Supplementary Materials

Table S1: Summary statistics of variables in the ordered logit model

Variable	Definition	Mean (S.E)
Dependent variable		
FISlevel	0=food secure household	0.28 (0.02)
	1=mildly food insecure	0.28 (0.02)
	2=moderately food insecure	0.21 (0.18)
	3=severely food insecure	0.24 (0.19)
Explanatory variables		
Vin	Vulnerability indices	0.43 (0.10)
Y_log	Logarithm of household annual income	13.07 (0.95)
Mstat	0 = single (omitted base group)	0.09 (0.01)
	1= married	0.77 (0.02)
	2= others	0.13 (0.02)
Saving	=1 if household saves, 0 otherwise	0.56 (0.02)
Non_farm_wk	=1 if household is engaged in non - farm work, 0 otherwise	0.38 (0.02)
Dep_ratio	Dependency ratio	3.27 (1.60)
Store_food	=1 if household store food, 0 otherwise	0.59 (0.02)
Receive_help	=1 if household receive help from family and friends during difficult times, 0 otherwise	0.46 (0.02)
Farmsize	Total farm size cultivated (hectares)	0.31 (0.49)
Age	Age of household head (years)	47.75 (12.60)
HHsize	Household size	7.42 (2.55)
State	0=Rivers (omitted base group);	0.51 (0.02)
Livelihood group	1=Bayelsa	0.50 (0.02)
	0=Farming households (omitted base group); 1=Fishing households	

Source: Field survey (2008)

Table S2: Correlation Matrix Between Food Security and Vulnerability Index

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. pwcorr FIES E SEN AC, star (5)

                 |     FIES        E      SEN       AC
-----------------+--------------------------------------
            FIES |   1.0000
               E |   0.2079*   1.0000
             SEN |   0.0689  -0.1506*   1.0000
              AC |  -0.3428*   0.1993* -0.1775*   1.0000

. pwcorr FIES CS RC ED SD LI SN, star (5)

                 |     FIES       CS       RC       ED       SD       LI       SN
-----------------+---------------------------------------------------------------
            FIES |   1.0000
              CS |   0.0196    1.0000
              RC |   0.2812*   0.2802*   1.0000
              ED |   0.1618*   0.4203*   0.3445*   1.0000
              SD |   0.0768    0.0791    0.1979*   0.1792*   1.0000
              LI |  -0.3767*   0.2274*  -0.0399    0.0923*  -0.0103    1.0000
              SN |  -0.3561*   0.1854*  -0.1198*   0.1496*   0.0469    0.5281*   1.0000

. pwcorr FIES agresive_land violent_conflict feel_insecure loss_conflict_dummy remittance access_credit
>  dummyincome_exp diversityn memb_asso ext_support information_access cooperation, star (5)

                 |     FIES agresi~d viole~ct feel_i~e loss_c~y remi~nce acces~it
-----------------+---------------------------------------------------------------
            FIES |   1.0000
     agresive_l~d |   0.2205*   1.0000
     violent_co~t |   0.1061*   0.4691*   1.0000
     feel_insec~e |   0.2150*   0.3223*   0.1281*   1.0000
     loss_confl~y |   0.2423*   0.2897*   0.4210*   0.2006*   1.0000
        remittance |  -0.0990*   0.0538    0.1546*  -0.0779    0.1054*   1.0000
     access_cre~t |   0.0749    0.1139*   0.1276*   0.0487    0.1715*   0.2206*   1.0000
     dummyincom~p |  -0.5110*  -0.1347*   0.0124   -0.2708*  -0.1264*   0.1927*  -0.0145
        diversityn |  -0.2840*  -0.0830    0.0037   -0.2448*  -0.1112*   0.1735*  -0.0478
         memb_asso |  -0.1343*   0.0770    0.0704   -0.0213    0.0517    0.1566*   0.1630*
       ext_support |  -0.3160*   0.0044    0.1854*  -0.1734*  -0.0072    0.2360*   0.1778*
     informatio~s |   0.0366    0.0047   -0.2108*   0.1328*  -0.3327*  -0.0966*   0.0386
       cooperation |  -0.3019*  -0.1122*   0.1157*  -0.2452*  -0.1014*   0.1711*   0.0029

