9	14.8	210.5	14.0	219.7	16.9	222.9	12.4	230.4	11.2	243.6	11.8
12	271.6	13.6	233.3	7.5	238.8	11.3	239.5	12.7	248.3	11.7	262.4	12.3
13	288.7	12.4	250.4	6.2	258.8	8.4	256.8	9.3	264.8	12.2	280.3	12.7
14	303.9	11.1	265.2	7.1	274.1	8.6	271.7	10.4	280.6	12.6	297.6	13.2
15	318.3	10.5	284.0	6.5	292.4	7.4	281.5	12.8	295.2	11.8	310.2	13.1
16	331.3	10.0	301.3	6.3	308.8	6.6	292.3	9.7	309.9	11.4	323.8	12.6
17	343.1	8.8	316.6	5.9	323.4	5.9	312.2	9.1	324.1	11.2	336.7	11.7
18	354.9	9.0	330.9	5.7	337.5	5.6	322.4	8.9	334.6	10.4	345.2	10.7
19	361.4	7.0	343.6	6.2	349.5	4.2	332.0	7.9	343.5	10.5	347.3	7.0
20	364.8	5.2	353.3	6.5	358.1	3.2	342.1	7.5	345.8	8.4	352.3	8.2
21	366.7	4.1	361.0	6.5	364.4	3.6	349.3	7.4	348.1	7.3	352.1	7.0
22	367.5	4.7	366.0	6.6	368.4	4.3	354.4	7.0	350.7	7.0	354.4	4.9
23	367.7	6.7	367.9	6.0	370.1	3.5	355.8	6.3	356.3	7.2	357.5	4.3
24	367.0	8.9	367.5	5.6	370.1	3.1	355.6	5.9	359.7	8.2	361.1	4.9
25	365.7	13.0	365.3	5.5	368.6	3.8	353.2	5.6	361.5	10.4	362.6	6.5

26	361.1	12.4	359.0	5.6	363.1	4.6	347.6	5.0	359.3	11.2	360.8	7.3
27	355.1	12.3	349.6	6.2	354.0	5.1	339.2	4.8	353.3	10.7	355.5	7.0
28	346.1	12.4	338.8	6.7	343.8	5.5	329.9	5.1	346.0	10.1	349.0	6.5
29	335.3	12.6	325.3	6.7	331.1	5.9	318.3	5.4	336.4	9.7	340.8	6.0
30	323.8	12.2	308.5	7.1	314.2	6.8	303.4	5.6	322.8	9.4	328.8	5.7
31	311.9	11.6	288.2	8.3	294.4	8.6	286.0	5.8	307.1	9.2	314.9	5.8
32	299.9	11.7	266.8	9.7	273.6	10.7	267.7	6.3	287.3	7.8	298.6	6.4
33	285.2	12.1	244.9	11.1	252.6	12.6	248.6	6.8	270.5	10.0	280.8	7.5
34	266.0	11.7	223.7	11.8	232.2	13.3	229.9	7.5	252.7	9.7	265.0	7.4
35	246.5	10.9	202.4	11.8	211.6	13.9	211.3	8.0	235.4	9.6	249.9	7.6
36	227.0	10.7	181.3	11.9	191.1	14.1	193.1	8.7	218.6	9.8	233.9	7.8
37	208.2	11.2	161.8	12.3	172.1	14.3	175.5	9.0	200.9	10.1	217.9	8.4
38	194.5	11.9	144.7	12.4	155.3	14.8	156.7	9.0	183.1	10.5	200.3	8.0
39	181.4	12.6	125.7	14.1	139.4	15.4	139.5	9.4	167.0	11.1	184.6	7.9
40	169.4	14.1	96.1	18.6	116.7	19.5	115.5	13.4	153.7	13.7	171.4	7.9
41	159.4	12.8	91.0	17.2	106.0	20.5	101.5	9.0	142.8	13.8	159.5	7.7
42	148.3	13.0	84.7	18.4	98.6	20.2	91.2	11.0	136.6	9.0	148.4	7.3
43	139.9	13.3	77.4	11.1	88.0	15.0	90.6	10.8	131.5	9.5	140.3	6.9
44	134.6	13.3	77.6	12.0	92.9	15.7	92.7	12.4	123.5	13.5	134.5	6.6
45	125.5	19.1	60.5	8.1	78.2	18.5	80.1	11.1	116.1	15.3	131.6	6.7
46	120.8	21.2	59.4	7.2	77.3	18.7	80.4	11.1	114.3	12.8	131.8	7.1

Table S18. Eight-day pixel number-weighted average radiative forcing, in W/m^2, and its weighted standard deviation for cropland/pasture that is converted to switchgrass or miscanthus in each AEZ

	AEZ7		AEZ8		AEZ9		AEZ10		AEZ11		AEZ12	
	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation	Weighted average	Weighted standard deviation
1	65.7	4.6	27.9	4.0	28.3	5.7	32.3	9.3	55.7	3.8	65.6	3.4
2	67.9	4.3	36.0	9.4	36.4	10.7	38.5	7.2	57.5	3.9	67.5	3.5
3	71.4	4.5	41.3	11.8	38.6	11.5	36.5	4.6	55.2	6.5	70.2	3.8
4	76.7	6.0	40.1	8.0	39.8	10.5	38.6	5.4	57.1	7.4	74.8	4.2
5	81.9	7.2	43.0	6.2	40.9	7.3	37.9	2.6	52.4	9.6	81.5	4.4
6	89.6	4.8	51.0	8.6	49.5	12.0	43.9	3.1	61.8	10.6	88.0	4.7
7	96.7	5.0	55.5	6.0	54.5	11.5	50.0	5.8	79.6	4.8	94.3	5.0
8	103.8	5.2	71.7	6.4	63.4	10.5	57.5	7.4	88.0	4.1	100.5	5.1
9	110.9	5.4	88.4	4.2	83.7	8.6	85.5	9.1	96.5	3.7	107.0	5.0
10	117.8	5.6	98.7	3.4	96.7	6.5	100.2	7.9	104.5	3.2	112.4	2.9
11	126.4	5.3	106.5	6.3	107.2	7.6	110.8	6.9	112.8	3.6	121.9	5.2
12	135.5	4.7	117.3	2.8	117.7	4.4	119.3	7.0	121.3	4.0	130.9	5.4
13	144.1	4.1	125.5	2.5	127.3	2.9	127.6	5.4	128.8	4.5	139.3	5.7
14	152.0	3.4	132.9	3.2	134.3	3.2	134.8	6.1	136.1	4.9	147.4	6.1
15	159.5	3.4	142.3	2.7	143.5	2.5	142.0	5.7	143.4	4.5	153.5	6.1
16	166.2	3.3	150.8	2.6	151.6	2.3	149.0	5.4	151.0	4.4	160.7	5.9
17	172.2	3.0	158.2	2.2	158.8	2.1	155.2	5.3	158.6	4.5	167.8	5.3
18	178.1	3.1	165.2	1.9	165.5	2.0	160.4	5.2	163.8	4.3	172.2	5.0
19	181.5	2.4	171.3	2.3	172.0	1.8	164.7	4.5	169.9	5.5	174.5	4.3
20	183.6	1.7	176.0	2.4	176.6	1.6	170.7	4.5	171.0	3.3	175.2	3.7
21	184.9	1.2	180.2	2.4	180.4	1.4	174.6	4.6	172.5	2.8	174.9	3.1
22	186.0	1.1	182.8	2.7	182.6	1.4	177.1	4.5	173.6	2.7	176.4	2.6
23	186.6	1.7	183.6	2.5	182.8	1.5	177.0	3.8	175.3	2.7	176.7	3.0
24	186.7	2.4	183.3	2.4	182.6	1.5	177.0	3.7	176.0	3.1	177.9	3.9
25	186.4	3.1	182.2	2.4	181.1	1.8	175.8	3.5	175.7	3.8	178.1	5.0

