

Supplementary Material:

**Table S1.** Temperature and precipitation change in Southeastern USA by the end of the 21st century [55]

Timeline	Temperature Change	Precipitation Change	Remarks
<b>By 2099</b> (started as early 1895, 1930, 1960s)	-2°C to 6°C	-30% to +35%	Meta-analysis
<b>By 2099</b> (historical base: 1950-2005)	2.5°C	No change (0%)	From GCM analysis (median: 50 <sup>th</sup> percentiles)
<b>By 2099</b> (historical base: 1950-2005)	-2°C to 6°C	-75% to 110%	From GCM analysis (5 <sup>th</sup> and 95 <sup>th</sup> percentiles)
<b>By 2099</b> (historical base: 1950-2005)	-3°C to 4°C	-40% to +40%	From GCM analysis (25 <sup>th</sup> and 75 <sup>th</sup> percentiles)

**Table S2.** Temperature and precipitation change in Florida & Southeastern USA by the end of the 21st century [54]

Timeline	Temperature Change	Precipitation Change	Remarks
<b>By 2099</b> (started as early as 1860 (temperature.) and 1895 (precipitation))	-3°C to 6°C (9 scenarios: +1°C)	-40% to +30% (7 scenarios: +10%)	Meta-analysis (32 studies)
<b>By 2099</b> (base: slightly before 2000)	1°C to 6°C (FL)	-12.5% to +20% (FL:1970-2050)	Scenario plots (spatial scenario plot)
<b>By 2099</b> (base: slightly before 2000)	1°C to 6°C (FL)	-20% to +30% (FL)	Scenario plots (temporal scenario plot: annual/diurnal/daily)

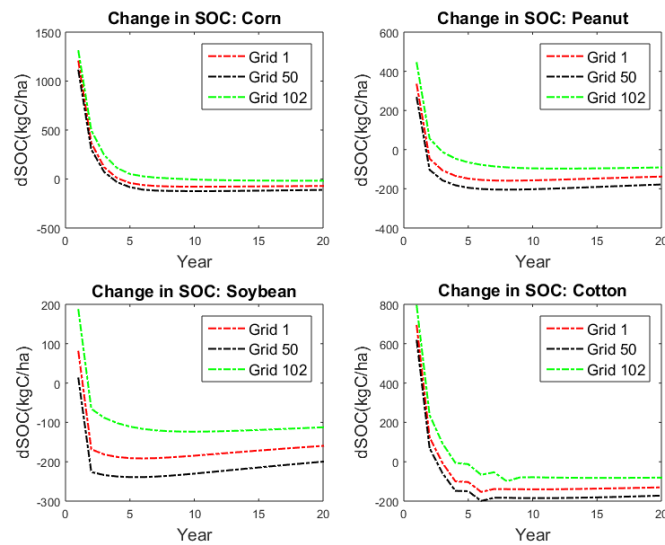
**Table S3.** Global temperature and CO<sub>2</sub> changes under Representative Concentration Pathways (RCPs) by the end of the 21st century [11,56]

RCP Scenarios	Mean CO <sub>2</sub> Concentration (projected for 2100)	Temperature Changing range	Mean Change in temperature (2081-2100), base: 1986-2005	Scenario Generation
RCP 2.6/ECP 3PD	421	0.3-1.7	1.0	
RCP 4.5/ECP 4.5	538	1.1-2.6	1.8	1.5, 3
RCP 6/ ECP 6	670	1.4-3.1	2.2	
RCP 8.5/ ECP 8.5	936	2.6-4.8	3.7	3, 4.5, 6

Note: (RCP 2.6 and RCP 6) were omitted from the scenario generation step in this study, as the associated CO<sub>2</sub> concentrations were in between the considered three levels. Which would have increased the numbers of scenarios without providing variations from the considered scenarios

**Table S4.** Sources of scenarios regarding nutrient management (fertilizer, manure), residue incorporation, and reduced tillage

Management Scenarios	Definition	References
<b>Baseline</b>	Conventional Tillage+15% residue+ Conventional dose of Mineral Fertilizer	[63]
<b>Manure Incorporation</b>	Addition of 2000 kgC/ha and 1000 kgC/ha farmyard manure with the conventional system	[36,37,63]
<b>80% Residue incorporation</b>	Incorporation of 80% above ground residue (Normal incorporation is approx. 15%)	[36]
<b>50% fertilizer+ 1000 kgC/ha manure</b>	Replacement of 50% of Conventional fertilizer with 1000 kg C/ha Manure	[63]
<b>No-till</b>	Conversion to No-till (Mulching) with different above-ground residue incorporation rates (15% and above)	[35, 62, 64 ]



**Figure S1.** Impact of the 20 years spin-up time in establishing SOC equilibrium on three example grids from the regional runs

**Table S5.** The median changes of grain yields, N<sub>2</sub>O, CO<sub>2</sub> and GWPs rates for four major crops of the Choctawhatchee Basin

Grain Yield					N <sub>2</sub> O				
Scenarios	Corn	Soybean	Cotton	Peanut	Scenarios	Corn	Soybean	Cotton	Peanut
Unit (% change)	%	%	%	%	Unit (% change)	%	%	%	%
80% residue	3.4	0.2	16.7	0.0	80% residue	20.9	42.1	17.1	40.9
500 kgC/ha Man.	5.8	0.1	39.1	0.0	500 kgC/ha Man.	16.5	52.6	20.0	54.5
1000 kgC/ha Man.	10.5	0.2	59.5	0.0	1000 kgC/ha Man.	30.4	105.3	41.4	213.6
2000 kgC/ha Man.	16.3	0.2	78.8	0.0	2000 kgC/ha Man.	61.4	231.6	92.9	213.6
50% fert.+ Man.	-4.8	0.2	38.4	0.0	50% fert.+ Man.	-20.9	105.3	-7.1	100.0
No-till-15% res.	7.2	-1.4	33.9	0.0	No-till-15% res.	25.3	-5.3	7.1	18.2
No-till-50% res.	6.9	1.1	36.5	0.0	No-till-50% res.	53.2	42.1	37.1	59.1

CO <sub>2</sub>					GWP				
Scenarios	Corn	Soybean	Cotton	Peanut	Scenarios	Corn	Soybean	Cotton	Peanut
Unit (NB)	kg CO <sub>2</sub> eq./ha	kg CO <sub>2</sub> eq./ha	kg CO <sub>2</sub> eq./ha	CO <sub>2</sub> kg eq./ha	Unit (NB)	kg CO <sub>2</sub> eq./ha	kg CO <sub>2</sub> eq./ha	kg CO <sub>2</sub> eq./ha	kg CO <sub>2</sub> eq./ha
80% residue	897	398	416	378	80% residue	765	362	368	340
500 kgC/ha Man.	265	285	293	279	500 kgC/ha Man.	151	238	228	222
1000 kgC/ha Man.	522	554	566	545	1000 kgC/ha Man.	313	463	440	449
2000 kgC/ha Man.	1001	1067	1092	1054	2000 kgC/ha Man.	575	880	812	855
50% fert.+ Man.	519	554	561	545	50% fert.+ Man.	689	463	595	449
No-till-15% res.	10	126	51	133	No-till-15% res.	-170	131	28	115
No-till-50% res.	315	255	205	257	No-till-50% res.	-64	217	88	199