

“Integrating Social-Ecological and Political-Ecological Models of Agrobiodiversity With Nutrient Management of Keystone Food Spaces to Support SDG 2”

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Supplementary Table 1 Results of Multiple Regression Analyses of the Associations of Social-Ecological Characteristics with Crop Species Agrobiodiversity in Fields (*Chakras*, *Parcelas*) Using Five Additional Biodiversity Indices (see formulas and explanations in Materials and Methods)

Social-Ecological Characteristic	Margalef (Coefficient)	Menhinick (Coefficient)	Simpson Diversity Index (D) (Coefficient)	Simpson Diversity Index (D') (Coefficient)	Modified Shannon Diversity Index (H') (Coefficient)
Extent of total cultivated area (hectares)	0.0001*	0.0001***	-0.00004	-0.00006	-0.00003
Extent of total cultivated area of fields (hectares)	-0.0002**	-0.0001***	0.00003	4.27×10^{-6}	-0.00005
Number of Cultivated Fields (count)	0.103***	0.011**	0.081***	0.334***	0.431***
Elevation of Residence (masl)	0.00005	0.00002	0.00003	0.00001	0.0001
Elevation Range of Fields (masl)	0.0002	0.00003	-0.0003*	-0.0005	-0.0005
Legume Crop Rotation Index (see Table 1)	0.071	0.015	0.066*	0.189	0.212

Garden Presence					
Garden Not Present (reference)	.	.	.	.	.
Garden Present	-0.224***	-0.049***	-0.059	-0.278	-0.431*
Multi-Species Maize Field					
No Multi-Species Maize Field (reference)	.	.	.	.	.
Multi-Species Maize Field Present	0.218***	0.020	0.216***	0.629***	0.917***
Self-Produced Food in Diet	-0.119	-0.033	0.057	0.164	0.044
Traditional Foods in Diet	-0.002	-0.0005	-0.0005	-0.003	-0.006
Dietary Diversity					
MDDW Not Achieved (reference)	.	.	.	.	.
MDDW Achieved	-0.032	-0.010	0.049	0.127	0.137
Household Food Security Status					
Food Insecure (reference)	.	.	.	.	.
Food Secure	-0.022	-0.003	-0.034	-0.158	-0.207
Age (head of household)	-0.0001	-0.00005	0.0006	-0.001	-0.0008
Gender (head of household)					
Male (reference)	.	.	.	.	.
Female	-0.017	-0.008	-0.017	-0.066	-0.095
Ethnicity and Language					

Primary Language Not Quechua (reference)	.	.	.	.	.
Primary Language Quechua	0.067	0.011	0.051	0.096	0.203
Household income (soles/year)	-1.9×10^{-6}	-3.4×10^{-7}	-1.5×10^{-6}	-6.5×10^{-6}	-7.2×10^{-6}
Social capital (sum of indicators)	0.016	0.007**	0.0003	-0.016	-0.005
Geographic sub-area (place)					
Quisqui (reference)	.	.	.	.	.
Amarilis	-0.043	-0.0008	0.008	0.079	0.004
Molino	-0.038	0.005	-0.091*	-0.317*	-0.439*
Level of Education (head of household)					
No Education (reference)	.	.	.	.	.
Incomplete Primary	-0.070	-0.018	-0.031	-0.317	-0.328
Complete Primary	-0.065	-0.014	-0.044	-0.439*	-0.432
Incomplete Secondary	-0.120	-0.014	-0.030	-0.440	-0.479
Complete Secondary	-0.037	-0.010	-0.023	-0.237	-0.265
Post-secondary	1.24***	0.582***	0.308	0.396	1.42
Fields with Chemical Fertilizer Use	0.012	-0.0001	-0.029	-0.037	-0.057
Degree of commercialization (agricultural fields)	-0.0001	1.4×10^{-6}	0.0004	0.003	0.002
Climate and climate change (number adaptations)	-0.0008	-0.002	0.014	0.051	0.049

Agrobiodiversity loss awareness	0.005	0.001	-0.007	-0.002	-0.028
R ²	0.396	0.549	0.438	0.335	0.365

Values are partial regression coefficients from OLS regressions adjusting for the other covariates shown. n = 245 for both models. * $P < 0.05$; * $P < 0.01$;
 *** $P < 0.001$

Supplementary Table 2 Results of Multiple Regression Analyses of the Associations of Social-Ecological Characteristics with Crop Species Agrobiodiversity in Gardens (*Huertos, Huertas*) Using Five Additional Biodiversity Indices (see formulas and explanations in Materials and Methods)

