Electronic Supplementary information (S) for

Changes in Particulate and Mineral Associated Organic Carbon with Land Use in Contrasting Soils

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This supporting information provides some additional tables and figures for the manuscript, as well as all of the raw data (Table 3-5) presented in the manuscript.

Table S1 Geological and climatic data for the four sites from where soils samples were collected for the study

WRB soil order	ASC soil order	Latitude	Longitude	Average annual precipitation (mm)	Average annual temperature (°C)	Elevation (m)	Land use	
							Native	Cropped
Ferralsol	Ferrolsol	-28° 48' 55.8"	153° 24' 0.7"	1810	19.4	166	Open woodland	Cereal
Luvisol	Chromosol	-31° 5' 48.4"	150° 43' 50.7"	632	17.3	404		
Vertisol	Vertosol	-31° 43' 13.1"	150° 40' 54.6"	681	16.8	390		
Solonetz	Sodosol	-31° 21' 11.0"	150° 4' 46.1"	638	18.4	285		Cereal + forage crops

WRB = World Reference Base, ASC = Australian Soil Classification. Climate data source: New South Wales Department of Primary Industries (2014); Australian Bureau of Meteorology, Bureau of Meteorology (2014)

Table S2 Mean ± S.E. (n = 3) values of iron (Fe) and aluminium (Al) extracted using different extractants from bulk soils

WRB soil order	Land use	Depth (cm)	Extractable Fe (g kg^{-1})				Extractable Al (g kg^{-1})		
			Fe_{Ox}	Fe_{DCB}	$Fe_{Na\text{-}py}$	Fe_{Ox} : Fe_{DCB}	Al_{Ox}	Al_{DCB}	$Al_{Na\text{-}py}$
Ferralsol	Native	0-10	6.0±0.04	150±2.13	9.0±0.31	0.04±0.00	3.2±0.04	12.7±0.15	3.7±0.10
		60-70	5.9±0.54	180±2.59	3.9±0.13	0.03±0.00	3.5±0.17	15.1±0.31	1.6±0.04
	Cropped	0-10	5.9±0.26	66±0.68	4.4±0.03	0.09±0.00	3.9±0.13	8.0±0.11	2.6±0.02
		60-70	5.5±0.38	73±0.27	1.1±0.02	0.07±0.01	3.6±0.12	8.2±0.05	0.74±0.02
Luvisol	Native	0-10	2.5±0.01	17±0.95	0.49±0.02	0.15±0.01	1.1±0.02	1.5±0.09	0.87±0.09
		60-70	1.4±0.06	16±0.15	0.30±0.01	0.09±0.00	1.3±0.04	1.9±0.01	0.21±0.01
	Cropped	0-10	2.9±0.08	15±1.08	0.54±0.25	0.19±0.02	1.1±0.03	1.4±0.10	1.0±0.47
		60-70	2.0±0.03	15±2.27	0.34±0.00	0.14±0.02	1.5±0.02	1.6±0.26	0.32±0.02
Vertisol	Native	0-10	7.9±0.21	15±0.30	0.38±0.01	0.53±0.01	2.0±0.03	1.3±0.03	0.15±0.00
		60-70	5.8±0.30	17±0.14	0.08±0.00	0.35±0.02	1.8±0.08	1.3±0.01	0.04±0.00
	Cropped	0-10	4.5±0.13	14±0.11	0.23±0.01	0.32±0.01	1.9±0.03	1.4±0.02	0.14±0.02
		60-70	3.8±0.12	14±0.24	0.14±0.01	0.27±0.00	2.0±0.04	1.4±0.01	0.06±0.00
Solonetz	Native	0-10	0.91±0.02	3.4±0.01	0.50±0.01	0.27±0.01	0.29±0.01	0.55±0.00	0.41±0.01
		60-70	1.2±0.05	22±0.57	0.12±0.00	0.05±0.00	0.71±0.04	2.4±0.06	0.13±0.00
	Cropped	0-10	0.93±0.02	3.0±0.06	0.51±0.01	0.31±0.01	0.28±0.01	0.44±0.01	0.36±0.01
		60-70	1.0±0.02	25±0.84	0.05±0.00	0.04±0.00	1.1±0.00	3.5±0.09	0.13±0.00

Ox = ammonium acid oxalate (pH = 3), DCB = dithionate-citrate-bicarbonate and Na-py = sodium pyrophosphate (pH = 10).

