Supplementary Information

Effects of land use and site on organic carbon fractions in some Humic soil profiles of KwaZulu-Natal, South Africa

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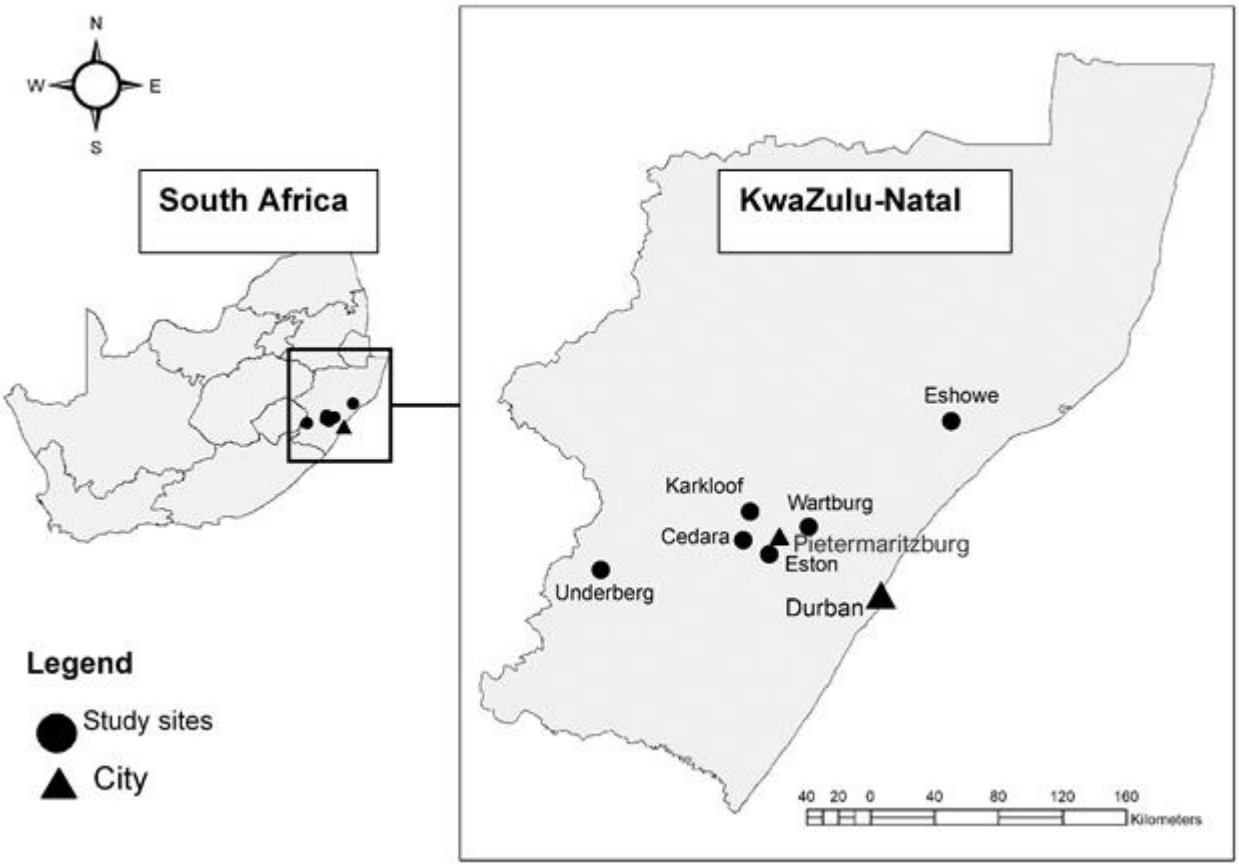

Figure S1: Location of the study sites in KwaZulu-Natal Province, South Africa (Malepfane et al. 2022)

Table S1: Geographic coordinates, elevation and climate of the study sites (Malepfane et al. 2022)

