Supplementary data for the article:

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Supplementary material

Tables

Table S1 Location of the sampling sites and grapevine varieties planted in the investigated parcels

Parcel		1	2	3	4	5	
Northern latitudes		44º41´51.11″	44º41´35.10″	44º41´31.55″	44º41´53.83″	44º41´53.04″	
East longitude		20º41´15.28´´	20º39´8.22´´	20º39´9.75″	20º41´23.21″	20º41´25.18″	
Altitude		175 m	195 m	185 m	155 m	145 m	
Grapevine variety		*Pannonia*	*Regent*	*Regent*	*Pannonia*	*Regent*	
Number of investigated composite samples							Σ composite samples
Soil samples	0-5 cm	3	3	3	3	3	
(samples prepared	0-30 cm	3	3	3	3	3	Σ45
of 10 subsamples)	30-60 cm	3	3	3	3	3	
Leaf samples (samples prepared of 10 subsamples)	Leaf	*3*	*3*	*3*	*3*	*3*	Σ 15
	Petiole	1	1	1	1	1	
Grapevine samples	Whole berry	1	1	1	1	1	
(samples prepared	Skin	1	1	1	1	1	Σ 25
of 10 subsamples)	Pulp	1	1	1	1	1	
	Seed	1	1	1	1	1	
Moss bag sample (one sample was prepared from three subsamples)		2	2	2	2	2	Σ 10

Table S2 Procedures for potentially toxic element single extractions and pseudo- total digestion from the soil samples and digestion of the plant material (leaf, petiole, berry, skin, pulp, seed and transplanted mosses)

Extractant	Procedure	References
soil samples		
Deionized water	2 g of each soil sample was measured and 20 mL of distilled water was added. The extraction was performed for 16 h on a rotary shaker.	Milićević et al., 2017.
Deionized water	2 g of each soil sample was measured and 20 mL of distilled water was added. The extraction was performed for 2 h on a rotary shaker.	Pueyo et al., 2004.
0.01 mol L^{-1} $CaCl_2$	2 g of each soil sample was measured and 20 mL of extractant was added. The extraction was performed for 3 h on a rotary shaker.	Pueyo et al., 2004; Quevauviller, 1998.
1 mol L^{-1} $BaCl_2$	2 g of each soil sample was measured and 20 mL of extractant was added. The extraction was performed for 3 h on a rotary shaker.	Sumner and Miller, 1996
0.1 mol L^{-1} NH_4NO_3	4 g of each soil sample was measured and 10 mL of extractant was added. The extraction was performed for 2 h on a rotary shaker.	Quevauviller, 1998.
0.1 mol L^{-1} $NaNO_3$	4 g of each soil sample was measured and 10 mL of extractant was added. The extraction was performed for 2 h on a rotary shaker.	Quevauviller, 1998.
0.05 mol L^{-1} Na_2EDTA	2 g of each soil sample was measured and 20 mL of extractant was added. The extraction was performed for 1 h on a rotary shaker.	Pueyo et al., 2004; Quevauviller, 1998.
0.11 mol L^{-1} CH_3COOH	1 g of each soil sample was measured and 40 mL of extractant was added. The extraction was performed for 16 h on a rotary shaker.	Pueyo et al., 2004; Quevauviller, 1998.
Aqua regia (HNO_3 : HCl)	0.5 g of each soil sample was digested using 9 mL 35% HCl and 3 mL 65% HNO_3	US EPA 3050b Method
grapevine samples (leaf, petiole, berry, skin, pulp, seed) and transplanted moss samples		
HNO_3 : H_2O_2	0.5 g of each leaf sample was digested using 1 mL 30% $H_2O_2$and 7 mL of 65% HNO_3	US EPA 3050 Method
HNO_3 : H_2O_2	0.5 g of each leaf sample was digested using 1 mL 30% $H_2O_2$and 7 mL of 65% HNO_3	US EPA 3050 Method
HNO_3 : H_2O_2	0.5 g of each leaf sample was digested using 1 mL 30% $H_2O_2$and 7 mL of 65% HNO_3	US EPA 3050 Method

Table S3: Recovery (%) of measured pseudo-total element concentrations in the soil obtained using CRMs (2711a, SARM 42 SAVM, ERM CC 135a and BCR 143 R)

2711 a		SARM 42 SAVM		ERM CC 135 a		BCR 143 R	
Al	65	Ba	67	Al	106	Cd	82
As	88	Co	75	Ba	118	Co	101
Ba	72	Cu	118	Be	118	Cr	92
Ca	83	Mo		Ca	107	Cu	80
Cd	91	Ni	79	Co	106	Mn	106
Co	86	Pb	115	Cr	116	Ni	85
Cr	72	Sr	103	Cu	109	Pb	83
Cu	96	V	75	Fe	113	Zn	110
Fe	95	Zn	75	K	91		
K	61			Mg	121		
Mg	87			Mn	112		
Mn	96			Na	110		
Na	59			Ni	88		
Ni	95			Pb	99		
P	88			V	120		
Pb	96			Zn	99		
Sr	78						
V	99						
Zn	91						

Table S4: Recovery (%) of measured elements in the soil extracts obtained using BCR 483 CRM