26	184.3	3.6	179.1	2.4	178.0	2.0	172.8	3.2	174.3	4.0	177.1	5.3
27	180.8	3.5	174.4	2.5	173.3	2.4	168.4	2.9	171.6	3.8	175.2	4.8
28	176.1	3.6	169.1	2.6	168.1	2.5	163.8	3.0	168.3	3.5	172.6	4.4
29	170.6	3.7	162.4	2.7	161.7	2.6	157.9	3.1	163.8	3.5	168.7	3.8
30	164.5	3.7	153.9	2.8	153.3	3.2	150.4	3.2	157.3	3.3	162.5	3.6
31	158.2	3.7	143.7	3.9	143.3	4.2	141.8	3.2	149.8	3.0	155.3	3.8
32	151.6	3.9	133.0	4.8	132.7	5.3	132.8	3.5	141.2	2.8	146.8	4.0
33	143.5	3.9	122.1	5.6	122.2	6.3	123.2	3.7	131.8	2.6	137.6	4.3
34	133.5	3.8	111.5	6.1	112.0	6.9	114.0	4.1	123.0	2.9	130.4	4.0
35	123.2	3.6	100.5	6.2	101.7	7.2	104.8	4.3	114.7	3.3	123.6	4.0
36	112.8	3.5	89.8	6.2	91.3	7.1	95.6	4.6	106.7	3.9	116.2	3.6
37	103.0	3.6	80.1	6.5	81.8	7.2	86.7	4.8	98.0	4.5	108.6	3.5
38	96.0	3.8	71.8	6.3	73.4	7.1	77.2	4.7	88.3	4.4	99.7	3.5
39	89.3	4.0	61.6	7.3	65.1	7.3	68.8	4.7	79.7	4.4	92.0	3.4
40	83.5	4.3	46.8	10.2	46.6	9.8	53.6	9.6	72.6	7.3	85.7	3.5
41	78.3	4.0	42.7	10.3	45.6	10.9	46.2	8.3	65.9	7.0	79.7	3.5
42	72.8	4.0	41.9	10.8	44.3	10.3	38.4	5.4	64.5	3.5	73.9	3.3
43	68.9	4.1	36.5	7.5	36.4	7.5	43.5	9.3	63.4	3.9	69.4	3.2
44	66.6	3.7	38.9	8.2	50.0	9.3	45.0	7.5	56.7	3.9	66.5	3.2
45	63.8	5.2	30.2	4.6	33.5	6.1	37.5	6.6	52.3	4.4	65.1	3.2
46	61.8	6.0	30.4	3.8	33.3	5.7	37.3	6.3	52.0	4.5	65.2	3.4

Table S19. Average corn yields in each AEZ[12]

	AEZ 7	AEZ 8	AEZ 9	AEZ 10	AEZ 11	AEZ 12
Tonne/Hectare	9.45	7.41	8.58	8.15	7.75	6.62

Table S20. Comparison of domestic and international LUCs, in hectares, for corn, switchgrass, and miscanthus ethanol production according to 2011 GTAP simulations [11]

	LUC scenario	Domestic LUC	International LUC
Corn ethanol production	From forest to corn	-3,331,465	-105,654
	From grassland to corn	-639,484	-1,212,443
	From cropland-pasture to corn	-1,168,943	-238,170
Switchgrass ethanol production	From forest to switchgrass	-783,021	-62,038
	From grassland to switchgrass	482,208	-690,528
	From cropland-pasture to switchgrass	-8,277,877	-154,375
Miscanthus ethanol production	From forest to miscanthus	-220,786	15,763
	From grassland to miscanthus	87,405	-290,016
	From cropland-pasture to miscanthus	-4,589,732	-55,661