                 |   dummyi~p diver~yn memb_a~o ext_su~t inform~s cooper~n
-----------------+------------------------------------------------------
     dummyincom~p |   1.0000
        diversityn |   0.3363*   1.0000
         memb_asso |   0.0604    0.0930*   1.0000
       ext_support |   0.4179*   0.3006*  -0.0101    1.0000
     informatio~s |  -0.0425   -0.0971*  -0.0186   -0.1613*   1.0000
       cooperation |   0.4940*   0.4365*   0.0464    0.4948*  -0.1002*   1.0000

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Table S3: Food Insecurity Questionaire

J1. In the past 4 weeks, were you worried your household would run out of food because of lack of money or other resources?
0 = No (Skip to J2) 1 = Yes

J1a. How often did this happen in the past 4 weeks?
0 = rarely (1–2 times)
1 = Sometimes (3–10 times)
2 = Often (more than 10 times)

J2. In the past 4 weeks were you or any member of your household unable to eat healthy and nutritional food because of lack of money or other resources?
0 = No (Skip to J3) 1 = Yes

J2a. How often did this happen in the past 4 weeks
0 = rarely (1–2 times)
1 = Sometimes (3–10 times)
2 = Often (more than 10 times)

J3. In the past four weeks did you or any member of your household have to eat only few kinds of food because of lack of money or other kinds of resources?
0 = No (Skip to J4) 1 = Yes

J3a. How often did this happen in the past 4 weeks
0 = rarely (1–2 times)
1 = Sometimes (3–10 times)
2 = Often (more than 10 times)

J4. In the past 4 weeks did you or any member of your household eat less than they should eat because of lack of money or other resources?
0 = No (Skip to J5) 1 = Yes

J4a. How often did this happen in the past 4 weeks
0 = rarely (1–2 times)
1 = Sometimes (3–10 times)
2 = Often (more than 10 times)

J5. In the past 4 weeks did your household ran out of food because of lack of money or other resources?
0 = No (Skip to J6) 1 = Yes

J5a. How often did this happen in the past 4 weeks
0 = rarely (1–2 times)
1 = Sometimes (3–10 times)
2 = Often (more than 10 times)

J6. In the past 4 weeks did you or any member of your household ever have to skip a meal because there was not enough money or other resources to get food?

0 = No (Skip to J7) 1 = Yes

J6a. How often did this happen in the past 4 weeks

0 = rarely (1–2 times)

1 = Sometimes (3–10 times)

2 = Often (more than 10 times)

J7. In the past 4 weeks did you or any household member go to sleep at night hungry because there was not enough food or other resources?

0 = No (Skip to J8) 1 = Yes

J7a. How often did this happen in the past 4 weeks

0 = rarely (1–2 times)

1 = Sometimes (3–10 times)   2 = Often (more than 10 times)

J8. In the past 4 weeks, did you or any household member go a whole day and night without eating anything at all because there was not enough food and lack of money or other resources?

0 = No (Skip to J9) 1 = Yes

J8a. How often did this happen in the past 4 weeks

0 = rarely (1–2 times)

1 = Sometimes (3–10 times)

2 = Often (more than 10 times)

Table S4: Major components and sub-components used in calculating the composite vulnerability index, definition, rationale for their selection and units of measurement

