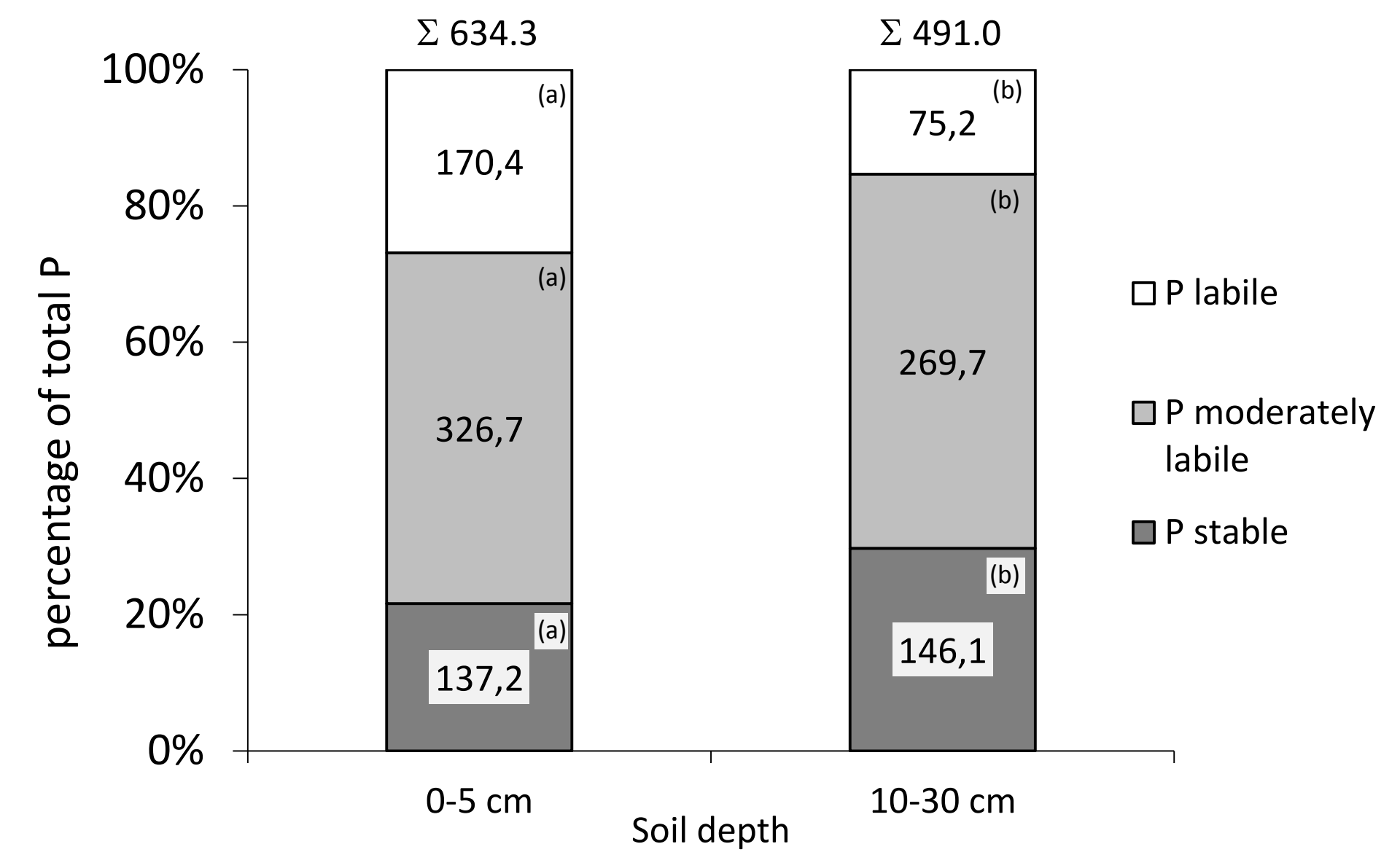

Figure S1: Mean values of P concentration and percentage of total P for all GFSI samples, grouped by depth, dark grey boxes P stable, light grey boxes P moderately labile and white boxes P labile, different letters per row showed significant differences in P pools per depths, non-parametric Wilcoxon test, $\alpha < 0.05$.

