The impact of climate change on agricultural net revenue:

a case study in the Fouta Djallon, West Africa

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ONLINE APPENDIX

Appendix A: Survey instrument

Agriculture Survey

Stephen Wood

Country:	Region:
Village:	Main Language:
Topography: Flat Hilly Mountainous (choose one)	

I) How many households are in the community?
II) How long does it take to get to the closest market?
III) How much does it cost to get there?
IV) What is the quality of the road between the village and the market? (good, average, bad)

Household questions

1) What ethnic group does the household belong to?

2) How many people are in the household?
3) How many people in the household do agriculture work?
4) How many children in the household go to school?

5) Does the head of household earn money outside of agriculture?
    a. What does he do?
    b. How much does he earn each month from this activity?

Agriculture production questions

6) How old is the head of household?
7) What crops did you grow last year?
8) How many ropes did you farm of each?
9) Did you buy any fertilizer last year?
    a. How much did a sack of urea cost?
    b. How many sacks of urea did you buy?
    c. How much did a sack of NPK cost?
    d. How many sacks of NPK did you buy?
    e. What crops did you use fertilizer on?
10) Did you buy herbicide last year?
    a. How many bottles?
    b. How much did a bottle cost?
    c. What crops did you use herbicide on?
11) Did you buy insecticide last year?
    a. How many bottles?
    b. How much did a bottle cost?
    c. What crops did you use insecticide on?

12) Did you use a plow last year?
    a. For which crops?
    b. Do you own the cows you used to plow?
    c. If not, did you have to pay to use them?
        i. How much did you pay?
    d. Did you have to train them last year?
        i. How long did that take?
    e. Do you own your plow?
        i. How much did it cost?
        ii. How long have you had it?
    f. If not, did you have to pay to borrow the machine? How much?

13) Is all or part of your farm on a hill?
    a. What direction does the field face?
    b. What crops do you farm on the slope?
    c. Is erosion a problem?
        i. How bad is it? (very bad, bad, slightly bad, not bad)

14) Did you hire farm labor last year?
    a. For how long did the person work for you?
    b. How much did you pay them?

15) If you want to hire agriculture labor at the beginning of the rainy season, how much would you pay per day?
16) If you want to hire agriculture labor at the end of the rainy season, how much would you pay per day?

17) Did you help anyone else with their work last year?
    a. How many days of work did you do for other people?
    b. How much did you make for the whole year?

Fonio

18) If you didn't grow fonio last year, why not?
19) Which varieties did you grow last year?
20) Are there other varieties that you didn't grow?
    a. Why didn't you grow them?
    b. Where do they grow these varieties?

21) How many sacks did you harvest?
22) How much seed did you use to grow this much?

23) What sort of soil did you grow fonio on last year?
24) How many days did you spend seeding your fonio?
25) Did you weed your fonio?
    a. How many days did you spend weeding?
26) How many days did you spend harvesting?

27) How many *kile* did you have last year for fonio?
    a. How many people came?
    b. Did you pay people?
        i. How much did you pay?

28) How much unpounded fonio did you sell last year?
29) What was the price?
30) When did you sell?
31) How much did you earn?
32) How much pounded fonio did you sell last year?
33) How long did it take you to pound?
34) What was the price?
35) When did you sell?
36) How much did you earn?
37) Where did you sell the fonio?

38) How often do you eat fonio in your home?
39) What is the main reason for choosing to eat fonio?
40) How long does it take you to eat a sack of fonio?

Corn

41) If you didn't grow corn last year, why not?

42) Are there traditional corn varieties?
43) Did you grow them last year?
    a. Why did you choose them?
44) If not, why not?
    a. If you had them, would you have grown them?
45) Where do they grow these varieties?

46) How many sacks did you harvest last year?
47) What sort of soil did you grow corn on last year?
48) How many days did you spend seeding your corn?
49) Did you weed your corn?
    a. How many days did you spend weeding?
50) How many days did you spend harvesting?
51) How many *kile* did you have last year for corn?
    a. How many people came?
    b. Did you pay people?
        i. How much did you pay?
52) Did you sell any corn last year?
    a. Where did you sell it?
    b. When did you sell it?
    c. How much did you sell?
    d. What was the price?
    e. How much did you earn?

