Supplementary Materials

Table S1. Study locations (states), switchgrass ecotype (L: Lowland, U: Upland), cultivars, minimum and maximum biomass dry yield (Mg ha^{-1}), and references.

State	Ecotype	Cultivars	Yield range Mg ha^{-1} Min	Max	Reference
Pennsylvania	U	CIR, Shaw, Trailblazer	2.87	6.69	Alder et al. [85]
Minnesota	U	Dacotah, Sunburst, Forestburg, Nebraska28 Summer, Pathfinder, CIR, Blackwell, nj-50	1.11	8.5	Tober et al. [86]
Wisconsin	U	CIR, Dacotah, Forestburg, Shawnee, Sunburst, Trailblazer	6.93	17.71	Casler and Boe [79]
Illinois	L	Alamo, Kanlow, Carthage	10	11.05	Kaiser and Bruckerhoff [87] Heaton et al. [59]
	U	Blackwell, CIR, Pathfinder, Trailblazer, Sunburst, Shelter, Nebraska28, Forestburg	7.51	19.8	
Iowa	L	Alamo, Kanlow, Carthage, NL93	5.97	18.96	Kaiser and Bruckerhoff [87]
	U	Blackwell, CIR, Pathfinder, Trailblazer, unburst, Shelter, Nebraska28, Forestburg, Caddo, HDMDC3, HYLDC3, IAGT, IALM, NU94, SU92lSO, SU94	0.3	19.44	Lemus et al. [88], Lemus et al. [89]
Missouri	L	Alamo, Kanlow, Carthage	15.28	24.85	Kaiser and Bruckerhoff [87] Kim et al [37], Brejda et al. [90]
	U	Blackwell, CIR, Pathfinder, Trailblazer, Sunburst, Shelter, Nebraska28, Forestburg	3.7	15.42	
Ohio	U	CIR	5.3	26.1	Jung et al. [52]
Kansas	L	Alamo, Kanlow, Exp54, Exp55, Exp56, Exp58	9.2	16.74	Holman et al. [91]
	U	Blackwell, CIR, Exp58, Trailblazer	9.53	11.6	Propheter et al.[53]
North Dakota	U	Dacotah, Sunburst, Forestburg, Nebraska28 Summer, Pathfinder, CIR, Blackwell, OKNU-2, ND3743	2	12.48	Tober et al. [86], Berdahl et al. [92]
South Dakota	U	Dacotah, Sunburst, Forestburg, Nebraska28	0.45	10.47	Tober et al. [86], Casler and Boe [79]

		Summer, Pathfinder, CIR, Blackwell			
Tennessee	L	Alamo, Kanlow	7.2	39.12	West and Kincer [93], Garten et al. [94]
	U	CIR, Shelter	10.2	16.4	Warwick et al. [95], Mooney et al. [96]
Kentucky	L	Alamo, Kanlow	15.1	15.5	Fike et al. [97]
	U	CIR, Shelter	9.6	10.6	
North Carolina	L	Alamo, Kanlow	15.1	15.1	Fike et al.[97]
	U	CIR, Shelter	8.3	9.3	
Virginia	L	Alamo, Kanlow	4.23	16.4	Fike et al. [83,97]
	U	CIR, Shelter	8.7	10	
West Virginia	L	Alamo, Kanlow	0.58	11.9	Fike et al. [97]
	U	CIR, Shelter, Carthage, Shawnee	17.5	18	Marra et al. [76]
Alabama	L	Alamo, Kanlow	18.9	23.5	Sladden et al. [74]
	U	Blackwell, CIR, Kansas, Pathfinder, Summer, Trailblazer	11.8	15.4	
Arkansas	L	Alamo, SL931, SL932, SL941, NL931, NL942	3.04	4.28	Cassida et al. [41]
	U	Caddo, NU9472, SU941	0.92	2.5	
Louisiana	L	Alamo, SL931, SL932, SL941, NL931, NL942	8.65	14	Cassida et al. [41], Kim et al. [37], Pitman [98]
Mississippi	L	Alamo, Kanlow	5	7.8	Shankle and Garrett [99]
	U	Shawnee, CIR	3.59	3.7	
Oklahoma	L	Alamo, Kanlow, PMT279	2.95	26.4	Kim et al. [37], Guretzky et al. [100], Thomason et al. [101], Kering et al. [54]
	U	CIR, Black, LSHY, Caddo	5	21	Fuentes and Taliaferro [102], Makaju et al. [103], Mosali et al. [104], Aravindhakshan et al. [105]
Texas	L	Alamo, Kanlow, SL931, SL932, SL941, NL931, NL942	1.9	39.29	Cassida et al. [41], Kim et al. [37], Sanderson et al. [78]
	U	CIR, Blackwell, Caddo, NU9472, SU941	3.51	6.98	Kiniry et al. [75]