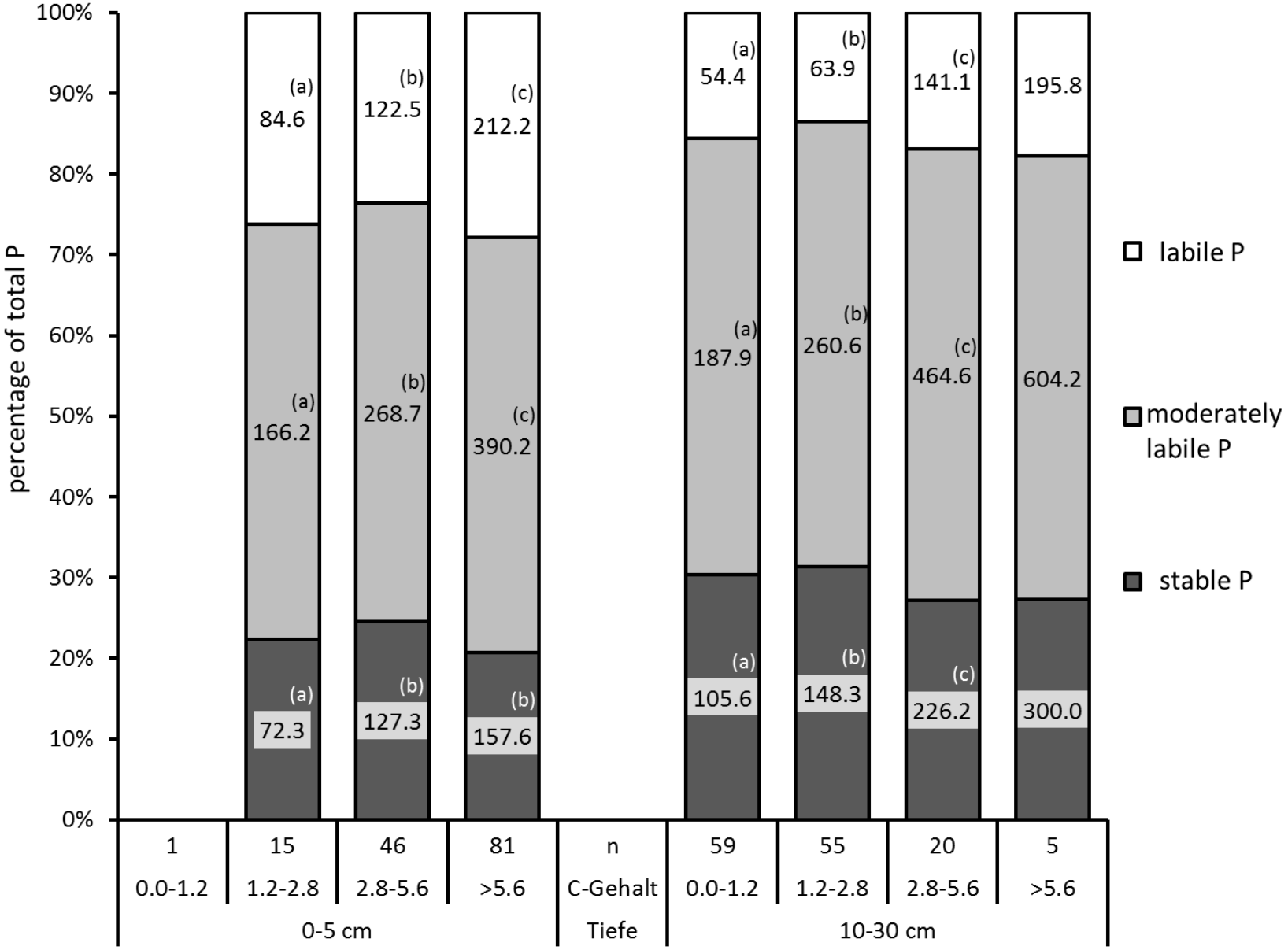

Figure S2: Absolute and relative shares of Hedley P pools and total P (mean values), grouped by grouped by C-content in % and depth; different letters per row showed significant differences in absolute values between C-classes, non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S1: Mean values (± standard deviation) of Hedley P fractions in soil samples, grouped by soil depth and soil acidity classes as indicated by pH ranges, all values in mg kg^{-1}.