Sorghum/Millet

53) If you didn't grow millet last year, why not?

54) Are there traditional millet varieties?
55) Did you grow them last year?
    a. Why did you choose them?
56) If not, why not?
    a. If you had them, would you?
57) Where do they grow these varieties?

58) How many sacks did you harvest last year?
59) What sort of soil did you grow millet on last year?
60) How many days did you spend seeding your millet?
61) Did you weed your millet?
    a. How many days did you spend weeding?
62) How many days did you spend harvesting?
63) How many *kile* did you have last year for millet?
    a. How many people came?
    b. Did you pay people?
        i. How much did you pay?
64) Did you sell any millet last year?
    a. Where did you sell it?
    b. How much did you sell?
    c. What was the price?
    d. How much did you earn?

Peanuts

65) If you didn't grow peanuts last year, why not?

66) Are there traditional peanut varieties?
67) Did you grow them last year?
    a. Why did you choose them?
68) If not, why not?
    a. If you had them, would you?
69) Where do they grow these varieties?

70) How many sacks did you harvest?
71) What sort of soil did you grow peanuts on last year?
72) How many days did you spend seeding your peanuts?
73) Did you weed your peanuts?
    a. How many days did you spend weeding?
    b. How many times did you weed?
74) How many days did you spend harvesting?
75) How many days did you spend taking them off the vine?
76) How many *kile* did you have last year for peanuts?
    a. How many people came?

b. Did you pay people?
    i. How much did you pay?

77) Did you sell any peanuts last year?
    a. How much did you sell?
    b. Were they shelled?
    c. Where did you sell it?
    d. What was the price?
    e. How much did you earn?

Rice

78) If you didn't grow rice last year, why not?

79) Are there traditional rice varieties?
80) Did you grow them last year?
    a. Why did you choose them?
81) If not, why not?
    a. If you had them, would you?
82) Where do they grow these varieties?

83) Did you grow 'upland' or 'flood' rice?
84) How many sacks did you harvest?
85) What sort of soil did you grow rice on last year?
86) How many days did you spend seeding your rice?
87) Did you weed your rice?
    a. How many days did you spend weeding?
    b. How many times did you weed?
88) How many days did you spend harvesting?
89) How many *kile* did you have last year for rice?
    a. How many people came?
    b. Did you pay people?
        i. How much did you pay?
90) Did you sell any rice last year?
    a. Where did you sell?
    b. How much did you sell?
    c. What was the price?
    d. How much did you earn?

Cotton

91) If you didn't grow cotton last year, why not?
92) How many sacks did you harvest?
93) How much did you pay for the seed?
94) What sort of soil did you grow cotton on last year?
95) How many days did you spend seeding your cotton?
96) Did you weed your cotton?
    a. How many days did you spend weeding?
97) How many days did you spend harvesting?

98) How much did you sell?
99) How much did you earn?

Other questions

100) Do you have cattle?
   a. How many buckets of milk did you get last year from your cattle?
   b. How many did you sell?
   c. How much did you make?
101) Did you inoculate your cows?
   a. How much did it cost you?
102) Did you sell any livestock last year?
   a. How much did you make?
103) Did you slaughter any?
   a. How many? Which type?

104) Do you have any useful trees on your farm?
   a. What types?

105) How many months of rain did you receive last year?
106) Was last year hot, very hot, or an okay temperature?

107) Have you noticed any long term changes in the temperature on your farm?
   a. What steps are you taking on your farm to deal with this change in temperature?
   b. What do you think caused this change ?
108) Have you noticed any long term changes in rainfall on your farm?
   a. What steps are you taking on your farm to deal with this change in precipitation?
   b. What do you think caused this change ?

109) What caste does the family belong to?