Supplementary Figures

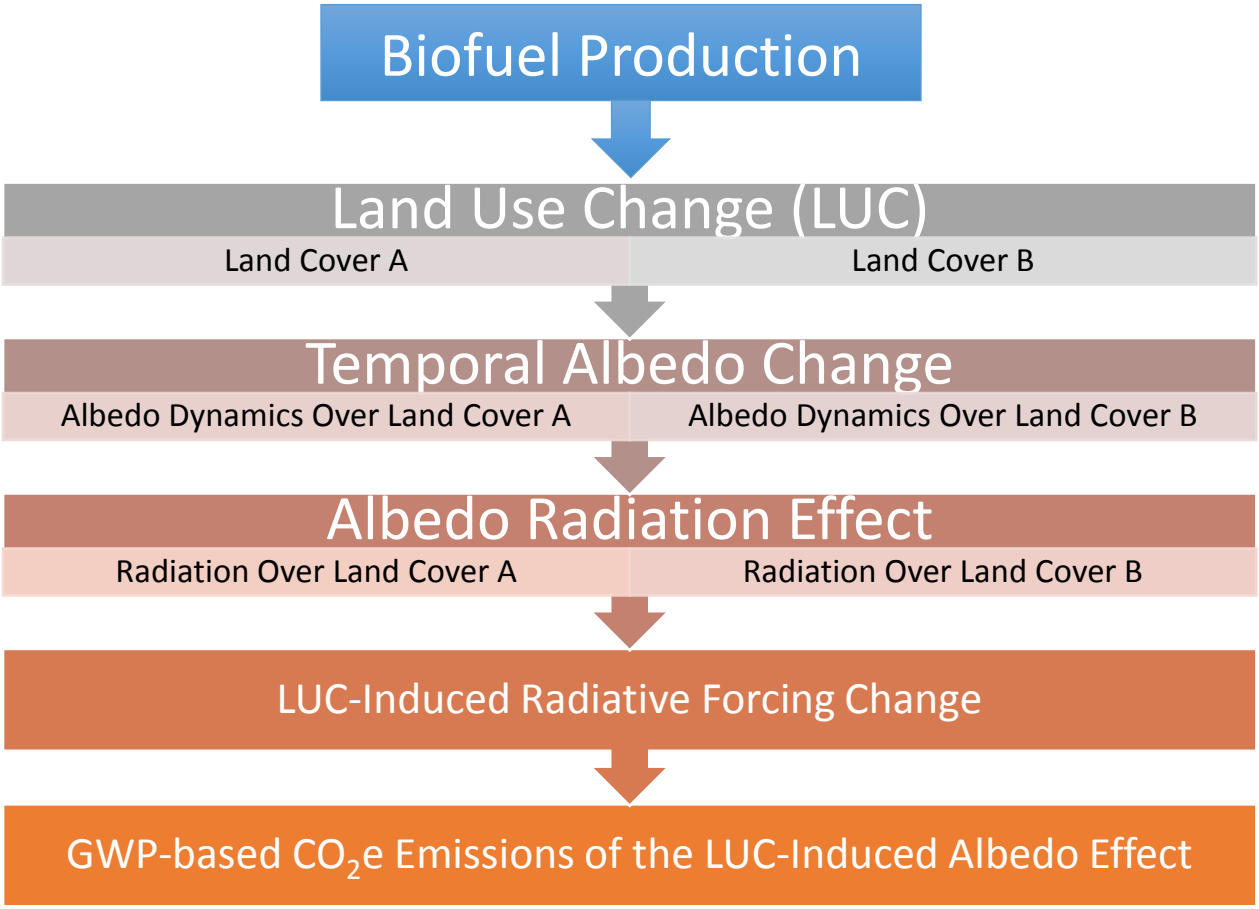


Fig. S1. Analytical flowchart for quantifying the LUC-induced albedo effects of biofuel production in the U.S.

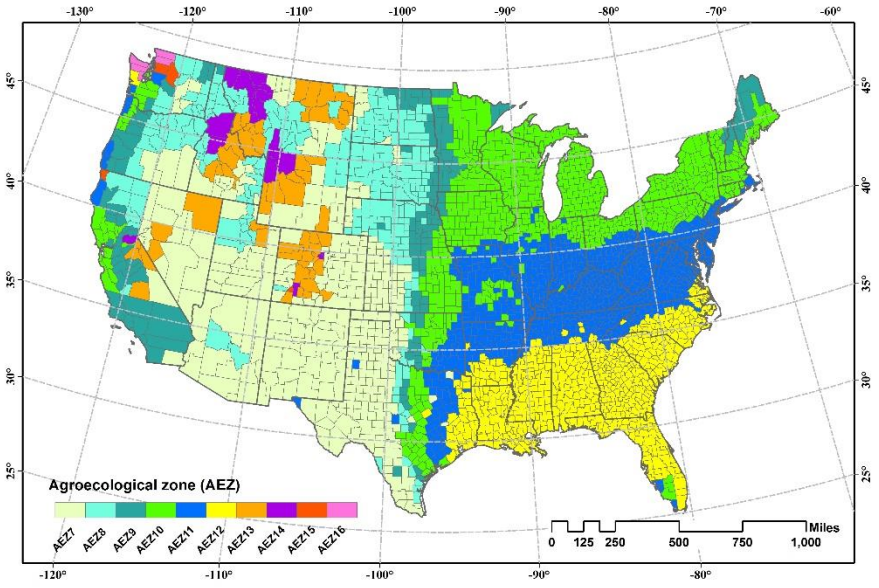


Fig. S2. A map of the Agro-Ecological Zones (AEZ) over the contiguous U.S.

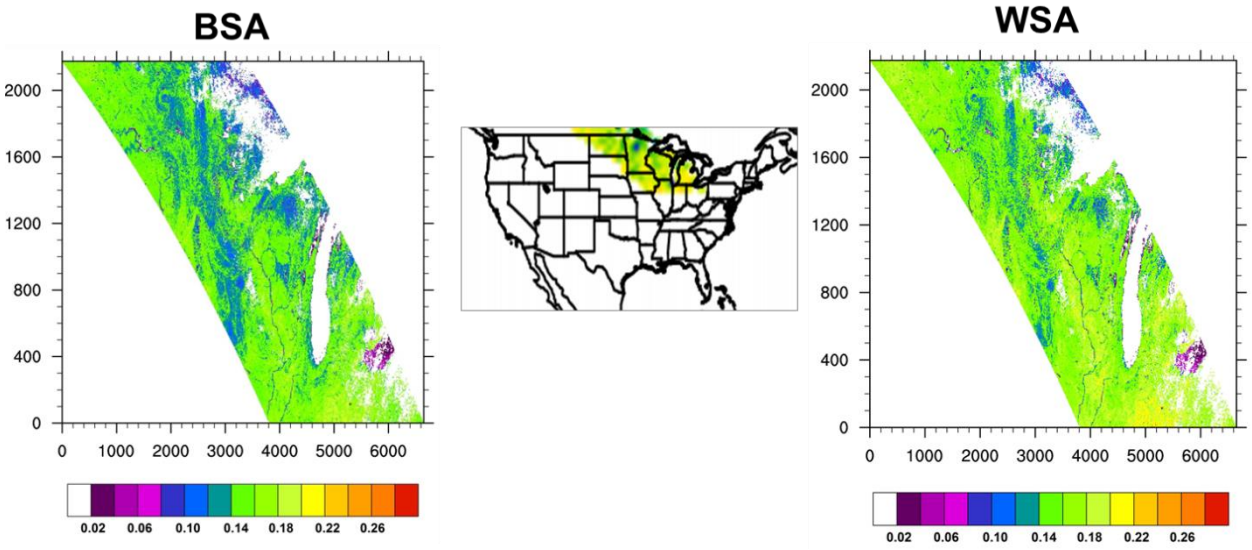


Fig. S3. Tile H11V04 of the MCD43A3 albedo data product, covering part of the U.S. Midwest.