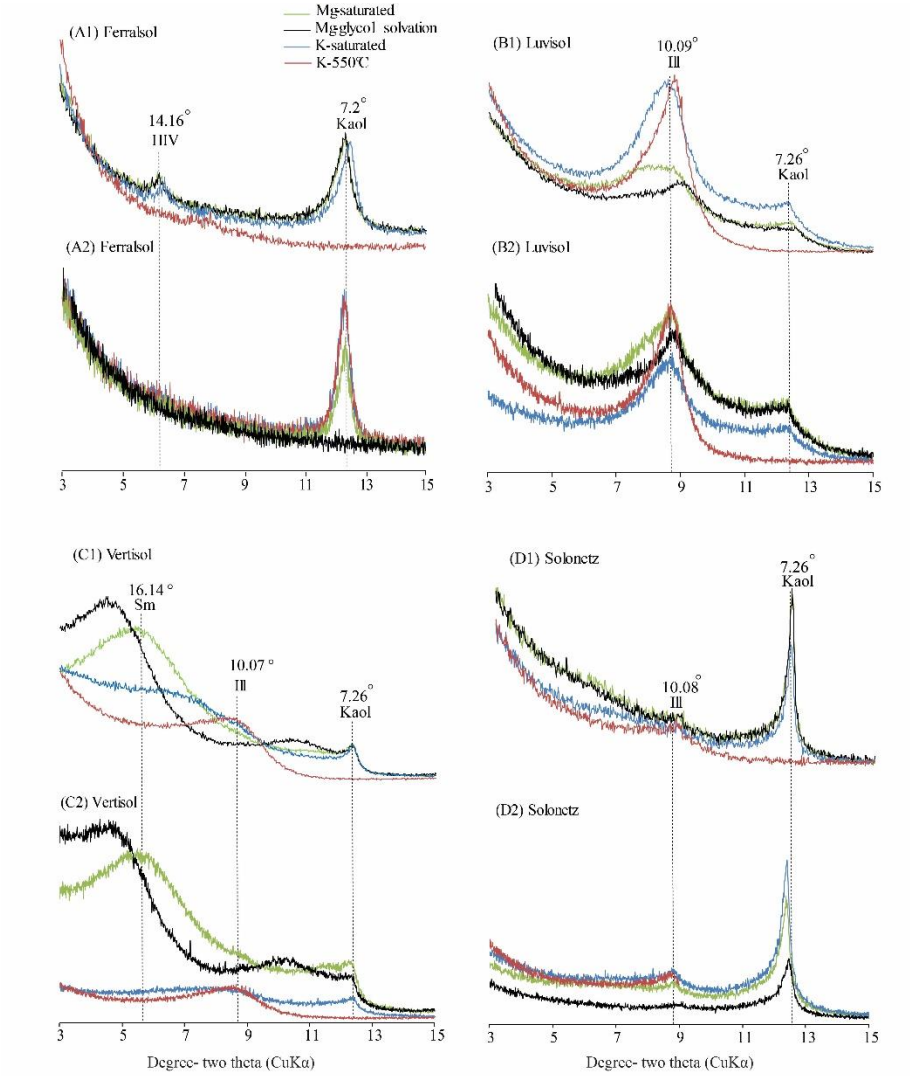

Fig. S1 X-ray diffraction analysis of the oriented clay fraction of four surface (0–10 cm) bulk soils from cropped (1) and native (2) land uses. HIV = hydroxyl interlayered vermiculite, Ill = illite, Kaol = kaolinite and Sm = smectite

