Annex: Supplementary materials

All 115 articles that are reviewed and included in the meta-analysis:

[1]. Allory, V., Cambou, A., Moulin, P., Schwartz, C., Cannavo, P., Vidal-Beaudet, L. and Barthès, B.G., 2019. Quantification of soil organic carbon stock in urban soils using visible and near infrared reflectance spectroscopy (VNIRS) in situ or in laboratory conditions. *Science of the total environment*, *686*, pp.764-773.

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Table S1. The values of the statistical features of the violin plots presented in figure 7

Soil Prop.	SOC			TN			SOM			TC		
Index	**R^2**	**RPD**	**RMSE**	**R^2**	**RPD**	**RMSE**	**R^2**	**RPD**	**RMSE**	**R^2**	**RPD**	**RMSE**
Number of records	263	235	226	52	53	51	78	41	71	63	29	44
Q1	0.70	1.76	0.14	0.73	1.91	0.01	0.66	1.56	0.35	0.79	2.20	0.04
Q2	0.79	2.17	0.28	0.86	2.48	0.02	0.73	2.02	0.47	0.85	2.60	0.26
Q3	0.86	2.60	0.53	0.90	2.70	0.04	0.82	2.53	0.63	0.91	3.66	1.15
Mean	0.75	2.21	0.50	0.81	2.43	0.13	0.73	2.20	0.60	0.80	2.85	0.86
Min	0.01	0.68	0.00	0.47	0.38	0.00	0.33	1.23	0.01	0.23	1.50	0.04
Max	0.98	4.92	7.38	0.96	6.98	1.06	0.96	3.77	5.49	0.99	5.28	7.36
Low Whisker	0.48	0.68	0.00	0.56	1.31	0.00	0.50	1.23	0.01	0.63	1.50	0.04
High Whisker	0.98	3.70	1.11	0.96	3.84	0.07	0.96	3.77	0.83	0.99	5.28	2.80

Table S1. Continued

Soil Prop.	Clay			SSC		Sand		MC	IC	Silt
Index	**R^2**	**RPD**	**RMSE**	**R^2**	**RPD**	**R^2**	**RMSE**	**R^2**	**R^2**	**R^2**
Number of records	37	34	38	25	25	9	10	26	18	10
Q1	0.62	1.66	1.05	0.68	1.78	0.67	4.70	0.81	0.76	0.56
Q2	0.79	2.20	4.25	0.77	2.03	0.80	6.27	0.89	0.85	0.71
Q3	0.81	2.65	8.84	0.83	2.31	0.84	7.70	0.97	0.89	0.83
Mean	0.70	2.29	5.31	0.76	2.12	0.76	6.05	0.87	0.79	0.68
Min	0.14	1.08	0.03	0.54	1.48	0.43	0.06	0.63	0.31	0.23
Max	0.97	6.20	15.42	0.97	3.81	0.96	10.64	0.99	0.98	0.95
Low Whisker	0.42	1.08	0.03	0.54	1.48	0.43	4.00	0.63	0.67	0.23
High Whisker	0.97	3.33	15.42	0.97	2.96	0.96	10.64	0.99	0.98	0.95

Table S2. The values of the statistical features of the violin plots presented in figure 8

Soil Prop.	SOC			TN		SOM		TC		IC	MC	Clay
Index	R^2			R^2		R^2		R^2		R^2	R^2	R^2
Reg. method	PLSR	SVMR	MPLSR	PLSR	MPLSR	PLSR	SVMR	PLSR	MPLSR	PLSR	PLSR	PLSR
Number of records	181	25	11	29	11	48	20	38	11	15	23	22
Q1	0.71	0.65	0.75	0.72	0.87	0.66	0.61	0.78	0.82	0.80	0.81	0.64
Q2	0.80	0.73	0.84	0.82	0.91	0.73	0.73	0.82	0.90	0.85	0.90	0.79
Q3	0.86	0.82	0.88	0.88	0.93	0.86	0.79	0.90	0.91	0.89	0.97	0.81
Mean	0.76	0.71	0.76	0.79	0.89	0.73	0.70	0.78	0.82	0.79	0.88	0.69
Min	0.01	0.08	0.34	0.47	0.75	0.33	0.51	0.23	0.39	0.31	0.63	0.14
Max	0.98	0.89	0.89	0.96	0.94	0.95	0.88	0.99	0.94	0.98	0.99	0.91
Low Whisker	0.57	0.52	0.75	0.56	0.86	0.39	0.51	0.61	0.81	0.67	0.63	0.50
High Whisker	0.98	0.89	0.89	0.96	0.94	0.95	0.88	0.99	0.94	0.98	0.99	0.91