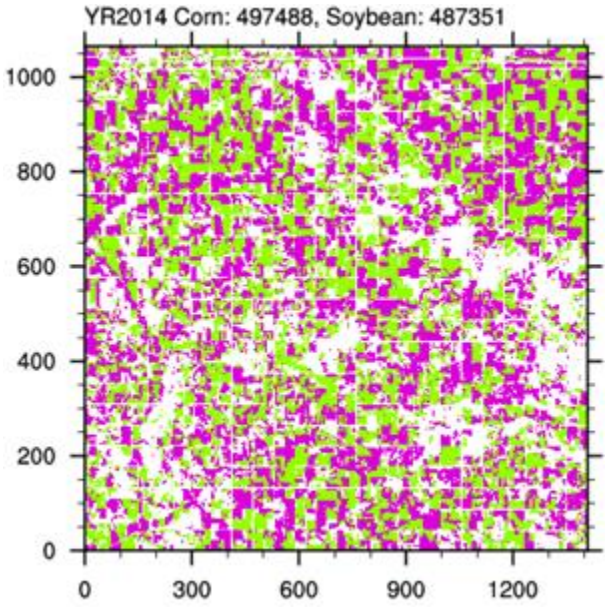
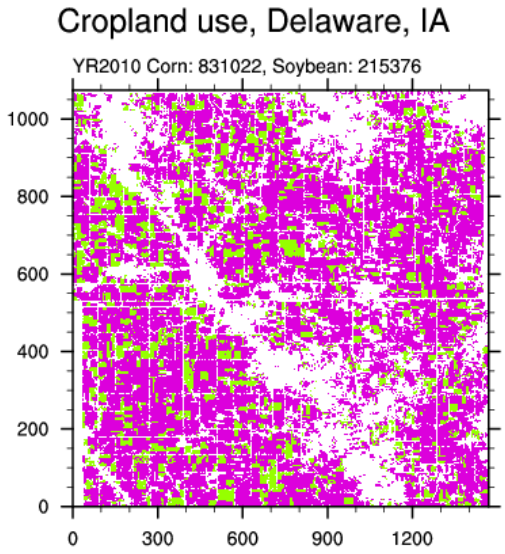
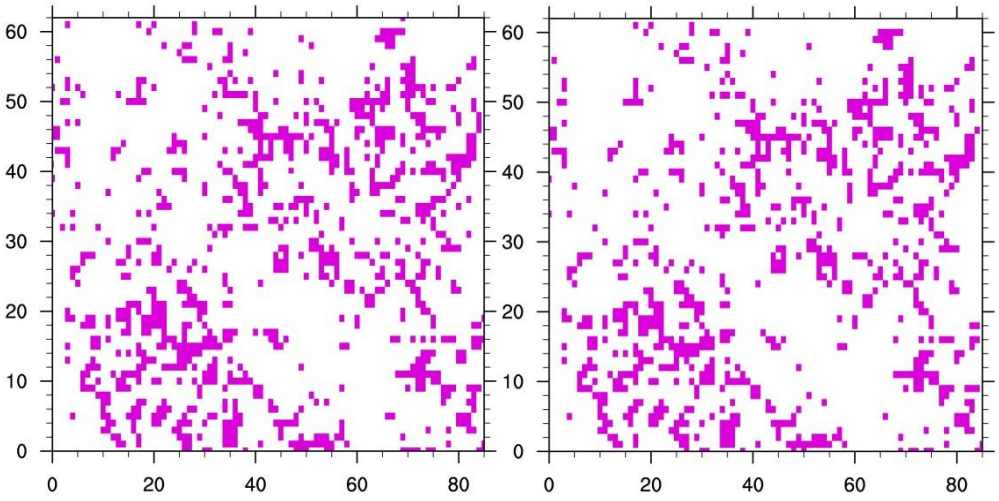


Fig. S4. CDL land cover data for Adair County, Iowa, in 2014. Purple and green pixels represent corn and soybean fields, respectively.

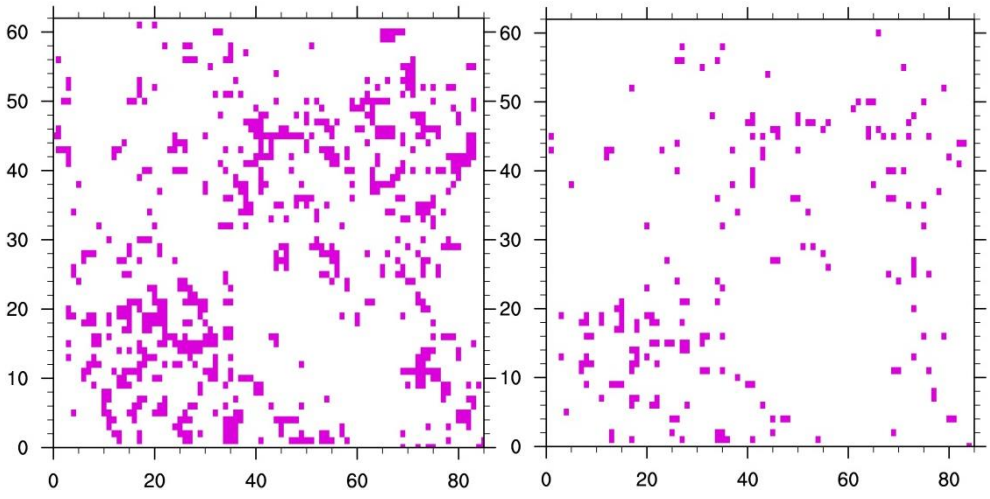


(a) Regridded CDL land cover data in Delaware County, Iowa. Purple and green pixels represent corn and soybean fields, respectively.



(b-1) 60% threshold

(b-2) 70% threshold



(b-3) 80% threshold (b-4) 100% threshold

(b) Screening of corn pixels at different thresholds of pixel-level corn coverage percentages

Fig. S5. An example of pairing and filtering CDL data geospatially with MODIS albedo data for identifying corn pixels at different thresholds of pixel-level corn coverage percentages in Delaware County, Iowa.

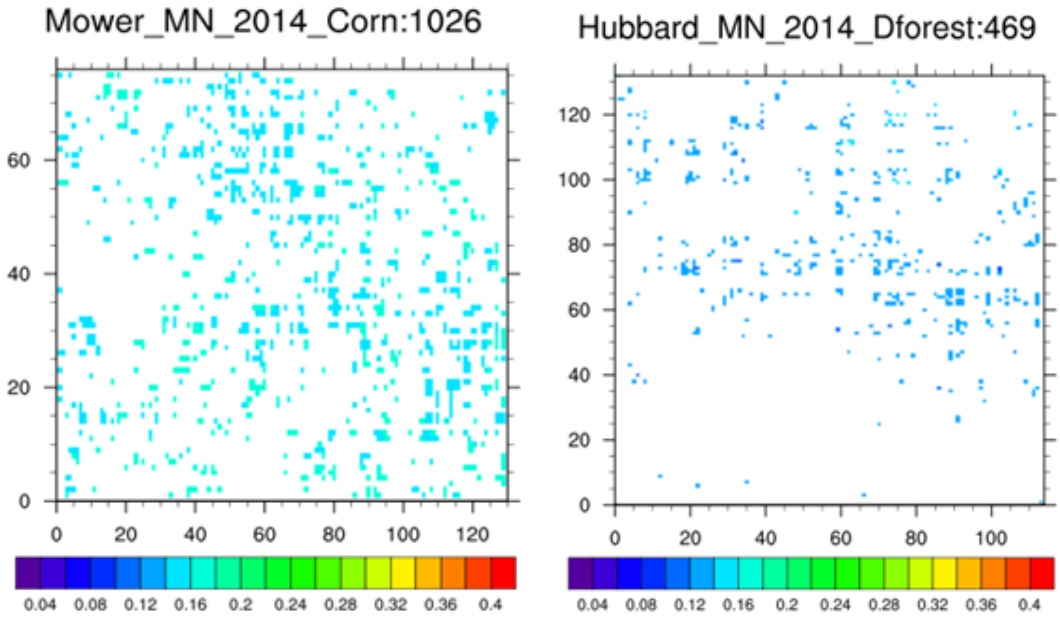


Fig. S6. Examples of county-level BSA data retrieved for cornfields and deciduous forest, 2014.

