ENVIRONMENT

DOCTORAL THESIS

ORGANIC MATTER DYNAMICS IN MIXED-FARMING SYSTEMS OF THE WEST AFRICAN SAVANNA

A VILLAGE CASE STUDY FROM SOUTH SENEGAL

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Appendices

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Annexes
Appendices

T H È S E

présentée par

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pour obtenir le grade de

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Spécialité : Sciences de l'Environnement

Sujet :

Dynamique de la matière organique à l'échelle d'un terroir agro-pastoral de savane ouest-africaine (Sud-Sénégal)

✸

Organic matter dynamics in mixed-farming systems of the West African savanna: a village case study from south Senegal

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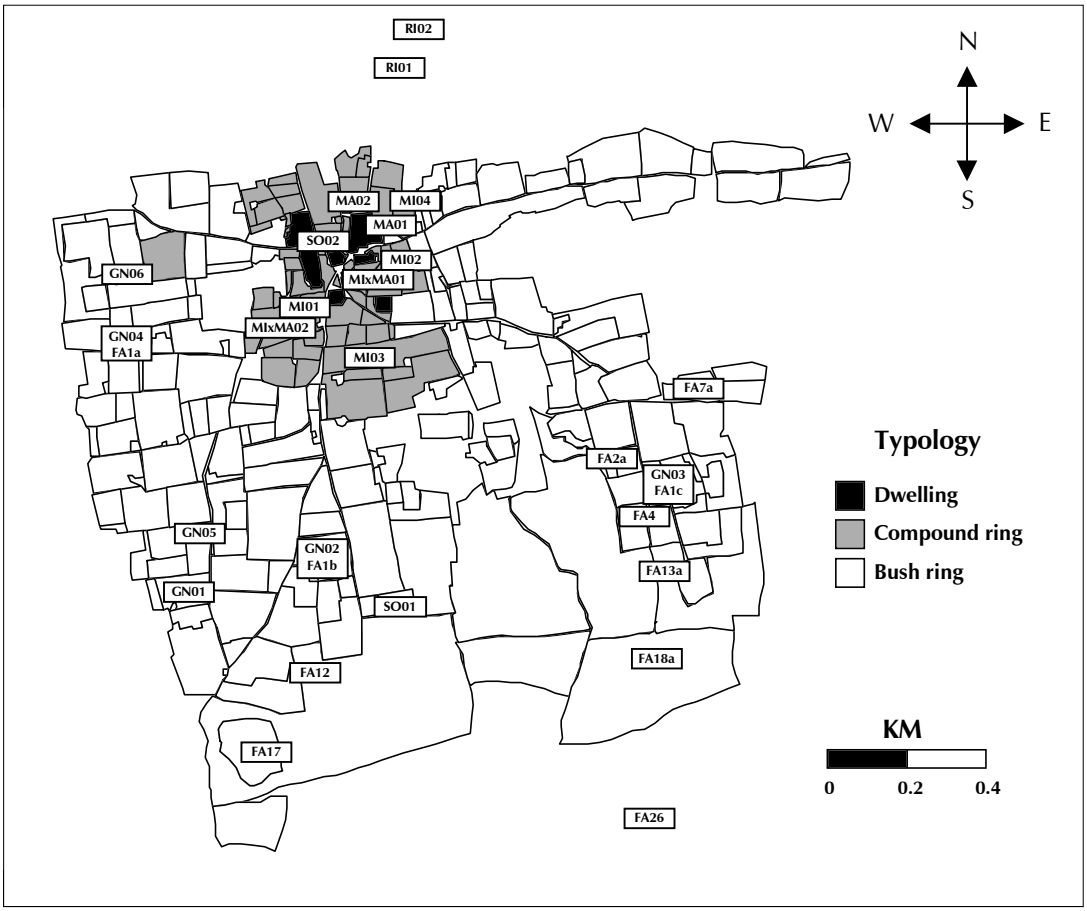
CHAPTER 1

Appendix 1 Location of sampled plots and local field typology in Sare Yorobana.



Appendix 2 Characteristics of plots owned by the village of Sare Yorobana (not including rice fields) in 1997.

Plot coding	Land tenure		Physical features			Land use		Cropping system				
	Owner	User	Geomorph.	Surface (ha)	Dist. to the compound (m)	Ring	Crop	Cropping intensity ($y\ y^{-1}$)	Age of fallow (y)	Manuring intensity ($tDM\ ha^{-1}$)	($tOM\ ha^{-1}$)	Yield ($tDM\ ha^{-1}$)
1 a	None	None	Glacis	0.56			Dwelling	1.00				
2 a	None	None	Glacis	0.14			Dwelling	1.00				
3 a	None	None	Glacis	0.51			Dwelling	1.00				
3 b	None	None	Glacis	0.47			Dwelling	1.00				
4 a	None	None	Glacis	0.16			Dwelling	1.00				
5 a	None	None	Glacis	0.17			Dwelling	1.00				
6 a	None	None	Glacis	0.13			Dwelling	1.00				
7 a	Isa	Isa	Glacis	0.33	64	Compound	Milletxmaize	1.00				2.50
8 a	Diou	Diou	Glacis	0.05	89	Compound	Sorghum	1.00				1.50
10 a	Isa	Isa	Glacis	0.03	62	Compound	Milletxmaize	1.00				0.62
11 a	Awa	Awa	Glacis	0.11	184	Compound	Millet	1.00				0.83
11 b	Awa	Awa	Glacis	0.34	190	Compound	Milletxmaize	1.00				0.83
12 a	Yaou	Yaou	Glacis	0.22	56	Compound	Maize	1.00				0.75
12 b	Yaou	Yaou	Glacis	0.06	69	Compound	Sorghum	1.00				1.50
13 a	Soul	Soul	Glacis	0.12	49	Compound	Sorghum	1.00				1.50
14 a	SaWA	SaWA	Glacis	0.13	65	Compound	Sorghum	1.00				1.50
15 a	Amad	None	Glacis	0.03	35	Compound	Fallow	0.91	2			
16 a	SaDI	SaDI	Glacis	0.04	42	Compound	Sorghum	1.00				1.50
17 a	SaDI	SaDI	Low glacis	0.16	137	Compound	Sorghum	1.00		8.55	6.69	0.31
17 b	SaDI	SaDI	Low glacis	0.22	112	Compound	Millet	1.00		8.55	6.69	1.38
17 c	SaDI	SaDI	Glacis	0.26	72	Compound	Milletxmaize	1.00		8.55	6.69	0.79
18 a	Amad	Amad	Low glacis	0.42	140	Compound	Millet	1.00		2.75	2.14	0.44
18 b	Amad	Amad	Glacis	0.35	97	Compound	Milletxmaize	1.00		10.26	7.99	1.76
18 c	Amad	Amad	Glacis	0.09	104	Compound	Sorghum	1.00		1.33	1.07	0.50
18 d	Amad	None	Glacis	0.01	56	Compound	Fallow	1.00	1			
19 a	SaDI	SaDI	Low glacis	1.13	194	Bush	Millet	0.64		1.08	0.83	0.58
20 a	Doud	Doud	Low glacis	0.84	414	Bush	Millet	1.00		0.44	0.34	0.80
20 b	Doud	None	Low glacis	1.74	447	Bush	Fallow	1.00	1			
20 c	Doud	None	Low glacis	0.32	488	Bush	Fallow	1.00	1			
22 a	Mama	Mama	Low glacis	1.39	695	Bush	Millet	1.00				1.98
22 b	Mama	None	Glacis	1.54	732	Bush	Fallow	1.00	1			
22 c	Mama	Seko	Glacis	0.38	698	Bush	Millet	0.82				0.93
22 d	Mama	Mama	Low glacis	0.40	635	Bush	Sorghum	1.00				0.50
22 e	Mama	Sali	Low glacis	1.09	602	Bush	Millet	1.00		0.51	0.39	1.34
23 a	Sali	Sali	Glacis	1.23	355	Compound	Millet	1.00		4.46	3.46	1.35
24 a	Amad	Amad	Glacis	0.59	277	Bush	Cotton	1.00				1.78
24 b	Amad	None	Glacis	0.10	314	Bush	Fallow	1.00	1			
24 c	Amad	None	Glacis	0.22	211	Bush	Fallow	0.82	2			
24 d	Amad	Amad	Glacis	0.76	196	Bush	Millet	1.00		2.55	1.93	0.51
25 a	None	None	Plateau	0.48		Bush	Fallow		10			
25 b	None	None	Plateau	2.74		Bush	Fallow		10			
26 a	SaDI	SaDI	Glacis	0.28	199	Compound	Cotton	1.00				2.00
26 b	SaDI	SaDI	Glacis	0.08	187	Compound	Sorghum	1.00				0.54
27 a	Seko	Seko	Glacis	0.73	231	Compound	Milletxmaize	1.00		7.02	5.42	0.94
28 a	Sali	Sali	Glacis	0.22	309	Compound	Milletxmaize	1.00		6.29	4.84	0.65
28 b	Sali	Sali	Glacis	0.49	268	Compound	Milletxmaize	1.00		6.29	4.84	1.09
28 c	Sali	Keba	Glacis	0.16	279	Compound	Millet	1.00				1.02
29 a	Yaou	None	Glacis	1.26	333	Bush	Fallow	0.55	1			
29 b	Yaou	Awa	Glacis	0.07	303	Bush	Fonio (*Digitaria ssp.*)	0.55				
30 a	SaBA	Keba	Glacis	0.27	567	Bush	Millet	0.64				0.24
30 b	SaBA	None	Glacis	0.04	611	Bush	Fallow	0.64	1			
30 c	SaBA	None	Glacis	0.19	564	Bush	Fallow	0.64	1			
30 d	SaBA	SaBA	Glacis	0.05	604	Bush	Millet	0.64				0.24
32 a	Mama	None	Glacis	0.20	466	Bush	Fallow	0.91	1			
32 b	Mama	Outer	Glacis	0.95	560	Bush	Millet	0.91				0.64
32 c	Mama	None	Glacis	0.68	659	Bush	Fallow	0.55	1			
33 a	Seko	Seko	Glacis	1.17	427	Bush	Millet	1.00		1.81	1.38	0.35
34 a	SaBA	Keba	Glacis	0.92	734	Bush	Sorghum	0.55				0.50
35 a	Yaou	Yaou	Glacis	0.83	553	Bush	Groundnut	1.00				0.92
35 b	Yaou	Yaou	Plateau	1.65	392	Bush	Millet	1.00				1.48
35 c	Yaou	Outer	Glacis	0.64	620	Bush	Millet	1.00				0.64
35 d	Yaou	Yaou	Plateau	0.79	474	Bush	Groundnut	1.00				0.75
35 e	Yaou	None	Glacis	0.09	514	Bush	Fallow	1.00	1			
36 a	Amad	Isa	Glacis	0.33	636	Bush	Cotton	0.91				1.13
36 b	Amad	Outer	Glacis	0.71	692	Bush	Millet	0.91				0.64
36 c	Amad	Amad	Glacis	0.78	707	Bush	Groundnut	0.91				0.92
36 d	Amad	None	Glacis	0.16	756	Bush	Fallow	0.82	2			
36 e	Amad	None	Glacis	0.05	695	Bush	Fallow	0.91	1			
37 a	SaDI	SaDI	Plateau	1.63	602	Bush	Groundnut	0.55				1.57
38 a	SaDI	Doud	Plateau	0.38	541	Bush	Groundnut	0.91				1.41
38 b	SaDI	SaDI	Plateau	0.49	511	Bush	Groundnut	0.91				1.67
38 c	SaDI	SaDI	Plateau	0.23	565	Bush	Groundnut	0.91		1.12	0.81	1.57
39 a	Seko	Seko	Plateau	1.40	691	Bush	Groundnut	0.82				1.49
39 b	Seko	Seko	Plateau	0.88	601	Bush	Cotton	0.55		0.35	0.25	1.81
39 c	Seko	None	Plateau	0.47	621	Bush	Fallow	0.45	2			
39 d	Seko	None	Plateau	0.15	664	Bush	Fallow	0.55	1			
39 f	Seko	Awa	Plateau	0.12	543	Bush	Groundnut	0.45				2.90
40 a	Sali	Sali	Plateau	1.04	758	Bush	Groundnut	1.00				1.11
40 b	Sali	Sali	Plateau	0.10	896	Bush	Millet	1.00				0.85
40 c	Sali	Sali	Glacis	1.14	779	Bush	Groundnut	1.00				1.06
40 d	Sali	None	Plateau	0.08	764	Bush	Fallow	1.00	1			
40 e	Sali	Sali	Plateau	1.23	817	Bush	Groundnut	1.00				1.33
40 f	Sali	Sali	Plateau	0.58	863	Bush	Groundnut	1.00				1.14
41 a	SaDI	Sali	Plateau	0.70	868	Bush	Cotton	0.91				1.66
41 b	SaDI	SaDI	Plateau	0.49	925	Bush	Millet	0.91		0.16	0.12	0.98
41 c	SaDI	None	Plateau	0.39	940	Bush	Fallow	0.91	1			
42 a	SaDI	None	Plateau	0.35	817	Bush	Fallow	1.00	1			
42 b	SaDI	Keba	Plateau	0.47	878	Bush	Millet	1.00				0.22

Appendix 2 (continued)

Plot coding	Land tenure		Physical features			Land use		Cropping system				
	Owner	User	Geomorph.	Surface (ha)	Dist. to the compound (m)	Ring	Crop	Cropping intensity ($y\ y^{-1}$)	Age of fallow (y)	Manuring intensity ($tDM\ ha^{-1}$)	($tOM\ ha^{-1}$)	Yield ($tDM\ ha^{-1}$)
43 a	Sali	Sali	Plateau	0.48	1025	Bush	Millet	1.00				2.22
43 b	Sali	None	Plateau	2.15	1124	Bush	Fallow	1.00	1			
43 c	Sali	Sali	Plateau	1.04	967	Bush	Millet	1.00				1.03
43 d	Sali	None	Plateau	0.20	1005	Bush	Fallow	0.18	1			
46 a	Mamo	Mamo	Plateau	2.46	774	Bush	Groundnut	1.00				1.70
46 b	Mamo	None	Plateau	0.80	771	Bush	Fallow	0.36	2			
46 c	Mamo	Mamo	Plateau	0.37	897	Bush	Groundnut	0.36				1.70
46 d	Mamo	None	Plateau	0.02	595	Bush	Fallow	0.36	2			
46 e	Mamo	Mamo	Plateau	0.62	752	Bush	Maize	0.36				0.75
46 f	Mamo	Mamo	Plateau	0.75	678	Bush	Cotton	0.36				2.01
46 g	Mamo	Mamo	Plateau	1.31	926	Bush	Groundnut	0.36				0.96
46 h	Mamo	Mamo	Plateau	0.58	858	Bush	Groundnut	0.36				0.36
46 i	Mamo	Mamo	Plateau	0.37	788	Bush	Groundnut	0.36				0.79
47 a	Diou	Diou	Plateau	1.71	1021	Bush	Groundnut	0.45				1.03
47 b	Diou	None	Plateau	0.29	1113	Bush	Fallow	0.45	3			
48 a	Diou	Diou	Plateau	1.37	830	Bush	Millet	0.64		1.73	1.30	1.09
48 b	Diou	Diou	Plateau	0.58	947	Bush	Cotton	0.64		1.73	1.30	0.83
48 c	Diou	Diou	Plateau	0.22	907	Bush	Sorghum	0.64		1.73	1.30	0.75
48 d	Diou	None	Plateau	1.29	1021	Bush	Fallow	0.64	1			
49 a	Diou	Diou	Plateau	0.69	913	Bush	Cotton	0.73		1.73	1.30	0.83
49 b	Diou	None	Plateau	1.50	1010	Bush	Fallow	0.73	1			
50 a	Mama	None	Plateau	1.53	1201	Bush	Fallow	0.09	3			
50 b	Mama	None	Plateau	1.47	1129	Bush	Fallow	0.18	1			
53 a	Mamo	Mamo	Plateau	2.69	809	Bush	Millet	1.00		4.25	3.23	1.63
53 b	Mamo	Mamo	Plateau	0.24	954	Bush	Sorghum	1.00		4.25	3.23	0.75
53 c	Mamo	None	Plateau	3.25	858	Bush	Fallow	1.00	1			
53 d	Mamo	Mamo	Plateau	0.48	948	Bush	Sorghum	1.00		4.25	3.23	1.00
54 a	Mama	None	Plateau	0.49	593	Bush	Fallow	0.55	1			
54 b	Mama	Mama	Plateau	0.11	580	Bush	Millet	0.82				1.72
55 a	Said	Isa	Plateau	0.21	618	Bush	Sorghum	0.55				0.50
55 b	Said	Isa	Plateau	0.31	638	Bush	Millet	0.55				0.27
55 c	Said	None	Plateau	0.80	676	Bush	Fallow	0.55	1			
56 a	Mama	Mama	Plateau	1.34	543	Bush	Groundnut	0.82				2.05
56 b	Mama	Mama	Plateau	1.06	648	Bush	Groundnut	0.82				1.21
56 c	Mama	None	Plateau	0.12	637	Bush	Fallow	0.73	1			
57 a	Diou	Diou	Plateau	1.16	651	Bush	Groundnut	1.00				0.90
57 b	Diou	Diou	Plateau	1.21	590	Bush	Groundnut	1.00				2.07
57 c	Diou	Keba	Plateau	0.12	450	Bush	Millet	1.00				0.43
57 d	Diou	Diou	Plateau	0.19	506	Bush	Sorghum	1.00				1.00
57 f	Diou	Keba	Plateau	0.20	437	Bush	Millet	1.00				0.43
58 a	Tidi	Tidi	Plateau	0.61	317	Bush	Cotton	1.00				0.24
58 b	Tidi	None	Plateau	0.63	369	Bush	Fallow	1.00	1			
58 c	Tidi	Tidi	Plateau	0.94	312	Bush	Millet	1.00				0.24
58 d	Tidi	Doud	Plateau	0.30	393	Bush	Groundnut	1.00				3.09
59 a	Mama	Isa	Plateau	0.33	654	Bush	Cotton	0.27				0.95
60 a	Yaou	Yaou	Glacis	0.60	285	Compound	Cotton	0.91				0.54
60 b	Yaou	Tidi	Glacis	0.66	247	Compound	Cotton	0.91				0.76
70 a	Awa	Awa	Glacis	0.26	310	Compound	Groundnut	1.00				2.00
71 a	Yaou	Tidi	Glacis	0.29	220	Compound	Cotton	1.00				0.76
72 a	Soul	Soul	Glacis	0.26	308	Compound	Milletxmaize	1.00		2.86	2.18	0.93
72 b	Soul	Soul	Glacis	1.52	357	Compound	Millet	1.00		2.86	2.18	0.93
73 a	Fode	Fode	Glacis	1.40	400	Compound	Millet	1.00				0.96
73 b	Fode	Fode	Glacis	0.23	353	Compound	Milletxmaize	1.00				0.96
74 a	Awa	Awa	Glacis	0.24	539	Bush	Millet	1.00				0.25
75 a	SaWA	SaWA	Plateau	0.81	533	Bush	Cotton	0.55		0.61	0.44	0.96
75 b	SaWA	SaWA	Plateau	0.05	577	Bush	Sorghum	0.55				0.50
76 a	Tidi	None	Plateau	0.69	617	Bush	Fallow	0.27	1			
77 a	Mama	None	Plateau	0.34	619	Bush	Fallow	0.36	8			
78 a	Soul	None	Plateau	0.75	535	Bush	Fallow	0.82	2	1.01	0.74	
78 b	Soul	Soul	Glacis	0.59	436	Bush	Millet	1.00		12.53	9.85	1.06
79 a	SaWA	SaWA	Glacis	1.99	288	Compound	Millet	1.00		3.33	2.60	1.13
80 a	Tidi	Tidi	Glacis	0.49	49	Compound	Milletxmaize	1.00		1.26	0.98	0.44
80 b	Tidi	Tidi	Glacis	0.43	78	Compound	Milletxmaize	1.00		1.26	0.98	0.54
80 c	Tidi	Tidi	Glacis	0.15	109	Compound	Millet	1.00		1.26	0.98	0.44
80 d	Tidi	Tidi	Glacis	0.13	57	Compound	Maize	1.00		1.26	0.98	0.75
80 e	Tidi	Tidi	Glacis	0.29	100	Compound	Millet	1.00		1.26	0.98	0.44
80 f	Tidi	Tidi	Glacis	0.15	103	Compound	Millet	1.00		1.26	0.98	0.44
81 a	Said	Said	Glacis	0.26	203	Compound	Maize	1.00				0.75
81 b	Said	Said	Glacis	0.29	219	Compound	Milletxmaize	1.00				0.44
81 c	Said	Said	Glacis	0.05	236	Compound	Millet	1.00				0.44
82 a	SaBA	Tidi	Glacis	0.31	99	Compound	Milletxmaize	1.00				0.54
82 b	SaBA	SaBA	Glacis	0.31	124	Compound	Millet	1.00				0.44
82 c	SaBA	SaBA	Glacis	0.07	60	Compound	Sorghum	1.00				1.50
82 d	SaBA	Mama	Glacis	0.39	139	Compound	Groundnut	1.00				0.43
83 a	Mama	Mama	Glacis	0.46	146	Compound	Milletxmaize	1.00		13.78	10.80	0.76
84 a	Isa	Isa	Glacis	0.80	235	Bush	Groundnut	1.00				1.02
84 b	Isa	Isa	Glacis	0.31	272	Bush	Groundnut	1.00				1.04
85 a	Said	Said	Glacis	0.30	334	Bush	Cotton	0.73				1.05
85 b	Said	Said	Glacis	0.15	265	Bush	Sorghum	0.73				0.50
85 c	Said	None	Glacis	0.05	296	Bush	Fallow	0.73	1			
85 d	Said	Said	Glacis	0.45	289	Bush	Groundnut	0.73				1.37
87 a	Mama	Mama	Glacis	0.47	162	Bush	Millet	1.00		7.36	5.64	2.07
87 b	Mama	Mama	Glacis	0.36	285	Bush	Millet	1.00				1.83
87 c	Mama	Mama	Glacis	2.43	341	Bush	Groundnut	1.00		0.31	0.22	1.23
87 d	Mama	Mama	Glacis	0.51	244	Bush	Groundnut	1.00				5.39

Appendix 2 (continued)

Plot coding	Land tenure		Physical features			Land use		Cropping system				
	Owner	User	Geomorph.	Surface (ha)	Dist. to the compound (m)	Ring	Crop	Cropping intensity ($y\ y^{-1}$)	Age of fallow (y)	Manuring intensity ($tDM\ ha^{-1}$)	($tOM\ ha^{-1}$)	Yield ($tDM\ ha^{-1}$)
88 a	Mama	Mama	Glacis	0.25	182	Bush	Maize	1.00		3.64	2.81	2.26
88 b	Mama	Mama	Glacis	0.19	200	Bush	Milletxmaize	1.00		4.65	3.53	2.99
88 c	Mama	Mama	Glacis	0.58	267	Bush	Millet	0.82		4.65	3.53	2.99
88 d	Mama	Mama	Low glacis	0.31	310	Bush	Maize	0.82				0.58
88 e	Mama	Mama	Low glacis	0.36	233	Bush	Sorghum	1.00		4.65	3.53	0.75
88 f	Mama	Keba	Glacis	0.09	78	Bush	Milletxmaize	1.00				1.32
88 g	Mama	Mama	Glacis	0.14	157	Bush	Millet	1.00		3.64	2.81	0.70
88 h	Mama	Keba	Glacis	0.17	125	Bush	Milletxmaize	1.00				1.32
88 i	Mama	None	Low glacis	0.16	274	Bush	Fallow	0.82	1	4.65	3.53	
89 a	Diou	Diou	Glacis	0.60	83	Compound	Maize	1.00		6.21	4.80	1.28
89 b	Diou	Diou	Glacis	0.95	137	Compound	Millet	1.00		6.21	4.80	0.86
89 c	Diou	Keba	Glacis	0.05	66	Compound	Milletxmaize	1.00				1.32
90 a	Mamo	Mamo	Glacis	0.07	43	Compound	Millet	1.00		13.30	10.40	1.61
90 b	Mamo	Mamo	Glacis	0.59	103	Compound	Maize	1.00		13.30	10.40	1.61
90 c	Mamo	Mamo	Low glacis	0.38	181	Compound	Millet	1.00		13.30	10.40	1.62
90 d	Mamo	Mamo	Low glacis	0.18	167	Compound	Sorghum	1.00		13.30	10.40	0.80
90 e	Mamo	Mamo	Glacis	0.02	68	Compound	Millet	1.00		6.56	5.13	1.61
91 a	Mama	Mama	Glacis	1.13	147	Compound	Millet	1.00		2.29	1.83	2.01
92 a	Soul	None	Glacis	0.11	495	Bush	Fallow	0.45	2			
92 b	SaWA	SaWA	Plateau	0.41	557	Bush	Groundnut	0.45				0.54
92 c	SaWA	SaWA	Plateau	1.59	546	Bush	Groundnut	0.45				0.54
93 a	Fode	Fode	Glacis	0.25	416	Bush	Sorghum	1.00				0.50
93 b	Fode	Fode	Glacis	0.30	447	Bush	Millet	1.00				0.52
93 c	Fode	None	Glacis	0.18	448	Bush	Fallow	1.00	1			
93 d	Fode	None	Glacis	0.25	455	Bush	Fallow	1.00	1			
94 a	Tidi	Tidi	Plateau	0.80	621	Bush	Groundnut	0.45				0.36
94 b	Tidi	None	Plateau	0.46	576	Bush	Fallow	0.45	2			
94 c	Tidi	None	Plateau	0.11	652	Bush	Fallow	0.45	2			
95 a	Isa	Outer	Plateau	0.59	739	Bush	Millet	0.09				0.10
95 b	Isa	None	Plateau	0.19	773	Bush	Fallow	0.09	1			
96 a	Soul	None	Plateau	0.21	916	Bush	Fallow	0.45	3			
96 b	Soul	None	Plateau	1.25	870	Bush	Fallow	0.45	4			
96 c	Soul	None	Plateau	0.44	951	Bush	Fallow	0.27	1			
97 a	Soul	None	Plateau	0.24	1020	Bush	Fallow	0.55	1			
98 a	Tidi	None	Plateau	0.66	894	Bush	Fallow	0.36	1			
98 b	Tidi	None	Plateau	0.85	962	Bush	Fallow	0.27	2			
99 a	Soul	None	Plateau	0.33	1058	Bush	Fallow	0.36	1			
99 b	Soul	None	Plateau	0.71	1118	Bush	Fallow	0.27	2			
100 a	Soul	None	Plateau	0.80	1265	Bush	Fallow	0.09	2			
101 a	Tidi	None	Plateau	0.91	1101	Bush	Fallow	0.18	1			
101 b	Tidi	None	Plateau	1.03	1166	Bush	Fallow	0.09	2			
102 a	Soul	None	Plateau	0.94	1097	Bush	Fallow	0.55	1			
102 b	Soul	None	Plateau	0.11	1101	Bush	Fallow	0.45	2			
102 c	Soul	None	Plateau	0.21	1155	Bush	Fallow	0.45	2			
103 a	Soul	None	Plateau	0.41	1168	Bush	Fallow	0.82	1			
103 b	Soul	None	Plateau	0.97	1184	Bush	Fallow	0.73	3			
107 a	SaWA	None	Plateau	1.69	980	Bush	Fallow	0.73	1			
107 b	SaWA	None	Plateau	1.58	1083	Bush	Fallow	0.64	2			
110 a	Soul	None	Plateau	0.55	1130	Bush	Fallow	0.00	2			
110 b	Soul	None	Plateau	1.47	1076	Bush	Fallow	0.09	11			
111 a	Soul	Soul	Plateau	1.15	872	Bush	Groundnut	0.36				1.71
112 a	Fode	Fode	Plateau	1.09	815	Bush	Groundnut	1.00				0.72
112 b	Fode	None	Plateau	0.65	778	Bush	Fallow	0.82	2			
112 c	Fode	Fode	Plateau	0.13	730	Bush	Groundnut	0.82				0.72
113 a	Tidi	Tidi	Plateau	0.76	662	Bush	Groundnut	0.36				0.50
113 b	Tidi	None	Plateau	1.40	705	Bush	Fallow	0.36	1			
113 c	Tidi	Tidi	Plateau	0.11	577	Bush	Groundnut	0.36				0.54
114 a	Mama	Mama	Glacis	0.49	493	Bush	Groundnut	0.18		0.45	0.33	1.93
115 a	Fode	Mama	Glacis	0.22	717	Bush	Maize	0.45		0.99	0.72	0.89
115 b	Fode	None	Low glacis	1.63	811	Bush	Fallow	0.45	1			
117 a	Tidi	None	Glacis	0.77	757	Bush	Fallow	0.55	2			
118 a	Tidi	None	Glacis	1.34	870	Bush	Fallow	0.09	1			
119 a	Soul	None	Low glacis	1.27	945	Bush	Fallow	0.18	1			
120 a	SaWA	None	Low glacis	1.56	1168	Bush	Fallow	0.45	3			
120 b	SaWA	None	Glacis	1.19	1135	Bush	Fallow	0.45	3			
121 a	Fode	None	Glacis	1.42	1306	Bush	Fallow	0.36	5			
121 b	Fode	None	Glacis	0.18	1349	Bush	Fallow	0.27	7			
122 a	Mama	Mama	Glacis	1.05	377	Bush	Groundnut	1.00				1.23
201 a	Isa	Isa	Glacis	0.21	42	Compound	Milletxmaize	1.00				2.50
201 b	Isa	Isa	Glacis	0.04	40	Compound	Milletxmaize	1.00				2.50
201 c	Isa	Said	Glacis	0.04	41	Compound	Sorghum	1.00				1.50
201 d	Isa	Isa	Glacis	0.02	24	Compound	Milletxmaize	1.00				2.50
201 e	Isa	Isa	Glacis	0.01	24	Compound	Millet	1.00				3.00
205 a	None	None	Glacis	0.01			Dwelling	1.00				
207 a	None	None	Plateau	9.30		Bush	Fallow	0.00	11			
208 a	None	None	Plateau	4.69		Bush	Fallow	0.00	11			
209 a	None	None	Plateau	9.25		Bush	Fallow	0.00	16			
210 a	None	None	Plateau	3.86		Bush	Fallow	0.00	18			
211 a	None	None	Plateau	9.33		Bush	Fallow	0.00	12			
212 a	None	None	Plateau	19.67		Bush	Fallow	0.00	11			
213 a	None	None	Plateau	0.73		Bush	Fallow	0.00	18			
214 a	None	None	Plateau	2.00		Bush	Fallow	0.00	18			
215 a	None	None	Plateau	2.04		Bush	Fallow	0.00	18			
218 a	Isa	Awa	Glacis	0.24	184	Bush	Sorghum	0.00				1.00
219 a	Soul	Soul	Glacis	0.31	1031	Bush	Groundnut	0.00				2.07
304 a	Said	Said	Plateau	0.28	623	Bush	Cotton	0.09				0.95

Appendix 3 Elementary statistics of rainfall, potential evapotranspiration and temperature at the station of Kolda, 1978-1997.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm y^{-1})													
Mean	2.2	4.4	2.8	1.0	18.4	128.0	249.9	304.4	192.6	63.1	9.6	3.1	959.8
SE	0.0	3.0	0.7	0.6	4.9	17.3	13.9	23.9	14.4	6.7	3.1	0.9	43.4
n	1	4	2	2	17	20	20	20	20	20	8	6	20
Temperature (°C)													
Mean	23.8	26.8	29.3	31.0	31.9	30.3	27.9	27.5	27.7	28.3	26.4	23.8	27.9
SE	0.4	0.2	0.2	0.4	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.1
n	20	20	20	20	20	20	20	19	19	19	19	20	20
Potential evapotranspiration													
	106.0	118.0	154.0	168.0	181.0	145.0	132.0	118.0	115.0	123.0	111.0	101.0	1572.0

SE: standard error

Appendix 4a. Geomorphological description .

Appendix 4 Description of four typical soil profiles along a toposequence in the village of Sare Yorobana.

PROFILE 1: FERRUGINOUS TROPICAL SOIL ON PLATEAU (LIXISOL ORDER).

Location: 12°48'811 N 14°53'068 W. 600 m south-east from the compounds.
Environment: Plateau edge. One year old fallow dominated by *Terminalia macroptera* G. et Perr.
Description:
. 0-15 cm (A): humus-bearing; light brown (2,5 YR 4/2); sand-clayey to silt-sandy texture; massive structure; good porosity; medium biological activity, many rootlets; splash crust; neat and undulated transition downwards deeper sublayer.
. 20-50 cm (B): weakly humus-bearing; brown-red (2,5 YR 5/4); sand-clayey to silt-sandy texture; massive structure with some splinters; weak to medium biological activity; progressive transition.
. 50-70 cm (B_T): brown-red (2,5 YR 5/4); sand-clayey to clay-sandy texture; weak biological activity; oxydo-reducing conditions during a part of the year, leading to iron immobilisation.
. 70-130 cm (B_{3FE}): pink (5 YR 7/3); sand-clayey to clay-sandy texture; medium biological activity, higher than in B_T; presence of red-yellowish stains (5 YR 5/8).

PROFILE 2: FERRUGINOUS TROPICAL SOIL ON GLACIS (LIXISOL ORDER).

Location: 12°49'136 N 14°53'442 W, 50 m far from the compounds.
Environment: mid-glacis. Compound field under continuous cultivation of cereal.
Description:
. 0-10 cm (A1p): tillage horizon; humus-bearing; crumbly, sand-clayey to sand-silty texture; medium biological activity (roots); massive structure; splash crust-less (trampling by cattle).
. 10-30 cm (A2): weakly humus-bearing; pink-grey (7,5 YR 6/2); sand-clayey texture; good porosity; medium biological activity (a few roots); progressive transition.
. 30-70 cm (B_T): light brown (7,5 YR 6/4); sand-clayey to clay-sandy texture; no biological activity.
. 70-130 cm (B_{TA}): pink (7,5 YR 7/4) Anthropized soil; increasing clay gradient downwards; no plinthit.

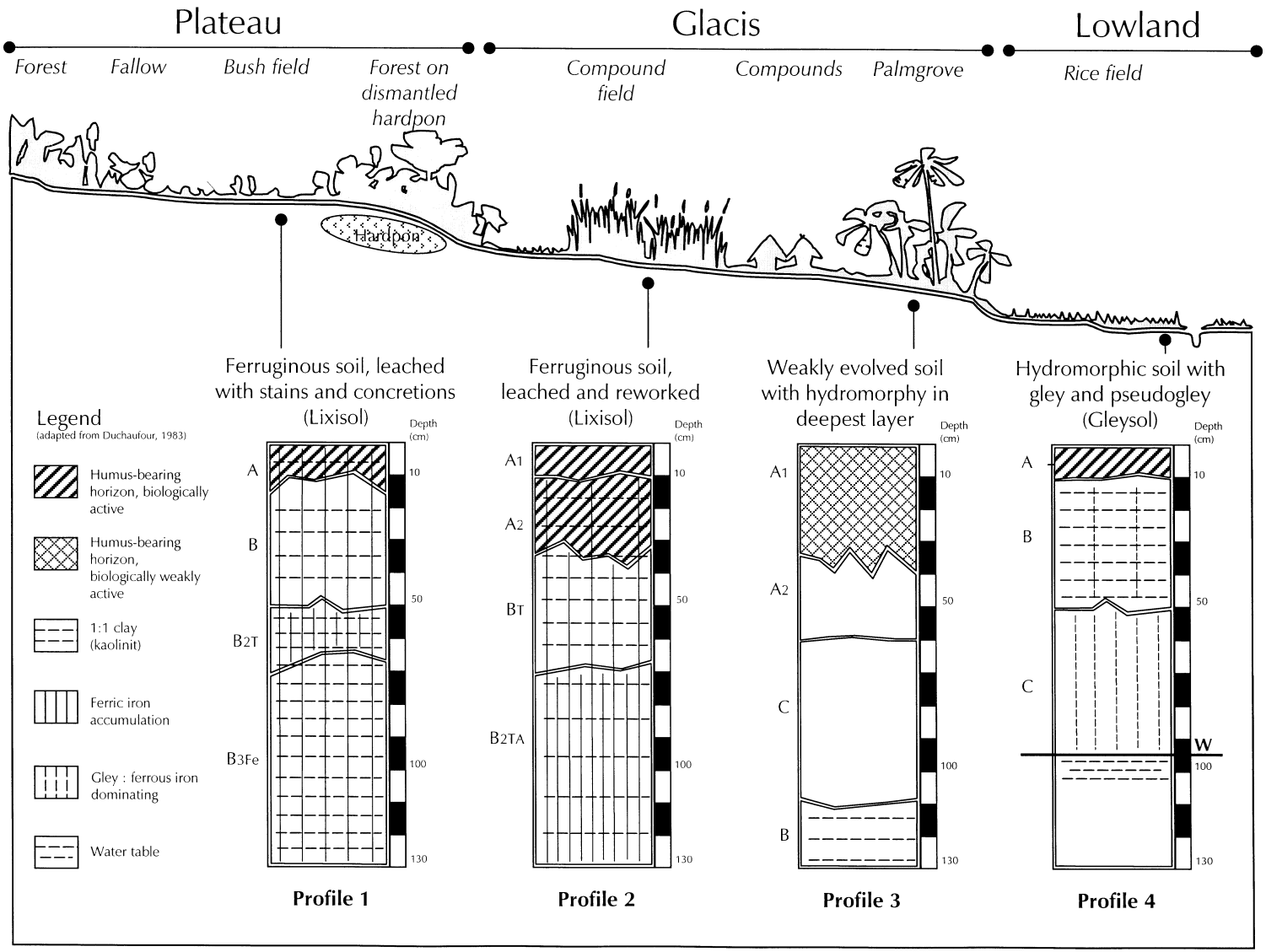
PROFILE 3: DOWNSLOPE WEAKLY EVOLVED SOIL (ALLUVIUM COVER).