Social-Ecological Characteristic	Margalef (Coefficient)	Menhinick (Coefficient)	Simpson Diversity Index (D) (Coefficient)	Simpson Diversity Index (D') (Coefficient)	Modified Shannon Diversity Index (H') (Coefficient)
Extent of total cultivated area (hectares)	-0.00004	-0.00002	4.2×10^{-6}	6.0×10^{-6}	-0.00002
Extent of total cultivated area of garden (hectares)	0.00002	-0.0002*	-0.00002	-0.0003	-0.00001
Number of Cultivated Fields (count)	0.072	-0.018	0.001	0.433	0.529
Elevation of Residence (masl)	0.0003	0.0002	0.00008	0.0007	0.0009
Elevation Range of Fields (masl)	0.0001	0.0002	-0.00003	-0.002	-0.002
Multi-Species Maize Field					
No Multi-Species Maize Field	.	.	.	.	.
Multi-Species Maize Field Present	-0.156	-0.128	0.009	-0.070	-0.094
Self-Produced Food in Diet (calories self-production)	-1.85	-1.03	-0.283	-4.91	-5.82
Traditional- Foods in Diet (fraction of calories from traditional foods)	0.017	0.005	0.001	0.037	0.060

Dietary Diversity (MDDW)					
MDDW Not Achieved	.	.	.	.	.
MDDW Achieved	-0.229	-0.164	-0.039	0.228	-0.010
Household Food Security Status					
Food Insecure (reference)	.	.	.	.	.
Food Secure	-0.176	-0.122	0.018	0.585	0.274
Age (head of household)	0.016	0.005	0.003*	0.058*	0.073*
Gender (head of household)					
Male (reference)	.	.	.	.	.
Female	0.314	0.151	-0.003	0.320	0.694
Ethnicity and Language					
Primary Language Not Quechua (reference)	.	.	.	.	.
Primary Language Quechua	-0.686*	-0.425*	-0.039	-0.784	-1.29
Household income (soles/year)	0.00002	4.8×10^{-6}	9.0×10^{-7}	0.00005	0.00007
Social capital (sum of indicators)	-0.029	-0.013	-0.008	-0.178	-0.171
Geographic sub-area (place)					

Quisqui (reference)	.	.	.	.	.
Amarilis	-0.178	-0.256	-0.020	0.651	0.675
Molino	0.569	0.408*	0.082	1.83	1.86
Level of Education (head of household)					
No Education (reference)	.	.	.	.	.
Incomplete Primary	0.273	0.158	-0.018	-0.089	0.381
Complete Primary	-0.356	-0.192	-0.025	-1.33	-1.24
Incomplete Secondary	-0.228	-0.096	-0.128	-0.590	-0.525
Complete Secondary	-0.433	-0.285	-0.107	-2.75	-2.35
Post-secondary	1.31	-0.335	0.218	11.2*	12.6*
Degree of commercialization (agricultural fields)	-0.004	-0.002	-0.0008	-0.026*	-0.025
Climate and climate change (number adaptations)	0.016	-0.007	-0.005	0.160	0.188
Agrobiodiversity loss awareness	0.061	0.032	0.011	0.143	0.183
R ²	0.236	0.279	0.202	0.274	0.266

Values are partial regression coefficients from OLS regressions adjusting for the other covariates shown. n = 130 for both models. * $P < 0.05$; * $P < 0.01$; *** $P < 0.001$

Supplementary Table 3. Results of Multiple Regression Analyses of the Associations of Farm Characteristics and Agroecology with Crop Species Agrobiodiversity in Fields (*Chakras, Parcelas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
overall				
farm area	0.000116 (0.0000607)	0.00000695 (0.0000565)	0.000116 (0.056)	0.00000695 (0.902)
area fields	-0.000179** (0.0000618)	-0.0000339 (0.0000573)	-0.000179** (0.004)	-0.0000339 (0.555)
field number	0.282*** (0.0250)	0.186*** (0.0226)	0.282*** (0.000)	0.186*** (0.000)
elevation (residence)	0.0000746 (0.0000803)	0.0000368 (0.0000633)	0.0000746 (0.352)	0.0000368 (0.562)
range_elev (fields)	0.000562 (0.000340)	-0.000362 (0.000291)	0.000562 (0.099)	-0.000362 (0.215)
legume crop rotation index	0.151* (0.0620)	0.138** (0.0487)	0.151* (0.015)	0.138** (0.005)
0.garden (not present)	0 (.)	0 (.)	0 (.)	0 (.)
1.garden (present)	-0.560*** (0.0764)	-0.207*** (0.0621)	-0.560*** (0.000)	-0.207*** (0.001)
0.multi-spp maize0 (not present)		0 (.)	0 (.)	0 (.)
1.multisppmaize (present)	0.471*** (0.0717)	0.401*** (0.0553)	0.471*** (0.000)	0.401*** (0.000)
_cons	0.415 (0.237)	0.0579 (0.186)	0.415 (0.081)	0.0579 (0.755)
MODEL 1				
N		268		
Pseudo-R2		0.156		
MODEL 2				
N			268	
Adj-R2			0.354	