Appendix B: Full regression models and results

Table A1. *Quadratic regressions*

	(1)	(2)	(3)	(4)	(5)
		All Seasons		Rainy / Dry	
	Station/Station	SSMI / ARTES	SSMI / Station	SSMI / ARTES	SSMI / Station
VARIABLES			Net Revenue		
ssmi_win		-2.993e+06	-6.116e+06		
		(8.505e+06)	(7.755e+06)		
ssmi_win_sq		55,923	126,096		
		(209,877)	(181,867)		
ssmi_spr		-969,174	360,022		
		(6.407e+06)	(7.777e+06)		
ssmi_spr_sq		21,851	-4,630		
		(124,905)	(143,410)		
ssmi_sum		-8.247e+06*	-6.901e+06		
		(4.885e+06)	(5.324e+06)		
ssmi_sum_sq		154,561	132,928		
		(100,542)	(103,120)		
ssmi_fall		2.158e+07	2.130e+07		
		(2.865e+07)	(2.039e+07)		
ssmi_fall_sq		-463,500	-458,461		
		(660,158)	(455,753)		
artes_aut_sq		-58.83			
		(138.0)			
roadQuality	30,708	48,120**	43,844	44,067*	39,564
	(23,144)	(23,236)	(27,236)	(23,026)	(24,661)
timeToClosestMarket		1,408**	1,322**		
		(534.7)	(572.5)		
Distance	-0.454	-0.926		-0.400	-0.358
	(0.413)	(0.914)		(0.576)	(0.518)
pplInHH	9,667**	8,328*	10,028***	8,966*	9,184*
	(4,745)	(4,953)	(3,775)	(5,124)	(5,186)
lowSoil	71,697	81,175		77,883	79,392
	(49,544)	(51,494)		(51,921)	(51,113)
farmArea	6,788***	6,049***	5,757*	5,675***	5,702***
	(1,979)	(1,720)	(3,142)	(1,665)	(1,784)
tempStationSq	908.2**				
	(371.4)				
meanStationPrecip	-8,816***				
	(2,931)				
precipStationSq	3.952***		0.0666		0.172
	(1.314)		(0.643)		(0.104)
ssmi_rainyseason				-353,026	-435,657
				(863,979)	(835,714)
ssmi_rainyseason_sq				2,246	8,794
				(15,631)	(16,428)
ssmi_dryseason				-171,064	-1.504e+06
				(2.101e+06)	(1.674e+06)
ssmi_dryseason_sq				10,846	31,639
				(42,615)	(35,877)
artes_rainyseason_sq				-56.51*	
				(33.49)	
Constant	4.088e+06***	-9.158e+07	-9.219e+07	7.212e+06	2.294e+07*
	(1.342e+06)	(2.492e+08)	(1.729e+08)	(1.584e+07)	(1.279e+07)
Observations	91	91	92	91	91
R-squared	0.319	0.401	0.344	0.340	0.336

Robust standard errors reported in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2. *Full socio-economic variables, including number of kids in school and age of farmer*