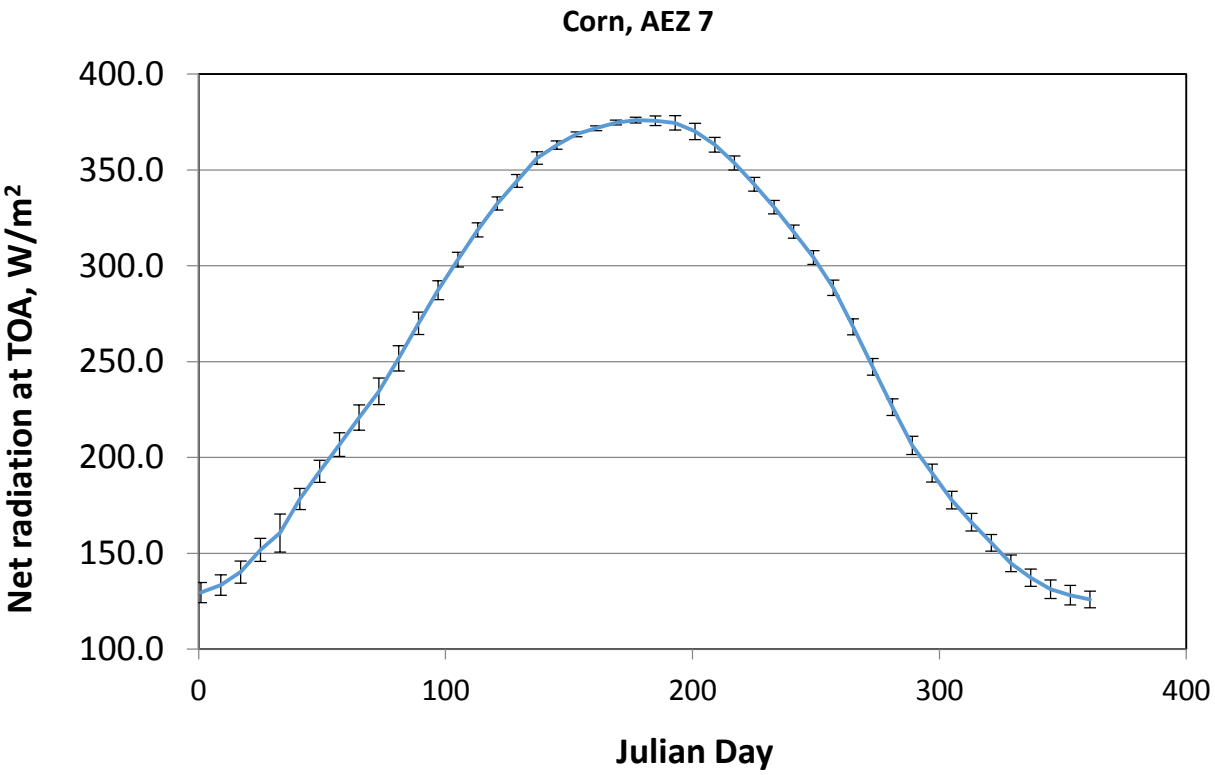


Fig. S7. Temporal variation in net radiation at the TOA, in W/m^2, over cornfields in AEZ 7 in 2014 as an example. The upper and lower bounds of the error bars represent the weighted average net radiation plus and minus twice the weighted standard deviation at an eight-day interval.

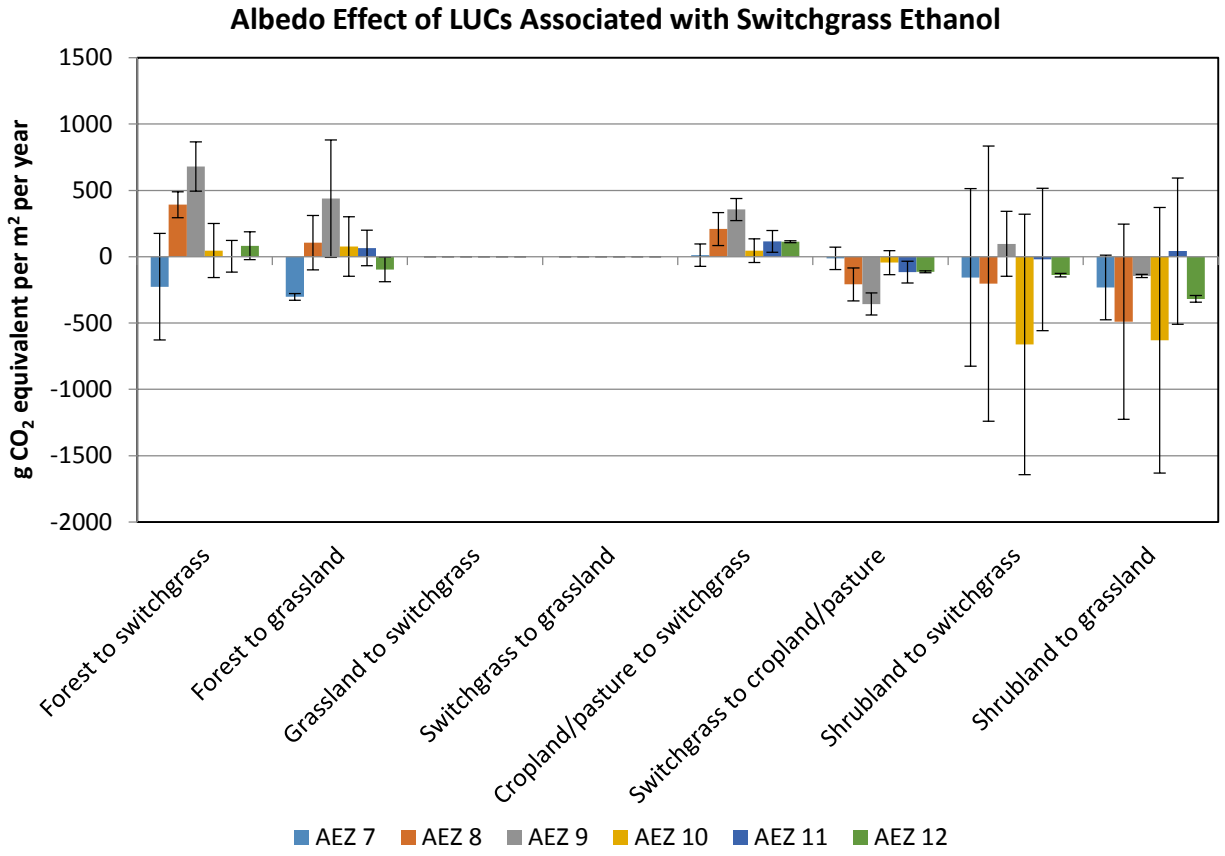


Fig. S8. Albedo effects at the AEZ level, in g CO_2e per m^2 per year, of different GTAP LUCs associated with corn ethanol expansion scenarios.

