

Supplement 1 List of all publications considered in the meta-analysis

Agbenin, J. O., and Tiessen, H.: Phosphorus forms in particle-size fractions of a toposequence from Northeast Brazil. *Soil Sci Soc Am J*, 59(6), 1687-1693, 1995.

Guzel, N., and Ibrikci, H.: Distribution and fractionation of soil phosphorus in particle-size separates in soils of Western Turkey. *Commun Soil Sci Plan*, 25(17-18), 2945-2958, 1994.

Lobe, I., Amelung, W., and Du Preez, C. C.: Losses of carbon and nitrogen with prolonged arable cropping from sandy soils of the South African Highveld. *Eur J Soil Sci*, 52(1), 93-101, 2001.

Makarov, M. I., Haumaier, L., Zech, W., and Malysheva, T. I.: Organic phosphorus compounds in particle-size fractions of mountain soils in the northwestern Caucasus. *Geoderma*, 118(1-2), 101-114, 2004.

Rubæk, G. H., Guggenberger, G., Zech, W., and Christensen, B. T.: Organic phosphorus in soil size separates characterized by phosphorus-31 nuclear magnetic resonance and resin extraction. *Soil Sci Soc Am J*, 63(5), 1123-1132, 1999.

Solomon, D., and Lehman, N.: Loss of phosphorus from soil in semi-arid northern Tanzania as a result of cropping: evidence from sequential extraction and ³¹P-NMR spectroscopy. *Eur J Soil Sci*, 51(4), 699-708, 2000.

Solomon, D., Lehmann, J., and Zech, W.: Land use effects on soil organic matter properties of chromic luvisols in semi-arid northern Tanzania: carbon, nitrogen, lignin and carbohydrates. *Agric Ecosyst Environ*, 78(3), 203-213, 2000.

Solomon, D., Lehmann, J., Mamo, T., Fritzsche, F., and Zech, W.: Phosphorus forms and dynamics as influenced by land use changes in the sub-humid Ethiopian highlands. *Geoderma*, 105(1-2), 21-48, 2002.

Syers, J. K., Shah, R., and Walker, T. W.: Fractionation of phosphorus in two alluvial soils and particle-size separates. *Soil Science*, 108(4), 283-289, 1969.

Tiessen, H. J. W. B., Stewart, J. W. B., and Moir, J. O.: Changes in organic and inorganic phosphorus composition of two grassland soils and their particle size fractions during 60–90 years of cultivation. *J Soil Sci*, 34(4), 815-823, 1983.

Uriyo, A. P., Singh, B. R., and Kesseba, A.: Forms of Phosphorus in the Separates of Three Tanzanian Soils Belonging to Mollisol, Alfisol and Oxisol Orders. *E Afr Agr Forestry J*, 43(2), 120-123, 1977.

Von Sperber, C., Stallforth, R., Du Preez, C., and Amelung, W.: Changes in soil phosphorus pools during prolonged arable cropping in semiarid grasslands. *Eur J Soil Sci*, 68(4), 462-471, 2017.

Williams, E. G., and Saunders, W. M. H.: Distribution of phosphorus in profiles and particle-size fractions of some Scottish soils. *Eur J Soil Sci*, 7(1), 90-109, 1956.

Supplement 3 Table S1 and Table S2 Regression models

Table S1 Intercepts and slopes of (multiple) linear regression models calculated for total organic C (TOC), total organic P (TOP), total inorganic P (TIP), and organic carbon (OC), organic phosphorus (OP) and inorganic phosphorus (IP) concentrations of the three particle size fractions as a function of latitude (Lat), mean annual temperature (MAT) and mean annual precipitation (MAP), either alone or in combination. Note that intercepts and slopes are only given for the significant regressions (>0.05). No star stands for >0.05, * stands for 0.05, ** stands for 0.01, and *** stands for 0.001.