	(1)	(2)	(3)	(4)	(5)
		All Seasons		Rainy / Dry	
	Station / Station	SSMI / ARTES	SSMI / Station	SSMI / ARTES	SSMI / Station
			Net Revenue		
ssmi_win		218,494**	438,027**		
		(108,463)	(186,442)		
ssmi_spr		69,893	-265,285		
		(91,840)	(195,583)		
ssmi_sum		-471,901	-87,102		
		(292,473)	(118,985)		
ssmi_fall		457,048	99,775		
		(477,821)	(351,172)		
artes_sum		-28,325*			
		(15,392)			
roadQuality	28,399	48,688**	46,124*	50,333**	28,263
	(25,091)	(23,951)	(26,510)	(24,624)	(23,832)
Distance	-0.139	-0.200	-0.413	-0.471	-0.395
	(0.461)	(0.604)	(0.578)	(0.425)	(0.433)
lowSoil	106,094*	74,483	78,230	69,068	74,018
	(56,177)	(52,390)	(51,900)	(50,451)	(51,002)
pplInHH	11,199	10,021	10,636	11,121	11,010
	(7,733)	(7,214)	(7,156)	(6,700)	(7,213)
kidsInSchool	-2,479	-3,017	-3,567	-5,054	-1,676
	(16,417)	(15,832)	(15,812)	(14,603)	(15,955)
age	-2,065	-1,157	-1,409	-615.4	-1,431
	(2,259)	(2,205)	(2,280)	(1,946)	(2,190)
farmArea	6,837***	6,092***	5,887***	6,251***	7,322***
	(2,076)	(1,727)	(1,688)	(1,717)	(1,963)
meanStationTemp	-20,025*				
	(10,611)				
meanStationPrecip	-533.7*		953.8		-168.4
	(305.6)		(592.1)		(299.3)
ssmi_rainyseason				-294,340**	-37,049
				(114,875)	(32,497)
ssmi_dryseason				441,133***	122,369***
				(147,606)	(45,762)
artes_rainyseason				-23,178**	
				(9,875)	
Constant	1.316e+06*	-1.249e+06	-3.122e+06	1.097e+06	-1.526e+06
	(728,786)	(2.597e+06)	(3.533e+06)	(1.519e+06)	(1.316e+06)
Observations	90	90	90	90	90
R-squared	0.257	0.346	0.340	0.340	0.309

Robust standard errors reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A3. *Log response variable*

	(1)	(2)	(3)	(4)	(5)
		All Seasons		Rainy / Dry	
	Station / Station	ARTES / SSMI	SSMI / Station	SSMI / ARTES	SSMI / Station
			ln(Net Revenue)		
ssmi_win		0.654**	1.274*		
		(0.294)	(0.657)		
ssmi_spr		0.235	-0.801		
		(0.338)	(0.741)		
ssmi_sum		-1.691	-0.243		
		(1.062)	(0.435)		
ssmi_fall		1.702	0.237		
		(1.720)	(1.318)		
artes_sum		-0.102*			
		(0.0576)			
roadQuality	0.0702	0.144*	0.132	0.146*	0.0731
	(0.0825)	(0.0823)	(0.0904)	(0.0833)	(0.0780)
Distance	-1.60e-07	-1.14e-07	-9.53e-07	-1.21e-06	-7.71e-07
	(1.58e-06)	(2.17e-06)	(2.18e-06)	(1.54e-06)	(1.60e-06)
lowSoil	0.569***	0.483***	0.497***	0.459***	0.482***
	(0.154)	(0.158)	(0.157)	(0.151)	(0.151)
pplInHH	0.0293	0.0260	0.0278	0.0284	0.0305
	(0.0194)	(0.0185)	(0.0184)	(0.0184)	(0.0185)
farmArea	0.0293***	0.0270***	0.0262***	0.0273***	0.0303***
	(0.00784)	(0.00702)	(0.00720)	(0.00666)	(0.00776)
meanStationTemp	-0.0444*				
	(0.0266)				
meanStationPrecip	-0.00114*		0.00284		-0.000393
	(0.000621)		(0.00213)		(0.000825)
ssmi_rainyseason				-0.968**	-0.0957
				(0.452)	(0.0889)
ssmi_dryseason				1.358**	0.290**
				(0.531)	(0.114)
artes_rainyseason				-0.0763**	
				(0.0375)	
Constant	13.90***	8.153	3.535	16.91***	7.650**
	(1.566)	(9.272)	(12.53)	(5.769)	(3.561)
Observations	89	89	89	89	89
R-squared	0.300	0.368	0.357	0.361	0.329

Robust standard errors reported in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A4. *Wage rate excluded*