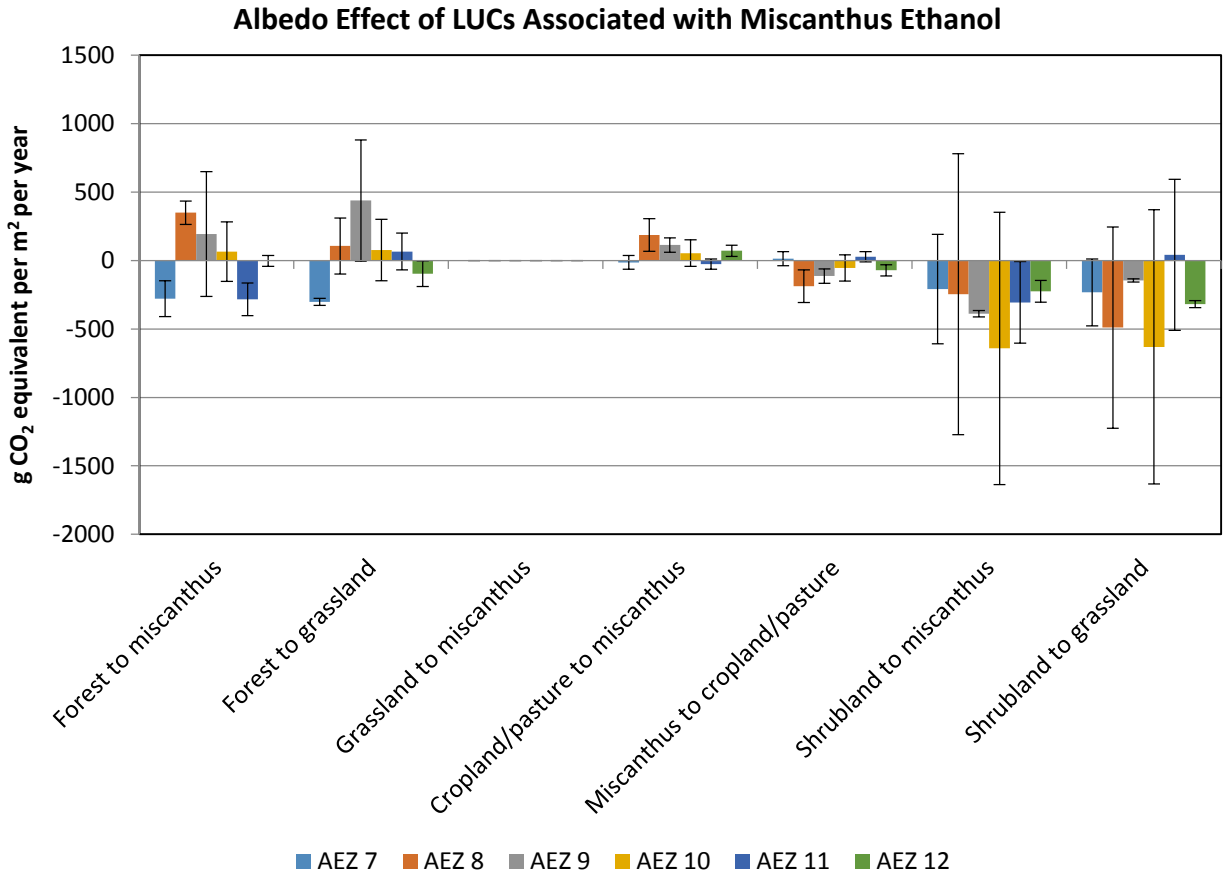


Fig. S9. Albedo effects at the AEZ level, in g CO_2e per m^2 per year, of different GTAP LUCs associated with corn ethanol expansion scenarios.

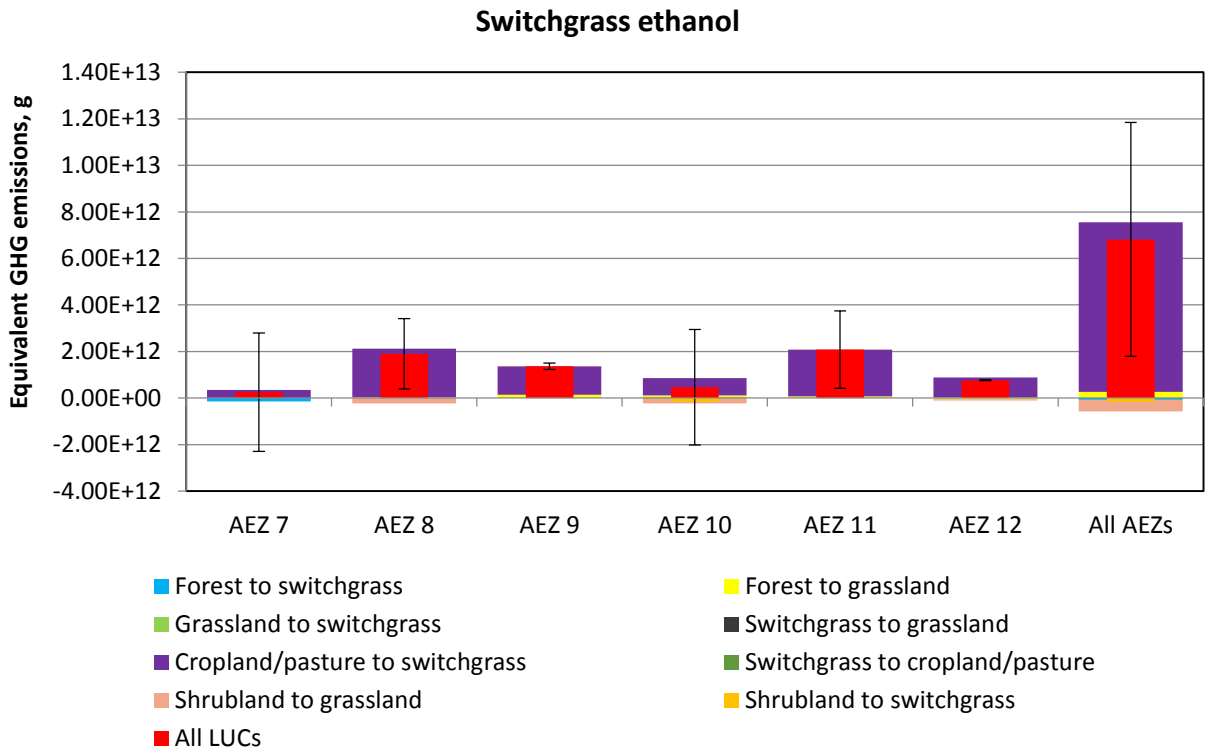


Fig. S10. Aggregated albedo effects at the AEZ level over the 30-year LUC time frame, in g CO_2e, of the 2011 GTAP LUC scenarios associated with switchgrass ethanol production.