Study site	Coordinates	Elevation (m)	Average maximum temperature (°C)	Average minimum temperature (°C)	Average annual rainfall (mm)
Eston	29°37′S; 30°23′E	928	24.2	12.4	805
Eshowe	28°52′S; 31°25′E	555	26.7	15.4	1 113
Wartburg	29°28′S; 30°37′E	933	24.5	11.1	798
Cedara	29°32′S; 30°17′E	1 118	25.0	14.1	874
Karkloof	29°37′S; 30°28′E	1 155	24.1	10.8	1 150
Underberg	29°28′S; 30°37′E	1 596	19.0	6.6	800

Table S2: Land use and management at the study sites (Malepfane et al. 2022)

Land use	Description of land use and management
	Eston and Wartburg
Sugarcane (cultivated)	Previously this land was under commercial wattle (*Paraserianthes lophanth*a) forestry but is now planted to sugarcane (*Saccharum officinarum*). Fertilisers (NPK) are applied regularly. Dolomitic lime is applied to some fields to reduce soil acid saturation to 20%, hence lime rates vary from 1 to 10 t ha^{-1}. There is no irrigation and 10 t ha^{-1} of chicken litter is applied before planting. The cane is burned before harvesting and the trash and residues are removed. Kale (*Brassica oleracea* var. *sabellica*) is usually planted as a rotation crop before re-planting sugarcane at Wartburg.
Wattle plantation (uncultivated)	The area has wattle trees (*Paraserianthes lophantha*) with no lime, fertilisers or irrigation used. Forest litter is left to accumulate on the soil surface.
	Eshowe
Sugarcane (cultivated)	The area is planted to sugarcane, with 130, 20, and 140 kg ha^{-1} of N, P and K, respectively, applied regularly. Dolomitic lime is also applied at 1 to 10 t ha^{-1} to reduce soil acid saturation to 20 % once every 10 years. There is no irrigation. Sunn hemp (*Crotalaria juncea*) or oats (*Avena sativa*) are usually planted as a rotation crop before re-planting sugarcane. The cane is burned before harvesting and the trash and residues are removed.
Forest (uncultivated)	The area has indigenous trees with no lime, fertilisers or irrigation used. Forest litter is left to accumulate on the soil surface.
	Cedara
Maize (cultivated)	Maize (*Zea mays*) is rotated with wheat (*Triticum aestivum*) during the winter (dry season). Fertilisers are applied every year at about 120 kg N ha^{-1}, 20 kg P ha^{-1} and 40 kg K ha^{-1} while lime is applied once every 3 years based on acid saturation. Organic matter inputs include excreta of grazing cows during the winter. The area has been ploughed and conservation tillage was introduced 3 years before sampling. There is no irrigation.
Pasture (cultivated)	*Eragrostis curvula* is grown, cut and baled for cattle feed when mature, and is also grazed. Fertilisers are applied annually at 300,10 and 200 kg ha^{-1}, for N, P and K respectively, with no liming or irrigation. Organic matter inputs include excreta of grazing cows. No-till has been practised for 16 years.
Grassland (uncultivated)	The area has Kikuyu grass (*Pennisetum clandestinum*), with no fertiliser, lime, irrigation or tillage. The grass is burned.
	Karkloof
Maize (cultivated)	Maize is rotated with winter wheat, and the area has been under conservation tillage for 10 years before sampling. Fertilisers are applied every year at about 150 kg N ha^{-1}, 14 kg P ha^{-1} and 50 kg K ha^{-1} while lime is applied based on acid saturation. Organic matter inputs include excreta of grazing cows during the winter season. There is no irrigation.
Pasture (cultivated)	Ryegrass (*Lolium perenne*) and clover (*Trifolium* spp) are grown for grazing dairy cattle. The area has been under no-till for more than 10 years. Annually about 350 kg N ha^{-1} as urea, 60 kg P ha^{-1}, 80 kg K ha^{-1} and lime are applied. Irrigation is applied with a centre pivot, while organic matter inputs are through excreta of grazing animals.
Grassland (uncultivated)	The area has Kikuyu grass. There is no application of fertilisers or lime and no irrigation or tillage. The grass is burned.
	Underberg
Maize (cultivated)	The area is used for maize and rotated with wheat during the winter season. Soil preparation involves the use of subsoiling, tillage and grading. Fertilisers are applied every year at about 120 kg N ha^{-1}, 20 kg P ha^{-1} and 40 kg K ha^{-1} while lime is applied based on acid saturation. Organic matter inputs included excreta of grazing cows during the winter There is no irrigation.
Pasture (cultivated)	Ryegrass has been grown for 10 years, and clover was recently planted (3 years). Lime at 1 t ha^{-1} and 365 kg N ha^{-1} as urea are applied annually after replanting. Phosphorus and K fertilisers are also applied with organic matter inputs from excreta of grazing cows. Centre pivot is used for irrigation.