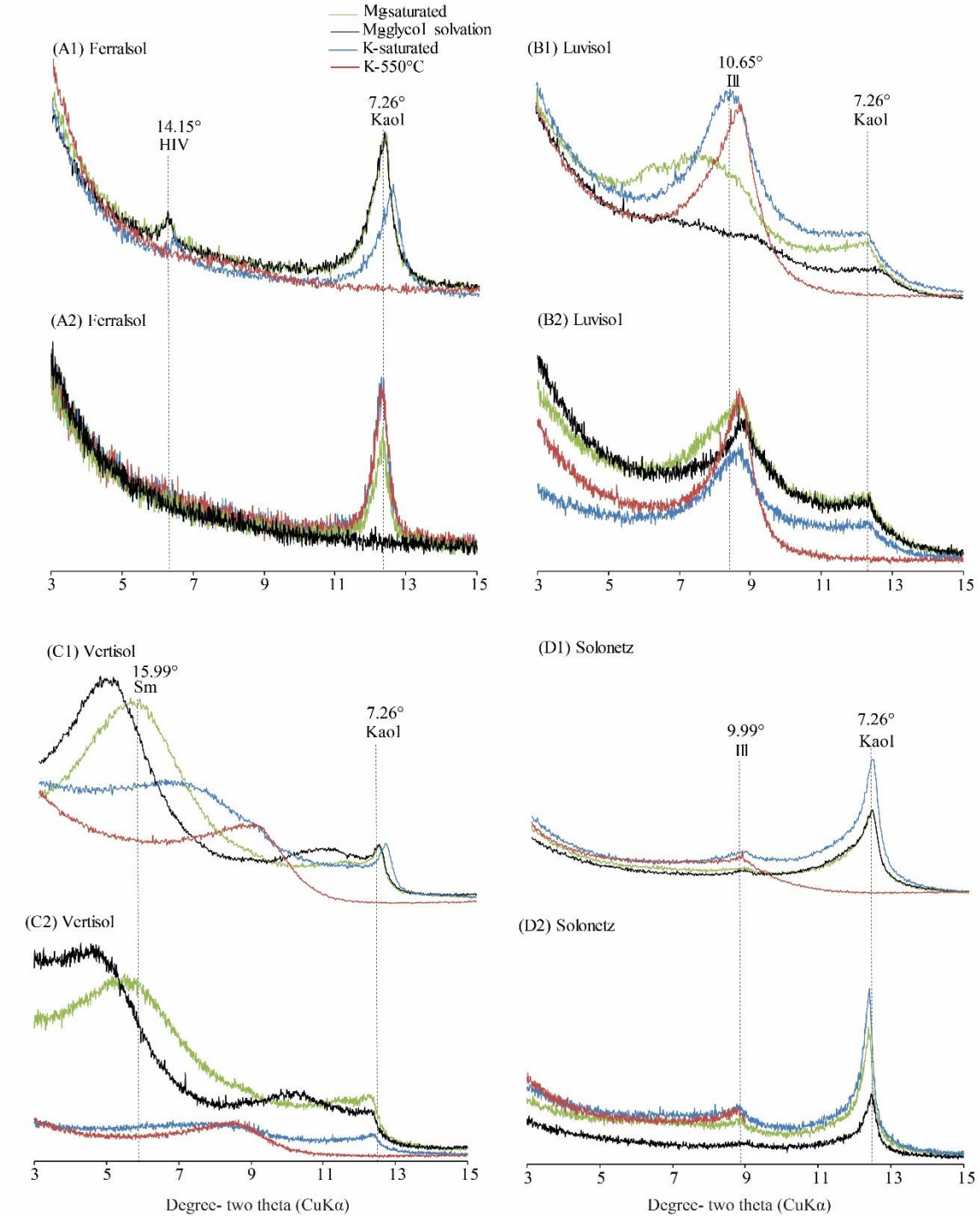

Fig. S2 X-ray diffraction analysis of the oriented clay fraction of four sub-surface (60–70 cm) bulk soils from cropped (1) and native (2) land uses. HIV = hydroxyl interlayered vermiculite, Ill = illite, Kaol = kaolinite and Sm = smectite