Supplementary Table 4. Results of Multiple Regression Analyses of the Associations of Food Characteristics with Crop Species Agrobiodiversity in Fields (*Chakras, Parcelas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		p-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
self-produced food in diet	-0.138 (0.223)	0.0297 (0.224)	-0.138 (0.536)	0.0297 (0.895)
traditional foods in diet	0.00263 (0.00293)	0.000192 (0.00294)	0.00263 (0.371)	0.000192 (0.948)
0.mddw (not achieved)	0 (.)	0 (.)	0 (.)	0 (.)
1.mddw (achieved)	0.106 (0.0663)	0.0977 (0.0662)	0.106 (0.109)	0.0977 (0.141)
0.food security (not achieved)	0 (.)	0 (.)	0 (.)	0 (.)
1.food security (achieved)	-0.107 (0.0660)	-0.0642 (0.0655)	-0.107 (0.106)	-0.0642 (0.328)
_cons	1.250*** (0.0976)	0.658*** (0.0968)	1.250*** (0.000)	0.658*** (0.000)
MODEL 1				
N		268		
Pseudo-R2		0.0046		
MODEL 2				
N			268	
Adj-R2			-0.0026	

Supplementary Table 5. Results of Multiple Regression Analyses of the Associations of Governance Characteristics with Crop Species Agrobiodiversity in Fields (*Chakras, Parcelas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
age	0.000351	0.00269	0.000351	0.00269
(head)	(0.00211)	(0.00205)	(0.868)	(0.190)
0.gender	0	0	0	0
(male)	(.)	(.)	(.)	(.)
1.gender	0.00950	0.0226	0.00950	0.0226
(female)	(0.0812)	(0.0793)	(0.907)	(0.776)
0.language	0	0	0	0
(not Quechua)	(.)	(.)	(.)	(.)
1.language	0.275***	0.209**	0.275***	0.209**
(Quechua)	(0.0826)	(0.0778)	(0.001)	(0.008)
income	-0.0000103	-0.00000363	-0.0000103	-0.00000363
	(0.00000547)	(0.00000357)	(0.059)	(0.310)
social	0.0516**	0.0242	0.0516**	0.0242
capital	(0.0168)	(0.0170)	(0.002)	(0.156)
1.landscape	0	0	0	0
(Quishqui)	(.)	(.)	(.)	(.)
2.landscape	0.0457	0.0816	0.0457	0.0816
(Amarilis)	(0.0805)	(0.0784)	(0.570)	(0.299)
3.landscape	-0.129	-0.186*	-0.129	-0.186*
(Molinos)	(0.0887)	(0.0869)	(0.147)	(0.033)
0.educ level	0	0	0	0
(no ed form.)	(.)	(.)	(.)	(.)
1.incomplete	-0.0644	-0.0552	-0.0644	-0.0552
primary	(0.102)	(0.105)	(0.528)	(0.600)
2. complete	-0.0872	-0.0671	-0.0872	-0.0671
primary	(0.116)	(0.116)	(0.452)	(0.565)
3. incomplete	-0.149	-0.0301	-0.149	-0.0301
secondary	(0.129)	(0.126)	(0.249)	(0.812)
4. complete	-0.0402	-0.0623	-0.0402	-0.0623
secondary	(0.131)	(0.131)	(0.759)	(0.636)
5.post-	0.965*	0.540	0.965*	0.540
secondary	(0.375)	(0.526)	(0.010)	(0.306)
_cons	1.048***	0.444**	1.048***	0.444**
	(0.171)	(0.168)	(0.000)	(0.009)
MODEL 1				
N	264			
Pseudo-R2	0.0289			
MODEL 2				
N			268	
Adj-R2			0.0367	