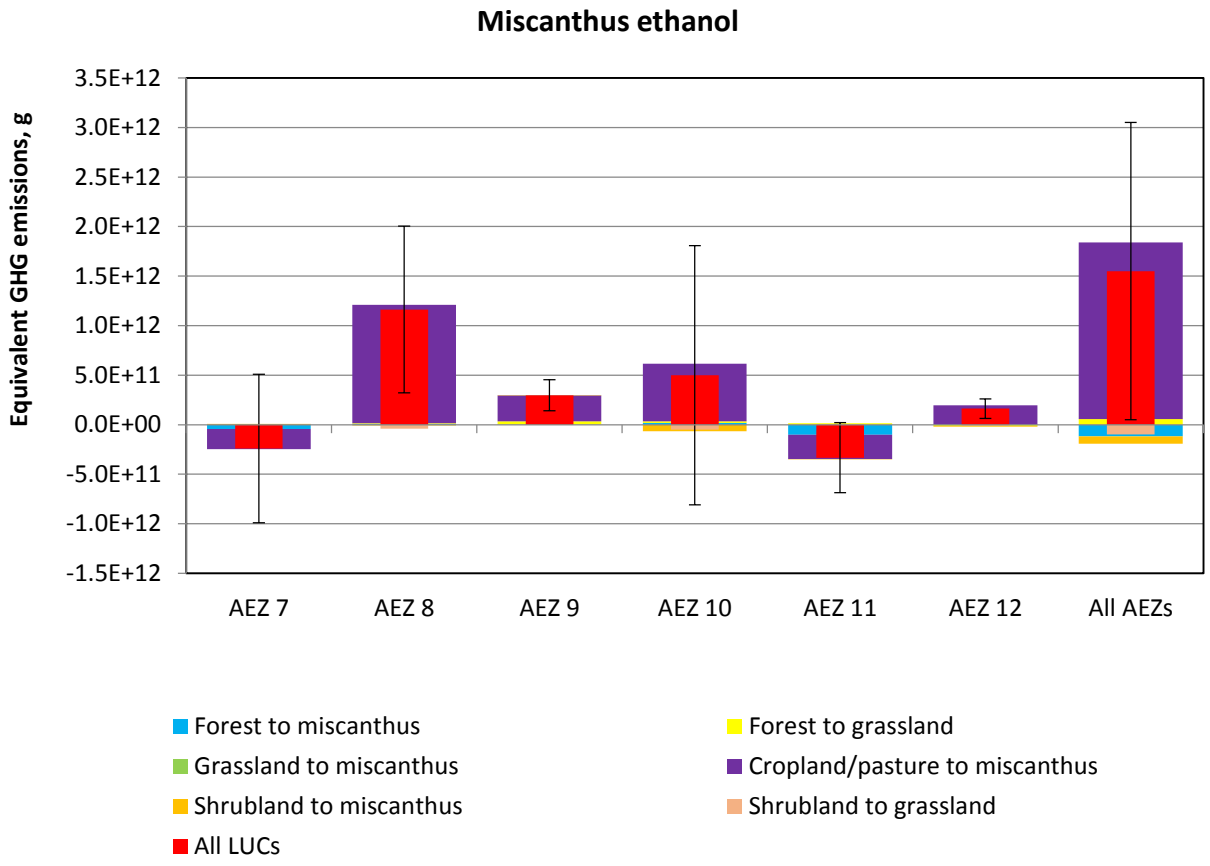


Fig. S11. Aggregated albedo effects at the AEZ level over the 30-year LUC time frame, in g CO_2e, of the 2011 GTAP LUC scenarios associated with miscanthus ethanol production.

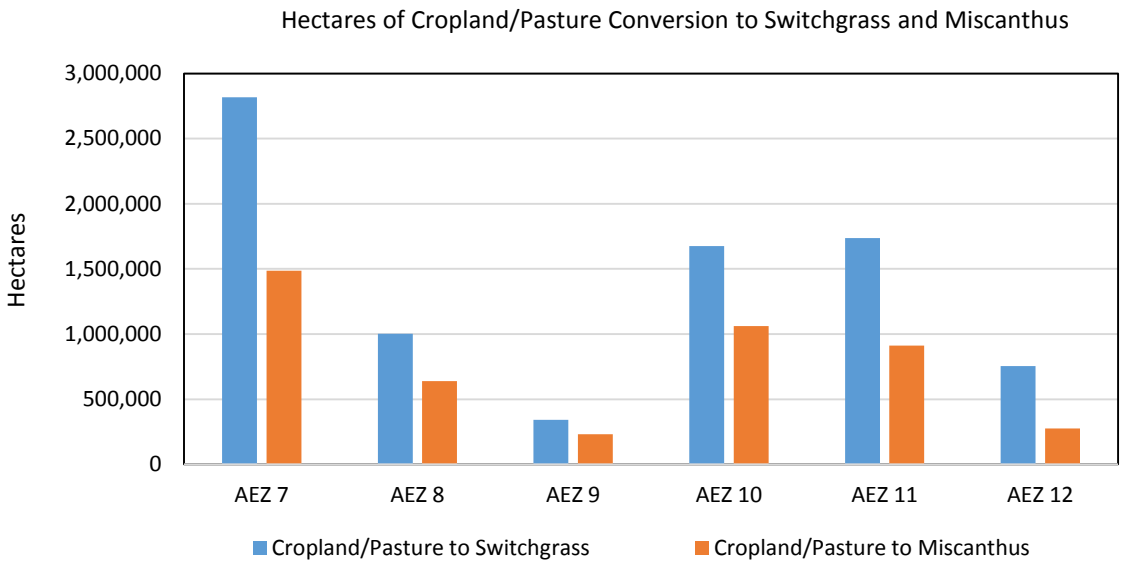


Fig. S12. Comparisons of hectares of conversion from cropland-pasture to switchgrass and miscanthus in different AEZs.