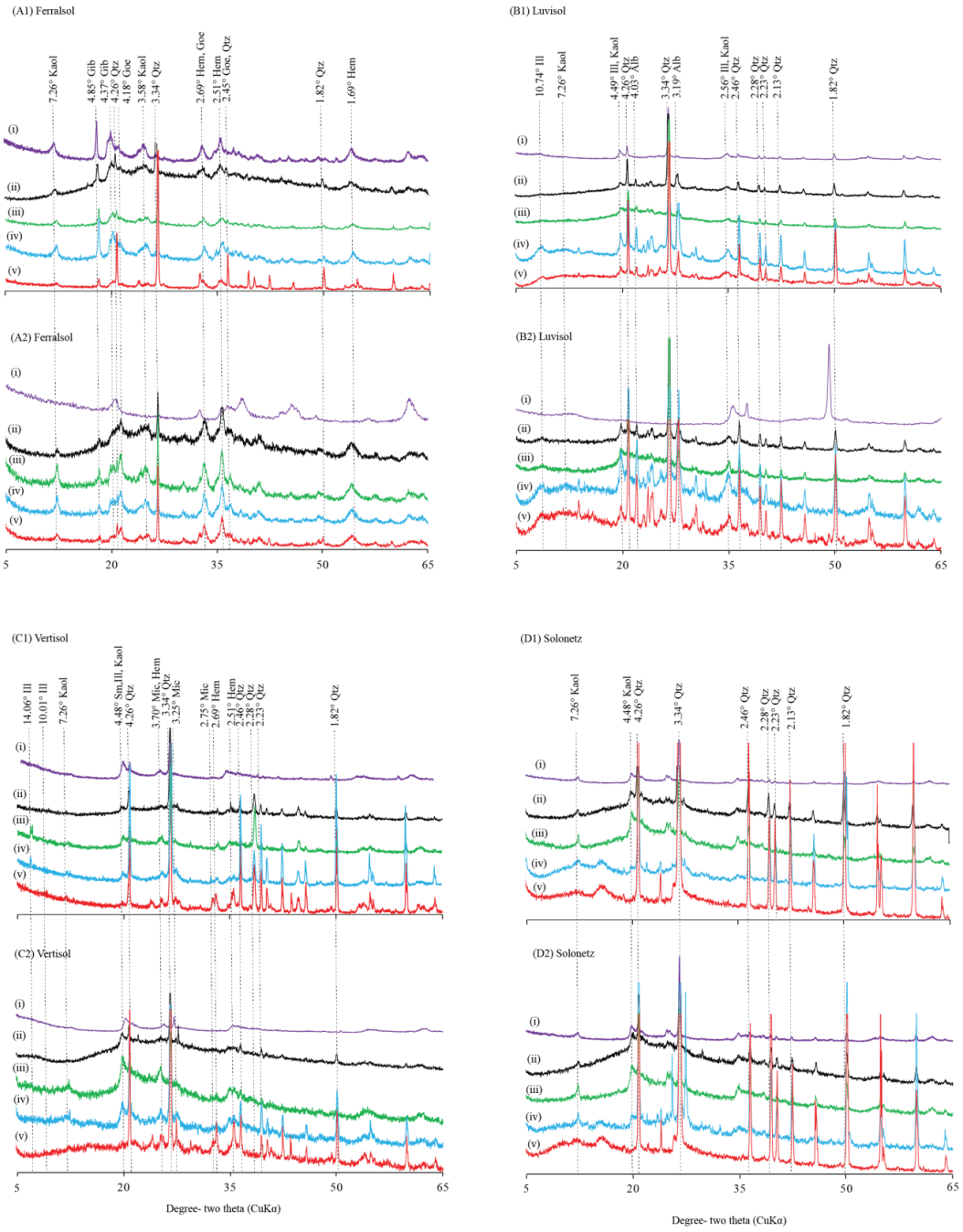

Fig. S3 X-ray diffraction analysis of the random powder of the bulk (i) and density fractions (ii = <1.8, iii = 1.8–2.2, iv = 2.2–2.6 and v = >2.6 g cm^{-3}) of four surface (0–10 cm) soils from cropped (1) and native (2) land uses. Alb = albite, Gib = gibbsite, Goe = goethite, Hem = hematite, Ill = illite, Kaol = kaolinite, Mic = microcline, Qtz = quartz and Sm = smectite