Location: low glacis, 300 m north from the compounds
Environment: uncropped palm grove; well developed herbaceous strata.
Description:
. 0-40 cm (A1): weakly humus-bearing; grey (5 YR 6/1); sandy to sand-silty texture; massive structure; good biological activity (grass and palm tree roots).
. 40-60 cm (A2): weakly humus-bearing; light grey (5 YR 7/1); massive structure; medium biological activity (palm tree roots).
. 60-110 cm (C): sandy texture; white (5 YR 8/1); massive structure.
. 110-130 cm (B): grey-pink (5 YR 7/2, humid); silt-sandy texture; massive structure; light hydromorphy.

Weakly evolved soil, hydromorphic below 1 m deep; good porosity; crumbly structure when humid, else massive. Azonal system linked to deep hydromorphy.

PROFILE 4: LOWLAND HYDROMORPHIC SOIL WITH GLEY AND PSEUDO GLEY (GLEYSOL ORDER).

Location: lowland, 600 m north from the village.
Environment: floodplain. Rice field seasonally flooded. Description done during the dry season; watertable at its lowest.
Description:
. 0-10 cm (A): highly humus-bearing; grey (2,5 Y 5/0); sand-clayey to silt-clayey texture; massive structure; high biological activity with high rice root density.
. 10-50 cm (B): light grey (2,5 Y 7/2, humid); pseudo-gley stains.
. 50-95 cm(C): hydromorphic with gley; watertable 0.95 m deep.


Plateau
Glacis
Lowland
Forest
Fallow
Bush field
Forest on dismantled hardpon
Compound field
Compounds
Palmgrove
Rice field
Hardpon
Ferruginous soil, leached with stains and concretions (Lixisol)
Ferruginous soil, leached and reworked (Lixisol)
Weakly evolved soil with hydromorphy in deepest layer
Hydromorphic soil with gley and pseudogley (Gleysol)
Legend
(adapted from Duchaufour, 1983)
Humus-bearing horizon, biologically active
Humus-bearing horizon, biologically weakly active
1:1 clay (kaolinit)
Ferric iron accumulation
Gley : ferrous iron dominating
Water table
Depth (cm)
A
B
B2T
B3Fe
A1
A2
BT
B2TA
C
W
10
50
100
130
Profile 1
Profile 2
Profile 3
Profile 4

Appendix 4b physical properties

Layer (cm)	clay (%)	fine silt (%)	coarse silt (%)	fine sand (%)	coarse sand (%)	total (%)
Profile 1						
0-15	5.7	6.2	10.1	35.7	41.2	98.9
15-50	22.1	7.6	7.4	24.7	37.3	99.1
50-70	39.5	7.1	6.3	18.1	30.8	101.8
70-130	46.8	8.2	4.4	18.3	23.0	100.7
Profile 2						
0-10	5.6	5.2	8.8	35.7	45.4	100.7
10-35	8.4	5.2	6.9	32.9	47.3	100.7
35-65	18.6	5.8	6.7	26.8	42.5	100.4
65-130	33.8	7.5	4.5	22.2	33.3	101.3
Profile 3						
0-40	7.4	12.6	13.6	30.3	36.7	100.6
40-60	3.1	5.5	8.6	33.4	50.5	101.1
60-110	1.6	4.5	7.4	33.4	52.9	99.8
Profile 4						
0-10	37.4	16.7	9.7	21.9	14.5	100.2
10-50	30.0	14.1	12.7	26.0	18.1	100.9
50-100	11.1	7.2	9.5	48.3	24.9	101.0

Appendix 4c chemical properties

Layer	C	N	C/N	Exchangeable bases (meq $100g^{-1}$)				CEC	Sat
	(mg g^{-1})	(mg g^{-1})		Ca	Mg	Na	K	(meq $100g^{-1}$)	rate (%)
Profile 1									
0-15	5.43	0.44	12.3	1.65	0.56	0.00	0.04	2.33	96
15-50	3.58	0.36	9.9	1.97	0.44	0.02	0.03	2.69	91
50-70	2.77	0.33	8.4	1.81	1.20	0.02	0.08	3.1	100
70-130	1.83	0.27	6.8	1.34	1.12	0.02	0.05	3.62	70
Profile 2									
0-10	4.24	0.34	12.5	1.74	0.76	0.02	2.31	2.13	227
10-35	2.24	0.2	11.2	1.15	0.53	0.03	0.31	1.61	125
35-65	2.19	0.24	9.1	1.21	0.92	0.01	0.43	2.13	121
65-130	1.97	0.26	7.6	0.61	0.41	0.02	0.25	2.57	50
Profile 3									
0-40	3.46	0.3	11.5	0.26	0.23	0.01	0.09	1.41	42
40-60	0.68	0.07	9.7	0.05	0.20	0.01	0.06	0.2	162
60-110	0.21	0.02	10.5	0.09	0.26	0.11	0.00	0.04	1153
Profile 4									
0-10	11.3	1.18	9.6	3.58	0.89	0.05	0.08	7.12	65
10-50	2.53	0.24	10.5	2.70	0.64	0.03	0.13	4.18	84
50-100	1.97	0.15	13.1	1.40	0.51	0.10	0.09	1.89	111

Appendix 5 Mean root biomass (tDM ha^{-1}) data from 9 fallow plots used for comparison between full excavation and coring technique.

Plot	Excavation	Coring
FA01a	5.44	4.59
FA01b	8.59	3.45
FA01c	3.40	0.83
FA02a	5.85	2.36
FA04	4.68	0.59
FA06b	13.81	7.37
FA13a	19.57	7.97
FA18a	14.06	7.89
FA26	19.88	4.62

Appendix 6 Carbon, nitrogen and phosphorus content of some above- and below-ground plant components of cropped and fallow fields (detailed data).

a.

	C (g 100g^{-1}DM)				
Plot	Herb.	Litter	Fine root	Coarse root	Stump
GN01	37.1		34.6	38.0 +	
GN02	38.3		35.4	38.0 +	38.0 +
GN03	37.8		33.9	38.0 +	38.0 +
GN04	38.0		34.2	38.0 +	38.0 +
GN05	35.8		31.7	38.0 +	
GN06	38.2		35.0	38.0 +	
FA1a	37.6	33.1	34.0	35.9	35.9 ‡
FA1b	38.8	33.1	35.4	39.5	39.5 ‡
FA1c	37.7	35.9	36.7	38.4	38.4 ‡
FA2a	33.7	32.4	32.7	36.0	36.0 ‡
FA4	33.5	33.1	32.6	35.4	35.4 ‡
FA7a	34.9	31.6	33.3	36.5	
FA12	34.4	29.8	34.3 †	36.6 †	
FA13a	32.8	34.5	34.1	36.3	
FA17	34.4	33.4	34.3 †	36.6 †	
FA18a	32.1	34.6	36.1	35.3	
FA26	28.3	32.4	33.6	36.2	

b.

	N (g 100g^{-1}DM)				
Plot	Herb.	Litter	Fine root	Coarse root	Stump
GN01	2.01		1.74	0.35 +	
GN02	1.88		1.56	0.35 +	0.35 +
GN03	1.90		1.61	0.35 +	0.35 +
GN04	1.92		1.73	0.35 +	0.35 +
GN05	1.90		1.65	0.35 +	
GN06	1.97		1.66	0.35 +	
FA1a	0.55	0.51	0.82	0.44	0.44 ‡
FA1b	0.48	0.51	0.35	0.24	0.24 ‡
FA1c	0.69	0.67	0.82	0.36	0.36 ‡
FA2a	0.62	0.53	0.86	0.62	0.60 ‡
FA4	0.95	0.51	0.86	0.40	0.40 ‡
FA7a	0.65	0.62	1.01	0.43	
FA12	0.72	0.53	0.78 †	0.40 †	
FA13a	1.04	0.50	0.78	0.34	
FA17	0.72	0.42	0.78 †	0.40 †	
FA18a	0.87	0.48	0.75	0.36	
FA26	0.63	0.36	0.73	0.39	

c.

	P (g 100g^{-1}DM)				
Plot	Herb.	Litter	Fine root	Coarse root	Stump
GN01	0.10		0.06	0.02 +	
GN02	0.11		0.06	0.02 +	0.02 +
GN03	0.11		0.06	0.02 +	0.02 +
GN04	0.11		0.09	0.02 +	0.02 +
GN05	0.11		0.06	0.02 +	
GN06	0.11		0.09	0.02 +	
FA1a	0.06	0.03	0.05	0.04	0.04 ‡
FA1b	0.07	0.03	0.03	0.01	0.01 ‡
FA1c	0.05	0.03	0.04	0.01	0.01 ‡
FA2a	0.04	0.04	0.04	0.02	0.02 ‡
FA4	0.09	0.03	0.05	0.03	0.03 ‡
FA7a	0.06	0.03	0.04	0.03	
FA12	0.07	0.04	0.04 †	0.03 †	
FA13a	0.11	0.03	0.04	0.04	
FA17	0.07	0.03	0.04 †	0.03 †	
FA18a	0.08	0.04	0.04	0.04	
FA26	0.1	0.0	0.0	0.0	

+: estimated as the mean of coarse root's values from FA1a, FA1b and FA1c.

‡: estimated as the content of coarse root measured in fallows aged one to four years; used for the calculation of C, N and P amounts in fallows aged one to four years only.

† not measured; estimated as the mean value of measures for other fallow plots.

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

Appendix 7 Carbon (a), nitrogen (b) and phosphorus (c) storage in plant biomass during a crop-fallow succession.
GN: groundnut crop. FA: fallow; the associated number stands for the age of fallow.

a. C storage (t ha^{-1})

	AGB[1]					Litter	Root						ABB[2]
	Woody				Herb.		Fine (per sampling depth in cm)				Coarse	Stump	
Plot	Trunk	Twig	Leaf	Total			0-10	10-20	20-30	30-40			
GN01				0.05	0.88		0.07	0.05	0.04	0.02	2.0		
GN02				0.01	1.31		0.07	0.06	0.03	0.02	1.1	5.3	
GN03				0.11	0.88		0.08	0.05	0.04	0.03	1.2	1.9	
GN04				0.45	1.31		0.11	0.06	0.04	0.02	1.1	1.3	
GN05				0.09	0.99		0.07	0.03	0.03	0.02	1.1		
GN06				0.01	1.31		0.10	0.06	0.03	0.02	1.2		
FA1a					2.45	0.61	0.27	0.09	0.07	0.05	2.0	1.3	
FA1b					2.14	0.70	0.41	0.10	0.09	0.09	3.4	5.5	
FA1c					1.88	0.55	0.30	0.06	0.08	0.07	1.3	1.9	
FA1d	0.8	0.5	0.3	1.6									1.6
FA1e	3.0	2.0	1.4	6.4									6.4
FA1f	3.3	2.3	1.8	7.3									7.3
FA2a					2.02	0.19	0.23	0.09	0.10	0.06	2.1	4.2	
FA2b	4.3	2.8	2.0	9.1									8.0
FA3a	2.2	1.2	0.5	3.9									2.9
FA3b	5.5	3.4	2.2	11.2									8.6
FA3c	4.6	3.1	1.7	9.4									7.3
FA4					3.16	0.91	0.29	0.09	0.07	0.05	1.7	1.7	
FA6a	5.8	3.4	2.4	11.6								4.2	7.5
FA6b	6.0	3.3	1.6	10.9								5.7	7.0
FA7a					1.16	0.94	0.37	0.19	0.15	0.11	5.0		
FA7b	6.1	3.2	1.2	10.5								4.1	6.0
FA10a	7.4	4.2	2.5	14.1								4.3	8.2
FA10b	8.1	4.3	2.3	14.6								6.5	8.1
FA12					0.66	1.15	0.41				5.2		
FA13a					0.31	0.41	0.62	0.41	0.25	0.23	7.1		
FA13b	8.0	3.9	1.5	13.5								4.6	6.7
FA15a	9.0	5.0	2.9	16.9								4.4	9.1
FA15b	8.4	4.4	2.4	15.2								6.8	8.0
FA17					0.74	0.89	0.45				5.8		
FA18a					0.58	0.60	0.44	0.27	0.22	0.19	5.0		
FA18b	10.1	4.3	2.2	16.6								5.6	7.7
FA25	8.4	4.5	2.4	15.3								5.1	7.7
FA26					0.41	0.56	0.41	0.27	0.23	0.27	7.2		

[1] AGB: live above-ground biomass. Derived from Kaïré (1999).
[2] ABB: available biomass for burning. Derived from Kaïré (1999).
Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

b. N storage (kg ha^{-1})

	AGB[1]					Litter	Root						ABB[2]
	Woody				Herb.		Fine (per sampling depth in cm)				Coarse	Stump	
Plot	Trunk	Twig	Leaf	Total			0-10	10-20	20-30	30-40			
GN01				0.63	47.7		3.39	2.62	1.92	1.15	17.9		
GN02				0.10	64.0		3.06	2.66	1.50	1.03	10.5	48.0	
GN03				1.36	44.5		3.98	2.57	2.01	1.27	10.8	17.3	
GN04				5.63	66.3		5.73	3.07	1.92	1.14	10.4	12.3	
GN05				1.12	52.5		3.43	1.55	1.35	0.89	10.2		
GN06				0.15	67.3		4.85	2.93	1.59	1.10	10.5		
FA1a					35.8	9.5	6.40	2.26	1.63	1.17	23.9	15.6	
FA1b					26.5	10.8	4.10	0.97	0.89	0.90	20.6	33.2	
FA1c					34.5	10.3	6.65	1.32	1.77	1.57	12.2	18.0	
FA1d	5.0	3.5	10.7	19.2									19.2
FA1e	16.9	15.7	45.9	78.4									78.4
FA1f	36.2	18.2	73.8	128.2									128.2
FA2a					37.3	3.0	6.15	2.34	2.55	1.69	35.1	70.0	
FA2b	22.4	22.4	65.2	110.0									104.3
FA3a	10.7	8.9	18.7	38.3									33.2
FA3b	33.3	27.5	75.7	136.6									120.9
FA3c	23.1	22.0	55.9	101.0									90.2
FA4					89.8	14.2	7.70	2.40	1.81	1.36	18.7	18.8	
FA6a	28.6	29.2	80.3	138.1								45.5	118.0
FA6b	49.0	24.2	60.3	133.5								61.8	101.4
FA7a					21.6	18.4	11.26	5.80	4.42	3.48	59.4		
FA7b	41.3	25.7	43.9	110.9								44.0	80.3
FA10a	49.9	31.5	88.1	169.5								46.8	129.3
FA10b	44.5	32.7	75.4	152.7								70.2	116.7
FA12					13.9	20.5	9.21				56.5		
FA13a					10.0	5.9	14.21	9.28	5.77	5.30	66.5		
FA13b	47.7	28.5	50.6	126.7								49.5	86.4
FA15a	56.6	38.8	101.2	196.5								47.5	147.8
FA15b	54.8	34.8	80.8	170.4								73.5	123.1
FA17					15.5	11.1	10.25				62.7		
FA18a					15.7	8.4	9.13	5.57	4.65	3.94	50.6		
FA18b	55.5	30.7	72.1	158.3								60.8	109.3
FA25	51.0	31.1	81.0	163.1								54.6	116.7
FA26					9.0	6.2	8.86	5.84	5.03	5.96	77.5		

Appendix 7 (continued)

c. P storage (kg ha^{-1})

	AGB[1]					Litter	Root						ABB[2]
	Woody				Herb.		Fine (per sampling depth in cm)				Coarse	Stump	
Plot	Trunk	Twig	Leaf	Total			0-10	10-20	20-30	30-40			
GN01				0.06	2.42		0.12	0.09	0.07	0.04	1.04		
GN02				0.01	3.71		0.12	0.10	0.06	0.04	0.60	2.77	
GN03				0.14	2.65		0.15	0.10	0.07	0.05	0.63	1.00	
GN04				0.56	3.88		0.30	0.16	0.10	0.06	0.60	0.71	
GN05				0.11	2.91		0.12	0.06	0.05	0.03	0.59		
GN06				0.01	3.63		0.26	0.16	0.09	0.06	0.61		
FA1a					3.91	0.62	0.39	0.14	0.10	0.07	2.18	1.42	
FA1b					3.86	0.71	0.35	0.08	0.08	0.08	0.86	1.38	
FA1c					2.50	0.46	0.32	0.06	0.09	0.08	0.34	0.50	
FA1d	1.61	0.36	0.20	2.18									2.18
FA1e	5.11	1.30	1.00	7.41									7.41
FA1f	7.40	2.44	1.98	11.81									11.81
FA2a					2.40	0.23	0.29	0.11	0.12	0.08	1.17	2.33	
FA2b	7.11	1.73	1.41	10.25									8.44
FA3a	3.83	0.73	0.37	4.93									3.13
FA3b	9.55	2.31	1.69	13.55									9.07
FA3c	7.76	1.83	1.20	10.79									7.15
FA4					8.50	0.93	0.45	0.14	0.11	0.08	1.40	1.41	
FA6a	9.12	2.07	1.71	12.91								3.33	6.49
FA6b	12.14	2.79	1.40	16.33								4.51	8.39
FA7a					1.99	0.89	0.45	0.23	0.18	0.14	4.14		
FA7b	11.47	2.33	0.95	14.75								3.22	6.27
FA10a	14.23	3.09	1.89	19.20								3.42	7.73
FA10b	13.98	2.74	1.60	18.32								5.12	7.05
FA12					1.35	1.55	0.49				4.13		
FA13a					1.05	0.36	0.73	0.48	0.30	0.27	7.83		
FA13b	14.65	2.61	1.09	18.36								3.62	5.98
FA15a	16.63	3.49	2.13	22.26								3.47	7.91
FA15b	15.30	3.06	1.80	20.17								5.37	6.97
FA17					1.50	0.80	0.54				4.58		
FA18a					1.45	0.70	0.49	0.30	0.25	0.21	5.62		
FA18b	17.61	2.68	1.56	21.85								4.44	6.31
FA25	15.77	3.04	1.67	20.47								3.99	6.12
FA26					1.00	0.52	0.49	0.32	0.28	0.33	7.95		

[1] AGB: live above-ground biomass. Derived from Kaïré (1999).

[2] ABB: available biomass for burning. Derived from Kaïré (1999).

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

Appendix 8 Fate of dry matter, carbon, nitrogen and phosphorus in above-ground woody biomass after clearing of a young (YF) and old (OF) fallow (young fallow: aged less than 10 years; old fallow: 10 years and more).
Two scenarios are considered: 50 % and 90 % of available plant biomass for burning is burnt.

Fallow type	Young fallow		Old fallow	
Burning efficiency	50%	90%	50%	90%
DM (t ha^{-1})				
Lost - harvest	5.02	5.02	19.99	19.99
Lost - fire	8.39	15.10	10.2	18.4
Returned - unburnt	8.39	1.68	10.25	2.05
Returned - ashes	0.00	0.00	0.00	0.00
C (t ha^{-1})				
Lost - harvest	1.93	1.93	7.26	7.26
Lost - fire	3.13	5.63	4.0	7.1
Returned - unburnt	3.13	0.63	3.95	0.79
Returned - ashes	0.00	0.00	0.00	0.00
N (kg ha^{-1})				
Lost - harvest	12.00	12.00	43.98	43.98
Lost - fire	43.71	78.68	59.2	106.6
Returned - unburnt	43.71	8.74	59.24	11.85
Returned - ashes	0.00	0.00	0.00	0.00
P (kg ha^{-1})				
Lost - harvest	3.46	3.46	13.22	13.22
Lost - fire	0.00	0.00	0.0	0.0
Returned - unburnt	3.52	0.70	3.43	0.69
Returned - ashes	3.52	6.33	3.43	6.18

CHAPTER 2

Appendix 9 Spearman correlation between soil physical and chemical properties of 11 fallow plots and six groundnut crops of the bush ring for the layers a. 0-10 cm, b. 10-20 cm, c. 20-30 cm, d. 30-40 cm, e. 0-40 cm.
Coding of variables: C: carbon. CA: calcium. CCoarFra: carbon content of the [50-2000] µm fraction. CEC: cation exchange capacity. CFinFrac: carbon content of the [0-50]µm fraction. CLAY: clay. CLAYFSI: clay+fine silt. CLAYSI: clay+silt. CN: C:N ratio. CSAND: coarse sand. CSILT: coarse silt. DENS: bulk density. FSAND: fine sand. FSILT: fine silt. K: potassium. MG: magnesium. N: nitrogen. NA: sodium. P: available phosphorus. PHH2O: pH in water. PHKCL: pH in KCl. PF25 and PF42: volumetric water content determined at a suction equivalent to pF2.5 and pF4.2. S: saturation rate.

a. Layer 0-10 cm

	C	CFINFRAC	CCOARFRA	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K
C	1.00 ***	0.92 ***	0.89 ***	0.85 ***	0.24	0.28	0.34	0.59 *	0.72 **	0.74 ***	0.27	0.08
CFINFRAC	0.92 ***	1.00 ***	0.69 **	0.74 ***	0.16	0.36	0.42	0.63 **	0.79 ***	0.74 ***	0.24	-0.01
CCOARFRA	0.89 ***	0.69 **	1.00 ***	0.81 ***	0.33	0.19	0.28	0.52 *	0.57 *	0.62 **	0.31	0.32
N	0.85 ***	0.74 ***	0.81 ***	1.00 ***	0.20	-0.23	0.28	0.49 *	0.71 **	0.74 ***	0.12	0.11
P	0.24	0.16	0.33	0.20	1.00 ***	0.12	0.40	0.55 *	0.37	-0.09	0.25	0.44
CN	0.28	0.36	0.19	-0.23	0.12	1.00 ***	0.25	0.30	0.12	0.04	0.43	0.06
PHH2O	0.34	0.42	0.28	0.28	0.40	0.25	1.00 ***	0.86 ***	0.63 **	0.10	0.16	0.03
PHKCL	0.59 *	0.63 **	0.52 *	0.49 *	0.55 *	0.30	0.86 ***	1.00 ***	0.74 ***	0.43	0.10	0.20
CA	0.72 **	0.79 ***	0.57 *	0.71 **	0.37	0.12	0.63 **	0.74 ***	1.00 ***	0.50 *	0.27	0.03
MG	0.74 ***	0.74 ***	0.62 **	0.74 ***	-0.09	0.04	0.10	0.43	0.50 *	1.00 ***	0.08	-0.01
NA	0.27	0.24	0.31	0.12	0.25	0.43	0.16	0.10	0.27	0.08	1.00 ***	0.23
K	0.08	-0.01	0.32	0.11	0.44	0.06	0.03	0.20	0.03	-0.01	0.23	1.00 ***
CEC	0.79 ***	0.85 ***	0.59 *	0.76 ***	-0.06	0.13	0.19	0.38	0.66 **	0.76 ***	0.29	0.06
S	0.66 **	0.72 **	0.54 *	0.67 **	0.35	0.08	0.68 **	0.77 ***	0.96 ***	0.49 *	0.19	-0.01
CLAY	0.53 *	0.47	0.42	0.57 *	-0.36	-0.05	-0.38	-0.16	0.29	0.55 *	0.12	-0.02
FSILT	0.41	0.43	0.32	0.49 *	-0.08	-0.10	-0.22	0.05	0.09	0.74 ***	0.05	-0.06
CSILT	0.22	0.44	0.05	0.25	-0.02	0.00	0.29	0.40	0.36	0.51 *	-0.10	-0.14
FSAND	-0.26	-0.37	-0.08	-0.38	0.40	0.27	-0.06	0.01	-0.22	-0.50 *	0.11	0.57 *
CSAND	-0.09	-0.05	-0.17	-0.06	-0.60 *	-0.18	-0.18	-0.45	-0.17	-0.08	-0.09	-0.57 *
CLAYFSI	0.50 *	0.47	0.39	0.63 **	-0.28	-0.18	-0.36	-0.12	0.26	0.69 **	0.13	-0.06
PF25	0.08	0.15	-0.14	-0.05	-0.50 *	0.23	-0.13	-0.23	0.04	0.05	-0.01	-0.48 *
PF42	0.60 *	0.52 *	0.48 *	0.52 *	-0.30	0.18	-0.11	-0.01	0.34	0.50 *	0.22	-0.17
DENS	-0.08	-0.14	-0.01	-0.05	0.11	0.06	-0.02	0.08	0.09	-0.04	0.31	0.58 *

a. Layer 0-10 cm (continued)

	CEC	S	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.79 ***	0.66 **	0.53 *	0.41	0.22	-0.26	-0.09	0.50 *	0.08	0.60 *	-0.08
CFINFRAC	0.85 ***	0.72 **	0.47	0.43	0.44	-0.37	-0.05	0.47	0.15	0.52 *	-0.14
CCOARFRA	0.59 *	0.54 *	0.42	0.32	0.05	-0.08	-0.17	0.39	-0.14	0.48 *	-0.01
N	0.76 ***	0.67 **	0.57 *	0.49 *	0.25	-0.38	-0.06	0.63 **	-0.05	0.52 *	-0.05
P	-0.06	0.35	-0.36	-0.08	-0.02	0.40	-0.60 *	-0.28	-0.50 *	-0.30	0.11
CN	0.13	0.08	-0.05	-0.10	0.00	0.27	-0.18	-0.18	0.23	0.18	0.06
PHH2O	0.19	0.68 **	-0.38	-0.22	0.29	-0.06	-0.18	-0.36	-0.13	-0.11	-0.02
PHKCL	0.38	0.77 ***	-0.16	0.05	0.40	0.01	-0.45	-0.12	-0.23	-0.01	0.08
CA	0.66 **	0.96 ***	0.29	0.09	0.36	-0.22	-0.17	0.26	0.04	0.34	0.09
MG	0.76 ***	0.49 *	0.55 *	0.74 ***	0.51 *	-0.50 *	-0.08	0.69 **	0.05	0.50 *	-0.04
NA	0.29	0.19	0.12	0.05	-0.10	0.11	-0.09	0.13	-0.01	0.22	0.31
K	0.06	-0.01	-0.02	-0.06	-0.14	0.57 *	-0.57 *	-0.06	-0.48 *	-0.17	0.58 *
CEC	1.00 ***	0.52 *	0.71 **	0.61 **	0.31	-0.35	0.02	0.74 ***	0.08	0.51 *	0.02
S	0.52 *	1.00 ***	0.16	0.02	0.40	-0.27	-0.16	0.16	0.04	0.33	0.04
CLAY	0.71 **	0.16	1.00 ***	0.47	-0.06	-0.25	0.19	0.91 ***	0.39	0.77 ***	0.15
FSILT	0.61 **	0.02	0.47	1.00 ***	0.33	-0.43	0.04	0.76 ***	-0.16	0.21	-0.31
CSILT	0.31	0.40	-0.06	0.33	1.00 ***	-0.58 *	-0.16	0.05	0.08	-0.12	-0.23
FSAND	-0.35	-0.27	-0.25	-0.43	-0.58 *	1.00 ***	-0.61 **	-0.39	-0.33	-0.36	0.49 *
CSAND	0.02	-0.16	0.19	0.04	-0.16	-0.61 **	1.00 ***	0.18	0.40	0.32	-0.38
CLAYFSI	0.74 ***	0.16	0.91 ***	0.76 ***	0.05	-0.39	0.18	1.00 ***	0.18	0.66 **	-0.01
PF25	0.08	0.04	0.39	-0.16	0.08	-0.33	0.40	0.18	1.00 ***	0.62 **	0.05
PF42	0.51 *	0.33	0.77 ***	0.21	-0.12	-0.36	0.32	0.66 **	0.62 **	1.00 ***	0.07
DENS	0.02	0.04	0.15	-0.31	-0.23	0.49 *	-0.38	-0.01	0.05	0.07	1.00 ***

Appendix 9 (continued)

b. Layer 10-20 cm

	C	CFINFRAC	CCOARFRA	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K
C	1.00 ***	0.62 **	0.31	0.60 *	0.31	0.60 *	0.20	0.21	0.40	0.27	0.30	0.52 *
CFINFRAC	0.62 **	1.00 ***	-0.48	0.25	-0.01	0.48 *	0.21	0.19	0.45	0.03	0.05	0.07
CCOARFRA	0.31	-0.48	1.00 ***	0.22	0.39	0.20	-0.04	-0.01	-0.17	0.33	0.33	0.31
N	0.60 *	0.25	0.22	1.00 ***	0.09	-0.18	0.32	0.37	0.53 *	0.52 *	0.17	0.34
P	0.31	-0.01	0.39	0.09	1.00 ***	0.33	0.27	0.23	0.05	-0.19	0.47	0.36
CN	0.60 *	0.48 *	0.20	-0.18	0.33	1.00 ***	0.03	-0.02	0.13	-0.19	0.17	0.26
PHH2O	0.20	0.21	-0.04	0.32	0.27	0.03	1.00 ***	0.99 ***	0.83 ***	0.14	0.26	0.09
PHKCL	0.21	0.19	-0.01	0.37	0.23	-0.02	0.99 ***	1.00 ***	0.82 ***	0.17	0.17	0.14
CA	0.40	0.45	-0.17	0.53 *	0.05	0.13	0.83 ***	0.82 ***	1.00 ***	0.16	0.24	0.22
MG	0.27	0.03	0.33	0.52 *	-0.19	-0.19	0.14	0.17	0.16	1.00 ***	0.04	0.01
NA	0.30	0.05	0.33	0.17	0.47	0.17	0.26	0.17	0.24	0.04	1.00 ***	0.30
K	0.52 *	0.07	0.31	0.34	0.36	0.26	0.09	0.14	0.22	0.01	0.30	1.00 ***
CEC	0.53 *	0.23	0.16	0.47	-0.05	0.24	-0.30	-0.23	0.08	0.02	-0.16	0.57 *
S	0.25	0.26	-0.04	0.50 *	0.17	-0.10	0.94 ***	0.92 ***	0.84 ***	0.36	0.30	0.07
CLAY	0.18	0.20	-0.13	0.22	-0.43	-0.12	-0.73 ***	-0.70 **	-0.38	0.15	-0.31	-0.04
FSILT	0.21	-0.03	0.38	0.07	-0.04	0.10	-0.26	-0.27	-0.31	0.57 *	0.02	-0.02
CSILT	-0.15	-0.02	0.08	-0.12	0.19	0.07	0.15	0.19	0.05	-0.09	-0.15	-0.05
FSAND	0.23	0.13	-0.05	-0.10	0.23	0.41	0.40	0.32	0.51 *	-0.27	0.47	0.42
CSAND	-0.37	-0.26	-0.13	-0.05	-0.48	-0.48 *	-0.51 *	-0.51 *	-0.55 *	0.24	-0.32	-0.56 *
CLAYFSI	0.28	0.13	0.16	0.25	-0.30	-0.04	-0.71 **	-0.67 **	-0.47	0.35	-0.25	0.01
PF25	-0.41	-0.05	-0.41	-0.14	-0.53 *	-0.42	-0.55 *	-0.57 *	-0.29	-0.02	-0.22	-0.43
PF42	-0.10	0.06	-0.36	0.20	-0.62 **	-0.45	-0.40	-0.36	-0.09	0.16	-0.33	-0.22
DENS	0.67 **	0.35	0.30	0.32	0.04	0.44	0.18	0.19	0.24	0.35	0.07	-0.05

c. Layer 20-30 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.82 ***	-0.01	0.17	-0.27	-0.21	0.07	0.46	0.26	0.47	0.47	0.06
N	0.82 ***	1.00 ***	0.02	-0.35	-0.35	-0.29	0.14	0.42	0.19	0.26	0.38	0.07
P	-0.01	0.02	1.00 ***	0.06	-0.03	-0.06	-0.10	-0.47	0.07	0.15	0.00	-0.10
CN	0.17	-0.35	0.06	1.00 ***	0.02	0.03	-0.21	0.01	0.09	0.03	0.20	-0.15
PHH2O	-0.27	-0.35	-0.03	0.02	1.00 ***	0.98 ***	0.79 ***	-0.07	0.62 **	0.07	-0.70 **	0.85 ***
PHKCL	-0.21	-0.29	-0.06	0.03	0.98 ***	1.00 ***	0.80 ***	-0.08	0.62 **	0.09	-0.68 **	0.84 ***
CA	0.07	0.14	-0.10	-0.21	0.79 ***	0.80 ***	1.00 ***	0.02	0.62 **	0.02	-0.52 *	0.86 ***
MG	0.46	0.42	-0.47	0.01	-0.07	-0.08	0.02	1.00 ***	0.34	0.09	0.08	0.26
NA	0.26	0.19	0.07	0.09	0.62 **	0.62 **	0.62 **	0.34	1.00 ***	0.12	-0.42	0.77 ***
K	0.47	0.26	0.15	0.03	0.07	0.09	0.02	0.09	0.12	1.00 ***	0.37	0.02
CEC	0.47	0.38	0.00	0.20	-0.70 **	-0.68 **	-0.52 *	0.08	-0.42	0.37	1.00 ***	-0.70 **
S	0.06	0.07	-0.10	-0.15	0.85 ***	0.84 ***	0.86 ***	0.26	0.77 ***	0.02	-0.70 **	1.00 ***
CLAY	0.70 **	0.73 ***	0.11	-0.03	-0.79 ***	-0.75 ***	-0.42	0.25	-0.16	0.19	0.68 **	-0.50 *
FSILT	-0.02	0.10	0.06	-0.19	-0.37	-0.34	-0.48 *	0.06	-0.47	0.04	0.30	-0.40
CSILT	0.07	0.04	-0.18	0.05	0.45	0.42	0.53 *	0.22	0.38	-0.12	-0.15	0.42
FSAND	-0.50 *	-0.60 *	0.34	0.18	0.43	0.39	0.12	-0.71 **	-0.14	0.10	-0.25	0.06
CSAND	0.09	0.15	-0.31	-0.02	-0.31	-0.26	-0.24	0.48 *	0.01	-0.33	-0.13	-0.06
CLAYFSI	0.64 **	0.69 **	0.04	-0.08	-0.83 ***	-0.80 ***	-0.52 *	0.27	-0.23	0.12	0.67 **	-0.55 *
PF25	0.37	0.65 **	-0.08	-0.35	-0.66 **	-0.65 **	-0.22	0.24	-0.18	-0.28	0.29	-0.33
PF42	0.48 *	0.68 **	0.05	-0.27	-0.72 **	-0.72 **	-0.32	0.28	-0.12	-0.05	0.44	-0.40
DENS	0.05	-0.04	-0.24	0.26	-0.13	-0.18	-0.17	0.09	0.06	0.02	0.29	-0.09

Appendix 9 (continued)

b. Layer 10-20 cm (continued)