Depth	pH-range	n	Pi Resin#	Pi HCO3#	Po HCO3#	Pi NaOH#	Po NaOH#	Pi 1M HCl#	P HCL_{conc}#	P Residual#
			mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
			labile P			moderately labile P			stable P	
0-5 cm	> 6.2	6	34.7 ±14.1 a	24.1 ±11.5 a	28.5 ±13.9 a	35.2 ±23.9 a	215.3 ±156.8 a	48.9 ±36.9 ab	262.3 ±165.3 a	105.6 ±60.5 a
	5.0-6.2	15	40.1 ±11.8 a	23.3 ±11.7 a	59.6 ±33.2 b	79.4 ±43.0 ab	217.5 ±125.9 a	71.1 ±55.1 b	162.7 ±108.1 a	67.2 ±30.7 ab
	4.2-5.0	43	46.3 ±35.2 a	32.4 ±33.0 a	77.6 ±41.5 b	103.4 ±111.0 b	190.5 ±108.8 a	70.6 ±160.6 b	109.9 ±93.5 b	44.6 ±27.6 b
	3.0-4.2	80	55.0 ±41.0 a	37.3 ±48.1 a	101.0 ±65.5 c	80.6 ±90.9 a	189.2 ±150.1 a	30.2 ±37.9 a	64.2 ±69.6 c	29.8 ±16.9 c
10-30 cm	> 6.2	6	19.5 ±8.2 a	11.7 ±7.9 ab	23.9 ±12.7 ab	22.0 ±14.1 a	143.7 ±148.2 ab	98.7 ±79.2 a	278.3 ±212.1 a	141.1 ±36.8 a
	5.0-6.2	21	19.6 ±20.0 a	16.5 ±17.9 a	26.9 ±18.2 ab	105.6 ±108.7 ab	105.5 ±86.7 ab	162.4 ±316.7 a	178.0 ±128.2 a	61.2 ±30.7 b
	4.2-5.0	81	22.6 ±26.6 a	25.6 ±35.0 a	37.0 ±34.2 a	112.6 ±110.9 b	143.1 ±111.6 a	38.7 ±48.5 b	95.7 ±91.3 b	36.3 ±24.3 c
	3.0-4.2	31	18.0 ±24.8 a	19.5 ±51.2 b	23.3 ±22.0 b	65.0 ±89.5 a	59.6 ±36.9 b	17.2 ±19.4 c	42.9 ±25.6 c	28.1 ±15.0 c

#) different letters within columns and per depth indicate significant differences between the pH-classes; non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S2: Mean value (± standard deviation) for P pools of all soil samples, grouped by soil depth and pH-value, all values in mg kg^{-1}.

Depth	pH-range	n	P labile# mg k^{-1}		P moderately labile# mg k^{-1}		P stable# mg k^{-1}		Pi extractable# mg k^{-1}		Po extractable# mg k^{-1}	
0-5 cm	> 6.2	6	87.3 ±41.9	a	299.3 ±210.2	a	367.9 ±199.0	a	142.8 ±74.6	a	243.8 ±186.5	a
	5.0-6.2	15	123.1 ±43.5	a	368.0 ±184.2	a	230.0 ±122.8	a	214.0 ±112.8	a	214.0 ±112.8	a
	4.2-5.0	43	156.3 ±86.8	b	364.5 ±324.6	a	154.4 ±117.6	b	252.7 ±308.8	a	268.1 ±148.1	a
	3.0-4.2	80	193.3 ±138.2	b	300.0 ±248.7	a	93.9 ±79.4	c	203.1 ±195.6	a	290.2 ±212.2	a
10-30 cm	> 6.2	6	55.2 ±26.0	ab	264.4 ±161.9	a	419.4 ±211.1	a	151.9 ±86.8	a	167.6 ±158.9	ab
	5.0-6.2	21	62.9 ±42.7	ab	373.5 ±488.3	a	239.3 ±152.1	b	304.1 ±455.3	a	132.4 ±104.4	ab
	4.2-5.0	81	85.1 ±83.4	a	294.4 ±216.9	a	132.0 ±108.7	c	199.5 ±187.5	a	180.1 ±142.9	a
	3.0-4.2	31	60.8 ±88.8	b	141.8 ±135.0	b	71.0 ±30.9	d	119.7 ±174.8	b	82.9 ±55.2	b

#) different letters indicate significant differences between the pH-classes, valid per column and per depth, non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S3: Mean values (± standard deviation) of Hedley P fractions of all analyzed GFSI samples, grouped by depth and carbon content, all values in mg kg^{-1}.