Table S2. Continued

Soil Prop.	SOC			TN	SOM		TC	Clay
Index	**RPD**			**RPD**	**RPD**		**RPD**	**RPD**
Reg. method	**PLSR**	**SVMR**	**MPLSR**	**PLSR**	**PLSR**	**SVMR**	**PLSR**	**PLSR**
Number of records	164	20	10	39	21	16	15	20
Q1	1.76	1.64	2.00	1.95	1.53	1.55	2.22	1.56
Q2	2.23	1.88	2.55	2.48	2.16	1.81	2.60	2.27
Q3	2.64	2.52	2.84	2.70	3.77	2.16	3.35	2.71
Mean	2.23	2.06	2.46	2.37	2.47	1.91	2.72	2.15
Min	0.68	1.43	1.60	0.38	1.23	1.43	1.60	1.08
Max	4.60	3.10	2.94	3.84	3.77	2.89	4.25	3.33
Low Whisker	0.68	1.43	1.60	1.49	1.23	1.43	1.60	1.08
High Whisker	3.70	3.10	2.94	3.45	3.77	2.89	4.25	3.33

Table S2. Continued

Soil Prop.	SOC		TN	SOM		TC	Clay
Index	**RMSE**		**RMSE**	**RMSE**		**RMSE**	**RMSE**
Reg. method	**PLSR**	**SVMR**	**PLSR**	**PLSR**	**SVMR**	**PLSR**	**PLSR**
Number of records	162	24	40	41	20	30	23
Q1	0.14	0.28	0.01	0.37	0.39	0.05	0.32
Q2	0.26	0.33	0.02	0.53	0.49	0.61	1.23
Q3	0.55	0.79	0.05	0.66	0.60	1.22	8.84
Mean	0.52	0.44	0.17	0.71	0.49	0.92	5.01
Min	0.00	0.06	0.00	0.01	0.26	0.04	0.03
Max	7.38	0.99	1.06	5.49	0.68	7.36	15.42
Low Whisker	0.00	0.06	0.00	0.01	0.26	0.04	0.03
High Whisker	1.12	0.99	0.07	0.83	0.68	2.80	15.42

Table S3. The values of the statistical features of the violin plots presented in figure 10

Soil Prop.	**SOC**					
Index	**R^2**		**RPD**		**RMSE**	
	Lab.	**In-situ**	**Lab.**	**In-situ**	**Lab.**	**In-situ**
Number of records	217	46	193	42	175	51
Q1	0.72	0.65	1.76	1.72	0.12	0.18
Q2	0.81	0.74	2.25	2.02	0.27	0.40
Q3	0.87	0.77	2.70	2.14	0.47	0.58
Mean	0.76	0.69	2.26	1.95	0.52	0.43
Min	0.01	0.12	0.68	1.08	0.00	0.06
Max	0.98	0.88	4.92	2.92	7.38	1.01
Low Whisker	0.52	0.61	0.68	1.15	0.00	0.06
High Whisker	0.98	0.88	4.04	2.51	0.99	1.01

Table S4. The proportion of spectra pre-processing methods reported in the reviewed articles

Pre-processing method	% of reported articles
1st derivative	21%
2nd derivative	10%
Absorbance	20%
Savitzky-Golay	24%
SNV	12%
MSC	10%
Continuum removal	2%
Not mentioned	2%