Table S2. Summary of soil characteristics (0-30 cm depth) measured for switchgrass production studies conducted in Ohio, Kansas, and Oklahoma, USA. SOC indicates soil organic carbon in soil; TN indicates total nitrogen in soil.

Site	Latitude, Longitude	Previous land use	Depth cm	Soil characteristics		
				Bulk density (Mg m^{-3})	SOC (%)	TN (g kg^{-1})
Northwest, OH[a]	41°13′49″N, 83°45′34″W	Sod	0-10	1.43	3.54	3.73
			10-20	1.54	2.54	2.72
			20-30	1.61	1.99	2.23
Jackson, OH[a]	39°1′39″N, 82°36′17″W	Cool season grasses	0-10	1.40	1.96	2.02
			10-20	1.52	1.34	1.49
			20-30	1.58	0.99	1.1
Western, OH[a]	39°51′21″ N, 83°40′40″W	Corn-Soybean rotation	0-10	1.55	1.63	1.54
			10-20	1.63	1.19	1.15
			20-30	1.66	1.06	1.07
Troy, KS[b]	39°47′N, 95°12′W	Soybean	0-15	1.44[d]	3.20	0.09
			15-30	1.44[d]	2.70	0.03
Manhattan, KS[b]	39°11′N, 96°35′W	Soybean	0-15	1.53[d]	2.50	0.063
			15-30	1.53[d]	2.30	0.010
Ardmore, OK[c]	34°10′N, 97°8′W	Bermudagrass and Crabgrass	0-15	1.50[d]	2.20	0.50
Waurika, OK[c]	34°10′N, 97°47′W	Wheat	0-15	1.50[d]	1.60	7.20

[a] Jung and Lal [52]

[b] Propheter et al. [53]

[c] Kering et al. [54]

[d] Web Soil Survey [44]

Table S3. Key ALMANAC plant parameters for switchgrass lowland and upland ecotypes.

Parameters		Switchgrass	
ALMANAC	Description	Lowland	Upland
DMLA	Maximum leaf area index (LAI)	12	2.5, 6
DLAI	Fraction of season when LAI starts to decline	0.7	0.7
HMX	Maximum crop height (m)	2.5	1.3
TB	Optimal temperature for plant growth	25	25
TG	Minimum temperature for plant growth	12	12
PHU	Potential heat use	1100-3000	900-2500