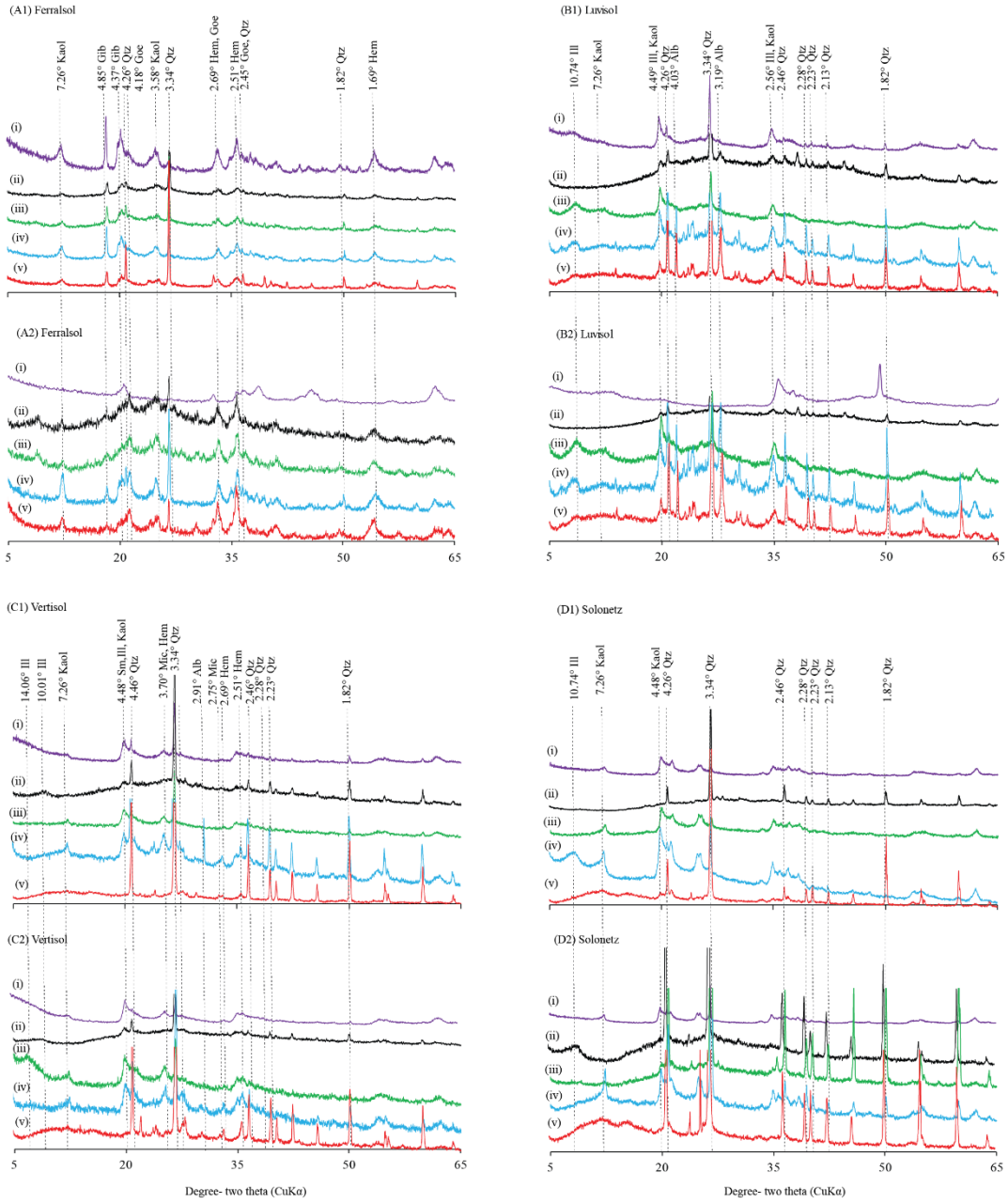

Fig. S4 X-ray diffraction analysis of the random powder of the bulk (i) and density fractions (ii = <1.8, iii = 1.8–2.2, iv = 2.2–2.6 and v = >2.6 g cm^{-3}) of four sub-surface (60-10 cm) soils from cropped (1) and native (2) land uses. Alb = albite, Gib = gibbsite, Goe = goethite, Hem = hematite, Ill = illite, Kaol = kaolinite, Mic = microcline, Qtz = quartz and Sm = smectite

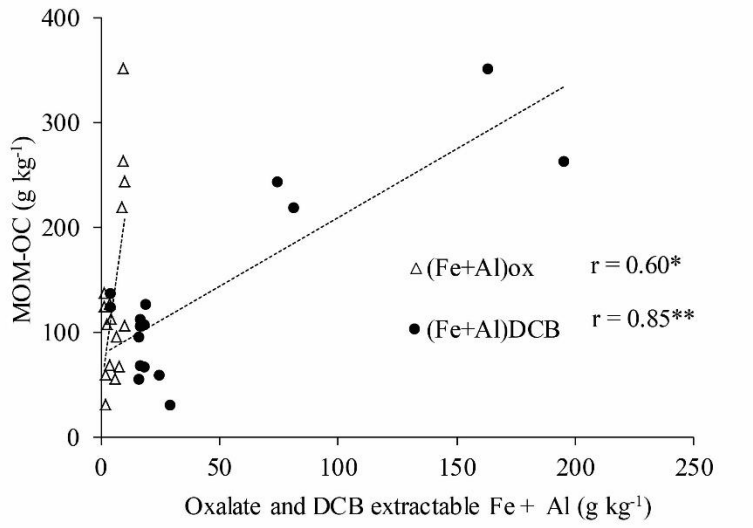

Fig. S5 Relation of the mineral associated organic matter (MOM, >1.8 g cm^{-3})-OC concentration of four soils with oxalate (ox) and DCB extractable Fe + Al of the respective bulk soils, irrespective of soil depth and land use. * indicates significance at p <0.05 and ** indicates significance at p <0.01

References

Bureau of Meteorology (2014) Climate and past weather. Available online at: http://www.bom.gov.au/climate/. Accessed 17 May 2014