Supplementary Table 6. Results of Multiple Regression Analyses of the Associations of Global Change Characteristics with Crop Species Agrobiodiversity in Fields (*Chakras*, *Parcelas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
chem	0.0146	-0.0764	0.0146	-0.0764
fert. use	(0.0439)	(0.0432)	(0.739)	(0.078)
agricultural	-0.00260*	-0.00175	-0.00260*	-0.00175
commercializ.	(0.00101)	(0.000985)	(0.010)	(0.077)
climate	-0.00765	0.0121	-0.00765	0.0121
change adapt	(0.0231)	(0.0228)	(0.741)	(0.596)
agrobiodiv	0.0247	0.0126	0.0247	0.0126
loss awareness	(0.0296)	(0.0301)	(0.405)	(0.675)
_cons	1.408***	0.801***	1.408***	0.801***
	(0.0902)	(0.0905)	(0.000)	(0.000)
MODEL 1				
N		249		
Pseudo-R2		0.0084		
MODEL 2				
N			249	
Adj-R2			0.024	

Supplementary Table 7. Results of Multiple Regression Analyses of the Associations of Production Characteristics with Cultivated Species Agrobiodiversity in Gardens (*Huertos, Huertas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors Parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
overall				
farm area	-0.00000228 (0.0000107)	0.0000162 (0.0000228)	-0.00000228 (0.832)	0.0000162 (0.479)
area garden	0.000118*** (0.0000213)	-0.0000292 (0.0000598)	0.000118*** (0.000)	-0.0000292 (0.626)
field number	0.0618** (0.0229)	0.0287 (0.0501)	0.0618** (0.007)	0.0287 (0.568)
elevation (residence)	0.00000403 (0.0000635)	0.00000639 (0.000134)	0.00000403 (0.949)	0.00000639 (0.962)
range_elev (fields)	-0.000400 (0.000282)	-0.000593 (0.000563)	-0.000400 (0.156)	-0.000593 (0.294)
0.multi-spp maize0 (not present)	(.)	(.)	(.)	(.)
1.multi-spp maize (present)	0.0680 (0.0512)	0.0588 (0.107)	0.0680 (0.184)	0.0588 (0.584)
_cons	2.072*** (0.166)	1.693*** (0.348)	2.072*** (0.000)	1.693*** (0.000)
MODEL 1				
N		159		
Pseudo-R2		0.0382		
MODEL 2				
N			159	
Adj-R2			-0.0167	

Supplementary Table 8. Results of Multiple Regression Analyses of the Associations of Food Characteristics with Cultivated Species Agrobiodiversity in Gardens (*Huertos*, *Huertas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
self-produced food in diet	-0.353 (0.190)	-0.0653 (0.402)	-0.353 (0.063)	-0.0653 (0.871)
traditional foods in diet	0.00573* (0.00247)	0.00356 (0.00522)	0.00573* (0.021)	0.00356 (0.495)
0.mddw (not achieved)	0 (.)	0 (.)	0 (.)	0 (.)
1mddw (achieved)	-0.0630 (0.0526)	-0.0512 (0.110)	-0.0630 (0.231)	-0.0512 (0.643)
0.food security (not achieved)	0 (.)	0 (.)	0 (.)	0 (.)
1food security (achieved)	0.00208 (0.0522)	0.0744 (0.109)	0.00208 (0.968)	0.0744 (0.497)
_cons	2.284*** (0.0745)	1.732*** (0.156)	2.284*** (0.000)	1.732*** (0.000)
MODEL 1				
N		159		
Pseudo-R2		0.0077		
MODEL 2				
N			159	
Adj-R2			-0.0139	