Depth	Carbon content	n	Pi Resin#	Pi HCO3#	Po HCO3#	Pi NaOH#	Po NaOH#	Pi 1M HCl#	P HCL_{conc}#	P Residual#
	%		mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
			labile P			moderately labile P			stable P	
0-5 cm	0.0-1.2	1	30.9	41.0	18.3	27.8	25.7	4.0	8.0	4.3
	1.2-2.8	15	28.4 ±27.1 a	22.6 ±30.8 a	33.7 ±22.9 a	56.0 ±76.9 a	77.3 ±67.6 a	32.9 ±40.5 a	49.6 ±58.7 a	22.7 ±15.6 a
	2.8-5.6	46	40.0 ±28.1 b	24.5 ±25.7 a	58.1 ±26.0 b	77.8 ±100.3 b	132.0 ±66.8 b	58.9 ±156.9 a	86.6 ±96.1 b	40.7 ±28.0 b
	>5.6	81	58.9 ±39.9 c	41.1 ±48.1 b	112.1 ±60.9 c	96.7 ±92.5 b	249.1 ±146.9 c	44.4 ±48.4 a	112.0 ±105.8 b	44.1 ±33.9 b
10-30 cm	0.0-1.2	59	18.9 ±23.6 a	19.2 ±23.1 ac	16.3 ±9.4 a	81.8 ±72.5 a	64.5 ±49.7 a	41.6 ±64.3 a	71.6 ±82.4 a	34.0 ±26.2 a
	1.2-2.8	55	17.9 ±20.1 a	15.6 ±23.0 a	30.4 ±15.3 b	81.9 ±91.5 a	107.1 ±67.7 b	71.6 ±209.2 a	104.2 ±103.5 a	45.7 ±34.0 ab
	2.8-5.6	20	32.5 ±30.8 b	42.6 ±63.8 b	66.1 ±35.7 c	159.4 ±135.7 b	255.0 ±99.2 c	50.2 ±37.6 b	166.6 ±115.9 b	59.6 ±39.0 b
	>5.6	5	39.1 ±43.8	60.0 ±90.9	96.7 ±71.8	203.0 ±273.1	349.5 ±141.6	51.6 ±33.2	235.5 ±241.7	64.4 ±55.9

#) different letters indicate significant differences between C content classes, valid per column and per depth, non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S4: Mean (± standard deviation) value for P pools of all soil samples, grouped by soil depth and Carbon content (%), all values in mg kg^{-1}.

Depth	Carbon content	n	P labile#	P moderately labile#	P stable#	Pi extractable#	Po extractable#
	%		mg k^{-1}	mg k^{-1}	mg k^{-1}	mg k^{-1}	mg k^{-1}
0-5 cm	0.0-1.2	1	90.3	57.5	12.3	103.8	44.0
	1.2-2.9	15	84.6 ±77.0 a	166.2 ±170.1 a	72.3 ±69.1 a	139.8 ±157.1 a	110.9 ±87.3 a
	2.9-5.8	46	122.5 ±63.2 b	268.7 ±303.9 b	127.3 ±117.8 b	201.1 ±290.7 a	190.1 ±83.8 b
	>5.8	81	212.2 ±128.3 c	390.2 ±240.7 c	157.6 ±126.9 b	241.1 ±194.6 b	361.2 ±194.8 c
10-30 cm	0.0-1.2	59	54.4 ±49.0 a	187.9 ±153.7 a	105.6 ±103.2 a	161.6 ±147.0 a	80.7 ±57.3 a
	1.2-2.9	55	63.9 ±47.4 b	260.6 ±320.5 ac	148.3 ±124.1 ac	186.9 ±304.7 a	137.5 ±78.1 b
	2.9-5.8	20	141.1 ±111.4 c	464.6 ±200.8 b	226.2 ±134.1 b	284.7 ±226.9 b	321.1 ±125.2 c
	>5.8	5	195.8 ±200.1 c	604.2 ±375.6 bc	300.0 ±296.8 bc	353.8 ±425.6 ab	446.3 ±192.9 c