New South Wales Department of Primary Industries (2014) Climate at the wollongbar primary industries institute. http://www.dpi.nsw.gov.au/agriculture/resources/climate-and-weather. Assessed 17 May 2014

Raw Data

Table 3. Proportion of total OC and total N in the density fractions of four surface (0-10 cm) and sub-surface (60-70 cm) soils under native and cropped land uses.

Soil order	Land use	Proportion of total OC in the fractions				Total fraction recovery (%)
		POM	1.8DF	2.2DF	>2.6DF	
Surface (0-10 cm)						
Ferralsol	Native	7	15	30	43	95
	Cropped	4	11	56	27	99
Luvisol	Native	33	23	20	9	86
	Cropped	40	26	32	1	99
Vertisol	Native	10	45	35	3	93
	Cropped	21	48	28	3	100
Solonetz	Native	73	21	3	3	100
	Cropped	44	29	12	2	87
Sub-surface (60-70 cm)						
Ferralsol	Native	14	12	19	48	93
	Cropped	7	5	46	38	96
Luvisol	Native	17	12	47	7	83
	Cropped	18	54	20	7	99
Vertisol	Native	4	56	35	6	101
	Cropped	14	39	38	9	99
Solonetz	Native	16	5	41	23	84
	Cropped	13	29	35	23	100