Table S5. The proportion of drying duration in the reviewed articles

Drying Duration	% of reported articles
Up to 24 hr	56%
48 hr	28%
More	16%

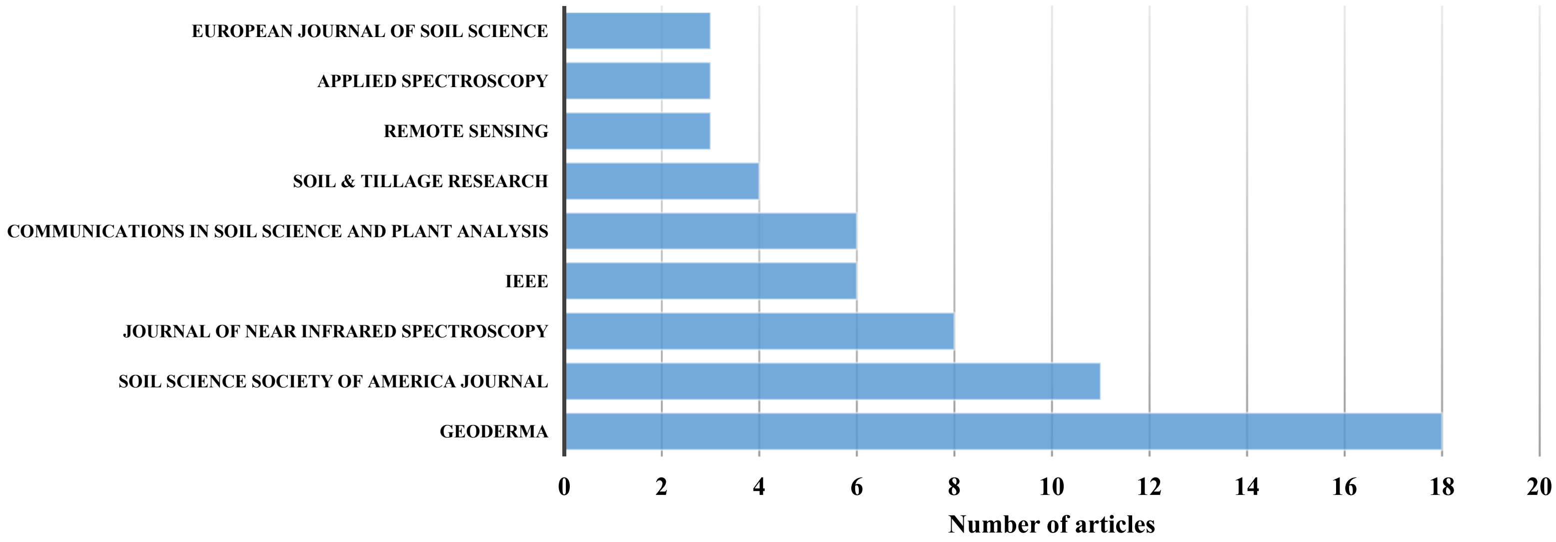

Figure S1. Percentage of reviewed articles published in each journal

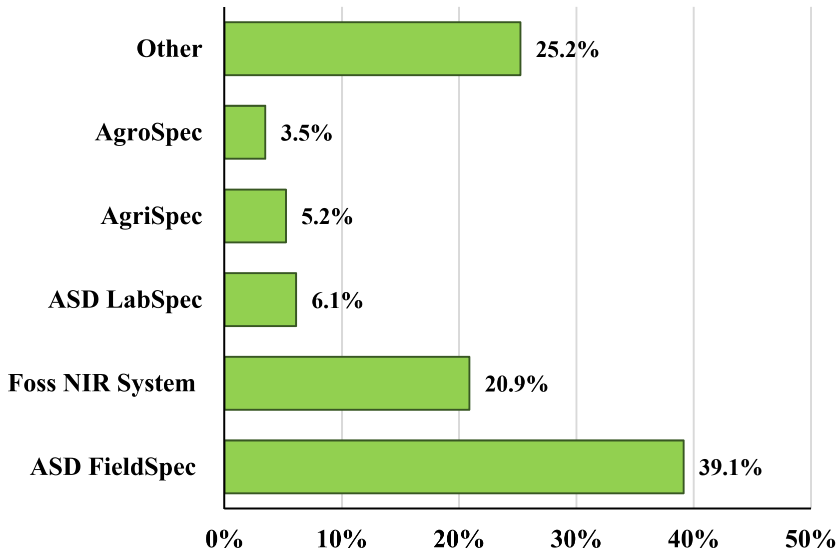

Figure S2. Percentage of the reviewed articles using different spectroscopy devices