Major component	Sub-component	Explanation of sub-component	Units	Rationale for selecting
Exposure Climate shocks	Shifts in temperature	% of households that report long term (>=20years) changes in temperature.	Percent	The perception of local people about climate variability offer insights for adaptation (Tambo and Abdoulaye, 2013). High temperatures and heavy rainfall affect crop productivity and fish catch (Kotir, 2011; Sarr, 2012). The resultant effect of reduced crop productivity and fish catch is low income. Hence, losses are used in this study to capture exposure.
	Shifts in rainfall	% of households that report long term (>=20years) changes in rainfall.	Percent	
	Climate related losses	% of households that report losses as a result of climate variability and flood	Percent	
	Number of floods	Average number of floods reported by households from 2012-2017	Count	
Resource Conflict	Involvement in conflict	% of households that report to being involved in conflict related to land and water resource	Percent	Conflict over resource is a stress factor in vulnerability index (Hahn et al. 2009). This is particularly evident in areas where the livelihood depends solely on the resource, as well as where rivers cross boundaries and institutions vested with the power to oversee the use of it is inefficient (Ludwig et al., 2011). Also, conflict sometimes results in injury, losses and sometimes death. It also has some psychological effect on individuals such as fear and feelings of insecurity.
	Others involvement in conflict	% of households that report to have heard about people fighting over land and water in their community	Percent	
	Feelings of insecurity	% of households that report having a feeling of insecurity in the community	Percent	
	Losses/death resulting from conflict	% of households that report to have suffered injury or death of a family member, relation or friend as a result of conflict.	Percent	
Environmental Degradation	Report on water bodies being polluted	% of households that report that their water bodies were being polluted	Percent	Pollution of water bodies and land with oil often leave the environment degraded with fauna and flora destroyed, biodiversity depleted, aquatic life destroyed and all these results in low productivity and income. It also has health implication for the household.
		% of households that report that their lands were being polluted.	Percent	

	Report on land being polluted Pollution related losses	% of households that report losses due to pollution.	Percent	
Sensitivity Current state of health, food and water.	Distance to healthcare facility	% of households that report long distance (>=5km) to the health care facility.	Percent	
	Number of days of illness	Average number of days household head was sick and unable to carry out livelihood activities	Count	
	Dependence on farm for food	% of households who depend on farm as the main source of food	Percent	
	Natural resource as main water source	% of households who report stream/river/creek as the main source of water	Percent	
Physical and natural assets	Quality of house	Aggregate index of quality of house[a*].	Count	Households who live in houses that are of low quality are more likely to be affected by any extreme event such as floods or storm which will in turn disrupt their livelihood (Paavola, 2008; Geest and Warner, 2015). Also, households who are unable to access land or rent land are most likely to be sensitive to climate shocks and conflict situation (Butler and Gates, 2012)
	Land tenure	% of households who do not own or can't access land for agricultural purposes.	Percent	
Adaptive capacity Socio-demographic profile	Adult workforce	% of households with members between 15-60 years of age	Percent	In this study we assume that individuals between the ages of 15-60 are active and can engage in income generating activities. In the literature it's been shown that households which are being headed by male,
	Presence of male headed household	% of households where the head is a male.	Percent	

				have acquired some level of formal education and have some years of experience are less vulnerable to shocks (Scoones, 2009, Chambers 1992)
	Education	% of households where the head had attended at least secondary school	Percent	
	Experience	% of households where head had at least 3 years' experience in farming or fishing	Percent	
Livelihood strategies	Remittance	% of households receiving remittance from household members who live outside.	Percent	Remittances have been reported in the literature as a means of livelihood strategy (Hamza, 2014). Remittance here in in the form of cash and kind. Access to credit enables households to invest in new livelihood activities or enhance the existing ones. Making them less vulnerable to stress. Sufficient income are scaled from 1-3 where 1 =insufficient income to cover basic needs; 2=just enough income to cover basic needs and 3=more than enough income to cover basic needs. Basic needs here refer to needs such as food, water, clothing, shelter, health care and education. The more diverse the household is the less vulnerable they are to stress.
	Access to credit	% of households who were able to access credit in the last five years	Percent	
	Sufficient income	% of households with enough income to cover important expenses	Percent	
	Diversification	Average number of income generating activities households are engaged in.	Count	
Social/political network	Association membership	% of households who belong to some group/association	Percent	Social capital which form part of the adaptive capacity are important assets that households draw upon during difficult times and help reduce vulnerability to climate shocks and other stressors (Baird and Gray, 2014; Thomas et. al, 2005).
	Access to external assistance	% of households living in communities that are able to access external assistance during difficult times	Percent	
	Access to information	% of households that report having access to climate information	Percent	
	Local cooperation	% of households that report enjoying cooperation and support from village folks during difficult times.	Percent	