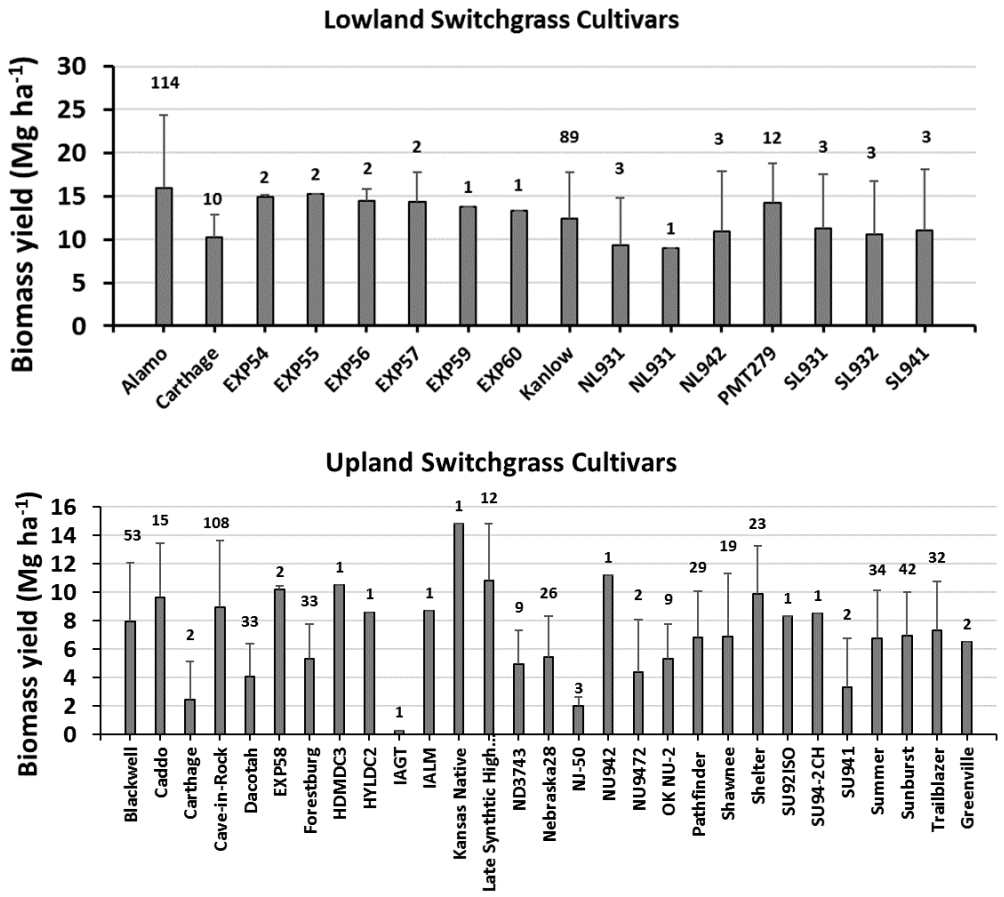

Figure S1. Biomass yields for lowland and upland cultivars of switchgrass. Grey bar indicates the mean yield value for each cultivar. Upper bar indicates standard deviation for each cultivar. Number above cap of bar indicates the number of observations for each cultivar.

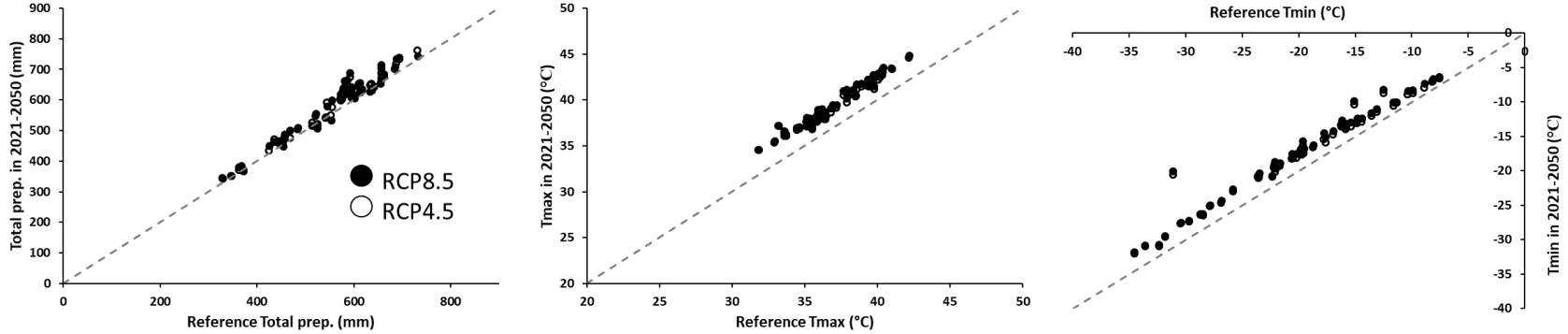

Figure S2. Changes in mean total precipitation (April – September), Tmax, and Tmin for the reference period (1976–2005) and two RCP scenarios (RCP4.5 and RCP8.5) in the future period (2021–2050) across study areas. Empty circle, RCP4.5, mean value of eight GCMs in future period (2021-2050). Dark circle, RCP8.5, mean value of eight GCMs in future period (2021-2050).