#) different letters indicate significant differences between the pH classes, valid per column and per depth, non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S5: Mean values (± standard deviation) of Hedley P fractions of GFSI samples, grouped by soil depth and soil texture, all values in mg kg^{-1}

Depth	Soil texture	n	Pi Resin#	Pi HCO3#	Po HCO3#	Pi NaOH#	Po NaOH#	Pi 1M HCl#	P HCL_{conc}#	P Residual#
			mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
			labile P			moderately labile P			stable P	
0-5 cm	sand	21	22.7 ±13.8 a	15.9 ±15.0 a	39.6 ±27.3 a	16.9 ±13.5 a	55.5 ±34.3 a	4.8 ±4.5 a	16.7 ±9.2 a	15.6 ±10.4 a
	loam	37	49.8 ±35.2 b	35.0 ±62.2 ab	87.5 ±50.2 b	73.5 ±100.6 b	153.6 ±94.0 b	30.7 ±32.0 b	49.8 ±27.7 b	29.4 ±16.7 b
	silt	71	57.3 ±40.6 b	39.0 ±34.0 c	103.7 ±61.8 b	111.3 ±96.7 c	242.6 ±136.0 c	66.9 ±130.4 c	120.9 ±93.7 c	48.1 ±30.4 c
	clay	15	47.5 ±22.4 b	30.3 ±17.7 bc	63.0 ±41.0 a	91.1 ±73.0 bc	242.9 ±158.2 c	56.6 ±42.7 c	205.9 ±157.0 c	73.9 ±40.4 d
10-30 cm	sand	22	17.9 ±23.3 a	32.3 ±59.7 a	18.9 ±21.0 a	55.0 ±87.9 a	38.7 ±35.5 a	7.7 ±10.0 a	17.8 ±12.0 a	17.4 ±15.1 a
	loam	42	21.5 ±29.3 a	24.0 ±41.2 a	36.9 ±38.2 b	103.2 ±127.0 b	133.4 ±110.2 b	30.6 ±23.9 b	59.9 ±29.7 b	29.8 ±17.9 b
	silt	60	20.1 ±21.9 ab	17.7 ±20.4 a	33.3 ±27.1 b	109.9 ±100.6 b	134.4 ±103.3 b	86.0 ±204.5 bc	137.2 ±115.1 c	47.9 ±24.0 c
	clay	16	27.8 ±24.7 b	22.9 ±32.8 a	29.4 ±18.3 b	87.5 ±82.2 ab	126.9 ±106.7 b	66.2 ±47.0 c	209.7 ±159.6 c	90.2 ±55.8 d

#) different letters indicate significant differences between main texture classes, valid per column and per depth, non-parametric Mann-Whitney-U-test, $\alpha < 0.05$.

Table S6: Results of linear regression models for P pools and P fractions, by soil variables in 10-30 cm soil depth, model quality and standardized regression coefficients.

depth 10-30 cm	n = 139	predictor variables		
		carbon mg kg^{-1}	sand %	pH
target	r^2 #	standardized regression coefficients§		
log P labile	*0.26*	*0.495*	*-0.155*	*-0.176*
log P moderately labile	0.43	**0.469**	-0.434	-0.250
log P stable	**0.62**	0.156	-**0.637**	0.239
log pi resin	*0.10*	*0.265*	*-0.164*	
log Pi HCO3	*0.09*	*0.305*		
log Po HCO3	0.41	**0.589**	-0.213	-0.324
log Pi NaOH	*0.23*	*0.242*	*-0.407*	*-0.302*
log Po NaOH	0.54	**0.564**	-0.436	-0.224
log Pi 1M HCl	*0.37*		*-0.531*	*0.188*
log P HCL conc	0.55	0.173	**-0.576**	0.213
log P residual	0.47		**-0.580**	0.231

adjusted r^2, P pools or P fractions with model performance r^2 below 0.4 are shown in italics. § significant predictors ($p < 0.05$, F-Test) are shown, strongest predictor are presented in bold.