	CEC	S	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.53 *	0.25	0.18	0.21	-0.15	0.23	-0.37	0.28	-0.41	-0.10	0.67 **
CFINFRAC	0.23	0.26	0.20	-0.03	-0.02	0.13	-0.26	0.13	-0.05	0.06	0.35
CCOARFRA	0.16	-0.04	-0.13	0.38	0.08	-0.05	-0.13	0.16	-0.41	-0.36	0.30
N	0.47	0.50 *	0.22	0.07	-0.12	-0.10	-0.05	0.25	-0.14	0.20	0.32
P	-0.05	0.17	-0.43	-0.04	0.19	0.23	-0.48	-0.30	-0.53 *	-0.62 **	0.04
CN	0.24	-0.10	-0.12	0.10	0.07	0.41	-0.48 *	-0.04	-0.42	-0.45	0.44
PHH2O	-0.30	0.94 ***	-0.73 ***	-0.26	0.15	0.40	-0.51 *	-0.71 **	-0.55 *	-0.40	0.18
PHKCL	-0.23	0.92 ***	-0.70 **	-0.27	0.19	0.32	-0.51 *	-0.67 **	-0.57 *	-0.36	0.19
CA	0.08	0.84 ***	-0.38	-0.31	0.05	0.51 *	-0.55 *	-0.47	-0.29	-0.09	0.24
MG	0.02	0.36	0.15	0.57 *	-0.09	-0.27	0.24	0.35	-0.02	0.16	0.35
NA	-0.16	0.30	-0.31	0.02	-0.15	0.47	-0.32	-0.25	-0.22	-0.33	0.07
K	0.57 *	0.07	-0.04	-0.02	-0.05	0.42	-0.56 *	0.01	-0.43	-0.22	-0.05
CEC	1.00 ***	-0.29	0.49 *	0.17	0.01	-0.01	-0.23	0.52 *	0.03	0.14	0.09
S	-0.29	1.00 ***	-0.53 *	-0.19	0.05	0.29	-0.35	-0.53 *	-0.43	-0.23	0.19
CLAY	0.49 *	-0.53 *	1.00 ***	0.19	-0.31	-0.41	0.50 *	0.91 ***	0.58 *	0.70 **	0.06
FSILT	0.17	-0.19	0.19	1.00 ***	0.17	-0.36	0.20	0.50 *	0.01	-0.10	0.35
CSILT	0.01	0.05	-0.31	0.17	1.00 ***	-0.37	-0.45	-0.12	-0.12	-0.40	-0.27
FSAND	-0.01	0.29	-0.41	-0.36	-0.37	1.00 ***	-0.55 *	-0.57 *	-0.22	-0.17	0.11
CSAND	-0.23	-0.35	0.50 *	0.20	-0.45	-0.55 *	1.00 ***	0.45	0.40	0.49 *	0.07
CLAYFSI	0.52 *	-0.53 *	0.91 ***	0.50 *	-0.12	-0.57 *	0.45	1.00 ***	0.38	0.46	0.16
PF25	0.03	-0.43	0.58 *	0.01	-0.12	-0.22	0.40	0.38	1.00 ***	0.77 ***	-0.30
PF42	0.14	-0.23	0.70 **	-0.10	-0.40	-0.17	0.49 *	0.46	0.77 ***	1.00 ***	0.07
DENS	0.09	0.19	0.06	0.35	-0.27	0.11	0.07	0.16	-0.30	0.07	1.00 ***

c. Layer 20-30 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.70 **	-0.02	0.07	-0.50 *	0.09	0.64 **	0.37	0.48 *	0.05
N	0.73 ***	0.10	0.04	-0.60 *	0.15	0.69 **	0.65 **	0.68 **	-0.04
P	0.11	0.06	-0.18	0.34	-0.31	0.04	-0.08	0.05	-0.24
CN	-0.03	-0.19	0.05	0.18	-0.02	-0.08	-0.35	-0.27	0.26
PHH2O	-0.79 ***	-0.37	0.45	0.43	-0.31	-0.83 ***	-0.66 **	-0.72 **	-0.13
PHKCL	-0.75 ***	-0.34	0.42	0.39	-0.26	-0.80 ***	-0.65 **	-0.72 **	-0.18
CA	-0.42	-0.48 *	0.53 *	0.12	-0.24	-0.52 *	-0.22	-0.32	-0.17
MG	0.25	0.06	0.22	-0.71 **	0.48 *	0.27	0.24	0.28	0.09
NA	-0.16	-0.47	0.38	-0.14	0.01	-0.23	-0.18	-0.12	0.06
K	0.19	0.04	-0.12	0.10	-0.33	0.12	-0.28	-0.05	0.02
CEC	0.68 **	0.30	-0.15	-0.25	-0.13	0.67 **	0.29	0.44	0.29
S	-0.50 *	-0.40	0.42	0.06	-0.06	-0.55 *	-0.33	-0.40	-0.09
CLAY	1.00 ***	0.15	-0.27	-0.57 *	0.21	0.97 ***	0.75 ***	0.88 ***	0.12
FSILT	0.15	1.00 ***	0.05	-0.30	0.14	0.34	0.13	0.09	-0.22
CSILT	-0.27	0.05	1.00 ***	-0.24	-0.31	-0.22	-0.16	-0.26	-0.23
FSAND	-0.57 *	-0.30	-0.24	1.00 ***	-0.58 *	-0.66 **	-0.60 *	-0.62 **	0.12
CSAND	0.21	0.14	-0.31	-0.58 *	1.00 ***	0.28	0.45	0.40	0.00
CLAYFSI	0.97 ***	0.34	-0.22	-0.66 **	0.28	1.00 ***	0.75 ***	0.85 ***	0.12
PF25	0.75 ***	0.13	-0.16	-0.60 *	0.45	0.75 ***	1.00 ***	0.93 ***	0.07
PF42	0.88 ***	0.09	-0.26	-0.62 **	0.40	0.85 ***	0.93 ***	1.00 ***	0.03
DENS	0.12	-0.22	-0.23	0.12	0.00	0.12	0.07	0.03	1.00 ***

Appendix 9 (continued)

d. Layer 30-40 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.86 ***	0.14	0.05	-0.73 **	-0.68 **	-0.38	0.40	0.36	0.26	0.80 ***	-0.60 *
N	0.86 ***	1.00 ***	-0.01	-0.44	-0.52 *	-0.53 *	-0.11	0.56 *	0.26	0.31	0.82 ***	-0.48
P	0.14	-0.01	1.00 ***	0.32	0.05	0.12	-0.02	-0.32	0.26	0.26	-0.05	0.01
CN	0.05	-0.44	0.32	1.00 ***	-0.19	-0.07	-0.36	-0.37	0.09	-0.16	-0.28	-0.03
PHH2O	-0.73 **	-0.52 *	0.05	-0.19	1.00 ***	0.82 ***	0.66 **	-0.31	-0.16	-0.22	-0.64 **	0.67 **
PHKCL	-0.68 **	-0.53 *	0.12	-0.07	0.82 ***	1.00 ***	0.69 **	-0.12	-0.05	-0.18	-0.82 ***	0.83 ***
CA	-0.38	-0.11	-0.02	-0.36	0.66 **	0.69 **	1.00 ***	0.26	0.08	-0.17	-0.49 *	0.85 ***
MG	0.40	0.56 *	-0.32	-0.37	-0.31	-0.12	0.26	1.00 ***	0.40	0.36	0.21	0.17
NA	0.36	0.26	0.26	0.09	-0.16	-0.05	0.08	0.40	1.00 ***	0.61 **	0.15	0.10
K	0.26	0.31	0.26	-0.16	-0.22	-0.18	-0.17	0.36	0.61 **	1.00 ***	0.33	-0.20
CEC	0.80 ***	0.82 ***	-0.05	-0.28	-0.64 **	-0.82 ***	-0.49 *	0.21	0.15	0.33	1.00 ***	-0.84 ***
S	-0.60 *	-0.48	0.01	-0.03	0.67 **	0.83 ***	0.85 ***	0.17	0.10	-0.20	-0.84 ***	1.00 ***
CLAY	0.83 ***	0.89 ***	-0.16	-0.30	-0.69 **	-0.79 ***	-0.37	0.35	0.08	0.14	0.93 ***	-0.72 **
FSILT	0.26	0.24	0.07	-0.10	-0.41	-0.30	-0.39	0.06	0.10	0.22	0.23	-0.25
CSILT	-0.64 **	-0.65 **	0.08	0.15	0.46	0.57 *	0.25	-0.29	0.00	-0.26	-0.62 **	0.47
FSAND	-0.36	-0.29	0.15	-0.02	0.61 **	0.55 *	0.34	-0.23	-0.35	-0.18	-0.44	0.38
CSAND	-0.31	-0.34	-0.48	0.03	0.09	0.20	0.19	0.22	0.25	0.19	-0.31	0.32
CLAYFSI	0.83 ***	0.89 ***	-0.15	-0.31	-0.67 **	-0.77 ***	-0.38	0.33	0.08	0.17	0.93 ***	-0.72 **
PF25	0.54 *	0.65 **	-0.28	-0.43	-0.42	-0.67 **	-0.11	0.27	-0.02	-0.04	0.69 **	-0.44
PF42	0.83 ***	0.86 ***	-0.11	-0.25	-0.60 *	-0.76 ***	-0.30	0.28	0.05	0.11	0.91 ***	-0.67 **
DENS	-0.18	0.01	-0.42	-0.47	-0.14	-0.06	-0.21	0.26	-0.04	0.40	0.11	-0.14

e. Layer 0-40 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.78 ***	0.13	-0.03	0.11	0.17	0.39	0.63 **	0.59 *	0.26	0.36	0.31
N	0.78 ***	1.00 ***	0.02	-0.53 *	0.01	0.04	0.38	0.63 **	0.32	0.10	0.39	0.33
P	0.13	0.02	1.00 ***	0.23	0.26	0.28	0.07	-0.38	0.45	0.39	-0.12	0.14
CN	-0.03	-0.53 *	0.23	1.00 ***	0.22	0.23	-0.08	-0.22	0.23	-0.01	-0.33	-0.02
PHH2O	0.11	0.01	0.26	0.22	1.00 ***	0.99 ***	0.83 ***	-0.01	0.51 *	0.13	-0.70 **	0.89 ***
PHKCL	0.17	0.04	0.28	0.23	0.99 ***	1.00 ***	0.83 ***	0.02	0.53 *	0.12	-0.66 **	0.88 ***
CA	0.39	0.38	0.07	-0.08	0.83 ***	0.83 ***	1.00 ***	0.28	0.48 *	0.01	-0.39	0.95 ***
MG	0.63 **	0.63 **	-0.38	-0.22	-0.01	0.02	0.28	1.00 ***	0.39	0.10	0.27	0.31
NA	0.59 *	0.32	0.45	0.23	0.51 *	0.53 *	0.48 *	0.39	1.00 ***	0.46	0.00	0.57 *
K	0.26	0.10	0.39	-0.01	0.13	0.12	0.01	0.10	0.46	1.00 ***	0.28	0.02
CEC	0.36	0.39	-0.12	-0.33	-0.70 **	-0.66 **	-0.39	0.27	0.00	0.28	1.00 ***	-0.54 *
S	0.31	0.33	0.14	-0.02	0.89 ***	0.88 ***	0.95 ***	0.31	0.57 *	0.02	-0.54 *	1.00 ***
CLAY	0.29	0.46	-0.21	-0.46	-0.76 ***	-0.76 ***	-0.38	0.26	-0.17	-0.03	0.80 ***	-0.50 *
FSILT	0.19	0.21	0.07	0.00	-0.31	-0.27	-0.35	0.25	0.10	0.12	0.27	-0.24
CSILT	-0.03	-0.14	0.29	0.23	0.37	0.43	0.24	-0.09	0.31	-0.23	-0.34	0.33
FSAND	-0.20	-0.33	0.27	0.33	0.51 *	0.49 *	0.25	-0.45	-0.09	0.29	-0.50 *	0.22
CSAND	0.08	0.23	-0.58 *	-0.22	-0.34	-0.36	-0.19	0.34	-0.28	-0.32	0.15	-0.18
CLAYFSI	0.34	0.52 *	-0.17	-0.51 *	-0.77 ***	-0.74 ***	-0.40	0.29	-0.09	0.00	0.87 ***	-0.50 *
PF25	0.13	0.32	-0.39	-0.43	-0.55 *	-0.57 *	-0.25	0.17	-0.21	-0.38	0.41	-0.31
PF42	0.37	0.53 *	-0.29	-0.45	-0.60 *	-0.61 **	-0.25	0.23	-0.16	-0.12	0.64 **	-0.36
DENS	0.13	0.05	-0.06	-0.13	0.04	0.02	0.07	0.48	0.31	0.51 *	0.17	0.08

Appendix 9 (continued)

d. Layer 30-40 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.83 ***	0.26	-0.64 **	-0.36	-0.31	0.83 ***	0.54 *	0.83 ***	-0.18
N	0.89 ***	0.24	-0.65 **	-0.29	-0.34	0.89 ***	0.65 **	0.86 ***	0.01
P	-0.16	0.07	0.08	0.15	-0.48	-0.15	-0.28	-0.11	-0.42
CN	-0.30	-0.10	0.15	-0.02	0.03	-0.31	-0.43	-0.25	-0.47
PHH2O	-0.69 **	-0.41	0.46	0.61 **	0.09	-0.67 **	-0.42	-0.60 *	-0.14
PHKCL	-0.79 ***	-0.30	0.57 *	0.55 *	0.20	-0.77 ***	-0.67 **	-0.76 ***	-0.06
CA	-0.37	-0.39	0.25	0.34	0.19	-0.38	-0.11	-0.30	-0.21
MG	0.35	0.06	-0.29	-0.23	0.22	0.33	0.27	0.28	0.26
NA	0.08	0.10	0.00	-0.35	0.25	0.08	-0.02	0.05	-0.04
K	0.14	0.22	-0.26	-0.18	0.19	0.17	-0.04	0.11	0.40
CEC	0.93 ***	0.23	-0.62 **	-0.44	-0.31	0.93 ***	0.69 **	0.91 ***	0.11
S	-0.72 **	-0.25	0.47	0.38	0.32	-0.72 **	-0.44	-0.67 **	-0.14
CLAY	1.00 ***	0.27	-0.65 **	-0.49 *	-0.35	0.99 ***	0.77 ***	0.96 ***	0.05
FSILT	0.27	1.00 ***	-0.19	-0.16	-0.21	0.32	0.19	0.22	0.41
CSILT	-0.65 **	-0.19	1.00 ***	-0.10	0.00	-0.68 **	-0.65 **	-0.77 ***	-0.05
FSAND	-0.49 *	-0.16	-0.10	1.00 ***	-0.03	-0.44	-0.33	-0.33	-0.16
CSAND	-0.35	-0.21	0.00	-0.03	1.00 ***	-0.34	-0.09	-0.29	0.42
CLAYFSI	0.99 ***	0.32	-0.68 **	-0.44	-0.34	1.00 ***	0.76 ***	0.96 ***	0.07
PF25	0.77 ***	0.19	-0.65 **	-0.33	-0.09	0.76 ***	1.00 ***	0.82 ***	0.10
PF42	0.96 ***	0.22	-0.77 ***	-0.33	-0.29	0.96 ***	0.82 ***	1.00 ***	-0.03
DENS	0.05	0.41	-0.05	-0.16	0.42	0.07	0.10	-0.03	1.00 ***

e. Layer 0-40 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.29	0.19	-0.03	-0.20	0.08	0.34	0.13	0.37	0.13
N	0.46	0.21	-0.14	-0.33	0.23	0.52 *	0.32	0.53 *	0.05
P	-0.21	0.07	0.29	0.27	-0.58 *	-0.17	-0.39	-0.29	-0.06
CN	-0.46	0.00	0.23	0.33	-0.22	-0.51 *	-0.43	-0.45	-0.13
PHH2O	-0.76 ***	-0.31	0.37	0.51 *	-0.34	-0.77 ***	-0.55 *	-0.60 *	0.04
PHKCL	-0.76 ***	-0.27	0.43	0.49 *	-0.36	-0.74 ***	-0.57 *	-0.61 **	0.02
CA	-0.38	-0.35	0.24	0.25	-0.19	-0.40	-0.25	-0.25	0.07
MG	0.26	0.25	-0.09	-0.45	0.34	0.29	0.17	0.23	0.48
NA	-0.17	0.10	0.31	-0.09	-0.28	-0.09	-0.21	-0.16	0.31
K	-0.03	0.12	-0.23	0.29	-0.32	0.00	-0.38	-0.12	0.51 *
CEC	0.80 ***	0.27	-0.34	-0.50 *	0.15	0.87 ***	0.41	0.64 **	0.17
S	-0.50 *	-0.24	0.33	0.22	-0.18	-0.50 *	-0.31	-0.36	0.08
CLAY	1.00 ***	0.06	-0.43	-0.55 *	0.30	0.96 ***	0.78 ***	0.91 ***	-0.06
FSILT	0.06	1.00 ***	0.10	-0.25	0.09	0.25	0.04	0.02	0.13
CSILT	-0.43	0.10	1.00 ***	-0.11	-0.55 *	-0.37	-0.30	-0.49 *	-0.16
FSAND	-0.55 *	-0.25	-0.11	1.00 ***	-0.49 *	-0.62 **	-0.52 *	-0.45	0.02
CSAND	0.30	0.09	-0.55 *	-0.49 *	1.00 ***	0.29	0.44	0.44	-0.14
CLAYFSI	0.96 ***	0.25	-0.37	-0.62 **	0.29	1.00 ***	0.74 ***	0.87 ***	0.02
PF25	0.78 ***	0.04	-0.30	-0.52 *	0.44	0.74 ***	1.00 ***	0.89 ***	-0.17
PF42	0.91 ***	0.02	-0.49 *	-0.45	0.44	0.87 ***	0.89 ***	1.00 ***	-0.16
DENS	-0.06	0.13	-0.16	0.02	-0.14	0.02	-0.17	-0.16	1.00 ***

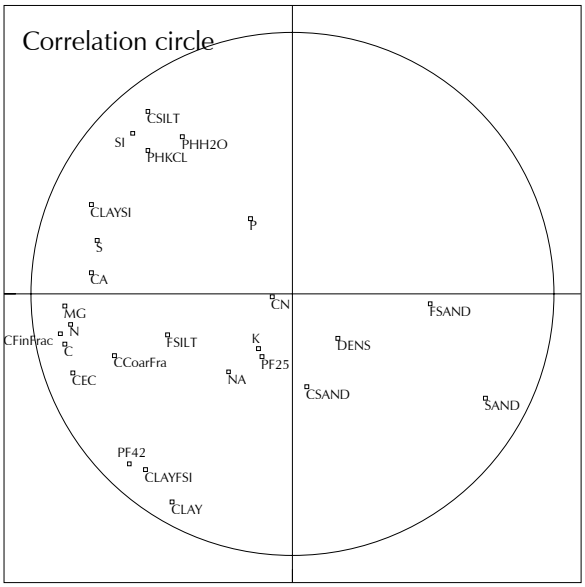
Appendix 10 Principal components (PC) analysis of the soil properties of a chronosequence consisting of six groundnut crops of the bush ring and 11 fallow plots

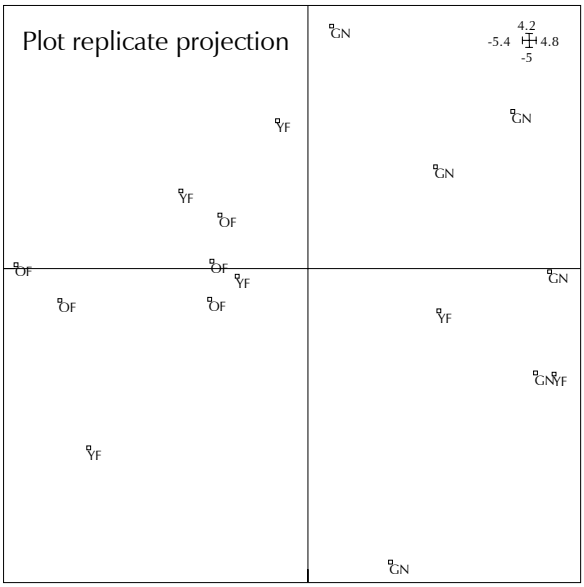
a. Correlation circles of the variables and projection of the plot replicates on planes PC 1x2 and 1x3 (PC1 as the horizontal axis) (Coding of variables: see p. A.23).

LAYER 0-10 cm

Relative inertias: PC1: 35% - PC2: 16% - PC3: 15%

Plane PC 1-3

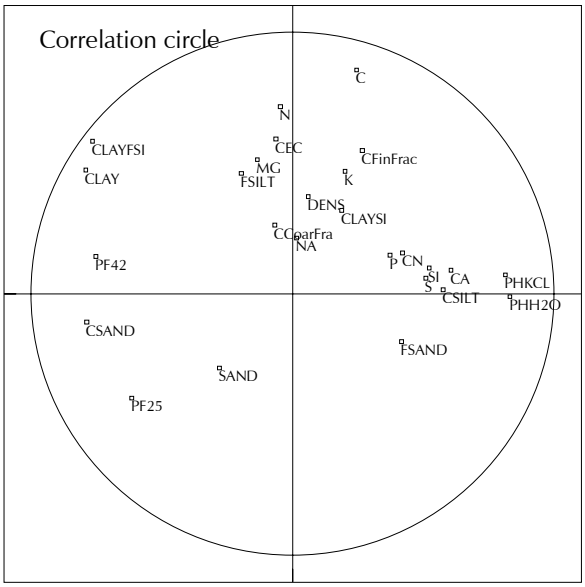


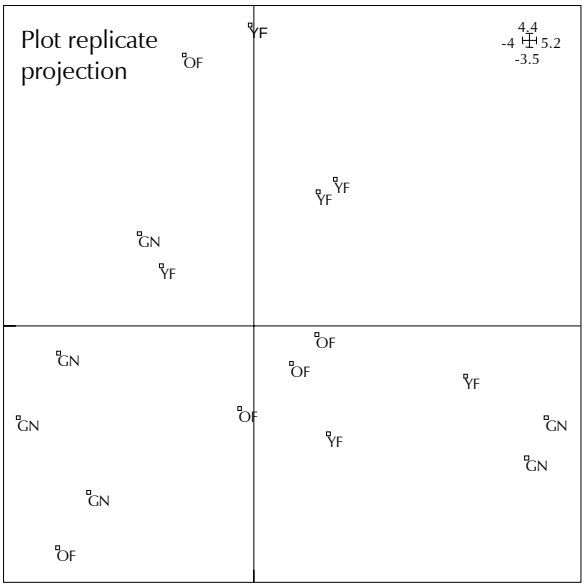


LAYER 10-20 cm

Relative inertias: PC1: 24% - PC2: 20% - PC3: 15%

Plane PC 1-3



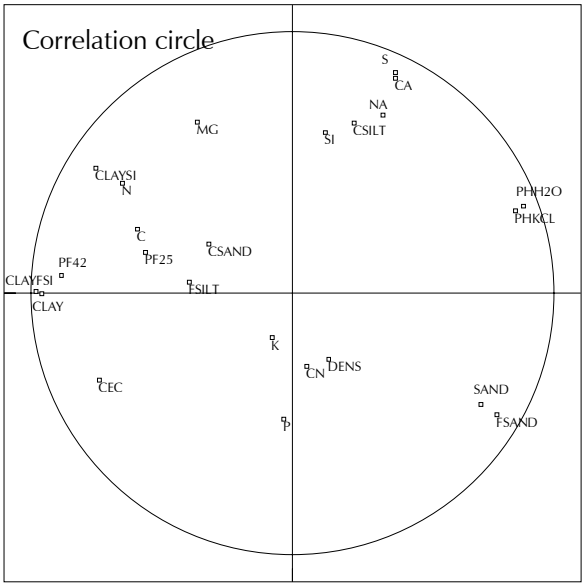


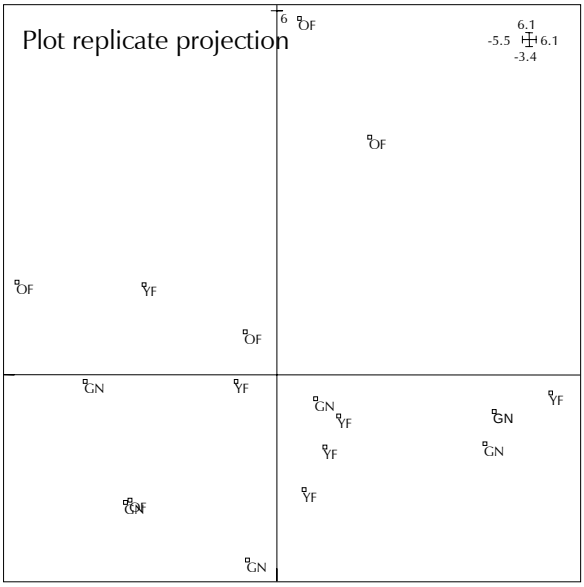
Appendix 10a (continued)

LAYER 20-30 cm

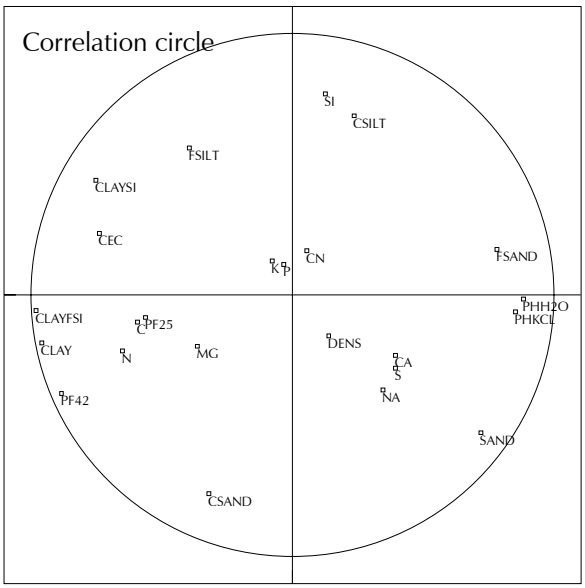
Relative inertias: PC1: 35% - PC2: 20% - PC3: 13%

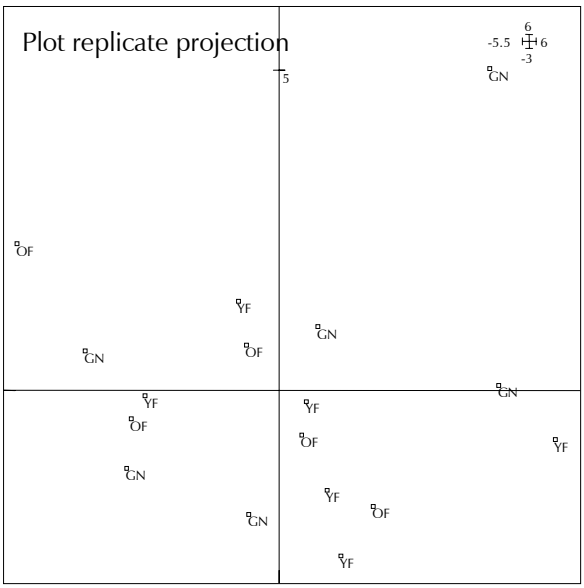
Plane PC 1-2





Plane PC 1-3



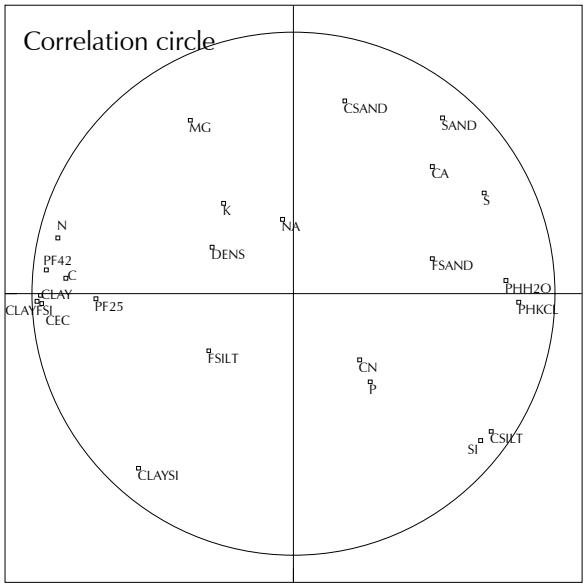


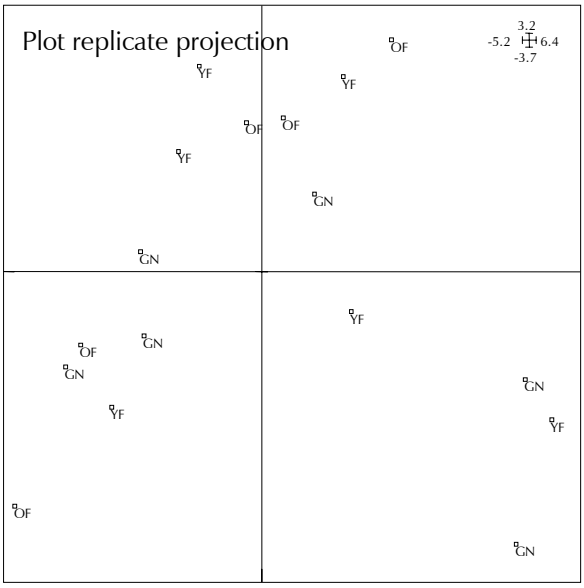
Appendix 10a (continued)

LAYER 30-40 cm

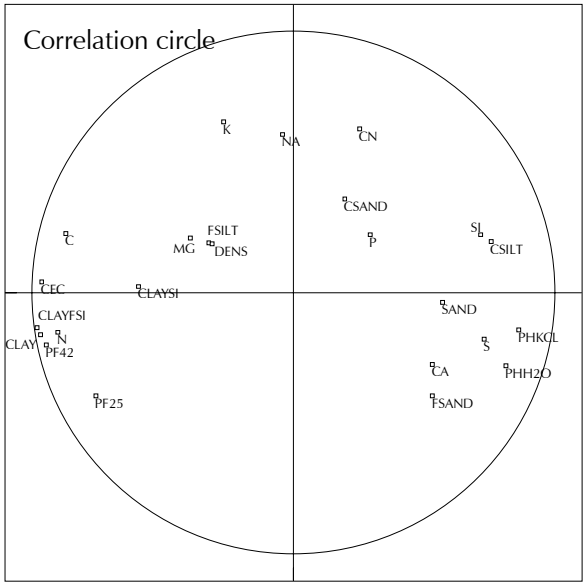
Relative inertias: PC1: 44% - PC2: 14% - PC3: 9%

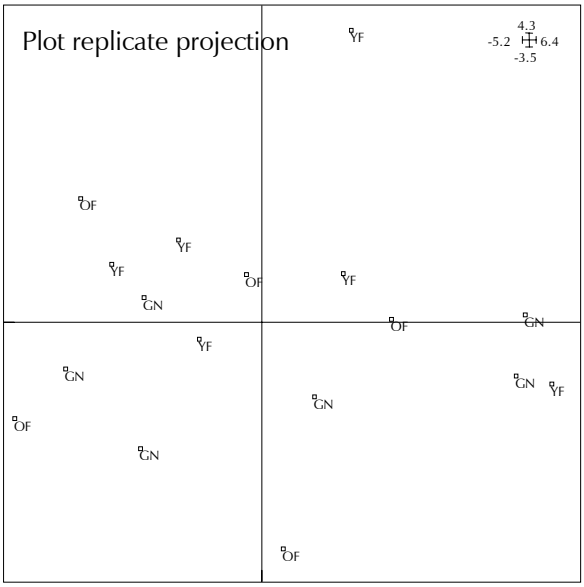
Plane PC 1-2





Plane PC 1-3



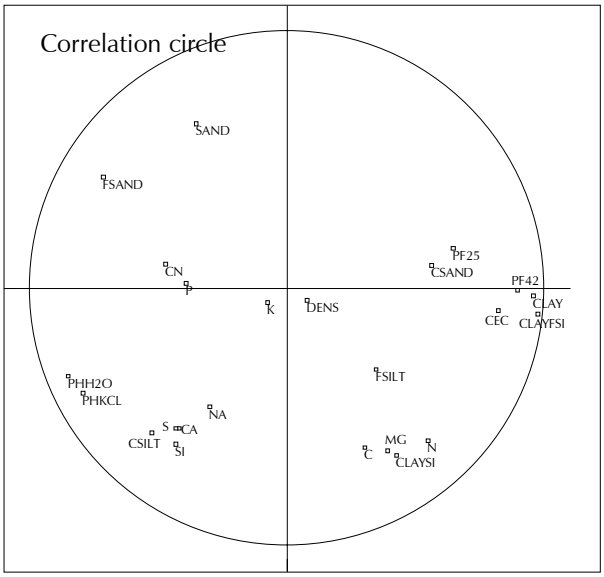


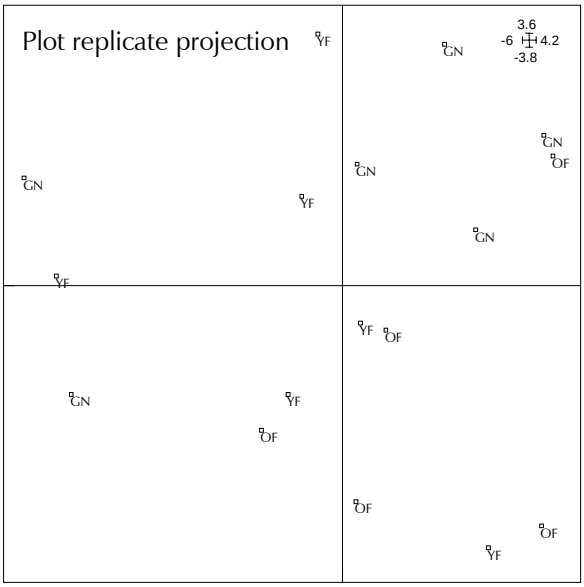
Appendix 10a (continued)

LAYER 0-40 cm

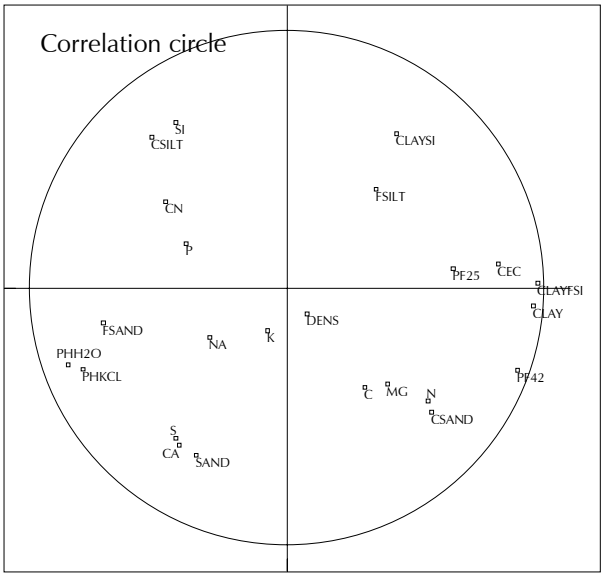
Relative inertias: PC1: 34% - PC2: 17% - PC3: 15%

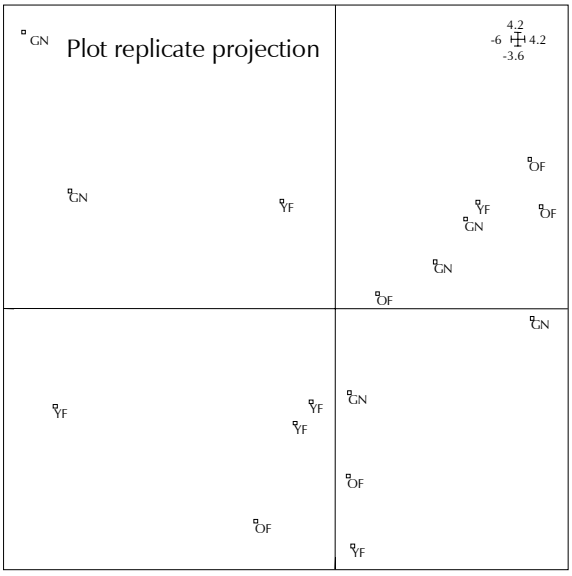
Plane PC 1-2





Plane PC 1-3





Appendix 10 (continued)
Coding of variables: C: carbon. CA: calcium. CCoarFra: carbon content of the [50-2000] µm fraction. CEC: cation exchange capacity CFinFrac: carbon content of the [0-50]µm fraction. CLAY: clay. CLAYFSI: clay+fine silt. CLAYSI: clay+silt. CN: C:N ratio. CSAND: coarse sand. CSILT: coarse silt. DENS: bulk density. FSAND: fine sand. FSILT: fine silt. K: potassium. MG: magnesium. N: nitrogen. NA: sodium. P: available phosphorus. PHH2O: pH in water. PHKCL: pH in KCl. PF25 and PF42: volumetric water content determined at a suction equivalent to pF2.5 and pF4.2. S: saturation rate. SAND: sand. SI: silt.
Coding of plot replicates: GN: groundnut crop. YF: young fallow (0-9 years). OF: fallow older than 9 years.
See Appendix 11 for data used in the PCA and Appendix 10b for eigen values.