	(1)	(2)	(3)	(4)	(5)
		All Seasons		Rainy / Dry	
	Station / Station	SSMI / ARTES	SSMI / Station	SSMI / ARTES	SSMI / Station
			Net Revenue (no wage rate)		
ssmi_win		199,447**	428,679**		
		(94,830)	(175,131)		
ssmi_spr		98,604	-247,673		
		(63,520)	(179,287)		
ssmi_sum		-454,117	-64,189		
		(288,352)	(99,001)		
ssmi_fall		410,926	51,631		
		(468,021)	(310,973)		
artes_sum		-28,723*			
		(15,102)			
roadQuality	22,523	44,356**	42,915*	44,901**	23,851
	(23,535)	(22,069)	(24,890)	(22,198)	(21,688)
Distance	-0.0863	-0.241	-0.454	-0.477	-0.379
	(0.445)	(0.585)	(0.538)	(0.419)	(0.424)
lowSoil	122,265**	81,092	84,571*	74,916	81,165
	(54,604)	(50,720)	(50,140)	(47,697)	(49,009)
pplInHH	9,492*	8,740*	9,188*	9,280*	9,871*
	(5,399)	(4,976)	(4,923)	(4,878)	(4,973)
farmArea	6,965***	6,220***	6,009***	6,363***	7,707***
	(2,095)	(1,724)	(1,709)	(1,684)	(2,041)
meanStationT	-16,999*				
	(8,888)				
meanStationP	-451.3		996.3*		-61.00
	(272.2)		(553.4)		(221.3)
ssmi_rainysea				-302,082***	-26,640
				(107,231)	(24,490)
ssmi_dryseas				450,356***	118,000***
				(139,094)	(42,349)
artes_rainysea				-23,717**	
				(9,165)	
Constant	1.047e+06*	-1.021e+06	-3.002e+06	1.166e+06	-1.885e+06*
	(584,848)	(2.497e+06)	(3.282e+06)	(1.385e+06)	(972,579)
Observations	93	93	93	93	93
R-squared	0.243	0.346	0.340	0.342	0.305

Robust standard errors reported in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A5. *Square farm area*

	(1)	(2)	(3)	(4)	(5)
		All Seasons		Rainy / Dry	
	Station / Station	SSMI / ARTES	SSMI / Station	SSMI / ARTES	SSMI / Station
			Net Revenue		
ssmi_win		194,039**	366,676**		
		(97,359)	(169,495)		
ssmi_spr		88,747	-173,932		
		(63,615)	(171,309)		
ssmi_sum		-333,708	-29,571		
		(302,297)	(96,868)		
ssmi_fall		228,173	-56,312		
		(495,794)	(310,643)		
artes_sum		-22,198			
		(15,636)			
roadQuality	23,673	45,269*	44,286*	46,220*	25,209
	(24,379)	(23,329)	(26,253)	(23,523)	(22,677)
Distance	-0.135	-0.379	-0.553	-0.489	-0.407
	(0.451)	(0.616)	(0.553)	(0.427)	(0.430)
lowSoil	113,745**	75,949	78,300	68,801	76,258
	(55,369)	(51,712)	(51,452)	(48,607)	(50,104)
pplInHH	9,320*	8,799*	9,156*	9,272*	9,774*
	(5,501)	(5,161)	(5,117)	(4,993)	(5,108)
farmArea	17,370**	13,527**	14,541**	14,222**	16,716**
	(6,782)	(6,325)	(6,017)	(6,076)	(6,443)
farmArea_sq	-247.9*	-176.2	-203.5*	-183.9	-217.5*
	(133.0)	(129.0)	(122.0)	(120.8)	(124.0)
meanStationTemp	-17,598**				
	(8,610)				
meanStationPrecip	-457.8*		761.0		-78.21
	(264.1)		(535.8)		(226.0)
ssmi_rainyseason				-284,516**	-28,789
				(108,280)	(24,472)
ssmi_dryseason				428,597***	118,050***
				(138,734)	(42,091)
artes_rainyseason				-22,207**	
				(9,268)	
Constant	1.041e+06*	-373,076	-1.851e+06	945,020	-1.841e+06*
	(569,993)	(2.695e+06)	(3.345e+06)	(1.442e+06)	(1.041e+06)
Observations	91	91	91	91	91
R-squared	0.264	0.354	0.351	0.351	0.320

Robust standard errors reported in parentheses
*** p<0.01, ** p<0.05, * p<0.1