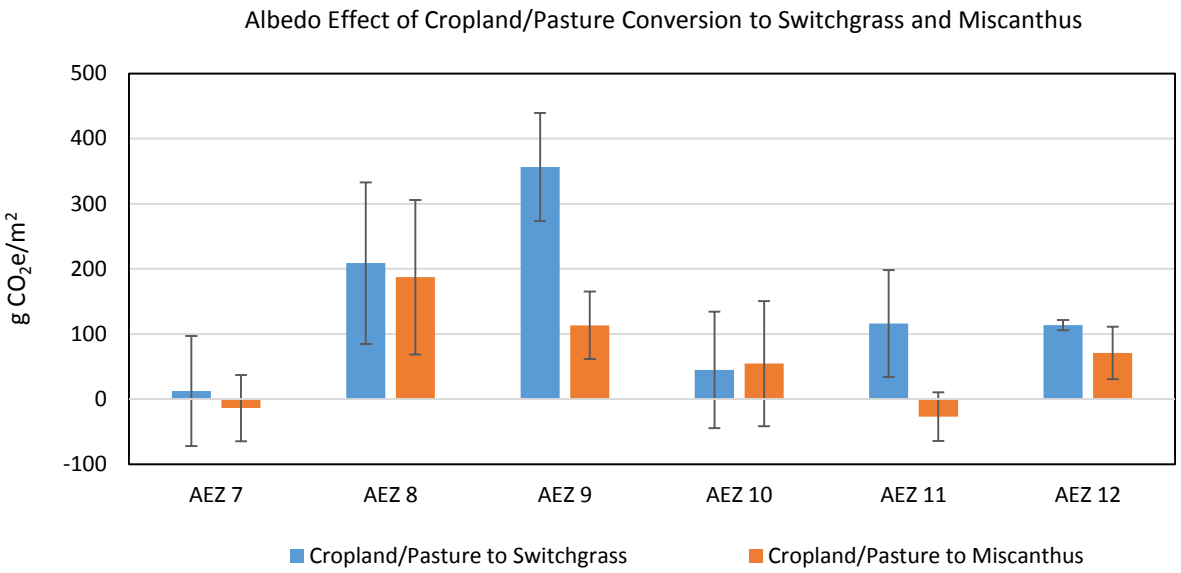


Fig. S13. Comparisons of the albedo effects associated with conversion from cropland-pasture to switchgrass and miscanthus in different AEZs (the upper and lower bounds of the error bars represent the weighted average net radiative forcings plus and minus twice the weighted standard deviation).

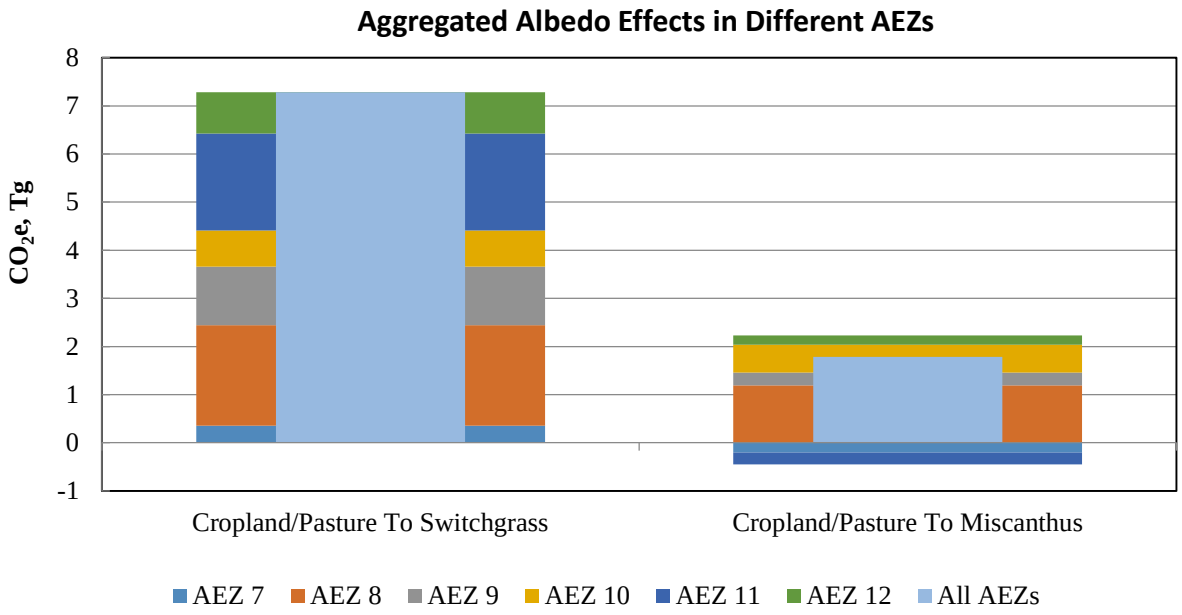


Fig. S14. Comparisons of the aggregated albedo effects of conversion from cropland/pasture to switchgrass and miscanthus, respectively.

Reference

1 NASA, 2013, http://newsroom.gsfc.nasa.gov/sdptoolkit/HEG/HEGHome.html.
2 A. M. Vogelmann, V. Ramanathan and I. A. Podgorny, *J. Clim.*, 2001, **14**, 1738–1752.
3 H. W. Barker, G. L. Stephens, P. T. Partain, J. W. Bergman, B. Bonnel, K. Campana, E. E. Clothiaux, S. Clough, S. Cusack, J. Delamere, J. Edwards, K. F. Evans, Y. Fouquart, S. Freidenreich, V. Galin, Y. Hou, S. Kato, J. Li, E. Mlawer, J.-J. Morcrette, W. O'Hirok, P. Räisänen, V. Ramaswamy, B. Ritter, E. Rozanov, M. Schlesinger, K. Shibata, P. Sporyshev, Z. Sun, M. Wendisch, N. Wood and F. Yang, *J. Clim.*, 2003, **16**, 2676–2699.
4 S. K. Satheesh, V. Ramanathan, X. Li-Jones, J. M. Lobert, I. A. Podgorny, J. M. Prospero, B. N. Holben and N. G. Loeb, *J. Geophys. Res. Atmospheres*, 1999, **104**, 27421–27440.
5 I. A. Podgorny, W. Conant, V. Ramanathan and S. K. Satheesh, *Tellus B*, 2000, **52**.
6 D. Kim and V. Ramanathan, *J. Geophys. Res. Atmospheres*, 2008, **113**, D02203.
7 Y. Feng and V. Ramanathan, *Tellus B*, 2010, **62**.
8 U.S. Department of Agriculture, 2015, http://nassgeodata.gmu.edu/CropScape.
9 NASA, 2014, https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd43a3.
10 Intergovernmental Panel on Climate Change, 2014, https://www.ipcc.ch/report/ar5/wg1.
11 F. Taheripour, W. Tyner and M. Wang, *GTAP Cellulosic Biofuels Analysis of Land Use Changes*, 2011.
12 Z. Qin, J. B. Dunn, H. Kwon, S. Mueller and M. M. Wander, *GCB Bioenergy*, 2016, n/a-n/a.