Supplementary Table 9. Results of Multiple Regression Analyses of the Associations of Governance Characteristics with Cultivated Species Agrobiodiversity in Gardens (*Huertos, Huertas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Richness</u>	(2) <u>Shannon</u>
Age	0.00981***	0.0130***	0.00981***	0.0130***
(head)	(0.00161)	(0.00327)	(0.000)	(0.000)
0.gender	0	0	0	0
(male)	(.)	(.)	(.)	(.)
1.gender	0.00632	0.000726	0.00632	0.000726
(female)	(0.0606)	(0.122)	(0.917)	(0.995)
0.language	0	0	0	0
(not Quechua)	(.)	(.)	(.)	(.)
1.language	-0.0538	-0.00235	-0.0538	-0.00235
(Quechua)	(0.0624)	(0.122)	(0.389)	(0.985)
income	0.00000579**	0.00000394	0.00000579**	0.00000394
	(0.00000185)	(0.00000453)	(0.002)	(0.386)
social	-0.00222	-0.00644	-0.00222	-0.00644
capital	(0.0111)	(0.0232)	(0.842)	(0.782)
1.landscape	0	0	0	0
(Quishqui)	(.)	(.)	(.)	(.)
2.landscape	0.176**	0.140	0.176**	0.140
(Amarilis)	(0.0658)	(0.127)	(0.007)	(0.273)
3.landscape	0.142*	0.246	0.142*	0.246
(Molinos)	(0.0712)	(0.137)	(0.046)	(0.074)
0.educ level	0	0	0	0
(no ed form.)	(.)	(.)	(.)	(.)
1.incomplete	0.106	0.0215	0.106	0.0215
primary	(0.0835)	(0.168)	(0.204)	(0.898)
2.complete	-0.211*	-0.124	-0.211*	-0.124
primary	(0.0984)	(0.187)	(0.032)	(0.507)
3.incomplete	-0.179	-0.272	-0.179	-0.272
secondary	(0.106)	(0.206)	(0.091)	(0.189)
4.complete	-0.145	-0.229	-0.145	-0.229
Secondary	(0.112)	(0.213)	(0.198)	(0.285)
5.post	-0.736**	1.035	0.736**	1.035
Secondary	(0.248)	(0.663)	(0.003)	(0.120)
_cons	1.730***	1.104***	1.730***	1.104***
	(0.134)	(0.266)	(0.000)	(0.000)
MODEL 1				
N		156		
Pseudo-R2		0.0871		
MODEL 2				
N			156	
Adj-R2			0.1139	

Supplementary Table 10. Results of Multiple Regression Analyses of the Associations of Global Change Characteristics with Cultivated Species Agrobiodiversity in Gardens (*Huertos, Huertas*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

	Standard errors in parentheses		P-values in parentheses	
	(1) <u>Richness</u>	(2) <u>Shannon</u>	(1) <u>Rich</u>	(2) <u>Shannon</u>
agricultural commercializ.	-0.00205* (0.000821)	-0.00275 (0.00170)	-0.00205* (0.012)	-0.00275 (0.107)
climate change adapt	0.0172 (0.0187)	0.00574 (0.0397)	0.0172 (0.357)	0.00574 (0.885)
agrobiodiv loss awareness	0.0231 (0.0262)	0.0584 (0.0561)	0.0231 (0.379)	0.0584 (0.300)
_cons	2.331*** (0.0748)	1.842*** (0.159)	2.331*** (0.000)	1.842*** (0.000)
MODEL 1				
N		133		
Pseudo-R2		0.0093		
MODEL 2				
N			133	
Adj-R2			0.0163	

Supplementary Table 11. Results of Multiple Regression Analyses of AKF Social-Ecological Factors Associated with Household Cultivation of a Multi-Species Maize Field (*Maizal*) (see Table 1, text, and Figure 1 of main article for explanation of factors)

Factor	Coefficient	Standard Error	P-Value
Overall farm area	1.00242	0.0012	0.00242**
area fields	0.997586	0.00121	0.045
field number	1.069802	0.142	0.635
elevation (residence)	0.9997016	0.000549	0.587
range_elev (fields)	1.003591	0.00186	0.053
legume crop rotation	4.012532	1.334049	0***
garden (presence)	0.7162413	0.3322305	0.472
self-prod food	5.661298	8.137544	0.228
traditional food	0.9971439	0.0159	0.857
mddw (achieved)	1.827417	0.6588917	0.094
food secur (achieved)	1.044875	0.3576981	0.898
age (household head)	0.988171	0.0112057	0.294
gender (house. Head)	1.781367	0.7758126	0.185
language (Quechua)	0.6282425	0.2822226	0.301
income	1.00001	0.0000295	0.728
social capital	1.055053	0.937997	0.6
2 Amarilis	2.313989	1.014299	0.056
3 Molino	1.361155	0.6042756	0.487
1 form educ incompl	0.931742	0.505535	0.896
2 compl primary	0.7848359	0.4823707	0.693
3 incompl secondary	0.7909995	0.5356685	0.729
4.compl secondary	0.6879903	0.4681863	0.583
chem fert use	0.6679571	0.1549523	0.082
ag commercialization	0.9836815	0.005148	0.002**
climate change aware.	0.9850997	0.1167783	0.899
agbiodiv loss aware.	1.205106	0.1913432	0.24
_cons	0.9981288	1.902561	0.999

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Pseudo R2 0.2637

Standard errors in parentheses p-values in parentheses
* p<0.05 ** p<0.01 *** p<0.001