Appendix 10 (continued) b. Eigen values.

	Layer (cm)				
Axis	0-10	10-20	20-30	30-40	0-40
1	9.17	6.17	8.40	10.69	8.20
2	4.14	5.13	4.72	3.39	4.08
3	4.03	3.88	3.14	2.24	3.66
4	2.69	3.23	2.28	2.11	2.87
5	1.59	2.27	1.46	1.71	1.48
6	1.05	1.54	1.30	1.47	1.13
7	0.92	1.04	0.89	0.72	0.76
8	0.80	0.92	0.68	0.64	0.59
9	0.57	0.78	0.41	0.35	0.40
10	0.42	0.37	0.30	0.29	0.39
11	0.27	0.22	0.19	0.17	0.26
12	0.20	0.20	0.10	0.10	0.11
13	0.06	0.12	0.06	0.06	0.06
14	0.04	0.09	0.04	0.05	0.01
15	0.03	0.04	0.00	0.01	0.00
16	0.01	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00

Appendix 11 Soil properties in a chronosequence consisting of six groundnut crops of the bush ring and 11 fallow plots.

a. Physical properties

	Layer	Texture (%)						pF	pF	Bulk density (kg dm^{-3})	
Plot	(cm)	Clay	Fine silt	Coarse silt	Fine sand	Coarse sand	Total	2.5	4.2	whole sample	[0-2]mm fr.
GN01	0-10	5.8	4.4	25.8	8.9	53.6	98.5	11.2	3.2	1.47	1.47
	10-20	12.6	4.5	23.9	8.5	49.6	99.1	9.1	4.6	1.50	1.50
	20-30	19.4	4.6	17.3	11.6	47.1	100.0	8.7	6.4	1.50	1.50
	30-40	31.0	4.4	17.5	6.7	39.5	99.1	12.8	9.0	1.50	1.50
GN02	0-10	6.9	4.6	21.6	13.0	54.5	100.6	8.8	2.8	1.51	1.51
	10-20	14.6	4.8	22.4	8.6	51.0	101.4	8.2	4.5	1.35	1.35
	20-30	23.3	6.0	16.9	11.1	43.0	100.3	9.3	6.9	1.60	1.60
	30-40	37.4	5.3	15.9	8.3	34.1	101.0	12.9	10.7	1.41	1.41
GN03	0-10	11.2	6.0	17.7	23.8	42.6	101.3	5.9	4.0	1.54	1.54
	10-20	14.9	5.1	17.4	20.6	43.0	101.0	6.5	4.5	1.54	1.54
	20-30	16.3	5.2	24.0	19.5	35.8	100.8	6.8	5.0	1.50	1.50
	30-40	21.4	4.9	20.7	15.7	38.9	101.6	8.3	6.5	1.53	1.51
GN04	0-10	4.9	4.5	32.8	16.5	40.6	99.3	5.3	2.1	1.53	1.53
	10-20	9.2	4.4	38.4	10.7	36.3	99.0	5.5	2.9	1.39	1.39
	20-30	12.1	4.4	24.6	20.4	38.1	99.6	6.2	3.8	1.66	1.66
	30-40	14.6	4.0	33.0	9.7	38.2	99.5	7.2	4.7	1.31	1.31
GN05	0-10	5.3	4.5	30.9	11.1	47.0	98.8	5.4	2.5	1.52	1.52
	10-20	15.0	5.0	25.3	10.4	43.9	99.6	12.9	5.3	1.52	1.52
	20-30	24.3	4.3	24.5	7.7	39.4	100.2	15.4	7.3	1.50	1.50
	30-40	31.4	5.1	16.0	11.4	37.6	101.5	19.9	9.7	1.52	1.52
GN06	0-10	4.4	5.2	28.0	28.0	33.2	98.8	5.1	1.6	1.53	1.52
	10-20	7.0	5.6	31.1	22.8	31.9	98.4	5.9	2.4	1.51	1.50
	20-30	8.5	6.4	30.4	25.7	27.4	98.4	6.4	2.7	1.49	1.49
	30-40	10.0	6.7	32.2	21.5	30.0	100.4	7.0	3.2	1.46	1.46
FA1a	0-10	5.6	4.6	27.3	22.1	39.9	99.5	4.4	2.7	1.50	1.50
	10-20	8.5	4.4	23.5	21.2	41.5	99.1	5.1	3.8	1.54	1.54
	20-30	10.2	4.3	22.5	25.2	36.9	99.1	6.1	3.9	1.45	1.45
	30-40	12.5	4.9	31.2	14.6	36.7	99.9	6.6	4.9	1.48	1.48
FA1b	0-10	9.7	5.5	25.9	12.3	45.4	98.8	7.3	4.8	1.55	1.54
	10-20	11.4	4.7	19.3	20.5	42.9	98.8	6.4	4.5	1.54	1.54
	20-30	16.8	5.3	17.4	14.2	46.6	100.3	7.0	5.6	1.47	1.47
	30-40	29.7	5.9	8.8	16.7	38.3	99.4	11.5	9.4	1.46	1.46
FA1c	0-10	6.8	4.4	24.9	23.5	41.0	100.6	4.8	3.1	1.61	1.61
	10-20	10.3	3.7	22.2	21.3	42.1	99.6	5.2	3.7	1.50	1.50
	20-30	18.4	3.9	19.9	19.9	38.7	100.8	6.9	5.7	1.55	1.55
	30-40	29.2	5.2	15.8	13.8	36.3	100.3	11.7	8.6	1.51	1.51
FA2a	0-10	6.2	5.4	19.0	20.5	47.2	98.3	4.2	2.5	1.51	1.51
	10-20	12.4	5.8	17.7	17.4	46.8	100.1	5.4	4.2	1.56	1.56
	20-30	15.4	5.3	20.8	16.1	42.5	100.1	6.7	5.2	1.53	1.52
	30-40	18.4	5.6	15.9	15.0	45.9	100.8	7.0	6.2	1.56	1.56
FA4	0-10	6.1	6.3	28.4	14.4	43.4	98.6	4.4	2.8	1.46	1.46
	10-20	10.8	6.3	29.5	11.9	41.1	99.6	5.4	3.9	1.55	1.55
	20-30	19.0	5.5	24.5	10.7	40.3	100.0	6.2	4.8	1.49	1.49
	30-40	14.9	5.7	28.4	7.1	44.1	100.2	7.3	5.5	1.52	1.52
FA7a	0-10	7.8	6.2	34.1	7.2	44.1	99.4	4.6	2.6	1.47	1.47
	10-20	14.3	6.1	28.7	6.6	44.2	99.9	5.7	3.9	1.57	1.57
	20-30	21.3	5.0	24.5	7.9	41.4	100.1	8.0	5.9	1.54	1.54
	30-40	31.6	5.9	24.3	4.5	34.8	101.1	11.0	8.9	1.51	1.51
FA12	0-10	8.0	5.2	30.3	10.2	46.2	99.9	8.9	4.3	1.56	1.56
	10-20	10.8	4.9	24.4	16.2	43.8	100.1	8.2	4.7	1.51	1.51
	20-30	18.0	5.2	28.5	6.8	42.8	101.3	14.2	6.1	1.52	1.52
	30-40	25.2	5.4	18.3	11.3	39.6	99.8	13.6	8.4	1.55	1.55
FA13a	0-10	8.2	7.7	33.0	9.3	41.4	99.6	5.4	3.0	1.53	1.53
	10-20	14.4	7.5	26.3	10.0	42.3	100.5	6.7	4.2	1.48	1.48
	20-30	25.1	7.5	24.9	3.8	39.4	100.7	9.2	7.4	1.41	1.41
	30-40	32.8	7.2	19.0	4.8	36.7	100.5	11.1	9.1	1.64	1.64
FA17	0-10	8.4	5.8	30.0	8.0	47.7	99.9	8.2	4.4	1.45	1.45
	10-20	11.7	5.3	20.8	17.9	45.4	101.1	7.4	4.6	1.55	1.55
	20-30	14.3	4.4	26.2	7.6	48.6	101.1	7.0	5.5	1.45	1.44
	30-40	19.5	3.8	20.5	12.9	43.9	100.6	8.2	6.8	1.36	1.36
FA18a	0-10	6.0	7.7	29.1	6.3	49.9	99.0	4.5	2.9	1.51	1.50
	10-20	9.5	7.0	24.1	7.6	50.8	99.0	5.1	3.5	1.52	1.52
	20-30	16.2	7.0	24.4	5.7	46.6	99.9	6.9	5.3	1.51	1.51
	30-40	21.9	6.8	18.1	7.7	45.3	99.8	14.8	8.1	1.53	1.53
FA26	0-10	7.4	6.2	31.6	8.0	46.4	99.6	14.4	4.1	1.45	1.45
	10-20	11.1	5.9	19.5	16.4	47.8	100.7	15.2	4.4	1.51	1.51
	20-30	21.2	5.6	19.7	11.7	42.0	100.2	16.6	7.0	1.50	1.50
	30-40	37.4	6.1	13.7	10.5	32.9	100.6	19.1	11.8	1.42	1.42

FA = fallow; GN = groundnut. The age of the fallow plots is mentioned in plot coding.

b. Chemical properties

Plot	Layer (cm)	pH (H_2O)	pH (KCl)	C (mg g^{-1})	N (mg g^{-1})	C/N	P_{OD} (x10^{-3} mg g^{-1})	Exchangeable cations (meq 100g^{-1} of soil) Ca	Mg	Na	K	CEC	Sat. rate
GN01	0-10	5.87	4.96	3.93	0.33	11.90	1.70	0.96	0.28	0.00	0.02	1.96	64
	10-20	5.24	4.37	3.19	0.30	10.63	1.90	0.65	0.35	0.00	0.02	2.28	45
	20-30	4.90	4.15	3.09	0.26	11.87	2.00	0.49	0.37	0.00	0.02	2.48	35
	30-40	4.67	4.00	3.87	0.33	11.73	1.30	0.54	0.44	0.01	0.03	3.40	30
GN02	0-10	5.82	4.99	4.40	0.38	11.58	2.30	1.05	0.31	0.00	0.04	2.32	60
	10-20	5.23	4.36	3.30	0.36	9.15	1.10	0.83	0.33	0.00	0.04	2.64	46
	20-30	4.88	4.10	3.55	0.35	10.14	2.00	0.90	0.44	0.00	0.05	3.04	46
	30-40	4.75	4.01	4.12	0.40	10.30	1.90	1.00	0.52	0.01	0.04	3.92	40
GN03	0-10	5.66	4.99	5.07	0.41	12.37	2.40	1.47	0.48	0.02	0.04	2.68	75
	10-20	5.44	4.65	4.28	0.35	12.22	1.40	1.19	0.49	0.00	0.05	2.80	62
	20-30	5.32	4.54	3.40	0.32	10.62	0.80	1.11	0.46	0.00	0.04	2.76	58
	30-40	5.23	4.46	3.41	0.35	9.73	1.20	1.12	0.51	0.01	0.03	2.96	56
GN04	0-10	6.24	5.71	5.02	0.37	13.56	2.90	1.78	0.43	0.00	0.05	2.48	91
	10-20	5.99	5.37	3.75	0.32	11.73	2.00	1.75	0.27	0.00	0.03	2.32	89
	20-30	5.86	5.17	3.30	0.27	12.20	1.60	1.48	0.28	0.02	0.03	2.56	70
	30-40	5.79	5.09	2.85	0.25	11.41	1.60	1.58	0.30	0.04	0.03	2.00	97
GN05	0-10	5.89	5.04	4.20	0.35	12.00	2.60	1.56	0.34	0.03	0.04	2.24	88
	10-20	5.10	4.27	3.77	0.31	12.15	1.90	0.70	0.24	0.00	0.04	2.44	40
	20-30	4.88	4.11	3.92	0.35	11.21	1.70	1.00	0.35	0.00	0.03	3.04	46
	30-40	5.41	4.06	3.60	0.37	9.73	1.10	0.99	0.43	0.01	0.04	3.68	40
GN06	0-10	6.02	5.22	4.31	0.29	14.87	3.20	1.12	0.34	0.02	0.04	2.20	69
	10-20	5.64	4.76	3.70	0.24	15.41	2.50	1.20	0.25	0.01	0.05	2.44	62
	20-30	5.52	4.59	2.66	0.23	11.55	2.30	1.00	0.22	0.00	0.03	2.32	54
	30-40	5.36	4.44	2.55	0.22	11.61	2.00	0.92	0.22	0.00	0.02	1.76	66
FA1a	0-10	6.22	5.65	5.82	0.58	10.03	4.70	2.03	0.48	0.00	0.05	2.34	109
	10-20	6.18	5.54	4.20	0.37	11.51	2.90	2.05	0.30	0.02	0.05	2.34	103
	20-30	5.91	5.18	3.02	0.31	9.75	2.30	1.71	0.23	0.02	0.05	1.94	104
	30-40	5.75	5.11	2.48	0.23	10.80	3.30	1.63	0.22	0.00	0.03	2.10	90
FA1b	0-10	6.02	5.22	7.42	0.58	12.70	3.70	2.19	0.50	0.05	0.09	2.86	99
	10-20	5.86	5.15	4.90	0.43	11.54	2.60	1.78	0.39	0.01	0.07	2.54	88
	20-30	5.51	4.74	3.90	0.34	11.47	2.10	1.45	0.36	0.02	0.04	2.30	81
	30-40	5.16	4.36	4.12	0.39	10.57	2.20	1.50	0.52	0.05	0.04	3.30	64
FA1c	0-10	5.82	5.19	5.09	0.40	12.72	2.90	1.37	0.43	0.01	0.08	2.22	85
	10-20	5.64	4.83	3.91	0.32	12.22	2.60	1.02	0.40	0.01	0.07	2.14	70
	20-30	5.35	4.46	3.67	0.32	11.67	2.00	0.93	0.57	0.02	0.06	2.42	65
	30-40	5.05	4.22	4.00	0.39	10.40	2.50	1.10	0.70	0.03	0.07	3.18	60
FA2a	0-10	5.78	4.99	4.40	0.37	11.88	2.30	1.00	0.38	0.00	0.06	2.40	60
	10-20	5.39	4.60	4.34	0.33	13.17	1.40	0.84	0.43	0.02	0.06	2.48	55
	20-30	5.22	4.42	3.25	0.28	11.61	0.90	0.78	0.51	0.00	0.06	3.04	45
	30-40	5.08	4.30	3.01	0.27	11.14	0.80	0.73	0.47	0.00	0.05	2.64	47
FA4	0-10	5.91	5.21	6.96	0.46	15.12	2.80	1.29	0.50	0.03	0.06	2.68	70
	10-20	5.59	4.86	4.27	0.35	12.19	2.20	1.01	0.50	0.00	0.07	2.64	59
	20-30	5.28	4.54	4.36	0.32	13.61	1.50	0.90	0.48	0.01	0.07	2.80	52
	30-40	5.02	4.29	3.77	0.28	13.46	2.00	0.86	0.44	0.04	0.05	2.78	50
FA7a	0-10	5.86	5.17	5.35	0.54	9.90	2.70	1.71	0.60	0.00	0.04	2.74	86
	10-20	5.46	4.71	5.29	0.40	13.22	2.50	1.04	0.66	0.00	0.03	2.50	69
	20-30	5.20	4.41	4.95	0.42	11.78	2.10	0.97	0.70	0.02	0.03	2.94	59
	30-40	4.81	4.11	4.01	0.39	10.29	1.20	0.92	0.68	0.02	0.04	3.62	46
FA12	0-10	6.21	5.57	7.49	0.54	13.88	2.20	2.10	0.69	0.03	0.04	2.86	100
	10-20	5.94	5.29	3.58	0.38	9.43	0.70	2.17	0.71	0.00	0.04	2.34	125
	20-30	5.56	4.80	3.45	0.35	9.85	0.70	3.28	0.67	0.03	0.03	2.14	187
	30-40	5.30	4.51	3.11	0.37	8.42	0.50	1.92	0.59	0.00	0.02	2.62	97
FA13a	0-10	5.79	5.13	4.82	0.47	10.25	2.00	1.22	0.65	0.00	0.08	2.62	74
	10-20	5.42	4.62	4.24	0.39	10.88	2.50	0.95	0.65	0.04	0.07	2.58	67
	20-30	4.95	4.19	4.16	0.39	10.68	2.10	0.90	0.58	0.01	0.06	3.06	51
	30-40	4.74	4.07	4.00	0.38	10.53	1.30	0.89	0.56	0.03	0.05	3.66	42
FA17	0-10	6.10	5.56	7.27	0.51	14.26	2.30	3.40	0.60	0.00	0.03	2.82	143
	10-20	5.95	5.24	4.02	0.36	11.16	1.00	2.70	0.63	0.01	0.02	2.10	160
	20-30	5.52	4.66	3.44	0.32	10.76	0.80	2.70	0.71	0.02	0.02	2.10	164
	30-40	5.12	4.34	3.74	0.30	12.47	0.90	1.82	0.68	0.02	0.03	2.22	115
FA18a	0-10	6.06	5.32	5.25	0.51	10.30	2.80	1.63	0.64	0.01	0.04	2.54	91
	10-20	5.65	4.88	3.57	0.32	11.14	2.30	0.80	0.60	0.00	0.03	1.82	79
	20-30	5.12	4.32	3.10	0.29	10.68	1.20	0.62	0.65	0.01	0.03	2.38	55
	30-40	4.84	4.08	3.22	0.32	10.07	1.20	1.36	0.55	0.03	0.04	2.78	71
FA26	0-10	5.74	5.05	5.96	0.46	12.95	2.60	1.37	0.62	0.00	0.03	2.42	84
	10-20	5.33	4.36	3.36	0.30	11.19	2.20	0.46	0.43	0.02	0.02	1.90	49
	20-30	4.70	4.02	3.40	0.33	10.29	1.70	0.23	0.29	0.00	0.02	2.70	20
	30-40	4.50	3.85	4.49	0.38	11.82	1.30	0.19	0.23	0.00	0.02	3.66	12

FA = fallow; GN = groundnut. The age of the fallow plots is mentioned in plot coding

Appendix 12 C, N and P storage in the plant-soil system at three main stages of the crop-fallow succession.

	Total storage		
	Groundnut field	Young fallow	Old fallow
C (t ha^{-1})			
Plant	5.5	17.7	29.0
Soil 0-20 cm fine fraction	9.9	11.6	11.3
Soil 0-20 cm coarse fractic	2.2	4.2	3.6
Soil 20-40 cm	10.1	11.2	10.7
Total	27.8	44.6	54.7
N (kg ha^{-1})			
Plant	106	231	333
Soil 0-20 cm	996	1304	1277
Soil 20-40 cm	924	985	1023
Total	2026	2520	2633
P (kg ha^{-1})			
Plant	5.9	19.6	33.8
Soil 0-20 cm (OD)	6.5	8.5	6.2
Soil 20-40 cm (OD)	4.9	5.7	3.5
Total	17.3	33.8	43.5

Young fallow: aged 0-9 years. Old fallow: older than 9 years. OD: available phosphorus (soil) as measured by Olsen's method modified by Dabin (1967).

Appendix 13 Soil storage of carbon, nitrogen and available phosphorus (P_{OD}) in a chronosequence consisting of six groundnut crops (GN) of the bush ring and 11 fallow plots (FA).

Plot	Storage (equivalent soil depth) per soil layer in cm				
	0-10	10-20	20-30	30-40	0-40
C storage (t ha^{-1})					
GN01	5.78	4.79	4.63	5.80	21.00
GN02	6.65	4.43	5.67	5.80	22.56
GN03	7.80	6.57	5.10	5.14	24.61
GN04	7.66	5.22	5.48	3.75	22.10
GN05	6.37	5.71	5.89	5.46	23.42
GN06	6.58	5.56	3.97	3.74	19.85
FA1a	8.71	6.49	4.40	3.68	23.28
FA1b	11.39	7.55	5.75	6.02	30.70
FA1c	8.20	5.87	5.67	6.02	25.76
FA2a	6.62	6.79	4.95	4.67	23.03
FA4	10.17	6.58	6.51	5.74	29.00
FA7a	7.83	8.29	7.60	6.04	29.76
FA12	11.66	5.42	5.25	4.84	27.18
FA13a	7.40	6.25	5.88	6.59	26.12
FA17	10.57	6.25	4.97	5.11	26.90
FA18a	7.82	5.43	4.67	4.94	22.85
FA26	8.58	5.08	5.11	6.38	25.15
N storage (kg ha^{-1})					
GN01	485	451	390	495	1821
GN02	574	484	559	564	2182
GN03	631	538	480	528	2177
GN04	565	445	449	328	1787
GN05	530	470	525	561	2086
GN06	442	361	344	322	1469
FA1a	866	564	452	341	2223
FA1b	896	654	501	569	2621
FA1c	645	480	485	579	2189
FA2a	558	515	426	420	1920
FA4	671	541	478	427	2117
FA7a	793	627	645	588	2654
FA12	841	574	534	575	2523
FA13a	721	576	551	623	2469
FA17	741	558	462	409	2170
FA18a	767	488	438	490	2182
FA26	669	454	494	539	2156
P_{OD} storage (kg ha^{-1})					
GN01	2.5	2.9	3.0	1.9	10.3
GN02	3.5	1.5	3.2	2.7	10.8
GN03	3.7	2.2	1.2	1.8	8.9
GN04	4.4	2.8	2.7	2.1	12.0
GN05	3.9	2.9	2.5	1.7	11.0
GN06	4.9	3.8	3.4	2.9	15.0
FA1a	7.1	4.5	3.3	4.9	19.8
FA1b	5.7	4.0	3.1	3.2	16.0
FA1c	4.7	3.9	3.1	3.8	15.4
FA2a	3.5	2.2	1.4	1.2	8.3
FA4	4.1	3.4	2.2	3.0	12.8
FA7a	4.0	3.9	3.2	1.8	12.9
FA12	3.4	1.1	1.1	0.8	6.3
FA13a	3.1	3.7	3.0	2.1	11.9
FA17	3.3	1.5	1.2	1.2	7.3
FA18a	4.2	3.5	1.8	1.8	11.4
FA26	3.8	3.3	2.5	1.8	11.5

The age of the fallow plots is mentioned in plot coding

Appendix 14 Carbon storage (t ha^{-1}) in two soil size fractions in a chronosequence consisting of six groundnut crops (GN) of the bush ring and 11 fallow plots (FA).

Fraction	[0-50] µm		[50-2000] µm	
	Layer (cm)		Layer (cm)	
Plot	0-10	10-20	0-10	10-20
GN1	4.87	4.90	1.71	0.67
GN2	6.39	4.81	1.27	0.41
GN3	5.04	4.91	1.26	0.81
GN4	4.57	4.54	1.21	0.20
GN5	4.99	3.27	1.64	1.17
GN6	6.11	5.16	1.70	1.42
FA1a	6.00	3.89	2.71	2.60
FA1b	8.30	7.29	3.09	0.26
FA1c	5.49	4.33	2.72	1.54
FA2a	4.89	5.18	1.73	1.60
FA4	7.59	4.27	2.58	2.30
FA7a	5.96	6.05	1.87	2.24
FA12	8.62	4.01	3.05	1.40
FA13a	5.64	4.73	1.76	1.53
FA17	8.09	6.05	2.48	0.20
FA18a	5.98	3.95	1.84	1.48
FA26	6.23	3.16	2.34	1.92

The age of the fallow plots is mentioned in plot coding

Appendix 15 Root decomposition dynamics of Combretum glutinosum *Perr. (% of remaining initial biomass) after clearing of a 15 years old fallow as measured during a mesh-bag experiment.*

Length of	Root diameter (mm)		
incubation	0-2	2-5	5-10
0	100.0	100.0	100.0
6	35.7 ±3.5	43.7 ±4.8	56.1 ±4.8
12	25.5 ±3.1	26.5 ±4.6	30.6 ±6.4
18	14.0 ±4.7	15.0 ±5.2	9.6 ±4.9
24	7.8 ±1.7	4.0 ±1.4	6.8 ±2.3

±*: standard error; n=20.*

Appendix 16 Remaining amounts of dry matter, carbon, nitrogen and phosphorus from the decaying root component after clearing of a young (YF) and old (OF) fallow (stumps removed).

Fallow type	Time after clearing (months)				
	0	6	12	18	24
Dry matter (t ha^{-1})					
Young fallow	8.7	4.7	2.3	0.8	0.5
Old fallow	20.5	11.2	5.4	2.0	1.3
Carbon (t ha^{-1})					
Young fallow	3.2	1.7	0.8	0.3	0.2
Old fallow	7.4	4.0	2.0	0.7	0.5
Nitrogen (kg ha^{-1})					
Young fallow	42	22	11	4	3
Old fallow	91	47	24	9	6
Phosphorus (kg ha^{-1})					
Young fallow	2.4	1.2	0.6	0.2	0.2
Old fallow	7.6	4.1	2.0	0.7	0.5

CHAPTER 3

Appendix 17 C, N and P_t content of biomass components of groundnut (GN), millet (MI), maize (MA) and rice (RI).

Plot	Panicle / pod	Stover / haulm	Weed and woody advent	Roots fine	Roots coarse
Carbon (g $100g^{-1}$DM)					
GN01	46.6	33.2	35.6	34.6	38.0 +
GN02	45.9	34.0	35.2	35.4	38.0 +
GN03	45.9	33.8	35.9	33.9	38.0 +
GN04	44.3	34.1	37.1	34.2	38.0 +
GN05	41.9	32.9	35.5	31.7	38.0 +
GN06	46.7	33.6	35.0	35.0	38.0 +
MI01	34.9	36.6	35.9	32.8	32.8 ‡
MI02	35.3	37.9	35.2	36.2	36.2 ‡
MI03	35.3	35.5	34.6	34.3	34.3 ‡
MI04	35.6	38.1	35.2	37.3	37.3 ‡
MA01	35.9	35.4	24.8	33.4	33.4 ‡
MA02	35.2	34.8	27.9	35.5	35.5 ‡
RI01	33.2	31.9	32.7	30.0	30.0 ‡
RI02	31.2	29.6	32.6	29.6	29.6 ‡
Nitrogen (g $100g^{-1}$DM)					
GN01	3.09	1.65	0.85	1.74	0.35 +
GN02	2.72	1.54	0.84	1.56	0.35 +
GN03	2.51	1.91	0.75	1.61	0.35 +
GN04	2.78	1.56	0.61	1.73	0.35 +
GN05	3.12	1.78	1.02	1.65	0.35 +
GN06	3.02	1.74	0.89	1.66	0.35 +
MI01	1.43	0.29	1.10	0.99	0.99 ‡
MI02	0.98	0.20	1.30	1.00	1.00 ‡
MI03	1.23	0.32	1.50	1.14	1.14 ‡
MI04	1.29	0.27	1.30	1.01	1.01 ‡
MA01	1.02	0.81	1.47	1.39	1.39 ‡
MA02	1.39	0.79	1.68	1.23	1.23 ‡
RI01	0.67	0.42	0.92	0.83	0.83 ‡
RI02	0.58	0.39	0.90	0.69	0.69 ‡
Phosphorus (g $100g^{-1}$DM)					
GN01	0.19	0.07	0.05	0.06	0.02 +
GN02	0.15	0.09	0.07	0.06	0.02 +
GN03	0.19	0.09	0.05	0.06	0.02 +
GN04	0.17	0.08	0.06	0.09	0.02 +
GN05	0.18	0.09	0.07	0.06	0.02 +
GN06	0.16	0.08	0.08	0.09	0.02 +
MI01	0.27	0.06	0.25	0.08	0.08 ‡
MI02	0.25	0.06	0.19	0.06	0.06 ‡
MI03	0.24	0.08	0.12	0.07	0.07 ‡
MI04	0.20	0.07	0.19	0.08	0.08 ‡
MA01	0.25	0.21	0.36	0.08	0.08 ‡
MA02	0.15	0.18	0.41	0.07	0.07 ‡
RI01	0.09	0.08	0.19	0.06	0.06 ‡
RI02	0.18	0.11	0.23	0.05	0.05 ‡

+: estimated as the mean value measured on coarse root biomass of three one-year old fallow plots(see Part I)

‡: extrapolated value from the content in fine root biomass.

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included

Appendix 18 Carbon, nitrogen and phosphorus storage in plant biomass of main cash and food crops along a typical toposequence in Sare Yorobana, southern Senegal.

Plot	Panicle	Stover	Weed and	Fine roots per soil layer in cm					Coarse
	/ pod	/ haulm	woody advent	0-10	10-20	20-30	30-40	0-40	roots
Carbon (t ha^{-1})									
GN01	0.31	0.50	0.12	0.07	0.05	0.04	0.02	0.18	1.97
GN02	0.54	0.63	0.14	0.07	0.06	0.03	0.02	0.19	1.15
GN03	0.34	0.39	0.27	0.08	0.05	0.04	0.03	0.21	1.19
GN04	0.55	0.60	0.61	0.11	0.06	0.04	0.02	0.23	1.14
GN05	0.28	0.39	0.41	0.07	0.03	0.03	0.02	0.14	1.12
GN06	0.52	0.51	0.29	0.10	0.06	0.03	0.02	0.22	1.15
MI01	0.49	1.61	0.10	0.11	0.06	0.03	0.03	0.23	0.08
MI02	0.65	2.38	0.14	0.12	0.08	0.04	0.03	0.28	0.04
MI03	0.86	3.48	0.46	0.18	0.11	0.05	0.03	0.37	0.01
MI04	0.87	3.67	0.45	0.26	0.09	0.02	0.03	0.40	0.27
MA01	1.31	1.67	0.34	0.05	0.02	0.02	0.01	0.10	0.00
MA02	1.97	1.81	0.27	0.06	0.02	0.02	0.02	0.12	0.01
RI01	0.43	0.69	0.03	0.88	0.26	0.10	0.08	1.31	0.03
RI02	1.44	1.32	0.13	0.46	0.11	0.04	0.03	0.65	0.01
Nitrogen (kg ha^{-1})									
GN01	20.5	25.0	2.8	3.4	2.6	1.9	1.1	9.1	17.9
GN02	32.2	28.6	3.3	3.1	2.7	1.5	1.0	8.3	10.5
GN03	18.4	21.9	5.6	4.0	2.6	2.0	1.3	9.8	10.8
GN04	34.5	27.3	10.1	5.7	3.1	1.9	1.1	11.9	10.4
GN05	21.0	21.0	11.6	3.4	1.6	1.3	0.9	7.2	10.2
GN06	33.9	26.3	7.3	4.9	2.9	1.6	1.1	10.5	10.5
MI01	20.2	12.7	3.0	3.2	1.9	0.8	1.1	6.9	2.3
MI02	18.2	12.6	5.1	3.4	2.3	1.2	0.9	7.8	1.0
MI03	30.0	31.4	19.8	6.0	3.6	1.8	1.0	12.4	0.4
MI04	31.5	26.0	16.8	7.1	2.4	0.7	0.7	10.9	7.4
MA01	37.3	38.1	20.2	2.2	0.6	0.7	0.6	4.1	0.2
MA02	78.0	41.2	16.4	2.1	0.8	0.7	0.6	4.2	0.4
RI01	8.7	9.1	0.8	24.2	7.2	2.7	2.2	36.3	0.9
RI02	26.7	17.4	3.6	10.7	2.5	1.0	0.8	15.0	0.2
Phosphorus (kg ha^{-1})									
GN01	1.26	1.06	0.16	0.12	0.09	0.07	0.04	0.31	1.04
GN02	1.78	1.67	0.27	0.12	0.10	0.06	0.04	0.32	0.60
GN03	1.39	1.03	0.37	0.15	0.10	0.07	0.05	0.37	0.63
GN04	2.11	1.40	0.93	0.30	0.16	0.10	0.06	0.62	0.60
GN05	1.21	1.06	0.75	0.12	0.06	0.05	0.03	0.26	0.59
GN06	1.80	1.21	0.64	0.26	0.16	0.09	0.06	0.57	0.61
MI01	3.81	2.63	0.68	0.26	0.15	0.06	0.09	0.56	0.19
MI02	4.63	3.77	0.72	0.21	0.14	0.07	0.05	0.47	0.06
MI03	5.83	7.86	1.58	0.37	0.22	0.11	0.06	0.76	0.02
MI04	4.88	6.73	2.39	0.56	0.19	0.05	0.06	0.86	0.59
MA01	9.14	9.89	4.95	0.13	0.04	0.04	0.03	0.24	0.01
MA02	8.41	9.38	3.99	0.12	0.04	0.04	0.04	0.24	0.02
RI01	1.17	1.73	0.17	1.75	0.52	0.20	0.16	2.63	0.06
RI02	8.30	4.90	0.92	0.78	0.18	0.07	0.06	1.09	0.02

GN: groundnut. MI: millet. MA: maize. RI: rice.

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included

Appendix 19 Carbon, nitrogen and available phosphorus storage in soil of main cash and food crops along a typical toposequence in Sare Yorobana (expressed in soil equivalent depth).

Plot	Storage (equivalent soil depth) per soil layer in cm				
	0-10	10-20	20-30	30-40	0-40
Carbon (t ha^{-1})					
GN01	5.78	4.79	4.63	5.80	21.0
GN02	6.65	4.43	5.67	5.80	22.6
GN03	7.80	6.57	5.10	5.14	24.6
GN04	7.66	1.76	5.48	3.75	22.1
GN05	6.37	5.71	5.89	5.46	23.4
GN06	6.58	5.56	3.97	3.74	19.8
MI01	10.83	5.25	4.05	4.60	24.7
MI02	7.85	5.54	4.36	3.47	21.2
MI03	9.53	5.81	3.77	4.69	23.8
MI04	8.56	5.85	4.09	4.34	22.8
MA01	12.40	5.78	3.53	3.28	25.0
MA02	17.16	10.23	5.72	4.10	37.2
RI01	20.13	15.56	12.61	11.28	59.6
RI02	26.25	20.53	17.39	13.60	77.8
Nitrogen (kg ha^{-1})					
GN01	485	451	390	495	1821
GN02	574	484	559	564	2182
GN03	631	538	480	528	2177
GN04	565	445	449	328	1787
GN05	530	470	525	561	2086
GN06	442	361	344	322	1469
MI01	807	461	394	495	2157
MI02	601	399	275	292	1568
MI03	768	491	466	498	2223
MI04	747	442	375	347	1910
MA01	1135	510	305	282	2233
MA02	1618	810	440	325	3193
RI01	1642	1101	668	493	3905
RI02	2519	2329	2010	1442	8300
Phosphorus (available) (kg ha^{-1})					
GN01	2.5	2.9	3.0	1.9	10.3
GN02	3.5	1.5	3.2	2.7	10.8
GN03	3.7	2.2	1.2	1.8	8.9
GN04	4.4	2.8	2.7	2.1	12.0
GN05	3.9	2.9	2.5	1.7	11.0
GN06	4.9	3.8	3.4	2.9	15.0
MI01	14.6	12.5	12.9	19.3	59.3
MI02	5.1	4.6	3.5	3.2	16.5
MI03	8.6	6.1	4.5	4.4	23.6
MI04	15.6	11.0	9.7	5.8	42.2
MA01	33.2	20.7	18.9	20.4	93.3
MA02	65.0	47.2	30.5	24.5	167.2
RI01	13.9	12.4	8.4	6.3	41.0
RI02	19.7	66.4	87.0	59.2	232.3

GN: groundnut. MI: millet. MA: maize. RI: rice.