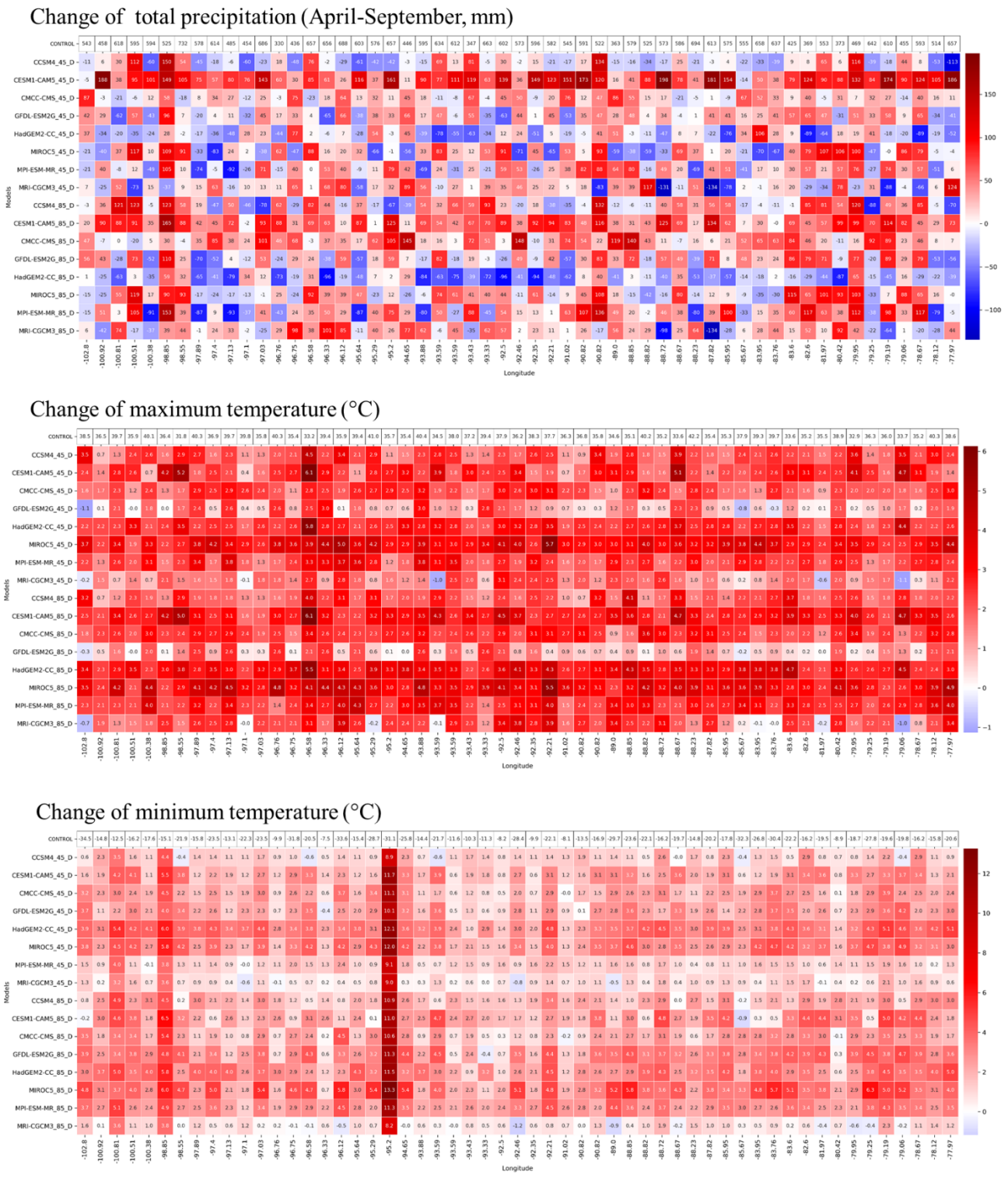

Figure S3. Changes of total precipitation (April- September, mm), and maximum and minimum temperatures (°C) of future period (2021-2050) as simulated by 8 climate models under RCP4.5 and 8.5 pathways from reference period (1976-2005) across all study areas. Values in control rows show the total precipitation and maximum and minimum temperatures in reference period (1976-2005).

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