Model	Parameter	TOC	TOP	TIP	TP	OC of sand size fraction	OC of silt size fraction	OC of clay size fraction	OP of sand size fraction	OP of silt size fraction	OP of clay size fraction	IP of sand size fraction	IP of silt size fraction	IP of clay size fraction	P of clay size fraction
Lat	Intercept		77.45					26.70**		121.07	353.92**		991.45***	2234.86***	
	Lat		6.43**					0.80**		6.79**	14.33***		-12.98*	-30.53*	
MAT	Intercept	58.58*	703.00***			31.91***	70.98***	88.75***	228.52***	683.80***	1385.28***	-68.71	19.35	-160.43	
	MAT	-2.34***	-34.06***			-1.24*	-2.32***	-3.14***	-10.42***	-26.69***	-44.38***	30.55*	43.68**	111.38***	
MAP	Intercept	-13.56***	84.32	113.13*	362.96	-15.35**	4.44	21.74**		75.08	354.70**				
	MAP	0.05***	0.25**	0.23***	0.51*	0.04***	0.05***	0.04***		0.30***	0.52***				
Lat +MAT	Intercept	165.33***	1420.26***	806.77***		128.51***	212.76***	181.44***	605.88***	1276.34***	1707.14***		-387.88	-1699.86	46.45
	Lat	-1.94***	-12.51***	-8.69**		-1.77***	-2.57***	-1.68***	-6.50***	-10.14**	-5.51		6.99	26.42	22.00
	MAT	-6.04***	-59.24***	-18.07**		-4.78***	-7.53***	-6.55***	-23.69***	-47.57***	-55.72***		57.93*	165.26**	100.33
MAT +MAP	Intercept	16.35*	517.37***	97.06	-561.68	-1.92	31.18**	59.72***	168.46**	440.43***	959.60***	-233.09	-245.28	-970.51	142.34
	MAT	-2.13***	-32.49***	1.20	47.43*	-1.05**	-2.09***	-2.97***	-9.91***	-24.66***	-40.82***	32.44*	46.71**	120.67***	69.07*
	MAP	0.05***	0.20***	0.23***	0.81**	0.04***	0.048***	0.03***	0.06	0.25***	0.44***	0.16	0.26	0.81	1.18*
Lat +MAT +MAP	Intercept	84.14***	1267.74***	639.56***	493.20	47.99	137.50***	121.64***	551.13***	1069.17***	1357.03***	-402.63	-590.98	-2315.84	-874.41
	Lat	1.09***	-13.46***	-9.73***	17.95	-0.81*	-1.71**	-0.99**	-6.74***	-10.99***	-6.95	3.01	6.08	23.67	17.89
	MAT	-4.24***	-59.39***	-18.25**	9.82	2.70**	-5.62***	-5.03***	-23.61***	-47.17***	-55.06***	38.47	59.02	168.55**	105.26
	MAP	0.042***	0.22***	0.25***	0.81**	0.03***	0.03***	0.05***	0.07	0.26***	0.45***	0.16	0.26	0.78	1.16*

1 **Table S2** Intercepts and slopes of (multiple) linear regression models of the molar ratio of total organic C-to-total organic P of the bulk soil
2 (TOC:TOP), the molar ratio of total inorganic P-to-total organic P of the bulk soil (TIP:TOP), and the molar ratio of inorganic P-to-organic P (IO:OP)
3 and organic C-to-organic P (IP:OP) of the particle size fractions as a function of latitude (Lat), mean annual temperature (MAT) and mean annual
4 precipitation (MAP). Note that intercepts and slopes are only given for the significant regressions (>0.05). No star stands for >0.05, * stands for 0.05,
5 ** stands for 0.01, and *** stands for 0.001.

Model	Parameter	TOC:TOP ratio	TIP:TOP ratio	TOC:TP ratio	OC:OP ratio of sand size fraction	OC:OP ratio of silt size fraction	OC:OP ratio of clay size fraction	IP:OP ratio of sand size fraction	IP:OP ratio of silt size fraction	IP:OP ratio of clay size fraction
Lat	Intercept	339.42***	2.98***	0.07***	2048.12***	750.23***	318.05***	23.48***	7.02***	4.76***
	Lat	-2.98***	0.04***	-0.00***	-40.76***	-10.43***	-3.66***	-0.40*	-0.13***	-0.09***
MAT	Intercept	200.23***	0.20	0.03***	91.59	186.60***	132.10***		-2.01	-1.19***
	MAT	3.95*	0.12***	0.00	60.10*	20.13***	6.06***		0.39***	0.25***
MAP	Intercept	171.42***		0.03**	-864.80*					
	MAP	0.11**		0.00*	2.04***					
Lat	Intercept	460.34***	1.00	0.11***	4719.68***	853.46***	456.45***	-26.13	-3.52	-1.33
+MAT	Lat	-4.91**	-0.01	-0.00*	-84.66***	-12.09***	-5.88***	0.32	0.03	0.00
	MAT	-5.02	0.09*	-0.00***	-114.68**	-4.37	-5.85	2.12**	0.44**	0.26***
MAT	Intercept	126.53***	0.02	0.05***	-1628.16***	47.41*	0.01***	-9.86	-2.16	-1.64
+MAP	MAT	3.72*	0.11***	-0.00**	64.81**	20.36***	6.10***	1.48***	0.39***	0.26***
	MAP	0.11**	0.00	-0.00	2.08***	0.05	0.00	0.00	0.00	0.00
Lat	Intercept	313.17**	1.01	0.10***	520.08	1020.13***	581.66***	-27.53	-3.60	-1.69
+MAT	Lat	-3.01	0.01	0.00	-34.95	-14.01***	-7.32***	0.31	0.03	0.00
+MAP	MAT	-1.70	0.08*	0.00***	-7.99	-8.60	-9.04*	2.12**	0.44**	0.26***
	MAP	0.07	0.00	0.00	1.79***	-0.07	-0.06*	0.00	0.00	0.00