Appendix 20 Spearman correlation between soil physical and chemical properties of main cash and food crops along a typical toposequence in Sare Yorobana for the layers a. 0-10 cm, b. 10-20 cm, c. 20-30 cm, d. 30-40 cm, e. 0-40 cm.
Coding of variables: C: carbon. CA: calcium. CCoarFra: carbon content of the [50-2000] µm fraction. CEC: cation exchange capacity. CFinFrac: carbon content of the [0-50] µm fraction. CLAY: clay. CLAYFSI: clay+fine silt. CLAYSI: clay+silt. CN: C:N ratio. CSAND: coarse sand. CSILT: coarse silt. DENS: bulk density. FSAND: fine sand. FSILT: fine silt. K: potassium. MG: magnesium. N: nitrogen. NA: sodium. P: available phosphorus. PHH2O: pH in water. PHKCL: pH in KCl. PF25 and PF42: volumetric water content determined at a suction equivalent to pF2.5 and pF4.2. S: saturation rate. SAND: sand. SI: silt.

a. Layer 0-10 cm

	C	CFINFRAC	CCOARFRA	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K
C	1.00 ***	0.90 ***	0.87 ***	0.95 ***	0.89 ***	-0.34	0.77 **	0.82 **	0.88 ***	0.92 ***	-0.51	0.88 ***
CFINFRAC	0.90 ***	1.00 ***	0.62 *	0.83 ***	0.86 ***	-0.27	0.70 *	0.78 **	0.98 ***	0.84 ***	-0.51	0.92 ***
CCOARFRA	0.87 ***	0.62 *	1.00 ***	0.79 **	0.81 **	-0.20	0.73 **	0.75 **	0.66 *	0.82 **	-0.29	0.72 **
N	0.95 ***	0.83 ***	0.79 **	1.00 ***	0.79 **	-0.53	0.64 *	0.67 *	0.79 **	0.84 ***	-0.42	0.80 **
P	0.89 ***	0.86 ***	0.81 **	0.79 **	1.00 ***	-0.29	0.86 ***	0.87 ***	0.90 ***	0.91 ***	-0.37	0.98 ***
CN	-0.34	-0.27	-0.20	-0.53	-0.29	1.00 ***	-0.13	-0.09	-0.23	-0.31	0.19	-0.31
PHH2O	0.77 **	0.70 *	0.73 **	0.64 *	0.86 ***	-0.13	1.00 ***	0.95 ***	0.78 **	0.85 ***	-0.55	0.83 ***
PHKCL	0.82 **	0.78 **	0.75 **	0.67 *	0.87 ***	-0.09	0.95 ***	1.00 ***	0.85 ***	0.88 ***	-0.61 *	0.84 ***
CA	0.88 ***	0.98 ***	0.66 *	0.79 **	0.90 ***	-0.23	0.78 **	0.85 ***	1.00 ***	0.85 ***	-0.48	0.94 ***
MG	0.92 ***	0.84 ***	0.82 **	0.84 ***	0.91 ***	-0.31	0.85 ***	0.88 ***	0.85 ***	1.00 ***	-0.45	0.90 ***
NA	-0.51	-0.51	-0.29	-0.42	-0.37	0.19	-0.55	-0.61 *	-0.48	-0.45	1.00 ***	-0.38
K	0.88 ***	0.92 ***	0.72 **	0.80 **	0.98 ***	-0.31	0.83 ***	0.84 ***	0.94 ***	0.90 ***	-0.38	1.00 ***
CEC	0.97 ***	0.94 ***	0.75 **	0.95 ***	0.85 ***	-0.41	0.65 *	0.74 **	0.91 ***	0.86 ***	-0.46	0.87 ***
S	0.73 **	0.80 **	0.57	0.62 *	0.78 **	-0.03	0.83 ***	0.80 **	0.80 **	0.85 ***	-0.42	0.83 ***
CLAY	0.00	-0.01	-0.21	0.19	-0.23	-0.58 *	-0.47	-0.44	-0.14	-0.16	0.01	-0.19
FSILT	0.05	0.07	0.04	0.13	0.11	-0.24	-0.30	-0.23	-0.02	0.08	0.39	0.14
CSILT	0.01	0.36	-0.09	-0.14	0.29	0.22	0.28	0.36	0.44	0.12	-0.13	0.35
FSAND	0.27	0.13	0.36	0.22	0.34	0.02	0.06	0.14	0.12	0.35	0.30	0.28
CSAND	-0.24	-0.32	-0.24	-0.15	-0.48	-0.05	-0.16	-0.27	-0.35	-0.38	-0.25	-0.46
CLAYFSI	0.08	0.04	-0.03	0.30	-0.05	-0.71 *	-0.42	-0.41	-0.08	-0.01	0.26	-0.02
PF25	-0.13	-0.09	-0.29	0.04	-0.30	-0.44	-0.44	-0.52	-0.24	-0.26	-0.04	-0.22
PF42	0.22	0.21	0.04	0.41	0.04	-0.79 **	-0.21	-0.18	0.12	0.13	-0.04	0.08
DENS	-0.35	-0.26	-0.29	-0.47	-0.47	0.70 *	-0.40	-0.25	-0.24	-0.41	0.11	-0.49

b. Layer 10-20 cm

	C	CFINFRAC	CCOARFRA	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K
C	1.00 ***	0.78 **	0.48	0.48	0.25	0.37	0.21	0.20	0.34	0.27	0.22	0.41
CFINFRAC	0.78 **	1.00 ***	-0.01	0.15	0.16	0.57	0.17	0.13	0.34	0.16	0.22	0.10
CCOARFRA	0.48	-0.01	1.00 ***	0.74 **	0.21	-0.07	0.22	0.27	0.26	0.38	0.08	0.62 *
N	0.48	0.15	0.74 **	1.00 ***	0.00	-0.46	0.04	0.09	0.25	0.29	0.11	0.29
P	0.25	0.16	0.21	0.00	1.00 ***	0.24	0.90 ***	0.94 ***	0.82 **	0.77 **	0.39	0.82 **
CN	0.37	0.57	-0.07	-0.46	0.24	1.00 ***	0.27	0.17	0.15	0.08	0.10	0.23
PHH2O	0.21	0.17	0.22	0.04	0.90 ***	0.27	1.00 ***	0.97 ***	0.80 **	0.85 ***	0.41	0.82 **
PHKCL	0.20	0.13	0.27	0.09	0.94 ***	0.17	0.97 ***	1.00 ***	0.87 ***	0.84 ***	0.41	0.83 ***
CA	0.34	0.34	0.26	0.25	0.82 **	0.15	0.80 **	0.87 ***	1.00 ***	0.61 *	0.44	0.68 *
MG	0.27	0.16	0.38	0.29	0.77 **	0.08	0.85 ***	0.84 ***	0.61 *	1.00 ***	0.08	0.85 ***
NA	0.22	0.22	0.08	0.11	0.39	0.10	0.41	0.41	0.44	0.08	1.00 ***	0.20
K	0.41	0.10	0.62 *	0.29	0.82 **	0.23	0.82 **	0.83 ***	0.68 *	0.85 ***	0.20	1.00 ***
CEC	0.28	0.18	0.58 *	0.39	0.28	0.12	0.11	0.25	0.39	0.24	-0.03	0.36
S	0.40	0.30	0.32	0.27	0.80 **	0.19	0.91 ***	0.88 ***	0.83 ***	0.78 **	0.45	0.82 **
CLAY	-0.04	-0.18	-0.06	0.17	-0.79 **	-0.45	-0.81 **	-0.78 **	-0.66 *	-0.55	-0.64 *	-0.60 *
FSILT	0.30	0.47	0.06	-0.22	0.24	0.79 **	0.23	0.15	0.10	0.33	-0.27	0.35
CSILT	0.31	0.65 *	-0.46	-0.28	0.28	0.54	0.27	0.19	0.32	0.05	0.44	-0.01
FSAND	0.36	0.24	0.43	-0.04	0.49	0.57	0.58 *	0.57	0.43	0.36	0.56	0.61 *
CSAND	-0.57	-0.79 **	0.13	0.11	-0.29	-0.66 *	-0.27	-0.22	-0.30	-0.15	-0.51	-0.16
CLAYFSI	0.20	0.16	0.10	0.29	-0.62 *	-0.15	-0.67 *	-0.65 *	-0.53	-0.28	-0.68 *	-0.42
PF25	-0.07	-0.04	-0.05	0.05	-0.43	-0.12	-0.60 *	-0.60 *	-0.60 *	-0.22	-0.63 *	-0.38
PF42	0.08	0.01	0.12	0.32	-0.54	-0.31	-0.69 *	-0.66 *	-0.55	-0.29	-0.65 *	-0.41
DENS	0.41	0.31	0.21	-0.11	0.55	0.53	0.66 *	0.56	0.24	0.70 *	0.09	0.60 *

Appendix 20 (continued)

a. Layer 0-10 cm (continued)

	CEC	S	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.97 ***	0.73 **	0.00	0.05	0.01	0.27	-0.24	0.08	-0.13	0.22	-0.35
CFINFRAC	0.94 ***	0.80 **	-0.01	0.07	0.36	0.13	-0.32	0.04	-0.09	0.21	-0.26
CCOARFRA	0.75 **	0.57	-0.21	0.04	-0.09	0.36	-0.24	-0.03	-0.29	0.04	-0.29
N	0.95 ***	0.62 *	0.19	0.13	-0.14	0.22	-0.15	0.30	0.04	0.41	-0.47
P	0.85 ***	0.78 **	-0.23	0.11	0.29	0.34	-0.48	-0.05	-0.30	0.04	-0.47
CN	-0.41	-0.03	-0.58 *	-0.24	0.22	0.02	-0.05	-0.71 *	-0.44	-0.79 **	0.70 *
PHH2O	0.65 *	0.83 ***	-0.47	-0.30	0.28	0.06	-0.16	-0.42	-0.44	-0.21	-0.40
PHKCL	0.74 **	0.80 **	-0.44	-0.23	0.36	0.14	-0.27	-0.41	-0.52	-0.18	-0.25
CA	0.91 ***	0.80 **	-0.14	-0.02	0.44	0.12	-0.35	-0.08	-0.24	0.12	-0.24
MG	0.86 ***	0.85 ***	-0.16	0.08	0.12	0.35	-0.38	-0.01	-0.26	0.13	-0.41
NA	-0.46	-0.42	0.01	0.39	-0.13	0.30	-0.25	0.26	-0.04	-0.04	0.11
K	0.87 ***	0.83 ***	-0.19	0.14	0.35	0.28	-0.46	-0.02	-0.22	0.08	-0.49
CEC	1.00 ***	0.67 *	0.16	0.11	0.07	0.27	-0.29	0.22	-0.07	0.36	-0.31
S	0.67 *	1.00 ***	-0.33	-0.15	0.32	0.02	-0.17	-0.29	-0.22	-0.12	-0.24
CLAY	0.16	-0.33	1.00 ***	0.19	-0.51	-0.01	0.21	0.82 **	0.64 *	0.80 **	-0.04
FSILT	0.11	-0.15	0.19	1.00 ***	-0.06	0.64 *	-0.65 *	0.63 *	0.30	0.32	-0.36
CSILT	0.07	0.32	-0.51	-0.06	1.00 ***	-0.22	-0.34	-0.43	-0.29	-0.26	0.11
FSAND	0.27	0.02	-0.01	0.64 *	-0.22	1.00 ***	-0.82 **	0.25	-0.36	-0.04	-0.16
CSAND	-0.29	-0.17	0.21	-0.65 *	-0.34	-0.82 **	1.00 ***	-0.12	0.37	0.04	0.19
CLAYFSI	0.22	-0.29	0.82 **	0.63 *	-0.43	0.25	-0.12	1.00 ***	0.67 *	0.88 ***	-0.36
PF25	-0.07	-0.22	0.64 *	0.30	-0.29	-0.36	0.37	0.67 *	1.00 ***	0.68 *	-0.26
PF42	0.36	-0.12	0.80 **	0.32	-0.26	-0.04	0.04	0.88 ***	0.68 *	1.00 ***	-0.33
DENS	-0.31	-0.24	-0.04	-0.36	0.11	-0.16	0.19	-0.36	-0.26	-0.33	1.00 ***

b. Layer 10-20 cm (continued)

	CEC	S	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.28	0.40	-0.04	0.30	0.31	0.36	-0.57	0.20	-0.07	0.08	0.41
CFINFRAC	0.18	0.30	-0.18	0.47	0.65 *	0.24	-0.79 **	0.16	-0.04	0.01	0.31
CCOARFRA	0.58 *	0.32	-0.06	0.06	-0.46	0.43	0.13	0.10	-0.05	0.12	0.21
N	0.39	0.27	0.17	-0.22	-0.28	-0.04	0.11	0.29	0.05	0.32	-0.11
P	0.28	0.80 **	-0.79 **	0.24	0.28	0.49	-0.29	-0.62 *	-0.43	-0.54	0.55
CN	0.12	0.19	-0.45	0.79 **	0.54	0.57	-0.66 *	-0.15	-0.12	-0.31	0.53
PHH2O	0.11	0.91 ***	-0.81 **	0.23	0.27	0.58 *	-0.27	-0.67 *	-0.60 *	-0.69 *	0.66 *
PHKCL	0.25	0.88 ***	-0.78 **	0.15	0.19	0.57	-0.22	-0.65 *	-0.60 *	-0.66 *	0.56
CA	0.39	0.83 ***	-0.66 *	0.10	0.32	0.43	-0.30	-0.53	-0.60 *	-0.55	0.24
MG	0.24	0.78 **	-0.55	0.33	0.05	0.36	-0.15	-0.28	-0.22	-0.29	0.70 *
NA	-0.03	0.45	-0.64 *	-0.27	0.44	0.56	-0.51	-0.68 *	-0.63 *	-0.65 *	0.09
K	0.36	0.82 **	-0.60 *	0.35	-0.01	0.61 *	-0.16	-0.42	-0.38	-0.41	0.60 *
CEC	1.00 ***	0.03	-0.14	0.31	-0.15	0.27	-0.16	0.25	0.19	0.18	0.07
S	0.03	1.00 ***	-0.71 **	0.17	0.31	0.51	-0.28	-0.62 *	-0.64 *	-0.61 *	0.48
CLAY	-0.14	-0.71 **	1.00 ***	-0.31	-0.46	-0.66 *	0.47	0.80 **	0.55	0.75 **	-0.43
FSILT	0.31	0.17	-0.31	1.00 ***	0.40	0.26	-0.50	0.17	0.28	0.02	0.52
CSILT	-0.15	0.31	-0.46	0.40	1.00 ***	0.10	-0.82 **	-0.24	-0.17	-0.39	0.24
FSAND	0.27	0.51	-0.66 *	0.26	0.10	1.00 ***	-0.46	-0.56	-0.63 *	-0.65 *	0.52
CSAND	-0.16	-0.28	0.47	-0.50	-0.82 **	-0.46	1.00 ***	0.13	0.18	0.34	-0.41
CLAYFSI	0.25	-0.62 *	0.80 **	0.17	-0.24	-0.56	0.13	1.00 ***	0.81 **	0.88 ***	-0.14
PF25	0.19	-0.64 *	0.55	0.28	-0.17	-0.63 *	0.18	0.81 **	1.00 ***	0.88 ***	-0.12
PF42	0.18	-0.61 *	0.75 **	0.02	-0.39	-0.65 *	0.34	0.88 ***	0.88 ***	1.00 ***	-0.30
DENS	0.07	0.48	-0.43	0.52	0.24	0.52	-0.41	-0.14	-0.12	-0.30	1.00 ***

Appendix 20 (continued)

c. Layer 20-30 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.67 *	-0.48	0.20	-0.54	-0.43	-0.12	-0.27	0.08	-0.36	0.69 *	-0.41
N	0.67 *	1.00 ***	-0.46	-0.51	-0.60 *	-0.47	-0.02	-0.12	-0.01	-0.18	0.88 ***	-0.36
P	-0.48	-0.46	1.00 ***	0.05	0.84 ***	0.72 **	0.45	0.68 *	-0.34	0.80 **	-0.23	0.74 **
CN	0.20	-0.51	0.05	1.00 ***	0.22	0.25	0.06	-0.09	0.26	-0.17	-0.44	0.14
PHH2O	-0.54	-0.60 *	0.84 ***	0.22	1.00 ***	0.95 ***	0.71 *	0.67 *	-0.29	0.77 **	-0.42	0.90 ***
PHKCL	-0.43	-0.47	0.72 **	0.25	0.95 ***	1.00 ***	0.84 ***	0.52	-0.12	0.64 *	-0.37	0.86 ***
CA	-0.12	-0.02	0.45	0.06	0.71 *	0.84 ***	1.00 ***	0.52	-0.27	0.52	0.06	0.76 **
MG	-0.27	-0.12	0.68 *	-0.09	0.67 *	0.52	0.52	1.00 ***	-0.70 *	0.83 ***	0.09	0.78 **
NA	0.08	-0.01	-0.34	0.26	-0.29	-0.12	-0.27	-0.70 *	1.00 ***	-0.46	-0.25	-0.39
K	-0.36	-0.18	0.80 **	-0.17	0.77 **	0.64 *	0.52	0.83 ***	-0.46	1.00 ***	-0.04	0.88 ***
CEC	0.69 *	0.88 ***	-0.23	-0.44	-0.42	-0.37	0.06	0.09	-0.25	-0.04	1.00 ***	-0.25
S	-0.41	-0.36	0.74 **	0.14	0.90 ***	0.86 ***	0.76 **	0.78 **	-0.39	0.88 ***	-0.25	1.00 ***
CLAY	0.38	0.67 *	-0.62 *	-0.51	-0.76 **	-0.74 **	-0.46	-0.31	0.15	-0.40	0.46	-0.64 *
FSILT	-0.23	-0.16	0.39	0.01	0.24	0.12	0.08	0.49	-0.50	0.29	0.10	0.31
CSILT	-0.57	-0.33	0.11	-0.03	0.24	0.26	0.20	-0.02	0.12	0.05	-0.29	0.24
FSAND	-0.10	-0.47	0.20	0.55	0.47	0.53	0.44	0.01	-0.15	0.08	-0.41	0.43
CSAND	-0.05	-0.07	-0.04	-0.10	-0.08	-0.13	-0.30	-0.13	0.29	-0.01	-0.25	-0.21
CLAYFSI	0.48	0.75 **	-0.39	-0.54	-0.68 *	-0.71 **	-0.41	-0.02	-0.18	-0.26	0.73 **	-0.56
PF25	0.29	0.56	-0.40	-0.55	-0.71 **	-0.77 **	-0.52	-0.17	-0.09	-0.36	0.55	-0.65 *
PF42	0.63 *	0.84 ***	-0.55	-0.43	-0.71 **	-0.64 *	-0.30	-0.21	0.06	-0.34	0.68 *	-0.56
DENS	0.11	0.16	0.19	0.04	0.24	0.32	0.50	0.37	-0.01	0.29	0.26	0.36

d. Layer 30-40 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.96 ***	-0.64 *	-0.49	-0.75 **	-0.64 *	0.13	-0.17	0.15	-0.40	0.85 ***	-0.67 *
N	0.96 ***	1.00 ***	-0.71 **	-0.62 *	-0.78 **	-0.67 *	0.18	-0.28	0.08	-0.45	0.82 **	-0.69 *
P	-0.64 *	-0.71 **	1.00 ***	0.34	0.75 **	0.75 **	0.20	0.70 *	-0.01	0.80 **	-0.32	0.73 **
CN	-0.49	-0.62 *	0.34	1.00 ***	0.39	0.15	-0.55	0.10	-0.13	0.08	-0.47	0.16
PHH2O	-0.75 **	-0.78 **	0.75 **	0.39	1.00 ***	0.90 ***	0.25	0.45	0.21	0.69 *	-0.52	0.86 ***
PHKCL	-0.64 *	-0.67 *	0.75 **	0.15	0.90 ***	1.00 ***	0.56	0.46	0.20	0.69 *	-0.49	0.98 ***
CA	0.13	0.18	0.20	-0.55	0.25	0.56	1.00 ***	0.16	0.14	0.31	0.14	0.57
MG	-0.17	-0.28	0.70 *	0.10	0.45	0.46	0.16	1.00 ***	0.12	0.78 **	0.19	0.39
NA	0.15	0.08	-0.01	-0.13	0.21	0.20	0.14	0.12	1.00 ***	0.03	0.00	0.13
K	-0.40	-0.45	0.80 **	0.08	0.69 *	0.69 *	0.31	0.78 **	0.03	1.00 ***	0.04	0.62 *
CEC	0.85 ***	0.82 **	-0.32	-0.47	-0.52	-0.49	0.14	0.19	0.00	0.04	1.00 ***	-0.54
S	-0.67 *	-0.69 *	0.73 **	0.16	0.86 ***	0.98 ***	0.57	0.39	0.13	0.62 *	-0.54	1.00 ***
CLAY	0.89 ***	0.87 ***	-0.62 *	-0.60 *	-0.68 *	-0.63 *	0.05	-0.13	0.19	-0.25	0.86 ***	-0.63 *
FSILT	-0.15	-0.16	0.45	0.29	0.19	0.13	-0.04	0.39	-0.10	0.25	-0.05	0.07
CSILT	-0.67 *	-0.67 *	0.47	0.47	0.64 *	0.66 *	0.22	-0.05	-0.01	0.07	-0.76 **	0.68 *
FSAND	-0.79 **	-0.68 *	0.31	0.28	0.41	0.28	-0.31	0.08	-0.15	0.15	-0.73 **	0.26
CSAND	-0.24	-0.29	0.17	-0.17	0.23	0.27	-0.05	0.31	0.11	0.44	-0.03	0.23
CLAYFSI	0.96 ***	0.92 ***	-0.52	-0.49	-0.64 *	-0.59 *	0.13	0.01	0.13	-0.22	0.94 ***	-0.61 *
PF25	0.92 ***	0.91 ***	-0.62 *	-0.55	-0.69 *	-0.68 *	0.02	-0.08	0.10	-0.32	0.90 ***	-0.70 *
PF42	0.94 ***	0.92 ***	-0.57	-0.55	-0.66 *	-0.60 *	0.15	-0.08	0.11	-0.27	0.92 ***	-0.61 *
DENS	-0.41	-0.48	0.73 **	0.27	0.61 *	0.57	0.07	0.86 ***	-0.06	0.78 **	-0.06	0.46

Appendix 20 (continued)

c. Layer 20-30 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.38	-0.23	-0.57	-0.10	-0.05	0.48	0.29	0.63 *	0.11
N	0.67 *	-0.16	-0.33	-0.47	-0.07	0.75 **	0.56	0.84 ***	0.16
P	-0.62 *	0.39	0.11	0.20	-0.04	-0.39	-0.40	-0.55	0.19
CN	-0.51	0.01	-0.03	0.55	-0.10	-0.54	-0.55	-0.43	0.04
PHH2O	-0.76 **	0.24	0.24	0.47	-0.08	-0.68 *	-0.71 **	-0.71 **	0.24
PHKCL	-0.74 **	0.12	0.26	0.53	-0.13	-0.71 **	-0.77 **	-0.64 *	0.32
CA	-0.46	0.08	0.20	0.44	-0.30	-0.41	-0.52	-0.30	0.50
MG	-0.31	0.49	-0.02	0.01	-0.13	-0.02	-0.17	-0.21	0.37
NA	0.15	-0.50	0.12	-0.15	0.29	-0.18	-0.09	0.06	-0.01
K	-0.40	0.29	0.05	0.08	-0.01	-0.26	-0.36	-0.34	0.29
CEC	0.46	0.10	-0.29	-0.41	-0.25	0.73 **	0.55	0.68 *	0.26
S	-0.64 *	0.31	0.24	0.43	-0.21	-0.56	-0.65 *	-0.56	0.36
CLAY	1.00 ***	-0.52	-0.43	-0.81 **	0.50	0.85 ***	0.87 ***	0.92 ***	-0.08
FSILT	-0.52	1.00 ***	0.35	0.29	-0.69 *	-0.11	-0.19	-0.46	0.23
CSILT	-0.43	0.35	1.00 ***	0.27	-0.61 *	-0.48	-0.30	-0.58 *	-0.13
FSAND	-0.81 **	0.29	0.27	1.00 ***	-0.53	-0.80 **	-0.83 ***	-0.71 **	-0.02
CSAND	0.50	-0.69 *	-0.61 *	-0.53	1.00 ***	0.24	0.29	0.38	-0.03
CLAYFSI	0.85 ***	-0.11	-0.48	-0.80 **	0.24	1.00 ***	0.92 ***	0.90 ***	0.01
PF25	0.87 ***	-0.19	-0.30	-0.83 ***	0.29	0.92 ***	1.00 ***	0.79 **	-0.11
PF42	0.92 ***	-0.46	-0.58 *	-0.71 **	0.38	0.90 ***	0.79 **	1.00 ***	0.00
DENS	-0.08	0.23	-0.13	-0.02	-0.03	0.01	-0.11	0.00	1.00 ***

d. Layer 30-40 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	0.89 ***	-0.15	-0.67 *	-0.79 **	-0.24	0.96 ***	0.92 ***	0.94 ***	-0.41
N	0.87 ***	-0.16	-0.67 *	-0.68 *	-0.29	0.92 ***	0.91 ***	0.92 ***	-0.48
P	-0.62 *	0.45	0.47	0.31	0.17	-0.52	-0.62 *	-0.57	0.73 **
CN	-0.60 *	0.29	0.47	0.28	-0.17	-0.49	-0.55	-0.55	0.27
PHH2O	-0.68 *	0.19	0.64 *	0.41	0.23	-0.64 *	-0.69 *	-0.66 *	0.61 *
PHKCL	-0.63 *	0.13	0.66 *	0.28	0.27	-0.59 *	-0.68 *	-0.60 *	0.57
CA	0.05	-0.04	0.22	-0.31	-0.05	0.13	0.02	0.15	0.07
MG	-0.13	0.39	-0.05	0.08	0.31	0.01	-0.08	-0.08	0.86 ***
NA	0.19	-0.10	-0.01	-0.15	0.11	0.13	0.10	0.11	-0.06
K	-0.25	0.25	0.07	0.15	0.44	-0.22	-0.32	-0.27	0.78 **
CEC	0.86 ***	-0.05	-0.76 **	-0.73 **	-0.03	0.94 ***	0.90 ***	0.92 ***	-0.06
S	-0.63 *	0.07	0.68 *	0.26	0.23	-0.61 *	-0.70 *	-0.61 *	0.46
CLAY	1.00 ***	-0.37	-0.87 ***	-0.71 **	0.08	0.92 ***	0.95 ***	0.96 ***	-0.43
FSILT	-0.37	1.00 ***	0.19	0.34	-0.60 *	-0.10	-0.20	-0.28	0.52
CSILT	-0.87 ***	0.19	1.00 ***	0.37	-0.21	-0.75 **	-0.80 **	-0.75 **	0.22
FSAND	-0.71 **	0.34	0.37	1.00 ***	0.07	-0.78 **	-0.69 *	-0.82 **	0.34
CSAND	0.08	-0.60 *	-0.21	0.07	1.00 ***	-0.16	-0.09	-0.08	0.27
CLAYFSI	0.92 ***	-0.10	-0.75 **	-0.78 **	-0.16	1.00 ***	0.97 ***	0.98 ***	-0.26
PF25	0.95 ***	-0.20	-0.80 **	-0.69 *	-0.09	0.97 ***	1.00 ***	0.97 ***	-0.34
PF42	0.96 ***	-0.28	-0.75 **	-0.82 **	-0.08	0.98 ***	0.97 ***	1.00 ***	-0.38
DENS	-0.43	0.52	0.22	0.34	0.27	-0.26	-0.34	-0.38	1.00 ***

Appendix 20 (continued)

e. Layer 0-40 cm

	C	N	P	CN	PHH2O	PHKCL	CA	MG	NA	K	CEC	S
C	1.00 ***	0.90 ***	0.41	-0.51	0.40	0.42	0.55	0.59 *	-0.01	0.72 **	0.69 *	0.46
N	0.90 ***	1.00 ***	0.36	-0.62 *	0.26	0.23	0.34	0.62 *	-0.12	0.71 *	0.71 **	0.34
P	0.41	0.36	1.00 ***	0.17	0.90 ***	0.84 ***	0.78 **	0.69 *	-0.24	0.83 ***	0.31	0.84 ***
CN	-0.51	-0.62 *	0.17	1.00 ***	0.33	0.33	0.14	-0.16	0.00	-0.21	-0.57	0.27
PHH2O	0.40	0.26	0.90 ***	0.33	1.00 ***	0.94 ***	0.82 **	0.68 *	-0.19	0.79 **	0.10	0.95 ***
PHKCL	0.42	0.23	0.84 ***	0.33	0.94 ***	1.00 ***	0.90 ***	0.51	-0.03	0.65 *	0.06	0.91 ***
CA	0.55	0.34	0.78 **	0.14	0.82 **	0.90 ***	1.00 ***	0.55	-0.06	0.67 *	0.37	0.83 ***
MG	0.59 *	0.62 *	0.69 *	-0.16	0.68 *	0.51	0.55	1.00 ***	-0.47	0.90 ***	0.49	0.70 *
NA	-0.01	-0.12	-0.24	0.00	-0.19	-0.03	-0.06	-0.47	1.00 ***	-0.34	-0.39	-0.18
K	0.72 **	0.71 *	0.83 ***	-0.21	0.79 **	0.65 *	0.67 *	0.90 ***	-0.34	1.00 ***	0.53	0.80 **
CEC	0.69 *	0.71 **	0.31	-0.57	0.10	0.06	0.37	0.49	-0.39	0.53	1.00 ***	0.09
S	0.46	0.34	0.84 ***	0.27	0.95 ***	0.91 ***	0.83 ***	0.70 *	-0.18	0.80 **	0.09	1.00 ***
CLAY	-0.05	0.07	-0.73 **	-0.70 *	-0.79 **	-0.76 **	-0.57	-0.34	0.06	-0.44	0.20	-0.74 **
FSILT	0.06	0.16	0.21	0.12	0.11	-0.11	-0.04	0.43	-0.21	0.34	0.20	0.12
CSILT	-0.11	-0.22	0.50	0.63 *	0.46	0.54	0.50	0.01	0.41	0.10	-0.27	0.46
FSAND	0.16	0.03	0.32	0.39	0.50	0.42	0.26	0.22	0.13	0.36	-0.25	0.49
CSAND	0.07	0.15	-0.15	-0.47	-0.14	-0.13	-0.20	-0.02	-0.36	-0.02	0.15	-0.17
CLAYFSI	0.07	0.22	-0.61 *	-0.66 *	-0.76 **	-0.79 **	-0.51	-0.12	-0.15	-0.29	0.46	-0.70 *
PF25	-0.03	0.10	-0.43	-0.57	-0.64 *	-0.72 **	-0.50	-0.03	-0.25	-0.22	0.42	-0.63 *
PF42	0.22	0.35	-0.54	-0.73 **	-0.68 *	-0.68 *	-0.42	-0.07	-0.18	-0.20	0.52	-0.60 *
DENS	0.35	0.16	0.59 *	0.20	0.68 *	0.49	0.56	0.75 **	-0.48	0.68 *	0.36	0.60 *

e. Layer 0-40 cm (continued)

	CLAY	FSILT	CSILT	FSAND	CSAND	CLAYFSI	PF25	PF42	DENS
C	-0.05	0.06	-0.11	0.16	0.07	0.07	-0.03	0.22	0.35
N	0.07	0.16	-0.22	0.03	0.15	0.22	0.10	0.35	0.16
P	-0.73 **	0.21	0.50	0.32	-0.15	-0.61 *	-0.43	-0.54	0.59 *
CN	-0.70 *	0.12	0.63 *	0.39	-0.47	-0.66 *	-0.57	-0.73 **	0.20
PHH2O	-0.79 **	0.11	0.46	0.50	-0.14	-0.76 **	-0.64 *	-0.68 *	0.68 *
PHKCL	-0.76 **	-0.11	0.54	0.42	-0.13	-0.79 **	-0.72 **	-0.68 *	0.49
CA	-0.57	-0.04	0.50	0.26	-0.20	-0.51	-0.50	-0.42	0.56
MG	-0.34	0.43	0.01	0.22	-0.02	-0.12	-0.03	-0.07	0.75 **
NA	0.06	-0.21	0.41	0.13	-0.36	-0.15	-0.25	-0.18	-0.48
K	-0.44	0.34	0.10	0.36	-0.02	-0.29	-0.22	-0.20	0.68 *
CEC	0.20	0.20	-0.27	-0.25	0.15	0.46	0.42	0.52	0.36
S	-0.74 **	0.12	0.46	0.49	-0.17	-0.70 *	-0.63 *	-0.60 *	0.60 *
CLAY	1.00 ***	-0.33	-0.73 **	-0.73 **	0.53	0.90 ***	0.78 **	0.89 ***	-0.49
FSILT	-0.33	1.00 ***	0.22	0.51	-0.69 *	0.01	0.05	-0.11	0.47
CSILT	-0.73 **	0.22	1.00 ***	0.39	-0.74 **	-0.66 *	-0.57	-0.71 **	0.13
FSAND	-0.73 **	0.51	0.39	1.00 ***	-0.62 *	-0.67 *	-0.73 **	-0.69 *	0.39
CSAND	0.53	-0.69 *	-0.74 **	-0.62 *	1.00 ***	0.33	0.36	0.45	-0.22
CLAYFSI	0.90 ***	0.01	-0.66 *	-0.67 *	0.33	1.00 ***	0.92 ***	0.97 ***	-0.26
PF25	0.78 **	0.05	-0.57	-0.73 **	0.36	0.92 ***	1.00 ***	0.87 ***	-0.12
PF42	0.89 ***	-0.11	-0.71 **	-0.69 *	0.45	0.97 ***	0.87 ***	1.00 ***	-0.27
DENS	-0.49	0.47	0.13	0.39	-0.22	-0.26	-0.12	-0.27	1.00 ***

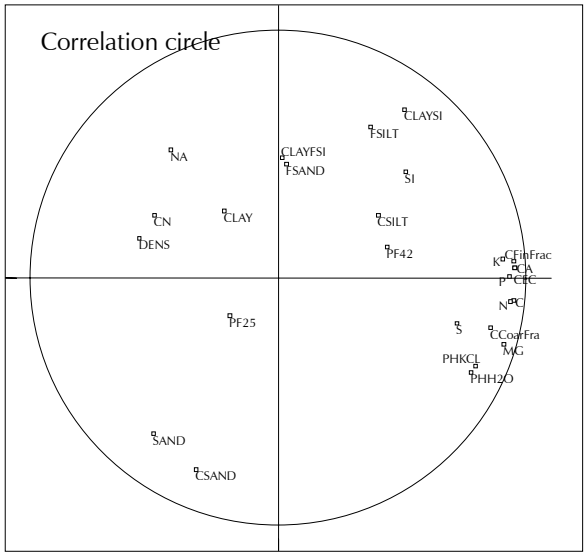
Appendix 21 Principal components (PC) analysis of the soil properties of 12 cropped plots.

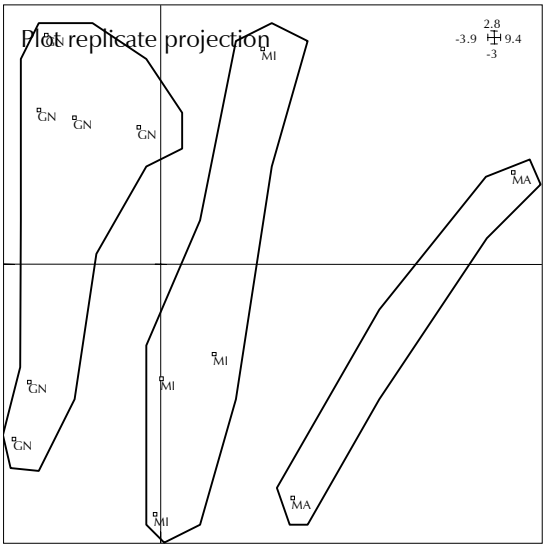
a. Correlation circles of the variables and projection of the plot replicates on planes PC 1x2 and 1x3 (PC1 as the horizontal axis)
Coding of variables: see p. A.41.