		Proportion of total N in the fractions				Total fraction recovery (%)
		POM	1.8DF	2.2DF	>2.6DF	
Surface (0-10 cm)						
Ferralsol	Native	4	10	38	44	95
	Cropped	3	9	67	15	93
Luvisol	Native	21	20	27	15	82
	Cropped	23	21	51	5	100
Vertisol	Native	3	28	67	3	99
	Cropped	6	41	48	5	101
Solonetz	Native	49	23	6	4	83
	Cropped	27	32	18	4	82
Sub-surface (60-70 cm)						

Ferralsol	Native	2	3	22	53	80
	Cropped	7	5	46	42	100
Luvisol	Native	6	4	79	10	99
	Cropped	6	30	47	11	95
Vertisol	Native	1	41	54	4	99
	Cropped	5	26	49	15	94
Solonetz	Native	4	3	60	20	87
	Cropped	3	14	61	21	99

Density fractions: POM = <1.8 g cm^{-3} and MOM: 1.8DF = 1.8-2.2 g cm^{-3}, 2.2DF = 2.2-2.6 g cm^{-3} and >2.6DF = >2.6 g cm^{-3}.

Table 4. Changes in OC and N concentrations in density fractions of four surface (0-10 cm) and sub-surface (60-70 cm) soils with land use conversion from native to cropped.

Soils	Depth (cm)	POM		1.8DF		2.2DF		>2.6DF	
		OC	N	OC	N	OC	N	OC	N
Ferrosol	0-10	-20	-5	-26	-4	-50	-48	-10	-49
	60-70	-20	-17	-18	-42	5	-9	-7	-4
Chromosol	0-10	-5	-5	-8	-8	-30	-24	-17	28
	60-70	-7	-5	-37	-1	-34	-4	-19	-7
Vertosol	0-10	-3	-29	-7	-9	-26	-54	-29	-1
	60-70	-21	2	-17	-9	-7	-10	-25	77
Sodosol	0-10	-8	1	-8	-2	-18	-31	-22	26
	60-70	-27	-16	-48	-42	-45	11	-5	25

Density fractions: POM = <1.8 g cm^{-3} and MOM: 1.8DF = 1.8-2.2 g cm^{-3}, 2.2DF = 2.2-2.6 g cm^{-3} and >2.6DF = >2.6 g cm^{-3}.

Table 5. Change in isotopic values, *i.e.*, $\Delta\delta^{13}C$ and $\Delta\delta^{15}N$ in density fraction of four surface (0-10 cm) and sub-surface (60-70 cm) soils with land use change.

Soils	Depth (cm)	POM		1.8DF		2.2DF		>2.6DF	
		^{13}C	^{15}N	^{13}C	^{15}N	^{13}C	^{15}N	^{13}C	^{15}N
Ferralsol	0-10	0.4	-3.8	1.7	-3.4	4.8	-1.4	4.3	-0.4
	60-70	-0.3	-0.1	0.3	0.6	1.7	0.3	2.9	1.1
Luvisol	0-10	-1.5	-1.9	0.0	-2.0	-0.5	-1.0	-0.6	-1.0
	60-70	-1.6	-1.7	0.0	3.3	0.1	0.8	0.8	1.1
Vertisol	0-10	0.9	1.8	1.1	1.2	1.6	1.8	1.1	2.3
	60-70	1.2	0.2	1.0	-0.3	1.7	0.3	3.8	1.6
Solonetz	0-10	4.6	-0.3	1.3	-0.6	1.5	-0.2	1.5	7.4
	60-70	0.1	-0.7	0.7	2.3	1.7	4.3	2.3	4.5

Density fractions: POM = <1.8 g cm^{-3} and MOM: 1.8DF = 1.8-2.2 g cm^{-3}, 2.2DF = 2.2-2.6 g cm^{-3} and >2.6DF = >2.6 g cm^{-3}.