Table S3: Concentration of total organic carbon (g kg^{-1}) under different land uses at the six sites at each sampled depth (*n* = 42) (Malepfane et al. 2022)

Site	Land use	0–5 cm	5–10 cm	10–15 cm	15–20 cm	20–30 cm	30–40 cm	40–50 cm	50–60 cm	60–80 cm	80–100 cm
Eston	Sugarcane	**40**^{abc}	**38**^{abc}	**28**^{a}	**23**^{a}	**22**^{abc}	**26**^{ab}	**26**^{abcd}	**18**^{abc}	**15**^{abcd}	10^{abc}
	Wattle plantation	**88**^{fgh}	**110**^{g}	**52**^{abc}	**33**^{abc}	**24**^{abc}	**20**^{ab}	**18**^{abcd}	**12**^{ab}	12^{abcd}	4^{a}
Eshowe	Sugarcane	**49**^{abcd}	**43**^{abcd}	**43**^{abc}	**41**^{abc}	**39**^{abcd}	**38**^{b}	**33**^{d}	**30**^{c}	22de	21de
	Forest	**72**^{defg}	**49**^{bcd}	**41**^{abc}	**35**^{abc}	**30**^{abcd}	**28**^{ab}	**27**^{bcd}	**27**^{c}	**21**^{cde}	18^{cde}
Wartburg	Sugarcane	**33**^{ab}	**31**^{ab}	**24**^{a}	**30**^{ab}	**29**^{abcd}	**26**^{ab}	**24**^{abcd}	22^{bc}	17^{bcde}	14^{bcd}
	Wattle plantation	**76**^{defg}	**54**^{bcdef}	**46**^{abc}	**44**^{bc}	**40**^{bcd}	**37**^{b}	**33**^{cd}	**30**^{c}	29^{e}	24^{e}
Cedara	Maize	**24**^{a}	**23**^{a}	22^{a}	22^{a}	14^{a}	11^{a}	10^{ab}	8^{a}	6^{ab}	3^{a}
	Pasture	**51**^{abcd}	**43**^{abcd}	**25**^{a}	26^{ab}	24^{abc}	15^{ab}	9^{ab}	6^{a}	4^{a}	3^{a}
	Grassland	**63**^{cdef}	**57**^{cdef}	**30**^{ab}	**23**^{a}	19^{ab}	18^{ab}	14^{abc}	13^{ab}	10^{abcd}	6^{ab}
Karkloof	Maize	**57**^{bcde}	**52**^{bcde}	**37**^{abc}	**28**^{ab}	**34**^{abcd}	20^{ab}	12^{ab}	10^{ab}	8^{abc}	7^{ab}
	Pasture	**108**^{h}	**64**^{def}	**50**^{abc}	**51**^{cd}	**46**^{cd}	**24**^{ab}	8^{a}	6^{a}	3^{a}	0.9^{a}
	Grassland	**97**^{gh}	**78**^{f}	**71**^{c}	**52**^{cd}	**45**^{cd}	**32**^{ab}	23^{abcd}	12^{ab}	5^{ab}	0.6^{a}
Underberg	Maize	**60**^{bcdef}	**52**^{bcde}	**46**^{abc}	**35**^{abc}	**32**^{abcd}	27^{ab}	21^{abcd}	12^{ab}	8^{abc}	6^{ab}
	Pasture	**85**^{efgh}	**76**^{ef}	**64**^{bc}	**66**^{d}	**51**^{ab}	32^{ab}	19^{abcd}	13^{ab}	11^{abcd}	3^{a}

BD = below detection Humic A horizon = bold font Humic B horizon = regular font

Means followed by different letters in a column are statistically different for each site-land use treatment per depth at $p = 0.05$