LAYER 0-10 cm

Relative inertias: PC1: 45% - PC2: 18% - PC3: 13%

Plane PC 1-3

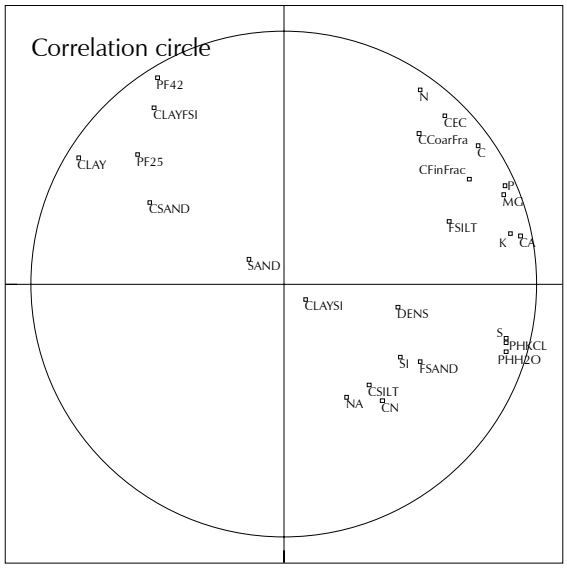


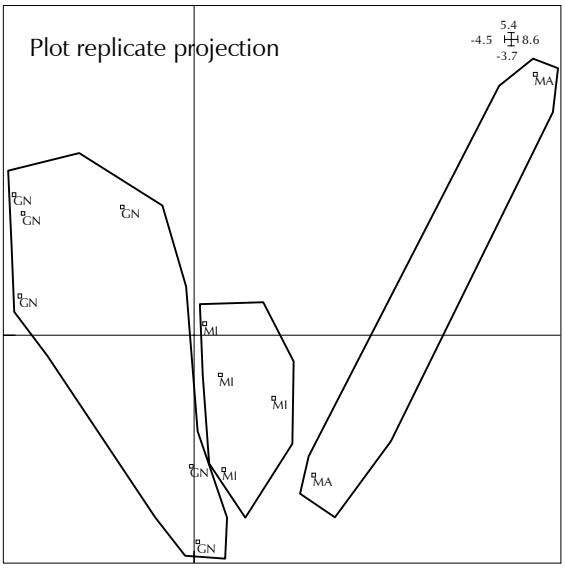


LAYER 10-20 cm

Relative inertias: 42% - 20% 19%

Plane PC 1-3



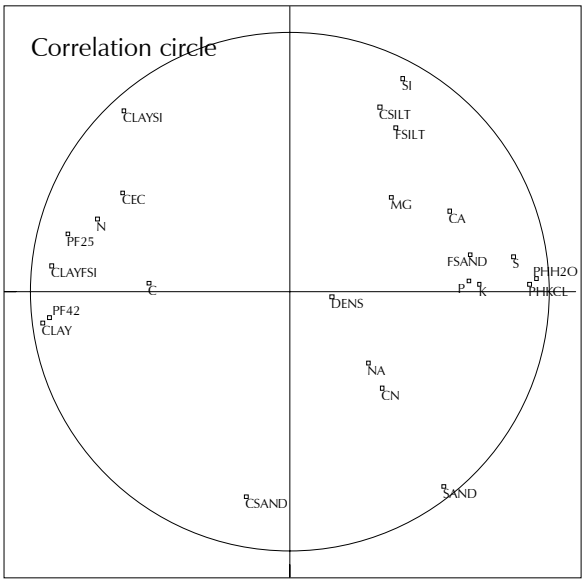


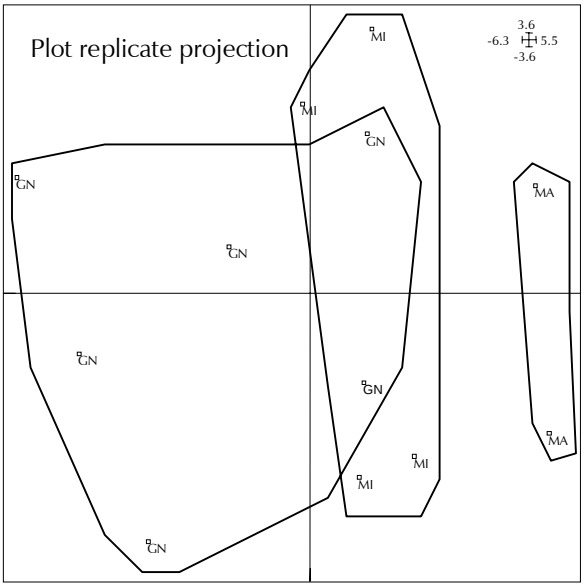
Appendix 21a (continued)

LAYER 20-30 cm

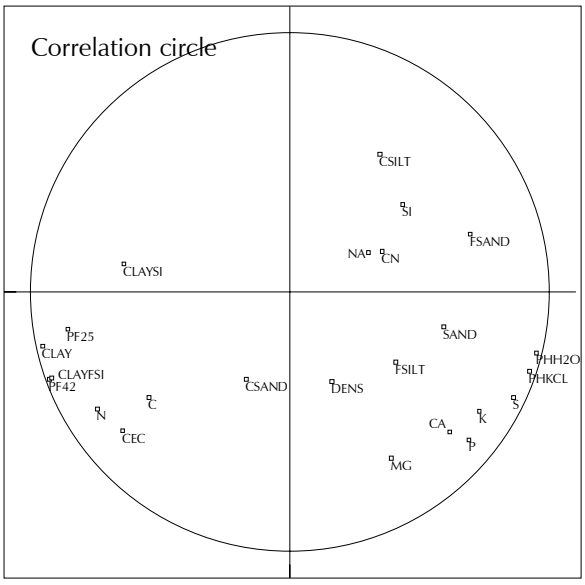
Relative inertias: PC1: 44% - PC2: 17% - PC3: 14%

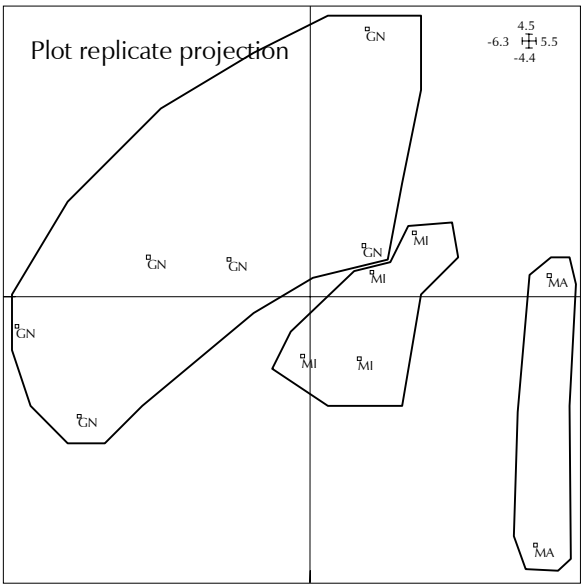
Plane PC 1-2





Plane PC 1-3



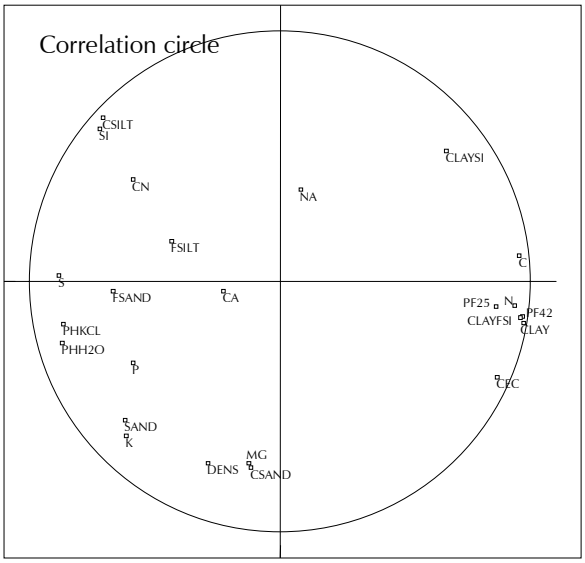


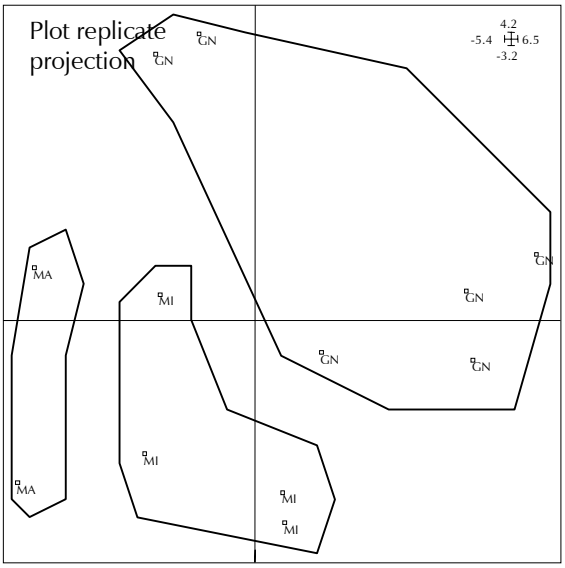
Appendix 21a (continued)

LAYER 30-40 cm

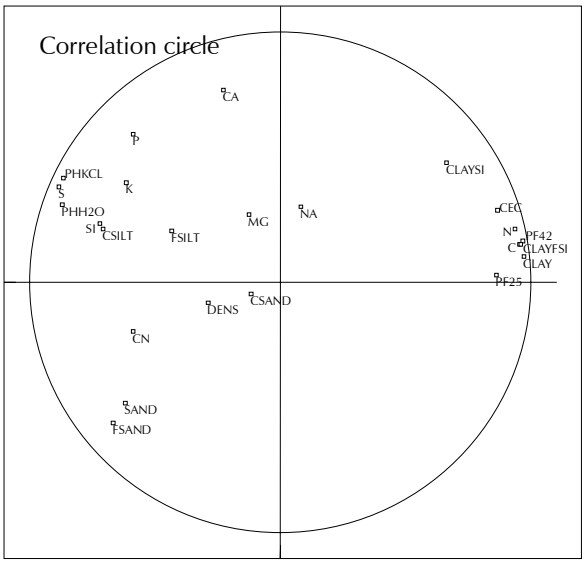
Relative inertias: PC1: 50% - PC2: 17% - PC3: 12%

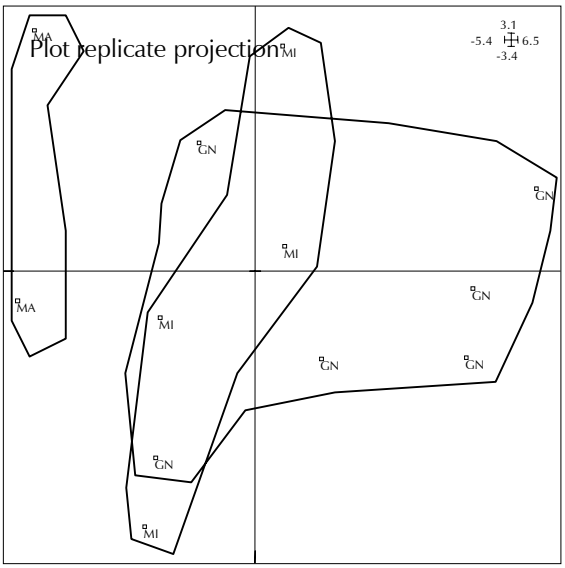
Plane PC 1-2





Plane PC 1-3



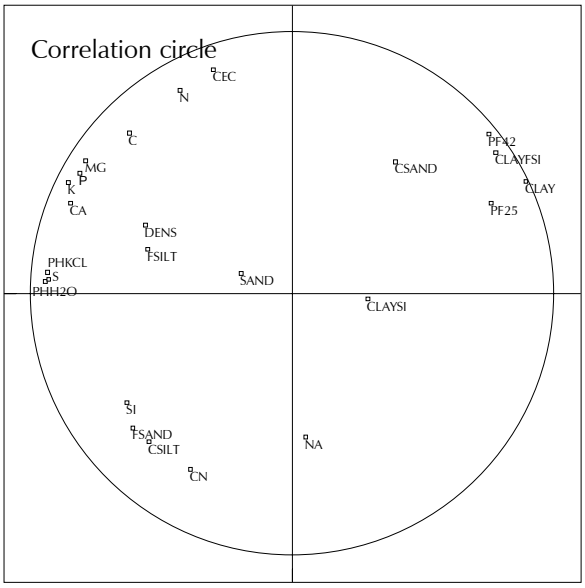


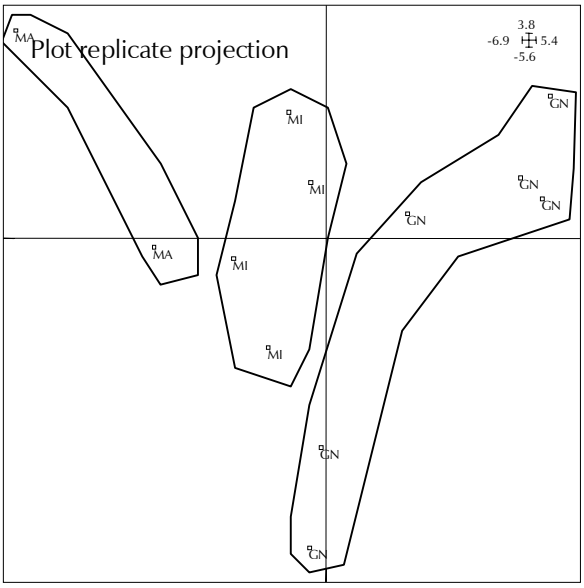
Appendix 21a (continued)

LAYER 0-40 cm

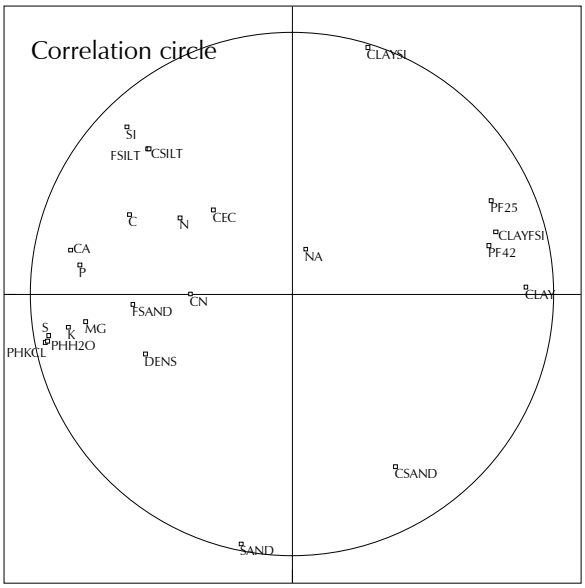
Relative inertias: PC1: 45% - PC2: 22% - PC3: 17%

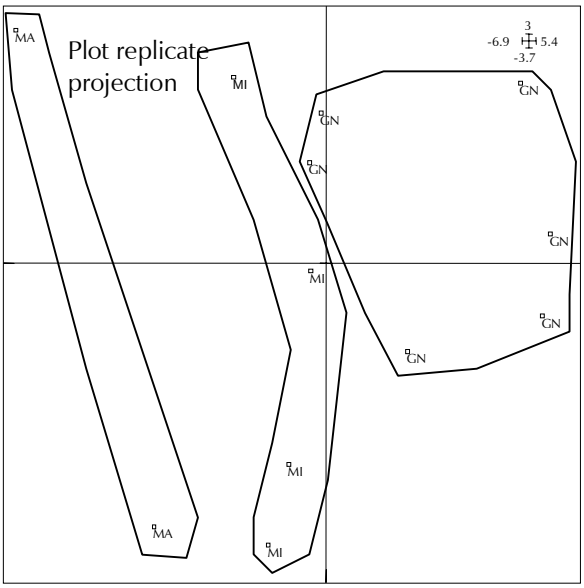
Plane PC 1-2





Plane PC 1-3





Appendix 21a (continued)

Coding of variables: C: carbon. CA: calcium. CCoarFra: carbon content of the [50-2000] µm fraction. CEC: cation exchange capacity. CFinFrac: carbon content of the [0-50] µm fraction. CLAY: clay. CLAYFSI: clay+fine silt. CLAYSI: clay+silt. CN: C:N ratio. CSAND: coarse sand. CSILT: coarse silt. DENS: bulk density. FSAND: fine sand. FSILT: fine silt. K: potassium. MG: magnesium. N: nitrogen. NA: sodium. P: available phosphorus. PHH2O: pH in water. PHKCL: pH in KCl. PF25 and PF42: volumetric water content determined at a suction equivalent to pF2.5 and pF4.2. S: saturation rate. SAND: sand. SI: silt.
Coding of plot replicates: GN: groundnut crop. MI: millet crop. MA: maize crop.

Appendix 21 (continued) b. Eigen values.

	Layer (cm)				
Axis	0-10	10-20	20-30	30-40	0-40
1	11.70	10.89	11.70	12.06	10.70
2	4.73	5.15	4.73	4.12	5.32
3	3.44	4.99	3.44	2.85	4.00
4	2.53	1.94	2.53	2.29	1.55
5	1.36	1.08	1.36	0.94	0.87
6	1.05	0.74	1.05	0.81	0.71
7	0.66	0.50	0.66	0.36	0.39
8	0.24	0.38	0.24	0.30	0.23
9	0.16	0.17	0.16	0.16	0.16
10	0.08	0.12	0.08	0.08	0.05
11	0.04	0.04	0.04	0.04	0.03
12	0.00	0.00	0.00	0.00	0.00

Appendix 22 Soil properties of main cash and food crops along a typical toposequence in Sare Yorobana.

a. Physical properties

Plot	Layer	Texture (%)						pF	pF	Bulk density (g.dm^{-3})	
		Clay	Fine silt	Coarse silt	Fine sand	Coarse sand	Total	2.5	4.2	whole sample	[0-2]mm fr.
GN06	0-10	4.4	5.2	28.0	28.0	33.2	98.8	5.1	1.6	1.53	1.52
	10-20	7.0	5.6	31.1	22.8	31.9	98.4	5.9	2.4	1.51	1.50
	20-30	8.5	6.4	30.4	25.7	27.4	98.4	6.4	2.7	1.49	1.49
	30-40	10.0	6.7	32.2	21.5	30.0	100.4	7.0	3.2	1.46	1.46
	0-40	7.5	6.0	30.4	24.5	30.6	99.0	6.1	2.5	1.50	1.50
GN04	0-10	4.9	4.5	32.8	16.5	40.6	99.3	5.3	2.1	1.53	1.53
	10-20	9.2	4.4	38.4	10.7	36.3	99.0	5.5	2.9	1.39	1.39
	20-30	12.1	4.4	24.6	20.4	38.1	99.6	6.2	3.8	1.66	1.66
	30-40	14.6	4.0	33.0	9.7	38.2	99.5	7.2	4.7	1.31	1.31
	0-40	10.2	4.3	32.2	14.3	38.3	99.4	6.1	3.4	1.47	1.47
GN05	0-10	5.3	4.5	30.9	11.1	47.0	98.8	5.4	2.5	1.52	1.52
	10-20	15.0	5.0	25.3	10.4	43.9	99.6	12.9	5.3	1.52	1.52
	20-30	24.3	4.3	24.5	7.7	39.4	100.2	15.4	7.3	1.50	1.50
	30-40	31.4	5.1	16.0	11.4	37.6	101.5	19.9	9.7	1.52	1.52
	0-40	19.0	4.7	24.2	10.2	42.0	100.0	13.4	6.2	1.51	1.51
GN01	0-10	5.8	4.4	25.8	8.9	53.6	98.5	11.2	3.2	1.47	1.47
	10-20	12.6	4.5	23.9	8.5	49.6	99.1	9.1	4.6	1.50	1.50
	20-30	19.4	4.6	17.3	11.6	47.1	100.0	8.7	6.4	1.50	1.50
	30-40	31.0	4.4	17.5	6.7	39.5	99.1	12.8	9.0	1.50	1.50
	0-40	17.2	4.5	21.1	8.9	47.5	99.2	10.5	5.8	1.49	1.49
GN02	0-10	6.9	4.6	21.6	13.0	54.5	100.6	8.8	2.8	1.51	1.51
	10-20	14.6	4.8	22.4	8.6	51.0	101.4	8.2	4.5	1.35	1.35
	20-30	23.3	6.0	16.9	11.1	43.0	100.3	9.3	6.9	1.60	1.60
	30-40	37.4	5.3	15.9	8.3	34.1	101.0	12.9	10.7	1.41	1.41
	0-40	20.6	5.2	19.2	10.3	45.7	100.8	9.8	6.2	1.47	1.47
GN03	0-10	11.2	6.0	17.7	23.8	42.6	101.3	5.9	4.0	1.54	1.54
	10-20	14.9	5.1	17.4	20.6	43.0	101.0	6.5	4.5	1.54	1.54
	20-30	16.3	5.2	24.0	19.5	35.8	100.8	6.8	5.0	1.50	1.50
	30-40	21.4	4.9	20.7	15.7	38.9	101.6	8.3	6.5	1.53	1.51
	0-40	16.0	5.3	20.0	19.9	40.1	101.2	6.9	5.0	1.53	1.52
MI02	0-10	3.3	4.4	26.1	16.2	49.0	99.0	5.4	1.9	1.50	1.50
	10-20	7.3	6.0	25.9	16.5	44.1	99.8	5.9	2.7	1.54	1.54
	20-30	11.0	5.9	21.7	20.0	41.6	100.2	6.5	3.6	1.53	1.53
	30-40	13.6	4.2	20.0	17.7	44.0	99.5	7.1	4.1	1.54	1.54
	0-40	8.8	5.1	23.4	17.6	44.7	99.6	6.2	3.1	1.53	1.53
MI01	0-10	5.6	4.0	29.2	10.3	50.6	99.7	5.8	2.5	1.56	1.55
	10-20	8.8	4.6	17.3	16.2	52.2	99.1	5.9	3.0	1.49	1.49
	20-30	13.4	4.3	19.8	15.6	46.6	99.7	7.1	4.1	1.52	1.51
	30-40	23.1	4.4	21.1	8.9	42.5	100.0	10.2	6.9	1.55	1.55
	0-40	12.7	4.3	21.9	12.8	48.0	99.6	7.3	4.1	1.53	1.53
MI03	0-10	4.9	4.9	25.0	17.4	46.6	98.8	5.7	2.3	1.45	1.45
	10-20	10.2	5.6	29.2	13.0	41.5	99.5	6.5	3.2	1.54	1.54
	20-30	16.4	6.1	26.6	13.0	37.8	99.9	8.2	4.9	1.55	1.55
	30-40	23.2	5.9	16.0	15.4	39.6	100.1	10.3	6.8	1.56	1.56
	0-40	13.7	5.6	24.2	14.7	41.4	99.6	7.7	4.3	1.53	1.52
MI04	0-10	6.6	8.3	26.2	19.5	38.4	99.0	7.6	2.9	1.44	1.44
	10-20	8.1	9.4	32.6	15.2	34.0	99.3	7.0	3.0	1.58	1.58
	20-30	10.1	9.9	28.7	15.1	35.7	99.5	7.3	3.6	1.56	1.56
	30-40	12.4	9.1	24.2	16.5	36.2	98.4	8.0	4.2	1.58	1.58
	0-40	9.3	9.2	27.9	16.6	36.1	99.1	7.5	3.4	1.54	1.54
MA02	0-10	5.4	6.5	30.9	17.0	38.8	98.6	7.0	4.5	1.44	1.43
	10-20	6.3	9.2	29.8	17.4	36.1	98.8	6.6	4.0	1.54	1.54
	20-30	7.6	9.4	21.6	25.5	34.9	99.0	5.9	3.7	1.57	1.57
	30-40	8.6	9.5	33.4	13.6	34.9	100.0	5.7	3.8	1.58	1.58
	0-40	7.0	8.7	28.9	18.4	36.2	99.1	6.3	4.0	1.53	1.53
MA01	0-10	5.7	4.1	25.3	19.3	45.8	100.2	4.7	2.8	1.46	1.45
	10-20	7.2	4.3	24.2	20.9	43.6	100.2	3.0	2.3	1.55	1.55
	20-30	9.1	5.0	25.5	15.3	45.3	100.2	2.7	2.8	1.53	1.53
	30-40	10.4	5.2	23.6	18.1	43.2	100.5	4.2	3.1	1.55	1.55
	0-40	8.1	4.7	24.7	18.4	44.5	100.3	3.7	2.8	1.52	1.52
RI01	0-10	16.6	29.0	32.4	13.5	7.0	98.5	21.4	10.1	1.38	1.38
	10-20	17.2	27.1	32.4	13.5	7.9	98.1	17.6	9.2	1.50	1.50
	20-30	13.7	25.1	35.0	15.8	10.9	100.5	14.7	6.8	1.64	1.64
	30-40	10.9	20.5	28.2	26.3	14.4	100.3	11.2	5.4	1.66	1.66
	0-40	14.6	25.4	32.0	17.3	10.1	99.4	16.2	7.9	1.54	1.54
RI02	0-10	44.9	21.1	21.7	5.7	5.6	99.0	26.3	19.4	1.37	1.37
	10-20	57.9	16.1	17.7	1.6	5.1	98.4	30.1	23.1	1.24	1.24
	20-30	43.8	15.4	18.8	13.7	6.9	98.6	27.7	20.9	1.30	1.30
	30-40	52.2	14.8	13.9	11.3	5.8	98.0	24.3	18.2	1.35	1.35
	0-40	49.7	16.9	18.0	8.1	5.9	98.5	27.1	20.4	1.32	1.32

GN: groundnut. MI: millet. MA: maize. RI: rice.

Appendix 22 (continued)

b. Chemical properties

Plot	Layer	pH	pH	C	N	C/N	P_{OD}	Exchangeable cations (meq $100g^{-1}$ of soil)				CEC	Sat.
		(H_2O)	(KCl)	(mg g^{-1})	(mg g^{-1})		(x10^{-3} mg g^{-1})	Ca	Mg	Na	K		rate
GN06	0-10	6.02	5.22	4.31	0.29	14.87	3.20	1.12	0.34	0.02	0.04	2.20	69
	10-20	5.64	4.76	3.70	0.24	15.41	2.50	1.20	0.25	0.01	0.05	2.44	62
	20-30	5.52	4.59	2.66	0.23	11.55	2.30	1.00	0.22	0.00	0.03	2.32	54
	30-40	5.36	4.44	2.55	0.22	11.61	2.00	0.92	0.22	0.00	0.02	1.76	66
	0-40	5.64	4.75	3.31	0.25	13.36	2.50	1.06	0.26	0.01	0.04	2.18	63
GN04	0-10	6.24	5.71	5.02	0.37	13.56	2.90	1.78	0.43	0.00	0.05	2.48	91
	10-20	5.99	5.37	3.75	0.32	11.73	2.00	1.75	0.27	0.00	0.03	2.32	89
	20-30	5.86	5.17	3.30	0.27	12.20	1.60	1.48	0.28	0.02	0.03	2.56	70
	30-40	5.79	5.09	2.85	0.25	11.41	1.60	1.58	0.30	0.04	0.03	2.00	97
	0-40	5.97	5.34	3.73	0.30	12.22	2.03	1.65	0.32	0.02	0.03	2.34	87
GN05	0-10	5.89	5.04	4.20	0.35	12.00	2.60	1.56	0.34	0.03	0.04	2.24	88
	10-20	5.10	4.27	3.77	0.31	12.15	1.90	0.70	0.24	0.00	0.04	2.44	40
	20-30	4.88	4.11	3.92	0.35	11.21	1.70	1.00	0.35	0.00	0.03	3.04	46
	30-40	5.41	4.06	3.60	0.37	9.73	1.10	0.99	0.43	0.01	0.04	3.68	40
	0-40	5.32	4.37	3.87	0.35	11.27	1.83	1.06	0.34	0.01	0.04	2.85	54
GN01	0-10	5.87	4.96	3.93	0.33	11.90	1.70	0.96	0.28	0.00	0.02	1.96	64
	10-20	5.24	4.37	3.19	0.30	10.63	1.90	0.65	0.35	0.00	0.02	2.28	45
	20-30	4.90	4.15	3.09	0.26	11.87	2.00	0.49	0.37	0.00	0.02	2.48	35
	30-40	4.67	4.00	3.87	0.33	11.73	1.30	0.54	0.44	0.01	0.03	3.40	30
	0-40	5.17	4.37	3.52	0.31	11.53	1.73	0.66	0.36	0.00	0.02	2.53	44
GN02	0-10	5.82	4.99	4.40	0.38	11.58	2.30	1.05	0.31	0.00	0.04	2.32	60
	10-20	5.23	4.36	3.30	0.36	9.15	1.10	0.83	0.33	0.00	0.04	2.64	46
	20-30	4.88	4.10	3.55	0.35	10.14	2.00	0.90	0.44	0.00	0.05	3.04	46
	30-40	4.75	4.01	4.12	0.40	10.30	1.90	1.00	0.52	0.01	0.04	3.92	40
	0-40	5.17	4.37	3.84	0.37	10.29	1.83	0.95	0.40	0.00	0.04	2.98	48
GN03	0-10	5.66	4.99	5.07	0.41	12.37	2.40	1.47	0.48	0.02	0.04	2.68	75
	10-20	5.44	4.65	4.28	0.35	12.22	1.40	1.19	0.49	0.00	0.05	2.80	62
	20-30	5.32	4.54	3.40	0.32	10.62	0.80	1.11	0.46	0.00	0.04	2.76	58
	30-40	5.23	4.46	3.41	0.35	9.73	1.20	1.12	0.51	0.01	0.03	2.96	56
	0-40	5.41	4.66	4.04	0.36	11.23	1.45	1.22	0.49	0.01	0.04	2.80	63
MI02	0-10	6.66	6.13	5.22	0.40	13.06	3.40	1.71	1.12	0.00	0.13	2.40	123
	10-20	6.39	5.43	3.61	0.26	13.87	3.00	1.34	0.56	0.00	0.15	2.08	99
	20-30	5.97	4.95	2.85	0.18	15.83	2.30	1.09	0.55	0.00	0.14	2.24	80
	30-40	5.76	4.70	2.26	0.19	11.88	2.10	0.87	0.57	0.00	0.14	2.20	72
	0-40	6.20	5.30	3.48	0.26	13.66	2.70	1.25	0.70	0.00	0.14	2.23	94
MI01	0-10	6.42	5.78	6.97	0.52	13.41	9.40	3.21	0.80	0.00	0.20	3.68	114
	10-20	6.33	5.60	3.53	0.31	11.38	8.40	1.87	0.55	0.00	0.18	2.96	88
	20-30	6.07	5.29	2.67	0.26	10.28	8.50	1.32	0.48	0.00	0.16	2.60	75
	30-40	5.76	4.96	2.98	0.32	9.30	12.50	1.82	0.63	0.01	0.26	3.64	75
	0-40	6.15	5.41	4.04	0.35	11.09	9.70	2.06	0.62	0.00	0.20	3.22	88
MI03	0-10	6.38	5.65	6.58	0.53	12.41	5.90	1.78	0.69	0.01	0.18	2.80	95
	10-20	6.17	5.39	3.78	0.32	11.82	4.00	1.49	0.62	0.00	0.19	2.32	99
	20-30	5.94	5.11	2.43	0.30	8.11	2.90	1.30	0.77	0.00	0.24	2.64	88
	30-40	5.72	4.84	3.02	0.32	9.42	2.80	1.25	0.83	0.01	0.25	3.20	73
	0-40	6.05	5.25	3.95	0.37	10.44	3.90	1.45	0.73	0.01	0.22	2.74	89
MI04	0-10	6.36	5.56	5.96	0.52	11.47	10.90	2.71	0.82	0.00	0.38	3.56	110
	10-20	6.34	5.48	3.71	0.28	13.24	7.00	1.58	0.64	0.00	0.14	2.92	81
	20-30	6.00	5.12	2.62	0.24	10.92	6.20	1.15	0.70	0.00	0.12	2.68	74
	30-40	5.81	4.83	2.75	0.22	12.49	3.70	0.91	0.74	0.02	0.12	2.56	70
	0-40	6.13	5.25	3.76	0.32	12.03	6.95	1.59	0.73	0.00	0.19	2.93	84
MA02	0-10	6.58	6.14	11.98	1.13	10.61	45.40	4.31	1.55	0.00	0.40	5.76	109
	10-20	6.69	6.04	6.66	0.53	12.63	30.70	3.16	1.13	0.00	0.37	4.04	115
	20-30	6.74	6.03	3.64	0.28	12.99	19.40	2.14	0.78	0.00	0.31	2.84	114
	30-40	6.66	5.98	2.59	0.21	12.63	15.50	1.39	0.65	0.00	0.31	2.28	103
	0-40	6.67	6.05	6.22	0.54	12.21	27.75	2.75	1.03	0.00	0.35	3.73	110
MA01	0-10	6.72	6.30	8.54	0.78	10.92	22.90	2.76	1.22	0.00	0.20	3.96	106
	10-20	6.75	6.21	3.74	0.33	11.33	13.40	1.61	0.66	0.03	0.24	2.36	107
	20-30	6.80	6.03	2.31	0.20	11.55	12.40	1.12	0.49	0.01	0.37	1.88	105
	30-40	6.73	5.96	2.12	0.18	11.62	13.20	0.98	0.53	0.01	0.38	2.00	95
	0-40	6.75	6.13	4.18	0.37	11.36	15.48	1.62	0.72	0.01	0.30	2.55	103
RI01	0-10	5.23	4.44	14.59	1.19	12.26	10.10	3.09	0.39	0.02	0.04	7.84	45
	10-20	4.90	4.04	10.38	0.74	14.13	8.30	2.03	0.17	0.02	0.02	6.92	32
	20-30	4.80	4.05	7.69	0.41	18.87	5.10	0.89	0.10	0.00	0.00	4.44	22
	30-40	4.80	4.05	6.81	0.30	22.90	3.80	0.77	0.11	0.01	0.00	3.40	26
	0-40	4.93	4.15	9.87	0.66	17.04	6.83	1.70	0.19	0.01	0.02	5.65	31
RI02	0-10	4.81	4.04	19.17	1.84	10.42	14.40	5.32	1.01	0.05	0.04	12.24	53
	10-20	4.68	3.86	16.51	1.87	8.82	53.40	4.39	0.93	0.04	0.06	13.60	40
	20-30	4.67	3.88	13.37	1.55	8.65	66.90	3.57	0.82	0.03	0.02	11.92	37
	30-40	4.71	3.88	10.07	1.07	9.43	43.80	3.24	0.76	0.03	0.02	10.40	39
	0-40	4.72	3.92	14.78	1.58	9.33	44.63	4.13	0.88	0.04	0.04	12.04	42

GN: groundnut. MI: millet. MA: maize. RI: rice.

Appendix 23 Carbon, nitrogen and available phosphorus storage in soil of main cash and food crops along a typical toposequence in Sare Yorobana, southern Senegal (expressed in soil equivalent mass).

Plot	Storage (soil equivalent mass) per soil layer in cm			
	0-10	0-20	0-30	0-40
Carbon (t ha^{-1})				
GN01	6.0	10.9	15.6	21.4
GN02	6.8	11.8	17.2	23.5
GN03	7.8	14.4	19.5	24.6
GN04	7.7	13.4	18.3	22.6
GN05	6.5	12.2	18.1	23.6
GN06	6.6	12.3	16.2	20.1
MI01	10.8	16.2	20.2	24.7
MI02	8.0	13.5	17.8	21.2
MI03	10.0	15.6	19.2	23.8
MI04	9.1	14.6	18.5	22.6
MA01	12.9	18.4	21.8	25.0
MA02	18.2	27.9	33.2	37.1
RI01	22.1	37.5	48.7	59.0
RI02	29.3	53.7	71.9	86.0
Nitrogen (kg ha^{-1})				
GN01	507	965	1356	1858
GN02	584	1136	1663	2270
GN03	631	1169	1649	2177
GN04	569	1057	1458	1835
GN05	538	1015	1541	2100
GN06	446	814	1159	1490
MI01	802	1279	1668	2152
MI02	613	1009	1277	1564
MI03	806	1288	1737	2220
MI04	788	1204	1563	1895
MA01	1184	1666	1961	2236
MA02	1707	2472	2877	3185
RI01	1795	2856	3432	3878
RI02	2834	5638	7723	9175
Phosphorus (kg ha^{-1})				
GN01	2.6	5.6	8.5	10.5
GN02	3.5	5.3	8.4	11.2
GN03	3.7	5.8	7.0	8.9
GN04	4.5	7.5	9.9	12.3
GN05	4.0	6.9	9.4	11.1
GN06	4.9	8.8	12.2	15.2
MI01	14.5	27.4	40.2	59.1
MI02	5.2	9.8	13.3	16.4
MI03	9.0	15.0	19.3	23.5
MI04	16.6	27.1	36.4	42.0
MA01	34.8	55.0	73.5	93.5
MA02	69.1	114.9	143.3	166.6
RI01	15.4	27.7	35.0	40.7
RI02	25.5	114.0	209.8	268.2

GN: groundnut. MI: millet. MA: maize. RI: rice. Reference plot for equivalent soil mass calculation was set as GN03.

Appendix 24 Carbon storage (t ha^{-1}) in two size fractions in soil of main cash and food crops along a typical toposequence in Sare Yorobana, southern Senegal (expressed in soil equivalent mass).