Figure S3. Worldwide distribution of the reviewed studies

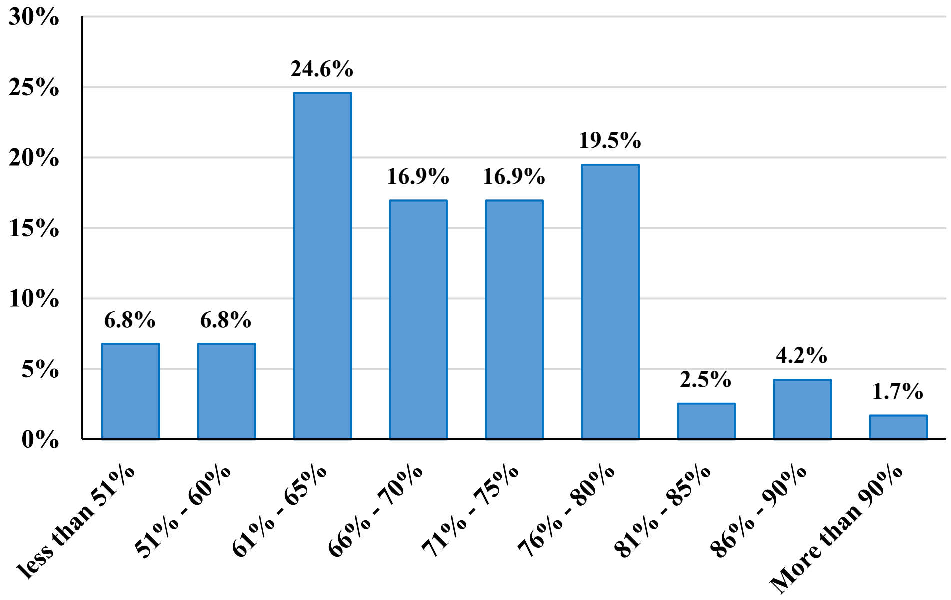

Figure S4. Percentage of the data used as the calibration set across the reports

Table S6. The list of 81 properties that were predicted by V-NIR spectroscopy in the reviewed articles

List of properties				
Al^{3+}	Fe_2O_3	MBN	pH	Solub. C
Al_2O_3	Gibbsite	MC	POC	SOM
$Al_{saturation}$	$H^+ + Al^{3+}$	MCF	POM	SON
Avail. N	Hematite	MCF C	POM C	SSC
Biom. C	Hydro. C	MCF $\delta^{13}C$	POM δ13C	SSOC
Biom. N	Inert. C	Mg^{2+}	POMN	Texture
BR	Inorg. C	mic. C	PWP	Therm. C
BS	Inorg. N	mic. C/SOC	Recal. C	TiO_2
Ca^{2+}	Inter. C	Min.Frac. C	S	Tot. C
$CaCO_3$	Inter. N	Min.Frac. N	SiO_2	Tot. N
CEC	IPM	Miner. C	SM	Tot. Pb.
Clay/SOC	K	Miner. N	SOC	Tot. Zn
CO_2	K^+	MnO_2	SOC acid.	WEON
D_b	Kaolinite	N supp.	SOC Lab.	
Ex. Pb	LFOMN	P	SOC Stab.	
Ex. Zn	Lit.Frac. C	Pass. C	SOC/(Silt+Clay)	
FC	Lit.Frac. N	Pass. N	SOC/Tot. N	

Table S7. Definition of the abbreviations used for soil properties

Abbreviation	Definition	Abbreviation	Definition
acid.	acid treated	mic.	microbial biomass
Biom.	Biomass	Min.Frac.	Mineral Fraction
BR	Basal Respiration	Miner.	Mineralizable
BS	Base Saturation (EB/CEC)	N	Nitrogen
C	Carbon	N supp.	Soil N supply
$CaCO_3$	Calcium Carbonate	P	Phosphorous
CEC	Cation Exchange Capacity (sum of Ca^{2+}, Mg^{2+}, K^+, H^+ and Al^{3+})	Pass.	Passive
CO_2	Fluch of CO_2	POC	Particulate Organic Carbon
D_b	Bulk Density	POM	Particulate Organic Matter
EB	Exchangeable Bases (sum of Ca^{2+}, Mg^{2+} and K^+)	POMN	Particulate Organic Matter Nitrogen
EC	Electrical Conductivity	PWP	Permanent Wilting Point
Ex.	Exchangable	Recal.	Recalcitrant
FC	soil water content at field capacity	S	Sulfur
Hydro.	Hydrolyzable	SOC	Soil Organic Carbon
Inert.	Inert organic C fraction	Solub.	hot water soluble
Inorg.	Inorganic	SOM	Soil Organic Matter
Inter.	Intermediate	SON	Soil Organic Nitrogen
IPM	Identifiable Plant Material	SSC	Soil Salinity Content
K	Potassium	SSOC	SOC stock
Lab.	Labile	Stab.	Stabilized
LFOMN	Light Fraction Organic Matter Nitrogen	Therm.	Thermolabile organic carbon
Lit.Frac.	Light Fraction	TN	Total Nitrogen
MBN	Microbial Biomass Nitrogen	Tot.	Total
MC	Moisture Content	WEON	Water-Extractable Organic Nitrogen
MCF	Mineral-associated C Fraction	$\delta^{13}C$	13C isotope ratio