Layer (cm)	0-10		0-20	
Fraction (μm)	[0-50]	[50-2000]	[0-50]	[50-2000]
GN01	4.74	1.24	9.45	1.37
GN02	5.08	1.67	8.86	3.02
GN03	6.11	1.70	11.26	3.11
GN04	6.42	1.28	11.63	1.72
GN05	5.15	1.29	10.10	2.10
GN06	4.91	1.72	9.90	2.40
MI01	7.89	2.86	12.16	4.05
MI02	6.20	1.77	11.03	2.46
MI03	6.28	3.71	11.24	4.41
MI04	7.38	1.65	12.40	2.20
MA01	6.96	5.99	11.20	7.22
MA02	10.36	7.86	18.37	9.67
RI01	19.23	3.35	33.65	4.44
RI02	26.40	3.52	51.09	4.63

GN: groundnut. MI: millet. MA: maize. RI: rice. Reference plot for equivalent soil mass calculation was set as GN03.

Appendix 25 Effect of management of organic inputs on soil physical properties and organic status.

Plot	Subplot	Management	[0-50] µm fraction mass (g 100 g^{-1} of soil) per soil layer (cm)							Bulk density (kg dm^{-3}) per soil layer (cm)					Carbon content (g kg^{-1}) per soil layer (cm)					Carbon storage (expressed in equivalent soil mass) (t ha^{-1}) per soil layer (cm)			
			0-10	10-20	20-30	30-40	0-20	0-30	0-40	0-10	10-20	20-30	30-40	0-40	0-10	10-20	20-30	30-40	0-40	0-10	0-20	0-30	0-40
GN04	1	BuFa	18.7	24.5	29.2	29.0	21.6	24.1	25.3	1.53	1.48	1.69	1.31	1.50	5.47	4.25	3.33	3.26	4.08	8.33	14.81	19.59	24.27
GN04	2	BuFa	20.3	23.4	23.7	23.3	21.9	22.5	22.7	1.53	1.48	1.69	1.31	1.50	5.43	4.34	2.65	2.12	3.64	8.26	14.86	18.71	21.79
GN04	3	BuFa	18.2	23.2	24.7	27.7	20.7	22.0	23.4	1.53	1.30	1.64	1.32	1.45	4.64	3.15	3.26	2.29	3.33	7.06	11.88	16.58	19.85
GN04	4	BuFa	19.0	24.0	25.0	29.7	21.5	22.6	24.4	1.53	1.30	1.64	1.32	1.45	4.53	3.26	3.94	3.74	3.87	6.89	11.94	17.69	23.03
GN02	1	BuFa	19.6	26.5	35.4	46.5	23.1	27.2	32.0	1.45	1.35	1.52	1.51	1.46	4.69	3.26	3.44	3.09	3.62	7.09	12.04	16.99	21.38
GN02	2	BuFa	17.8	25.5	34.5	48.6	21.7	25.9	31.6	1.58	1.35	1.68	1.31	1.48	4.11	3.33	3.66	5.15	4.06	6.27	11.39	16.60	23.88
GN03	1	BuFa	24.9	26.8	30.1	37.5	25.9	27.3	29.8	1.52	1.53	1.44	1.50	1.50	4.63	4.08	3.33	3.02	3.76	7.04	13.27	18.07	22.38
GN03	2	BuFa	26.2	28.0	29.9	33.9	27.1	28.0	29.5	1.52	1.53	1.50	1.53	1.52	5.43	4.00	3.81	3.42	4.16	8.26	14.37	19.87	24.76
GN03	3	BuFa	26.0	26.7	29.0	30.5	26.4	27.2	28.1	1.50	1.59	1.55	1.56	1.55	5.19	4.52	3.07	3.73	4.13	7.89	14.81	19.22	24.51
GN03	4	BuFa	25.3	26.9	27.3	29.1	26.1	26.5	27.2	1.62	1.51	1.51	1.51	1.54	5.04	4.50	3.38	3.46	4.09	7.68	14.63	19.53	24.47
GN06	1	BuCor	28.9	32.6	25.7	32.9	30.7	29.0	30.0	1.56	1.50	1.49	1.46	1.50	4.65	3.75	2.66	2.39	3.36	7.09	12.83	16.68	20.11
GN06	2	BuCor	22.1	29.3	34.4	37.2	25.7	28.6	30.7	1.56	1.50	1.49	1.46	1.50	4.04	3.08	1.84	2.66	2.91	6.16	10.89	13.52	17.31
GN06	3	BuCor	23.5	30.1	29.0	33.7	26.8	27.5	29.1	1.49	1.51	1.50	1.46	1.49	4.93	4.58	3.45	2.49	3.87	7.49	14.46	19.42	22.99
GN06	4	BuCor	18.4	30.6	28.2	31.5	24.5	25.7	27.2	1.49	1.51	1.50	1.46	1.49	3.63	3.39	2.67	2.66	3.09	5.52	10.67	14.51	18.32
GN05	1	BuCor	19.1	31.0	35.6	47.1	25.0	28.6	33.2	1.50	1.51	1.49	1.49	1.50	4.69	4.22	3.99	3.42	4.08	7.13	13.57	19.32	24.22
GN05	2	BuCor	22.1	30.3	35.7	44.6	26.2	29.4	33.2	1.45	1.55	1.54	1.55	1.53	6.33	4.10	4.66	3.32	4.60	9.55	15.74	22.50	27.28
GN05	3	BuCor	14.9	25.9	36.4	42.5	20.4	25.7	29.9	1.55	1.53	1.48	1.51	1.52	3.01	3.49	4.05	4.14	3.67	4.57	9.88	15.71	21.63
GN05	4	BuCor	19.4	24.0	30.1	37.0	21.7	24.5	27.6	1.56	1.47	1.49	1.52	1.51	2.76	3.26	2.99	3.52	3.13	4.19	9.16	13.46	18.49
MI02	1	Com	18.1	22.5	26.1	28.7	20.3	22.2	23.8	1.50	1.53	1.53	1.54	1.52	6.06	3.11	3.06	2.40	3.66	9.19	13.92	18.34	21.80
MI02	2	Com	21.3	22.5	24.9	26.4	21.9	22.9	23.8	1.50	1.55	1.53	1.54	1.53	4.39	4.10	2.64	2.11	3.31	6.67	12.93	16.76	19.81
MI01	1	Com	16.5	23.5	25.4	36.4	20.0	21.8	25.5	1.58	1.53	1.55	1.57	1.55	6.13	2.93	2.61	2.65	3.58	9.41	13.98	17.74	21.53
MI01	2	Com	16.7	23.8	33.7	41.4	20.3	24.7	28.9	1.54	1.52	1.51	1.54	1.53	6.39	2.84	2.97	3.93	4.03	9.75	14.12	18.36	23.93
MI01	3	Com	17.2	23.0	22.3	31.1	20.1	20.8	23.4	1.55	1.50	1.48	1.54	1.52	6.31	4.91	2.62	2.61	4.11	9.61	17.12	20.90	24.62
MI01	4	Com	18.0	19.6	24.9	33.9	18.8	20.9	24.1	1.55	1.40	1.52	1.54	1.50	9.07	3.42	2.49	2.72	4.43	13.87	19.12	22.67	26.56
MI04	1	ComCor	36.6	40.1	47.3	48.2	38.3	41.3	43.0	1.37	1.60	1.57	1.56	1.53	7.93	5.52	4.65	3.63	5.43	11.87	20.07	26.77	31.98
MI04	2	ComCor	28.2	28.3	29.5	31.3	28.2	28.6	29.3	1.44	1.57	1.55	1.55	1.53	5.36	3.33	2.05	3.55	3.57	8.07	13.06	15.94	20.97
MI04	3	ComCor	29.3	33.0	30.5	32.7	31.1	30.9	31.4	1.46	1.60	1.62	1.63	1.58	5.64	3.46	1.99	2.11	3.30	8.51	13.73	16.61	19.61
MI04	4	ComCor	20.6	25.9	27.0	27.0	23.2	24.5	25.1	1.47	1.53	1.51	1.58	1.52	4.92	2.52	1.79	1.70	2.73	7.42	11.20	13.77	16.20
MI03	1	ComCor	19.0	27.0	31.3	44.6	23.0	25.8	30.5	1.46	1.54	1.55	1.59	1.54	4.84	3.05	2.58	2.62	3.27	7.31	11.89	15.61	19.35
MI03	2	ComCor	16.5	24.5	29.8	49.1	20.5	23.6	30.0	1.46	1.54	1.55	1.59	1.54	5.53	4.14	3.16	2.81	3.91	8.37	14.62	19.16	23.19
MI03	3	ComCor	19.3	26.1	27.5	37.9	22.7	24.3	27.7	1.44	1.53	1.55	1.53	1.51	5.99	3.57	1.60	2.86	3.50	9.01	14.29	16.50	20.56
MI03	4	ComCor	21.8	29.9	27.2	31.0	25.8	26.3	27.5	1.44	1.53	1.55	1.53	1.51	9.94	4.38	2.38	3.78	5.12	14.89	21.28	24.61	29.99
MA02	1	ComCorWa	18.4	23.1	22.7	26.1	20.8	21.4	22.6	1.40	1.44	1.56	1.58	1.49	16.55	8.61	3.25	2.48	7.72	24.64	36.63	40.67	44.18
MA02	2	ComCorWa	28.1	30.9	31.1	31.2	29.5	30.0	30.3	1.40	1.52	1.58	1.58	1.52	11.60	6.38	3.30	2.57	5.96	17.29	26.46	31.00	34.67
MA02	3	ComCorWa	26.1	39.2	40.9	35.4	32.7	35.4	35.4	1.48	1.56	1.54	1.56	1.54	10.38	7.56	4.99	3.08	6.50	15.72	27.18	34.44	38.93
MA02	4	ComCorWa	30.3	39.2	40.4	40.3	34.7	36.6	37.6	1.48	1.63	1.61	1.61	1.58	9.41	4.10	3.02	2.23	4.69	14.20	20.38	24.86	28.13
MA01	1	ComCorWa	15.7	16.8	21.8	19.1	16.3	18.1	18.4	1.37	1.55	1.55	1.55	1.51	7.95	4.18	2.37	2.26	4.19	11.78	17.73	21.03	24.26
MA01	2	ComCorWa	14.8	17.1	18.4	23.7	15.9	16.8	18.5	1.40	1.56	1.57	1.49	1.51	7.28	3.53	1.96	1.96	3.68	10.83	15.90	18.65	21.45
MA01	3	ComCorWa	14.7	39.1	19.5	22.0	26.9	24.4	23.8	1.40	1.54	1.45	1.48	1.47	8.05	2.95	1.96	1.87	3.70	11.92	16.04	18.80	21.46
MA01	4	ComCorWa	24.1	27.1	26.9	28.9	25.6	26.0	26.7	1.66	1.54	1.54	1.67	1.60	10.89	4.30	2.95	2.40	5.14	17.02	24.14	28.56	32.06

See description of the treatments in Figure 3.1. The subplot 1 of the GN03 plot was set as reference for equivalent soil mass calculation.

Appendix 26 Carbon, nitrogen and phosphorus organic inputs in compound fields under three different patterns of organic management of fertility.

Treatment	Millet, uncorralled (Com)	Millet, corralled (ComCor)	Maize corralled + wastes (ComCorWa)
Carbon input (t ha^{-1} y^{-1})			
Root	0.2	0.5	0.1
Manure	0.1	1.6	2.8
Waste	0.0	0.0	1.4
Crop residue	1.7	3.2	2.0
Total	2.0	5.3	6.3
Nitrogen input (kg ha^{-1} y^{-1})			
Root	7.1	13.4	3.2
Manure	3.8	67.8	114.3
Waste	0.0	0.0	35.1
Crop residue	13.3	37.6	57.9
Total	24.2	118.8	210.5
Phosphorus input (kg ha^{-1} y^{-1})			
Root	0.5	1.0	0.2
Manure	0.9	16.4	27.7
Waste	0.0	0.0	5.1
Crop residue	2.8	3.4	4.6
Total	4.3	20.8	37.5

Assumption: (1) chemical composition of fresh dungs (g $100g^{-1}$ dry OM): C: 35 [DeRidder, 1990 #466]; N: 1.44; P_i: 0.35 (Hamon, in Coulomb et al.*, 1980). (2) 80 % of crop residues are returned to the soil as a result of trampling by livestock.*
Note: root exsudation of C and biological fixation of N are not included.

Appendix 27 Assessment of soil quality of 23 crop and fallow plots (Chapters 2 and 3) as predicted by Feller's criterion (1995b) based on carbon content and fine texture.

Plot	Type	Clay + fine silt (%)	C content (g kg^{-1} soil)
FA1a	Young fallow	10.2	5.82
FA1b	Young fallow	15.2	7.42
FA1c	Young fallow	11.2	5.09
FA2a	Young fallow	11.6	4.40
FA4	Young fallow	12.4	6.96
FA7a	Young fallow	14	5.35
FA12	Old fallow	13.2	7.49
FA13a	Old fallow	15.9	4.82
FA17	Old fallow	14.2	7.27
FA18a	Old fallow	13.7	5.25
FA26	Old fallow	13.6	5.96
GN01	Bush field	10.2	3.93
GN02	Bush field	11.5	4.40
GN03	Bush field	17.2	5.07
GN04	Bush field	9.4	5.02
GN05	Bush field	9.8	4.20
GN06	Bush field	9.6	4.31
MI01	Compound field	9.6	6.97
MI02	Compound field	7.7	5.22
MI03	Compound field	9.8	6.58
MI04	Compound field	14.9	5.96
MA01	Compound field	9.8	8.54
MA02	Compound field	11.9	11.98
RI01	Ricefield	45.6	14.59
RI02	Ricefield	66	19.17

Young fallow: aged 0-9 years. Old fallow: older than 9 years.

CHAPTER 4

Appendix 28 Mean annual rainfall (mm) over the last 60 years (Service de la Météorologie Nationale, station of Kolda).

Year	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947
Rainfall	975			1063	1018	1558	1028	1071	1378	1186
Year	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
Rainfall		1019	1543	1286	1372	1356	1232	1289	1221	1629
Year	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Rainfall	2152	1139	1115	1206	1216	1440	1200	1178	1147	1219
Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Rainfall	760	1410	1046	1383	873	1172	1019	1188	920	645
Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Rainfall	992	823	566	1002	848	726	865	794	1110	1072
Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Rainfall	1018	1102	787	656	1325	1196	1175	959	1003	1125

Appendix 29 Spatial distribution of land use as illustrated by the distance of crops to the compound.

Crop	Mean distance to the compound (m)
millet x maize	160
maize	287
millet	416
sorghum	516
cotton	543
groundnut	640
fallow	903

Appendix 30 Surfaces(in ha) benefiting from fallowing and manuring (applied during the 1996-1997 dry season, night corralling only) in the mixed-farming system of the village of Sare Yorobana.

	Manuring intensity (tDM ha^{-1})									
Cropping intensity	0.00	>0-1	1-2	2-3	3-4	4-5	6-7	7-8	8-9	>9
0-0.1	6.9									
0.1-0.2	3.8	0.5								
0.2-0.3	3.2									
0.3-0.4	11.0									
0.4-0.5	12.2	0.2								
0.5-0.6	8.5	1.7								
0.6-0.7	3.4		3.3							
0.7-0.8	5.2		0.7							
0.8-0.9	6.2		0.7			0.7				
0.9-<1	6.3	0.5	0.2							
1	41.6	4.4	2.9	4.1	2.4	5.2	2.3	1.2	0.6	2.6

Appendix 31 Structure of population and means of production of 16 holdings of the village of Sare Yorobana.

Type of lineage		Noble					
Compound		Amad	Diou	Mama	Mamo	Sali	Seko
Structure of population in june 1997							
Permanent population							
Man	> 59 years old	0	0	1	0	0	0
	15-59 years old	2	6	4	1	3	2
Woman	> 59 years old	0	0	2	0	1	1
	15-59 years old	2	3	4	7	4	3
Total	actual	7	14	32	27	22	12
	feed unit†	5.5	11.5	21.5	17.5	15	9
	working unit†	4.2	7.7	10.2	7.1	6.2	3.7
Total population (including temporary workers)							
Total	actual	7	16	37	30	24	13
	feed unit†	5.5	13.5	26.5	20.5	17	10
	working unit†	4.2	9.7	15.2	10.1	8.2	4.7
Means of production							
Livestock	(in TLU‡)	0	79	71	100	49	31
Equipement	plough	1	3	6	3	3	2
	hoe	1	2	4	3	2	2
	seeder	0	2	4	2	2	1
	cart	0	2	3	1	1	1

† see 4.2.2.2 for the method of calculation.
‡ tropical livestock unit (1TLU = 250 kg of live weight).

Appendix 31 (continued)

Type of lineage		Captive									
Compound		Awa	Doud	Fode	Isa	SaDI	Said	SaWA	Soul	Tidi	Yaou
Structure of population in june 1997											
Permanent population											
Man	> 59 years old	0	1	0	1	0	0	1	1	0	0
	15-59 years old	1	0	6	6	2	2	3	4	7	2
Woman	> 59 years old	0	0	0	0	1	0	0	1	1	0
	15-59 years old	1	1	2	6	3	2	4	6	8	4
Total	actual	4	3	17	22	12	9	8	22	31	13
	feed unit†	3	2.5	12.5	17.5	9	6.5	8	17	23.5	9.5
	working unit†	1.7	0.5	8.2	10.2	5.9	4	5	8.4	14.3	4.5
Total population (including temporary workers)											
Total	actual	4	4	17	22	13	9	8	22	31	13
	feed unit†	3	3.5	12.5	17.5	10	6.5	8	17	23.5	9.5
	working unit†	1.7	1.5	8.2	10.2	6.9	4	5	8.4	14.3	4.5
Means of production											
Livestock	(in TLU‡)	0	0	0	0	21	0	19	36	9	0
Equipement	plough	1	1	2	1	2	0	1	0	2	1
	hoe	1	1	2	0	1	0	2	1	1	1
	seeder	0	1	1	0	1	0	1	1	0	0
	cart	0	1	0	0	0	0	0	1	0	0

† see 4.2.2.2 for the method of calculation.
‡ tropical livestock unit (1TLU = 250 kg of live weight).

Appendix 32 Spearman correlation between variables describing structure of 16 out of the 18 holdings of Sare Yorobana.

	TLU	OS	%foodS	%cashS	%fallowS
TLU	1.00 ***	0.80 ***	0.05	0.12	-0.05
OS	0.80 ***	1.00 ***	-0.23	-0.20	0.27
%foodS	0.05	-0.23	1.00 ***	0.78 ***	-0.94 ***
%cashS	0.12	-0.20	0.78 ***	1.00 ***	-0.93 ***
%fallowS	-0.05	0.27	-0.94 ***	-0.93 ***	1.00 ***
TLU:adu	0.99 ***	0.75 ***	0.13	0.20	-0.13
OS:adu	0.63 **	0.66 **	-0.11	-0.17	0.19
SeaWU:TotWU	0.59 *	0.28	0.29	0.19	-0.23
Equ:PrmWU	0.38	0.08	0.07	-0.14	0.05
PrmWU:PrmFU	-0.22	-0.04	-0.06	0.08	0.01

":" stands for "ratio"
Adu: size of the adult population (aged 15 years or more). Equ: equipment (see 4.2.2.2.). OS: owned surface. PrmFU: permanent feed unit (see 4.2.2.2.). TLU: size of the cattle herd (in tropical livestock units). WU: working unit (see 4.2.2.2.). Prm/Sea/Tot: permanent, seasonal, total population. %fallowS, %foodS, %cashS: respective shares of surface devoted to fallow, food and cash crop (in % of OS).
.

Appendix 32 (continued)

	TLU:adu	OS:adu	SeaWU:TotWU	Equ:PrmWU	PrmWU:PrmFU
TLU	0.99 ***	0.63 **	0.59 *	0.38	-0.22
OS	0.75 ***	0.66 **	0.28	0.08	-0.04
%foodS	0.13	-0.11	0.29	0.07	-0.06
%cashS	0.20	-0.17	0.19	-0.14	0.08
%fallowS	-0.13	0.19	-0.23	0.05	0.01
TLU:adu	1.00 ***	0.61 *	0.63 **	0.42	-0.21
OS:adu	0.61 *	1.00 ***	0.67 **	0.53 *	-0.27
SeaWU:TotWU	0.63 **	0.67 **	1.00 ***	0.79 ***	-0.58 *
Equ:PrmWU	0.42	0.53 *	0.79 ***	1.00 ***	-0.49
PrmWU:PrmFU	-0.21	-0.27	-0.58 *	-0.49	1.00 ***

":" stands for "ratio"
Adu: size of the adult population (aged 15 years or more). Equ: equipment (see 4.2.2.2.). OS: owned surface. PrmFU: permanent feed unit (see 4.2.2.2.). TLU: size of the cattle herd (in tropical livestock units). WU: working unit (see 4.2.2.2.). Prm/Sea/Tot: permanent, seasonal, total population. %fallowS, %foodS, %cashS: respective shares of surface devoted to fallow, food and cash crop (in % of OS).

Appendix 33 Data used for principal component analysis of the structure of 16 out of the 18 holdings of Sare Yorobana.

Type of lineage	Noble					
Compound	Amad	Diou	Mama	Mamo	Sali	Seko
TLU	0.0	79.3	70.5	99.6	49.1	31.2
OS	4.6	12.2	22.6	15.2	10.2	4.9
TLU:adu	0.00	8.81	6.41	12.45	6.14	5.20
OS:adu	1.15	1.35	2.05	1.90	1.27	0.82
SeaWU:TotWU	0.00	0.21	0.33	0.30	0.24	0.21
Equ:PrmWU	0.48	0.91	1.37	1.13	1.13	1.35
PrmWU:PrmFU	0.76	0.67	0.47	0.41	0.41	0.41
%foodS	45.6	28.6	31.6	34.8	39.5	43.9
%cashS	38.5	45.3	36.0	38.4	39.8	44.1
%fallowS	15.9	26.1	32.3	26.8	20.6	12.0

":" stands for "ratio"

Adu: size of the adult population (aged 15 years or more). Equ: equipment (see 4.2.2.2.). OS: owned surface. PrmFU: permanent feed unit (see 4.2.2.2.). TLU: size of the cattle herd (in tropical livestock units). WU: working unit (see 4.2.2.2.). Prm/Sea/Tot: permanent, seasonal, total population. %fallowS, %foodS, %cashS: respective shares of surface devoted to fallow, food and cash crop (in % of OS).

Appendix 33 (continued)

Type of lineage	Captive									
Compound	Awa	Doud	Fode	Isa	SaDI	Said	SaWA	Soul	Tidi	Yaou
TLU	9.1	0.0	21.1	0.0	0.0	0.0	0.0	0.0	19.4	36.0
OS	14.0	2.9	7.3	7.2	2.8	3.1	1.0	7.9	11.0	14.7
TLU:adu	0.57	0.00	3.52	0.00	0.00	0.00	0.00	0.00	2.43	3.00
OS:adu	0.87	1.45	1.22	1.19	0.22	0.79	0.48	0.99	1.37	1.23
SeaWU:TotWU	0.00	0.67	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equ:PrmWU	0.21	6.00	0.68	0.44	0.10	0.00	1.18	0.61	0.80	0.24
PrmWU:PrmFU	0.61	0.20	0.66	0.47	0.58	0.62	0.57	0.66	0.63	0.49
%foodS	19.3	23.4	41.5	35.2	37.0	29.5	70.6	28.4	19.7	16.9
%cashS	21.6	19.0	45.7	40.4	56.8	38.6	29.4	15.8	25.6	9.9
%fallowS	59.1	57.6	12.8	24.5	6.3	31.8	0.0	55.9	54.7	73.2

":" stands for "ratio"

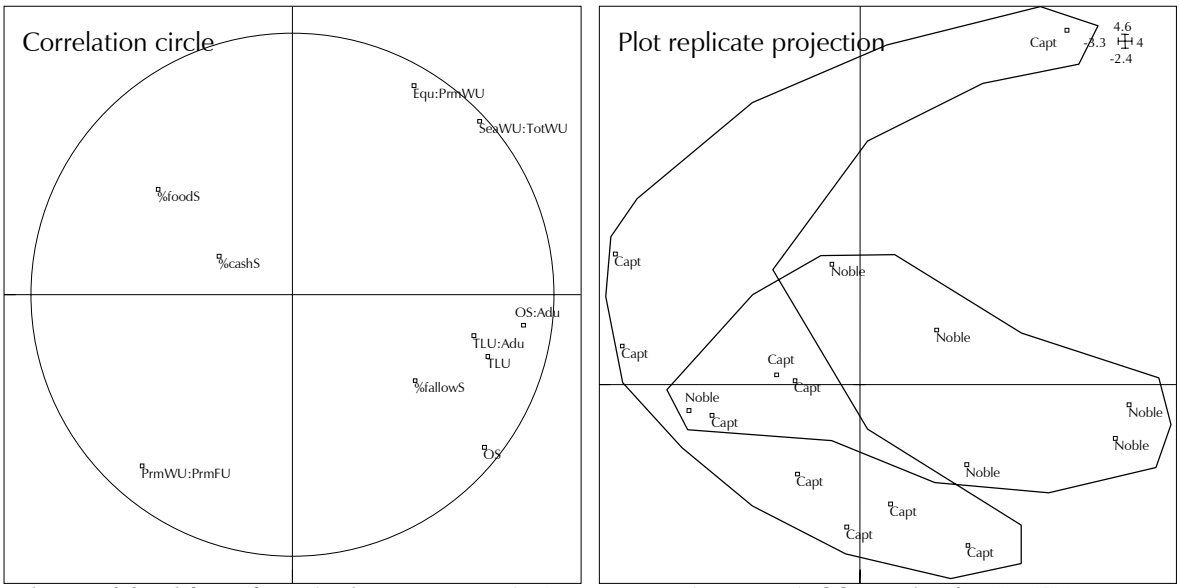
Adu: size of the adult population (aged 15 years or more). Equ: equipment (see 4.2.2.2.). OS: owned surface. PrmFU: permanent feed unit (see 4.2.2.2.). TLU: size of the cattle herd (in tropical livestock units). WU: working unit (see 4.2.2.2.). Prm/Sea/Tot: permanent, seasonal, total population. %fallowS, %foodS, %cashS: respective shares of surface devoted to fallow, food and cash crop (in % of OS).

Appendix 34 Principal component (PC) analysis of the structure of 16 out of the 18 holdings of Sare Yorobana.

a. correlation circles of the variables and compound replicate projections (1st and 3rd PC).

Relative inertias: PC1: 40% - PC2: 25% - PC3: 22%

Plane PC 1-3



Adu: size of the adult population (aged 15 years or more). Equ: equipment (see 4.2.2.2.). OS: owned surface. PrmFU: permanent feed unit (see 4.2.2.2.). TLU: size of the cattle herd (in tropical livestock units). WU: working unit (see 4.2.2.2.). Prm/Sea/Tot: permanent, seasonal, total population. %fallowS, %foodS, %cashS: respective shares of surface devoted to fallow, food and cash crop (in % of OS).

b. eigen values.

Axis	Eigen value
1	4.51
2	2.28
3	1.42
4	0.73
5	0.45
6	0.32
7	0.15
8	0.13
9	0.01
10	0.01

Appendix 35 Yield (tDM ha^{-1}) of harvestable biomass components of: a. groundnut; b. millet; c. maize; d. sorghum; e. rice.

a. Groundnut

Plot	Subplot	Root		Haulm		Advent		Pod	
		fine	coarse	stalk	leaf	woody	herbaceous	grain	shell
GN01	1	0.392	0.372	0.74	0.26	0.08	0.07	0.14	0.07
	2	0.524	1.419	1.07	0.58	0.04	0.08	0.56	0.26
	3	0.761	3.331	1.33	0.56	0.41	0.43	0.68	0.25
	4	0.409	0.020	1.15	0.37	0.00	0.18	0.47	0.22
GN02	1	0.363	0.032	1.36	0.43	0.00	0.25	0.85	0.38
	2	0.485	0.093	2.31	0.47	0.04	0.27	1.17	0.45
	3	0.541	0.020	1.24	0.47	0.00	0.16	0.62	0.33
	4	0.729	0.020	0.81	0.34	0.04	0.80	0.69	0.26
GN03	1	0.709	0.406	0.70	0.42	0.82	0.62	0.45	0.19
	2	0.479	0.000	0.58	0.48	0.27	0.57	0.23	0.12
	3	0.758	0.000	0.67	0.57	0.04	0.40	0.88	0.34
	4	0.495	0.000	0.82	0.34	0.03	0.25	0.52	0.21
GN04	1	0.643	0.020	1.33	0.53	1.30	1.20	1.23	0.08
	2	0.698	0.020	1.37	0.55	0.44	0.20	0.93	0.35
	3	0.654	0.036	1.54	0.62	2.32	0.17	1.09	0.45
	4	0.748	0.020	0.68	0.27	0.73	0.26	0.59	0.24
GN05	1	0.543	0.000	1.49	0.39	0.00	0.60	0.85	0.36
	2	0.418	0.000	0.91	0.21	0.96	1.53	0.51	0.18
	3	0.472	0.000	0.81	0.28	0.00	0.71	0.22	0.17
	4	0.316	0.000	0.40	0.22	0.00	0.77	0.29	0.11
GN06	1	0.605	0.020	1.00	0.40	0.02	0.85	0.94	0.38
	2	0.763	0.120	1.34	0.54	0.09	0.54	0.85	0.39
	3	0.464	0.020	1.15	0.46	0.01	0.71	0.77	0.29
	4	0.689	0.020	0.82	0.33	0.00	1.05	0.62	0.25
GN07	1			0.78	0.45	0.70	0.26	0.70	0.26
	2			0.96	0.49	0.43	0.21	0.43	0.21
	3			1.17	0.26	0.40	0.16	0.40	0.16
	4			1.34	0.33	0.69	0.27	0.69	0.27

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

b. Millet

Plot	Subplot	Root		Stover	Weed	Panicle	
		fine	coarse			grain	non edible
MI01	1	0.558	0.000	4.75	0.34	1.23	0.568
	2	0.614	0.000	3.61	0.29	0.87	0.465
	3	0.397	0.022	3.45	0.27	0.71	0.349
	4	1.235	0.921	5.72	0.19	0.96	0.491
MI02	1	0.654	0.019	6.42	0.40	1.00	0.564
	2	0.730	0.019	5.23	0.33	1.20	0.766
	3	0.693	0.043	7.53	0.47	1.53	0.579
	4	1.059	0.317	5.93	0.37	1.19	0.578
MI03	1	0.878	0.019	9.18	0.59	1.52	0.727
	2	1.208	0.046	8.52	0.87	1.51	1.075
	3	1.088	0.042	11.28	2.46	1.52	1.031
	4	1.185	0.019	10.33	1.36	1.58	0.761
MI04	1	1.253	1.422	8.62	1.16	1.38	0.756
	2	0.626	0.000	8.58	1.15	1.86	1.060
	3	1.938	1.508	9.70	1.30	1.84	0.977
	4	0.499	0.000	11.59	1.55	1.23	0.652
MIxMA01	1			2.22	1.41	0.38	0.38
	2			4.10	0.99	0.54	0.45
	3			5.56	0.90	0.77	0.89
	4			3.62	1.90	1.01	0.59
MIxMA02	1			7.34	3.15	0.83	0.78
	2			2.74	4.04	0.40	0.29
	3			2.76	3.49	0.49	0.42
	4			4.54	2.70	0.59	0.77

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

Appendix 35 (continued)

c. Maize

Plot	Subplot	Root		Stover	Weed	Panicle		
		fine	coarse			grain	spathe	cob
MA01	1	0.290	0.000	5.61	1.23	2.51	0.42	0.63
	2	0.243	0.000	3.85	1.73	2.79	0.44	0.81
	3	0.358	0.000	4.60	1.42	1.91	0.37	0.59
	4	0.299	0.049	4.77	1.12	3.00	0.44	0.73
MA02	1	0.280	0.000	5.83	1.36	4.34	0.58	1.32
	2	0.209	0.039	4.80	1.40	4.21	0.72	1.27
	3	0.397	0.000	5.08	0.85	3.88	0.94	0.95
	4	0.475	0.085	5.13	0.29	2.96	0.54	0.73
MIxMA01	1			2.00		0.82	0.11	0.23
	2			2.67		2.01	0.32	0.52
	3			3.04		2.20	0.29	0.61
	4			2.40		1.58	0.18	0.39
MIxMA02	1			1.35		1.03	0.16	0.20
	2			1.24		0.59	0.09	0.14
	3			1.43		0.66	0.10	0.16
	4			1.03		0.56	0.10	0.14

Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included)

d. Sorghum

Plot	Subplot	Stover	Weed	Panicle	
				grain	non edible
SO01	1	8.44	0.72	1.99	0.90
	2	2.38	2.01	0.48	0.21
	3	9.22	0.95	2.46	1.48
	4	4.52	1.31	0.97	0.55
SO02	1	16.38	0.23	2.26	0.84
	2	11.28	0.48	1.72	0.74
	3	15.37	1.62	2.12	1.21
	4	10.80	2.80	1.57	0.82

e. Rice

Plot	Subplot	Root		Stover	Weed	Panicle	
		fine	coarse			grain	non edible
RI01	1	5.35	0.110	2.31	0.08	0.64	0.72
	2	3.49	0.073	2.50	0.14	0.69	0.53
	3	4.88	0.108	1.67	0.09	0.53	0.62
	4	3.78	0.120	2.17	0.05	0.94	0.53
RI02	1	2.21	0.000	4.82	0.48	2.60	1.75
	2	2.47	0.000	3.47	0.32	3.40	1.98
	3	1.79	0.082	4.33	0.55	2.33	1.36
	4	2.24	0.043	5.18	0.24	3.02	2.00

Fine roots: diameter ranging 0-2 mm. Coarse roots:diameter above 2 mm (stump not included)

Appendix 36 Total amount and spatial and vertical distribution of dry matter, carbon, nitrogen and phosphorus in biomass (Pt) and soil (P_{OD}) of land use systems of the village. a. surfaces; b. dry matter; c. carbon; d. nitrogen; e. phosphorus; f. C, N and POD storage values used for computation of whole amounts in soil down to 40 cm deep (derived from Chapters 2 and 3).

a. Surface

Surface (ha)	Bush ring				Compound ring		Palm grove	Rice field
	Plateau		Glacis		Glacis			
	Uncropped	Cropped	Uncropped	Cropped	Uncropped	Cropped		
	100.0	44.0	16.7	25.9	0.0	21.4	31.9	16.2

b. Dry matter (t ha^{-1})

	Bush ring				Compound ring		Palm grove	Rice field	All uncropped	All cropped	Village	
	Plateau		Glacis		Glacis							Distribution (%)
	Uncropped	Cropped	Uncropped	Cropped	Uncropped	Cropped						
Tree	3042	6	241	1	1	0	958	0	4242	7	4249	44
Grass/herb. advent	329	22	90	17	0	24	96	4	515	67	582	6
Harvest		52		30		23		22		127	127	1
Stover		106		79		74		37		297	297	3
Litter	209		35		0		67		310		310	3
Stump	1227	139	148	34	0	0	0	0	1376	173	1548	16
Coarse root	1230	66	83	19	0	5	169	2	1483	92	1575	16
Fine root	262	29	23	16	0	12	470	69	756	126	881	9
Total	6300	420	621	198	1	137	1759	133	8681	889	9570	100
Distribution(%)	66	4	6	2	0	1	18	1	91	9	100	

c. Carbon (t ha^{-1})

	Bush ring				Compound ring		Palm grove	Rice field	All uncropped	All cropped	Village		
	Plateau		Glacis		Glacis							Distribution (%)	
	Uncropped	Cropped	Uncropped	Cropped	Uncropped	Cropped						0-20†	0-40†
Tree	1141	2	91	1	0	0	441	0	1673	3	1676	22	16
Grass/herb. advent	116	8	33	6	0	8	35	1	184	23	207	3	2
Harvest		22		12		8		7		50	50	1	0
Stover		38		29		28		11		106	106	1	1
Litter	68		11		0		22		101		101	1	1
Stump	451	53	55	13	0	0	0	0	506	66	572	8	5
Coarse root	448	25	29	7	0	2	76	0	554	34	588	8	6
Fine root	90	10	8	6	0	4	211	20	309	41	350	5	3
Soil (0-20 cm)	1538	529	257	306	1	340	317	669	2112	1844	3956	52	38
Soil (20-40 cm)	1116	491	139	216	0	178	336	445	1591	1330	2922		28
Total 0-20 cm	3853	689	485	379	1	390	1101	710	5440	2167	7607	100	
Distribution(%)	51	9	6	5	0	5	14	9	72	28	100		
Total 0-40 cm	4968	1179	624	596	2	568	1438	1155	7031	3498	10529		100
Distribution(%)	47	11	6	6	0	5	14	11	67	33	100		

†: soil layer for which C, N and P_{OD} amounts in soil were taken into account. Amounts in roots were always computed down to 40 cm deep. Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included).

Appendix 36 (continued)

d. Nitrogen (kg ha^{-1})

	Bush ring				Compound ring		Palm grove	Rice field	All uncropped	All cropped	Village		
	Plateau		Glacis		Glacis							Distribution (%)	
	Uncropped	Cropped	Uncropped	Cropped	Uncropped	Cropped						0-20†	0-40†
Tree	12583	277	1202	67	3	0	7950	0	21739	345	22083	6	3
Grass/herb. advent	2138	254	529	211	1	311	629	36	3297	812	4109	1	1
Harvest		1203		594		297		137		2230	2230	1	0
Stover		1074		508		260		151		1993	1993	1	0
Litter	1076		179		0		344		1600		1600	0	0
Stump	4835	482	559	118	1	0	0	0	5396	600	5995	2	1
Coarse root	4644	252	390	95	1	49	1352	13	6386	408	6795	2	1
Fine root	2115	395	183	205	0	129	3757	521	6056	1251	7307	2	1
Soil (0-20 cm)	128257	43495	21389	25723	51	28728	27473	61568	177170	159514	336684	87	52
Soil (20-40 cm)	102429	45059	12470	19382	30	16010	29171	37408	144100	117859	261959		40
Total 0-20 cm	155648	47432	24431	27521	59	29774	41505	62426	221642	167153	388795	100	
Distribution(%)	40	12	6	7	0	8	11	16	57	43	100		
Total 0-40 cm	258077	92491	36901	46903	89	45783	70676	99834	365742	285012	650754		100
Distribution(%)	40	14	6	7	0	7	11	15	56	44	100		

e. Phosphorus (total in plant, available in soil)(kg ha^{-1})

	Bush ring				Compound ring		Palm grove	Rice field	All uncropped	All cropped	Village		
	Plateau		Glacis		Glacis							Distribution (%)	
	Uncropped	Cropped	Uncropped	Cropped	Uncropped	Cropped						0-20†	0-40†
Tree	1501	28	112	7	0	0		0	1614	34	1648	26	19
Grass/herb. advent	195	28	50	28	0	47		8	245	112	357	6	4
Harvest		109		65		54		29		257	257	4	3
Stover		112		66		62		35		275	275	4	3
Litter	3		1		0				4		4	0	0
Stump	338	0	35	0	0	0		0	372	0	372	6	4
Coarse root	380	15	25	6	0	3		1	405	25	430	7	5
Fine root	113	13	11	3	0	0		0	124	16	139	2	2
Soil (0-20 cm)	718	280	120	171	0	643		913	838	2006	2844	45	32
Soil (20-40 cm)	428	208	71	127	0	426		1304	500	2065	2565	41	29
Total 0-20 cm	3248	583	352	347	1	809		987	3601	2726	6327	100	
Distribution(%)	51	9	6	5	0	13		16	57	43	100		
Total 0-40 cm	3676	792	424	473	1	1235		2291	4101	4791	8892		100
Distribution(%)	41	9	5	5	0	14		26	46	54	100		

†: soil layer for which C, N and POD amounts in soil were taken into account. Amounts in roots were always computed down to 40 cm deep. Fine roots: diameter ranging 0-2 mm. Coarse roots: diameter above 2 mm (stump not included.

Appendix 36 (continued) f. Soil C, N and P_{OD} amounts per hectare used for the computation of the stock values at the scale of the whole village territory in the 20-40 cm soil layer (derived from Chapters 2 and 3).

Geomorphological unit	Glacis	Plateau	Lowland
C (t ha^{-1})	8.3	11.2	27.4
N (kg ha^{-1})	748	1024	2306

Ring	Compound; adjoining dwelling:		Bush		Lowland
	yes	no	crop	fallow	
P_{OD} (kg ha^{-1})	46.5	13.1	4.7	4.3	80.4

Appendix 37 Self sufficiency in manure and forage availability in the holdings of Sare Yorobana as derived from a simplified agro-pastoral budget.

Compound	Flock size (mean for dec 96-june 97)	Metabolic weight of the herd (mean for dec 96-june 97)	Forage stock (supply)	Forage need	Forage supply:need ratio	Surface cropped with rainfed	Manure production during the night	Manure need
Unit	(TLU)	(kg)	(tDM)	(tDM)		(ha)	(tDM)	(tDM)
Calculation	(1)†	(2)†	(3)	(4)=(2)*OMI†/10^6	(5)=(3)/(4)	(6)	(7)=(2)*FOME†/10^6*0.53	(8)=(7)/(6)/2.5
Amad	0	0	16.0	0.0	nd	1.6	0.0	0.00
Diou	79	5526	46.9	85.0	0.6	3.4	25.6	3.04
Mama	71	4870	118.2	74.9	1.6	6.4	22.6	1.42
Mamo	100	6907	72.3	106.3	0.7	5.3	32.0	2.42
Sali	49	3381	48.7	52.0	0.9	4.7	15.7	1.35
SaBA	0	0	8.7	0.0	nd	0.4	0.0	0.00
Seko	31	2167	17.2	33.3	0.5	2.3	10.0	1.76
Tidi	9	634	62.9	9.8	6.5	2.9	2.9	0.41
Doud	0	0	18.0	0.0	nd	0.8	0.0	0.00
SaDI	21	1471	24.5	22.6	1.1	2.4	6.8	1.14
Yaou	0	0	27.2	0.0	nd	1.9	0.0	0.00
Isa	0	0	16.2	0.0	nd	1.2	0.0	0.00
Said	0	0	11.7	0.0	nd	0.8	0.0	0.00
Awa	0	0	3.5	0.0	nd	0.9	0.0	0.00
Fode	0	0	37.4	0.0	nd	2.2	0.0	0.00
SaWA	20	1344	48.7	20.7	2.4	2.2	6.2	1.15
Soul	36	2463	70.0	37.9	1.8	2.5	11.4	1.84
Village	416	28762	648.2	442.6	1.5	42	133.3	1.28

† see Chapter 5; OMI (organic matter intake)=15.4 kg of OM per kilo of metabolic weight (December to June); FOME (faecal organic matter excretion)=8.7 kg of OM per kilo of metabolic weight (December to June). Source: ISRA/CIRAD-EMVT, Program ABT.

Appendix 38 Analysis of sensitiveness of carbon storage as related to the threshold value of cropping intensity (CI) driving woody advent biomass in cropped plots.

	Variation of the CI threshold	
Component	-10%	+10%
Cropped fields		
Tree	-6.9	23.0
Stump	-6.9	23.0
Coarse root	-6.0	19.8
Below ground biomass	-4.7	15.5
Biomass	-2.1	7.0
Ecosystem	-0.2	0.6
Whole village territory		
Tree	0.0	0.0
Stump	-0.8	2.6
Coarse root	-0.3	1.2
Below ground biomass	-0.4	1.5
Biomass	-0.2	0.6
Ecosystem	-0.1	0.2

Relative variation (in %) of the dry matter storage in different components.

Appendix 39 Evolution of land use (data in ha) in the village of Sare Yorobana for the 1997-2047 period as predicted by a static model (see description in 4.2.4.).

Y0 S0

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Rainfed cereal	47	45	46	50	53	57	61	65	69	74	79	84	89	94
Groundnut	44	45	46	49	51	54	57	59	62	66	69	72	76	80
Young fallows	51	51	52	55	59	62	66	70	74	69	61	52	43	34
Old fallows	66	67	63	54	45	35	25	14	3	0	0	0	0	0

Y30 S0

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Rainfed cereal	47	35	34	36	38	41	44	47	50	54	57	61	65	69
Groundnut	44	45	46	49	51	54	57	59	62	66	69	72	76	80
Young fallows	51	45	45	47	50	53	56	60	63	67	71	75	67	59
Old fallows	66	83	83	76	68	60	51	42	32	22	11	0	0	0

Y100 S0

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Rainfed cereal	47	23	20	20	21	23	24	26	28	30	32	34	36	39
Groundnut	44	45	46	49	51	54	57	59	62	66	69	72	76	80
Young fallows	51	38	37	38	41	43	45	48	51	54	57	60	63	66
Old fallows	66	102	105	101	95	89	82	74	67	59	51	42	33	23

Y30 S30

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Rainfed cereal	47	49	49	51	55	58	62	66	70	74	79	84	89	94
Groundnut	44	59	60	63	67	70	74	77	81	85	90	94	99	104
Young fallows	51	61	61	64	68	72	73	65	57	48	40	30	21	10
Old fallows	66	39	38	29	19	8	0	0	0	0	0	0	0	0

Y100 S30

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Rainfed cereal	47	32	28	29	31	33	35	37	39	42	45	47	50	53
Groundnut	44	59	60	63	67	70	74	77	81	85	90	94	99	104
Young fallows	51	51	50	52	54	58	61	64	68	71	74	67	59	51
Old fallows	66	66	69	64	56	48	39	30	20	9	0	0	0	0

Appendix 39 (continued)

Y0 S0

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Rainfed cereal	100	106	113	119	126	134	142	150	158	167	177	187	208
Groundnut	84	88	93	89	82	74	67	58	50	41	31	21	0
Young fallows	24	14	3	0	0	0	0	0	0	0	0	0	0
Old fallows	0	0	0	0	0	0	0	0	0	0	0	0	0

Y30 S0

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Rainfed cereal	73	77	82	87	92	98	103	109	116	122	129	137	144
Groundnut	84	88	93	97	102	108	105	99	92	86	79	71	64
Young fallows	51	42	33	24	13	3	0	0	0	0	0	0	0
Old fallows	0	0	0	0	0	0	0	0	0	0	0	0	0

Y100 S0

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Rainfed cereal	41	44	46	49	52	56	59	62	66	70	74	78	83
Groundnut	84	88	93	97	102	108	113	119	125	131	134	130	125
Young fallows	70	74	69	61	53	45	36	27	17	7	0	0	0
Old fallows	13	2	0	0	0	0	0	0	0	0	0	0	0

Y30 S30

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Rainfed cereal	99	105	111	118	124	132	139	147	155	164	173	182	192
Groundnut	109	103	97	90	84	76	69	61	53	44	35	26	16
Young fallows	0	0	0	0	0	0	0	0	0	0	0	0	0
Old fallows	0	0	0	0	0	0	0	0	0	0	0	0	0

Y100 S30

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Rainfed cereal	57	60	63	67	71	75	80	84	89	94	99	105	110
Groundnut	109	115	121	127	133	133	129	124	119	114	109	103	98
Young fallows	42	33	24	14	4	0	0	0	0	0	0	0	0
Old fallows	0	0	0	0	0	0	0	0	0	0	0	0	0

"Y" stands for relative increase (%) of cereal yield as compared to value in 1997.

"S" stands for relative increase (%) of standard of living as compared to value in 1997.

Appendix 40 Evolution of carbon storage (tC) in the plant-soil system of the territory of the village of Sare Yorobana for the 1997-2047 period as predicted by modelling (see description in 4.2.4.).

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Above ground plant biomass														
Y=0, S=0	1644	1656	1614	1509	1396	1277	1153	1022	884	816	767	715	661	604
Y=30, S=0	1644	1849	1845	1765	1670	1569	1464	1353	1236	1114	985	850	801	752
Y=100, S=0	1644	2075	2107	2061	1989	1910	1826	1739	1647	1550	1449	1342	1230	1113
Y=30, S=30	1644	1323	1306	1198	1074	944	833	786	737	685	630	573	512	449
Y=100, S=30	1644	1641	1678	1614	1519	1416	1308	1194	1075	949	829	783	735	684
Below ground plant biomass														
Y=0, S=0	1215	1225	1193	1110	1020	926	827	723	614	564	529	493	455	415
Y=30, S=0	1215	1385	1383	1320	1245	1166	1083	996	904	807	706	600	566	532
Y=100, S=0	1215	1571	1598	1564	1508	1446	1382	1314	1242	1167	1088	1005	918	826
Y=30, S=30	1215	970	959	874	776	673	588	556	522	486	449	409	368	325
Y=100, S=30	1215	1232	1264	1216	1142	1062	978	890	797	699	606	576	544	511
Plant biomass and soil														
Y=0, S=0	6495	6517	6437	6235	6017	5789	5549	5298	5033	4896	4792	4683	4569	4449
Y=30, S=0	6495	6889	6881	6727	6544	6351	6148	5934	5710	5475	5227	4968	4866	4763
Y=100, S=0	6495	7324	7385	7297	7158	7006	6846	6677	6501	6315	6120	5915	5700	5473
Y=30, S=30	6495	5876	5845	5637	5399	5148	4933	4834	4730	4621	4506	4386	4259	4126
Y=100, S=30	6495	6489	6560	6437	6254	6057	5849	5630	5400	5159	4926	4830	4729	4623

Appendix 40 (continued)

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Above ground plant biomass													
Y=0, S=0	543	480	414	401	406	412	417	423	430	436	443	451	466
Y=30, S=0	701	647	591	532	469	404	389	394	398	403	408	414	419
Y=100, S=0	989	859	797	750	700	648	593	535	475	411	368	371	374
Y=30, S=30	386	391	395	400	405	410	415	421	427	434	440	447	455
Y=100, S=30	631	575	517	455	391	368	372	375	379	382	386	390	394
Below ground plant biomass													
Y=0, S=0	372	328	282	266	260	255	249	242	236	229	221	214	197
Y=30, S=0	497	461	422	381	339	294	278	274	269	264	258	252	246
Y=100, S=0	730	629	585	554	522	487	451	413	373	332	301	298	294
Y=30, S=30	281	277	272	267	262	256	251	245	238	231	224	217	209
Y=100, S=30	476	440	401	361	318	300	297	293	290	286	282	277	273
Plant biomass and soil													
Y=0, S=0	4322	4190	4050	4022	4031	4042	4052	4064	4075	4088	4101	4114	4144
Y=30, S=0	4656	4543	4424	4299	4169	4031	4000	4008	4017	4026	4036	4046	4056
Y=100, S=0	5236	4986	4861	4761	4657	4548	4433	4312	4185	4051	3959	3965	3971
Y=30, S=30	3994	4002	4011	4020	4029	4039	4049	4060	4071	4083	4095	4108	4122
Y=100, S=30	4512	4395	4273	4144	4008	3961	3967	3973	3980	3987	3994	4002	4010

"Y" stands for relative increase (%) of cereal yield as compared to value in 1997.
"S" stands for relative increase (%) of standard of living as compared to value in 1997.

Appendix 41 Anthropogenic flows of carbon, nitrogen and phosphorus established from November 1996 to November 1997 in Sare Yorobana: a. absolute amounts; b. distribution with regard to the source; c. distribution with regard to the site.
Livestock flows include the dry season only.

a. Amounts in absolute value.

	Savanna ring								Bush ring							
	Woody sav.		Bush sav.		Grass sav.		Total		Fallow		Cash		Food		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (t)																
Harvest												107	0	29	0	136
Cattle	13	46	2	7	21	79	36	132	11	36	15	41	58	63	84	140
Wood										86						86
Straw						8		8								
Residue	nd		nd		nd				nd		2		70		72	
Total	**13**	**46**	**2**	**7**	**21**	**87**	**36**	**140**	**11**	**122**	**17**	**148**	**128**	**93**	**156**	**362**
Balance		*-34*		*-5*		*-65*		*-104*		*-111*		*-130*		*+35*		*-206*
Carbon (t)																
Harvest												42	0	10	0	53
Cattle	5	16	1	2	9	27	15	45	5	12	6	14	24	23	35	49
Wood										32						32
Straw						3		3								
Residue	nd		nd		nd				nd		2		26		28	
Total	**5**	**16**	**1**	**2**	**9**	**30**	**15**	**48**	**5**	**45**	**8**	**56**	**50**	**33**	**63**	**134**
Balance		*-11*		*-2*		*-21*		*-34*		*-40*		*-48*		*+17*		*-71*
Nitrogen (kg)																
Harvest												2343		360		2703
Cattle	383	958	57	143	649	1623	1089	2723	357	780	481	864	2634	1348	3472	2991
Wood										200						200
Straw						57		57								
Total	**383**	**958**	**57**	**143**	**649**	**1680**	**1089**	**2780**	**357**	**980**	**481**	**3207**	**2634**	**1707**	**3472**	**5894**
Balance		*-575*		*-85*		*-1031*		*-1691*		*-623*		*-2726*		*+927*		*-2422*
Phosphorus (kg)																
Harvest												148		69		218
Cattle	31.7	61.3	4.8	9.3	53.8	104.1	90.3	174.7	28.8	48.3	39.1	54.0	147.4	81.6	215.4	183.8
Wood										59						59
Straw						6		6								
Total	**32**	**61**	**5**	**9**	**54**	**110**	**90**	**180**	**29**	**107**	**39**	**202**	**147**	**151**	**215**	**460**
Balance		*-30*		*-5*		*-56*		*-90*		*-78*		*-163*		*-4*		*-245*
Surface (ha)		171		175		99		445		117		42		28		187

Appendix 41 (continued)

a. Amounts in absolute value (continued).

	Compound ring								Farmyard		Rice field						Other		Village		Total	
	Fallow		Cash		Food		Total				Village		Outer		Total							
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (t)																						
Harvest				3	54	24	54	27	129	81		22				22			55	185	184	265
Cattle	1	3	0	0	88	52	88	55			6	21	22	81	27	102	4	14	178	216	239	443
Wood									86	86										86	86	172
Straw					8		8		8	8									8		16	16
Residue	nd		2		42		45				20		nd		20		nd		137		137	
Total	**1**	**3**	**2**	**3**	**193**	**76**	**196**	**81**	**223**	**175**	**26**	**43**	**22**	**81**	**47**	**124**	**4**	**14**	**378**	**487**	**662**	**897**
Balance		*-2*		*-1*		*+117*		*+114*		*+48*		*-17*		*-59*		*-77*		*-10*		*-109*		*-235*
Carbon (t)																						
Harvest				1	18	8	18	10	44	27		7				7			19	69	19	69
Cattle	0	1	0	0	36	19	36	20			2	6	9	25	11	31	2	5	73	75	98	150
Wood									32	32										32		32
Straw					3		3		3	3									3		3	3
Residue	nd		1		15		17				6		nd		6		nd		51		51	
Total	**0**	**1**	**1**	**1**	**73**	**27**	**74**	**29**	**79**	**62**	**9**	**13**	**9**	**25**	**18**	**38**	**2**	**5**	**146**	**177**	**171**	**255**
Balance		*-1*		*0*		*+46*		*+45*		*+17*		*-5*		*-16*		*-21*		*-4*		*-31*		*-84*
Nitrogen (kg)																						
Harvest				61	1193	289	1193	351	1704	1193		137				137			1193	3190	1193	3190
Cattle	23	60	1	1	2762	1109	2786	1171			178	451	683	1730	861	2181	125	313	6436	4613	8333	9379
Wood									200	200										200		200
Straw					57		57		57	57									57		57	57
Total	**23**	**60**	**1**	**63**	**4011**	**1399**	**4035**	**1521**	**1961**	**1450**	**178**	**587**	**683**	**1730**	**861**	**2317**	**125**	**313**	**7685**	**8003**	**9583**	**12825**
Balance		*-37*		*-62*		*+2613*		*+2514*		*+511*		*-409*		*-1047*		*-1456*		*-188*		*-317*		*-3243*
Phosphorus (kg)																						
Harvest				7	99	57	99	64	198	99		29				29			99	311	99	311
Cattle	1.8	3.5	0.0	0.1	222.9	66.7	224.8	70.2			14.4	27.9	55.3	107.0	69.7	134.8	10.3	19.9	454.5	281.9	610.3	583.5
Wood					59		59		59	59									59	59	59	59
Straw					6		6		6	6									6		6	6
Total	**2**	**3**	**0**	**7**	**386**	**124**	**388**	**134**	**262**	**163**	**14**	**57**	**55**	**107**	**70**	**164**	**10**	**20**	**617**	**652**	**773**	**959**
Balance		*-2*		*-7*		*+262*		*+254*		*+99*		*-43*		*-52*		*-95*		*-10*		*-34*		*-186*
Surface (ha)		0		2		19		21				16		62		79		81		224		812

Appendix 41 (continued)

b. Distribution according to source.

	Savanna ring								Bush ring							
	Woody sav.		Bush sav.		Grass sav.		Total		Fallow		Cash		Food		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (%)																
Harvest												72	0	32	0	38
Cattle	100	100	100	100	100	91	100	94	100	30	88	28	45	68	54	39
Wood										70						24
Straw						9		6								
Residue	nd		nd		nd				nd		12		55		46	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Carbon (%)																
Harvest												75	0	31	0	39
Cattle	100	100	100	100	100	91	100	94	100	28	75	25	48	69	55	37
Wood										72						24
Straw						9		6								
Residue	nd		nd		nd				nd		25		52		45	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Nitrogen (%)																
Harvest												73		21		46
Cattle	100	100	100	100	100	97	100	98	100	80	100	27	100	79	100	51
Wood										20						3
Straw						3		2								
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Phosphorus (%)																
Harvest												73		46		47
Cattle	100	100	100	100	100	95	100	97	100	45	100	27	100	54	100	40
Wood										55						13
Straw						5		3								
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

c. Geographical distribution.

	Savanna ring								Bush ring							
	Woody sav.		Bush sav.		Grass sav.		Total		Fallow		Cash		Food		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (%)	2	5	0	1	3	10	5	16	2	14	3	16	19	10	24	40
Carbon (%)	3	6	0	1	5	12	9	19	3	18	5	22	29	13	37	53
Nitrogen (%)	4	7	1	1	7	13	11	22	4	8	5	25	27	13	36	46
Phosphorus (%)	4	6	1	1	7	11	12	19	4	11	5	21	19	16	28	48

Appendix 41 (continued)

b. Distribution according to source (continued).

	Compound ring								Farmyard		Rice field						Other	
	Fallow		Cash		Food		Total				Village		Outer		Total			
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (%)																		
Harvest				98	28	31	28	33	58	46		51				18		
Cattle	100	100	1	2	46	69	45	67			22	49	100	100	58	82	100	100
Wood									39	49								
Straw					4		4		4	5								
Residue	nd		99		22		23				78		nd		42		nd	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Carbon (%)																		
Harvest				98	25	31	25	33	56	44		52				18		
Cattle	100	100	1	2	49	69	49	67			27	48	100	100	64	82	100	100
Wood									41	52								
Straw					4		4		4	4								
Residue	nd		99		21		22				73		nd		36		nd	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Nitrogen (%)																		
Harvest				98	30	21	30	23	87	82		23				6		
Cattle	100	100	100	2	69	79	69	77			100	77	100	100	100	94	100	100
Wood									10	14								
Straw					1		1		3	4								
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Phosphorus (%)																		
Harvest				99	26	46	25	48	76	61		51				18		
Cattle	100	100	100	1	58	54	58	52			100	49	100	100	100	82	100	100
Wood					15		15		22	36								
Straw					1		1		2	3								
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

c. Geographical distribution (continued).

	Compound ring								Farmyard		Rice field						Other		All	
	Fallow		Cash		Food		Total				Village		Outer		Total					
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Dry matter (%)	0	0	0	0	29	8	30	9			4	5	3	9	7	14	1	2	100	100
Carbon (%)	0	0	1	1	43	11	43	12			5	5	5	10	10	15	1	2	100	100
Nitrogen (%)	0	0	0	0	42	11	42	12			2	5	7	13	9	18	1	2	100	100
Phosphorus (%)	0	0	0	1	50	13	50	14			2	6	7	11	9	17	1	2	100	100

Appendix 42 Weight of herds owned or managed by holdings.

Holding		96					97						
	(ABT coding)	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Apr	May	June	Jul
Live weight (kg)													
Diou	(MOS)	19193	19543	19968	20270	20318	20324	20241	19943	19702	19206	19022	22051
Mama	(BALA)	7466	7832	7916	8014	8162	8429	8662	8705	8778	8786	8598	6917
Mama	(MAMA)	9390	9491	9507	9514	9607	9594	9199	8914	8848	8693	8475	10696
Mamo	(MAO)	25546	25642	25477	25611	25585	25406	25085	24620	24389	24528	24655	21320
SaDI	(DIAO)	5412	5299	5185	5348	5432	5385	5391	5354	5239	5104	5008	3480
Sali	(SALI)	11752	11853	11925	12119	12328	12404	12279	12129	12291	12377	12176	10107
SaWA	(ALIW)	4682	4840	4958	4963	4984	4933	4883	4968	5052	4967	4210	5357
Seko	(SEKO)	8090	8060	8160	8310	8342	8209	7967	7849	7514	7298	7405	8244
Soul	(SOUL)	9190	9272	9129	8965	8909	8845	8890	9007	9049	9113	9157	9172
Tidi	(LADE)	1903	1973	2165	2334	2498	2438	2260	2181	2193	2206	2206	5770
Live weight (TLU†)													
Diou	(DIOUB)	77	78	80	81	81	81	81	80	79	77	76	88
Mama	(BALA)	30	31	32	32	33	34	35	35	35	35	34	28
Mama	(MAMA)	38	38	38	38	38	38	37	36	35	35	34	43
Mamo	(MAMO)	102	103	102	102	102	102	100	98	98	98	99	85
SaDI	(DIAO)	22	21	21	21	22	22	22	21	21	20	20	14
Sali	(SALI)	47	47	48	48	49	50	49	49	49	50	49	40
SaWA	(ALIW)	19	19	20	20	20	20	20	20	20	20	17	21
Seko	(SEKO)	32	32	33	33	33	33	32	31	30	29	30	33
Soul	(SOUL)	37	37	37	36	36	35	36	36	36	36	37	37
Tidi	(LADE)	8	8	9	9	10	10	9	9	9	9	9	23
Metabolic weight (kg)													
Diou	(DIOUB)	5295	5402	5538	5638	5656	5661	5638	5559	5495	5364	5311	6089
Mama	(BALA)	2059	2163	2189	2221	2263	2332	2395	2407	2430	2434	2377	1908
Mama	(MAMA)	2559	2591	2605	2615	2643	2640	2533	2456	2439	2399	2339	2962
Mamo	(MAMO)	7070	7106	7063	7097	7091	7048	6961	6831	6767	6802	6848	5909
SaDI	(DIAO)	1495	1464	1433	1481	1508	1501	1507	1495	1461	1424	1400	973
Sali	(SALI)	3210	3237	3257	3317	3382	3412	3383	3342	3384	3407	3360	2781
SaWA	(ALIW)	1283	1330	1363	1369	1381	1365	1349	1375	1400	1376	1162	1474
Seko	(SEKO)	2216	2222	2260	2304	2314	2279	2210	2177	2089	2034	2064	2273
Soul	(SOUL)	2509	2530	2489	2449	2441	2423	2434	2466	2476	2494	2509	2515
Tidi	(LADE)	533	550	601	647	691	676	628	606	609	613	613	1577

Source: ISRA/CIRAD-EMVT, Program ABT.

† TLU = tropical livestock unit (1 TLU = 250 kg of live weight)

Appendix 43 Mean monthly carbon, nitrogen and phosphorus content (g 100 g^{-1}DM) of cow dungs in Sare Yorobana.

Month	C	N†	P
January	42.4	1.62	0.27
February	40.7	1.41	0.24
March	38.9	1.44	0.25
April	40.2	1.56	0.27
May	41.5	1.50	0.24
June	42.2	1.62	0.27
July		1.88	
August		1.91	
September		1.87	
October		1.82	
November	41.5	1.75	0.26
December	41.5	1.53	0.26

† Source: ISRA/CIRAD-EMVT, Program ABT.

Appendix 44 Time (d ha^{-1}) spent by three cattle herds on the plots of the village, with regard to land owner.

	Flock owner			
Plot owner	Diao	Mama	Mamo	Total
Amad	**3.91**	0.18	**0.77**	4.86
Awa	1.63	0.05	**2.10**	3.78
Diou	0.19	0.69	**0.91**	1.79
Doud	1.09	0.08	0.17	1.33
Fode	0.00	0.43	0.35	0.79
Isa	0.28	0.48	**0.87**	1.63
Mama	0.37	***1.28***	**0.91**	2.55
Mamo	0.14	0.44	***0.76***	1.35
SaBA	0.75	1.02	0.29	2.07
SaDI	***2.58***	0.14	0.73	3.45
Said	0.00	**2.93**	**2.07**	5.00
Sali	0.84	0.04	0.59	1.46
SaWA	0.00	0.80	**0.85**	1.65
Seko	1.99	0.00	0.11	2.10
Soul	0.01	0.43	0.31	0.75
Tidi	0.71	0.67	0.24	1.61
Yaou	2.13	0.04	0.15	2.33
None	0.14	0.11	0.17	0.43
Total	0.52	0.40	0.45	1.37

Figures higher than the time spent by the herd on its owner's plots are typed in bold.

Appendix 45 Input of dry matter (t ha^{-1}) to fields from manuring during night corralling as influenced by the plant species planned for cropping.

Owner	Millet x maize	Maize	Millet	Sorghum	Cotton	Groundnut	Fallow	All plots
Amad	10.26		2.62	1.33				2.28
Awa								
Diou		6.21	3.56	0.81	1.73			1.67
Doud			0.44					0.24
Fode								
Isa								
Keba								
Mama	11.13	1.44	2.21	2.19		0.13		1.49
Mamo		6.47	5.55	6.04				2.78
SaBA								
SaDI	8.55		1.75	4.98		0.11		1.41
Said								
Sali	6.29		1.54					1.13
SaWA			3.33		0.61			1.43
Seko	7.02		1.37		0.35			1.66
Soul	2.86		5.55					3.15
Tidi	0.94	1.26	0.49					0.34
Yaou								
None							0.01	0.01

Appendix 46 Organic matter inflows and outflows initiated by intake and faecal excretion of three herds during the 1995-1996 dry season.

	Biomass per surface unit (tDM.ha^{-1})	
Land use	Inflow	Outflow
Territory owned by the village (not including rice fields)		
Compound	0.22	-0.95
Millet	0.18	-0.82
Maize	0.16	-0.72
Millet (x maize)	0.13	-0.56
Groundnut	0.08	-0.36
Sorghum	0.07	-0.30
Fallow	0.03	-0.12
Total	0.07	-0.32
Land prospected by animals		
Woody savanna	0.02	-0.09
Bush savanna	0.00	-0.01
Grass savanna	0.06	-0.27
Bush ring	0.06	-0.26
Compound ring	0.19	-0.84
Rice field	0.10	-0.45
Outer cropped field	0.01	-0.06
Pond	0.11	-0.49
Total	0.04	-0.19

Appendix 47 Millet yield as related to manuring practices in the compound and bush rings.

Plot code	Manuring intensity (tOM ha^{-1})	Grain yield of millet (tDM ha^{-1})
Compound		
11 a	0.00	0.50
17 b	6.69	0.84
18 a	2.14	0.27
23 a	3.46	0.82
28 c	0.00	0.62
72 b	2.18	0.57
73 a	0.00	0.58
79 a	2.60	0.69
80 c	0.98	0.27
81 c	0.00	0.27
89 b	4.80	0.52
90 a	10.40	0.98
90 e	5.13	0.98
91 a	1.83	1.22
Bush		
19 a	0.83	0.35
20 a	0.34	0.49
22 e	0.39	0.82
24 d	1.93	0.31
33 a	1.38	0.21
41 b	0.12	0.60
48 a	1.30	0.66
53 a	3.23	0.99
87 a	5.64	1.26
88 c	3.53	1.83
88 g	2.81	0.43

Appendix 48 Evolution of anthropogenic carbon outflows (tC) and ratio of C outflow to C amount stored in plant above-ground biomass of the territory of the village of Sare Yorobana for the 1997-2047 period as predicted by modelling (see description of the model in Chapter 4).
Outflows considered are: harvested crop biomass, livestock uptake during the dry season, and wood collecting.

Year	1997	1998	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
Anthropogenic flow (tC)														
Y=0, S=0	258	263	270	283	298	313	329	345	363	381	400	421	442	464
Y=30, S=0	258	259	265	278	292	307	322	339	356	374	392	412	433	455
Y=100, S=0	258	255	260	272	286	300	315	331	347	365	383	402	423	444
Y=30, S=30	258	326	333	350	367	386	405	426	447	470	494	518	545	572
Y=100, S=30	258	319	326	341	358	376	395	415	436	458	481	505	530	557
Anthropogenic flow:stock ratio														
Y=0, S=0	0.16	0.16	0.17	0.19	0.21	0.24	0.29	0.34	0.41	0.47	0.52	0.59	0.67	0.77
Y=30, S=0	0.16	0.14	0.14	0.16	0.17	0.20	0.22	0.25	0.29	0.34	0.40	0.49	0.54	0.60
Y=100, S=0	0.16	0.12	0.12	0.13	0.14	0.16	0.17	0.19	0.21	0.24	0.26	0.30	0.34	0.40
Y=30, S=30	0.16	0.25	0.26	0.29	0.34	0.41	0.49	0.54	0.61	0.69	0.78	0.91	1.06	1.27
Y=100, S=30	0.16	0.19	0.19	0.21	0.24	0.27	0.30	0.35	0.41	0.48	0.58	0.65	0.72	0.81

Appendix 48 (continued)

Year	2023	2025	2027	2029	2031	2033	2035	2037	2039	2041	2043	2045	2047
Anthropogenic flow (tC)													
Y=0, S=0	488	513	539	557	572	588	606	624	642	662	683	705	721
Y=30, S=0	478	502	527	554	582	611	633	653	673	695	718	742	767
Y=100, S=0	466	490	514	540	567	596	626	657	690	725	758	784	811
Y=30, S=30	600	618	637	657	678	700	723	747	772	799	827	856	887
Y=100, S=30	585	615	646	678	712	741	766	792	820	849	880	912	946
Anthropogenic flow:stock ratio													
Y=0, S=0	0.90	1.07	1.30	1.39	1.41	1.43	1.45	1.47	1.50	1.52	1.54	1.57	1.55
Y=30, S=0	0.68	0.78	0.89	1.04	1.24	1.51	1.63	1.66	1.69	1.72	1.76	1.79	1.83
Y=100, S=0	0.47	0.57	0.64	0.72	0.81	0.92	1.06	1.23	1.45	1.76	2.06	2.12	2.17
Y=30, S=30	1.55	1.58	1.61	1.64	1.67	1.71	1.74	1.77	1.81	1.84	1.88	1.91	1.95
Y=100, S=30	0.93	1.07	1.25	1.49	1.82	2.01	2.06	2.11	2.17	2.22	2.28	2.34	2.40

TABLE OF APPENDICES

Organic matter dynamics in mixed-farming systems of the West African savanna: a village case study from south Senegal

Raphaël Manlay

Organic matter (OM) is a multi-purpose tool in West African smallholder mixed-farming systems, but its supply has been decreasing for several decades. To assess the viability of a mixed-farming system of south Senegal, carbon (C), nitrogen (N) and phosphorus (P; available in soil and noted P_{OD}) budgets (stocks and flows) were thus quantified.

The village territory of the study showed a ring-like organisation with growing intensification of fertilization and cropping practices from the periphery (bush ring) to the compounds (compound fields).

Stocks in plant and soil averaged 55 tC, 26 tN and 43 kgP ha^{-1} in old fallows. They were 100, 30 and 250 % higher than in the bush cropped fields, plant biomass accounting for nearly all of the rise. C, N and P amounts recorded in the soil of compound fields were higher than those of the bush field, but the increase was restricted mainly to the 0-10 cm layer. However, the rather weak response of local sandy soils to management can be interpreted only by reassessing the bio-thermodynamical signification of soil organic carbon cycling in the maintenance of the integrity of local agroecosystems.

Manageable stocks of the whole village territory were estimated to 30 tC, 1.5 tN and 26 kgP ha^{-1} in 1997. Carbon was stored mainly in soil. Livestock, crop harvest and wood collecting were responsible for respectively 59, 27 and 14 % of the C uptake on the village territory. As a result, large C flows were set towards the compound ring (3.8 tC ha^{-1} y^{-1}). N and P depletion of the system amounted to 4 kgN and 1 kgP ha^{-1} y^{-1}, suggesting that the system was close to nutrient balance.

Under current demographic growth rate, C depletion may reach 0.38 tC ha^{-1} y^{-1} and C demand may double during the next three decades. Without any intensification of farming practices, the viability of the system might soon be called into question.

Doctoral Thesis

ENVIRONMENT