	Cd	Cr	Cu	Ni	Pb	Zn
			0.44 mol L^{-1} CH_3COOH			
BCR 483	87	81	92	95	91	103
			0.01 mol L^{-1} $CaCl_2$			
BCR 483	108	118	120	108	80	121
			0.1 mol L^{-1} NH_4NO_3			
BCR 483	81	122	87	85	82	79
			0.05 mol L^{-1} Na_2EDTA			
BCR 483	111	115	103	109	118	103

Table S5: Recovery (%) of measured element concentrations in the moss material obtained using CRMs (M2 and M3)

Elements	M2	M3	Elements	M2	M3
Al	98	97	Li	/	/
As	82	107	Mg	93	100
B	88	87	Mn	86	89
Ba	101	99	Mo	77	/
Be	/	60	Na	92	89
Bi	/	/	Ni	91	75
Ca	98	109	P	/	/
Cd	96	94	Pb	94	/
Co	88	78	S	/	/
Cr	60	/	Sb	78	/
Cu	86	81	Sr	88	119
Fe	99	114	V	95	94
K	75	80	Zn	92	85

Table S6 Equations for assessing environmental risk in the organic vineyard

Environmental risk assessment formulas	Formula	Description	Range	References
		soil samples		
Mobility factor	MF=Ce/Cp-t	Cextracted Cpseudo-total		Milićević et al., 20018a, b
Mobility %	MF %= MF*100	MF-mobility factor		Milićević et al., 20018a, b
Contamination factor (CF)	CF=Cn/Bn	Cn is an element's concentration and Bn is the initial (control) concentration of the metal in the soil	CF≤1 low 1≤CF≤3 moderate 3≤CF≤6 considerably 6≤CF very high contamination factor	Likuku et al., 2013.
Pollution load index (PLI)	$PLI = (CF1 \times CF2 \times CF3 \ldots \times CFn)^{1/n}$	CF is contamination factor; n=number of determined element concentrations	PLI<1 not polluted PLI=1 baseline levels of pollution PLI>1 deterioration of site quality	Likuku et al., 2013
Ecological risk (RI)	Eri=TR×CF RI=ΣEri	CF is contamination factor; TR is toxic response factor given for the elements (it was reported by Hakason (1980) only for As, Cd, Cr, Cu, Ni, Pb, and Zn with known values 10, 30, 2, 5, 5, 5, and 1 respectively). Eri is the potential risk of every individual element (i=As, Cd, Cr, Cu, Pb, and Zn). In Equation S4, RI represents the sum of the potential risks of individual elements.	RI≤150 low 150≤CF≤300 moderate 300≤CF≤600 acceptable 600≤CF very high	Hakason, 1980;
Biogeochemical index (BGI)	BGI= Osl/Asl	Osl-element concentration in O soil layer Asl-element concentration in A soil layer	where BGI>1 indicate sorption of the elements in surface soil lyer (O)	Jamshidi-Zanjani et al. 2015;
Bioavailability risk assessment index (BRAI)	BRAI=ΣBdi (i=1 to n)/ΣTEi (i=1 to n)	n is the number of the PTE, TE is the toxic effect of the PTE (As, Cd, Cr, Cu, Ni, Pb and Zn) derived from the effect range median (ERM) values, calculated using probable effect levels (PEL) published by NOAA (2004)	BRAI ≤1 low risk of bioavailability 1< BRAI ≤3 medium risk of bioavailability 3< BRAI ≤5 high risk of bioavailability BRAI >5 very high risk of bioavailability	Long et al., 1995; NOAA, 2004; Jamshidi-Zanjani et al. 2015; Milićević et al., 2018b

		soil-leaf system		
Biological accumulation formula (BAC)	BAC=Cp/Cs	Cp is the element concentration in differentgrapevine parts and Cs is the concentration of the same element inthe soil sample from the same sampling site	The values BAC > 1 then the plants could be accumulators; BAC = 1 there are no influences of the soil and if the BAC < 1 means that the plant can be an excluder	Radulescu et al., 2013. Bravo et al., 2017
		air-plant		
Ratio factor (RF)	$RF = C_{leaf}/C_{seed}$ $RF = Cl_{eaf}/C_{pulp}$ $RF = C_{skin}/C_{seed}$ $RF = C_{skin}/C_{pulp}$ $RF = C_{petiole}/C_{seed}$ $RF = C_{petiole}/C_{pulp}$	C_{leaf}- concentration in the leaf sample C_{seed}-concentration in the seed sample C_{skin}-concentration in the skin sample C_{pulp}-concentration in the pulp sample $C_{petiole}$-concentration in the petiole sample	where RF>1 indicates pollution via atmosphere	Oliva and Mingorance, 2006
Limit of quantification for moss bag method (LOQ_T)	$LOQ_T = M + 1.96 \times SD$	M is the mean value of the initial element concentration in the unexposed moss, and SD the corresponding standard deviation	Higher values indicate higher element enrichment	Ares et al., 2015;
Relative accumulation factor (RAF)	$RAF = (C_{exposed} - C_{initial}) / C_{initial}$		Higher values indicate higher element enrichment	Ares et al., 2015

Table S7 Equations for health risk assessment for field workers and grapevine consumers

Health risk assessment	
equation	description
health risk for workers	
$CDIo = \frac{C \times EF \times ED \times IR \times RBA \times CF}{AT \times BW}$	CDI_o–chronic daily intake. oral exposure (mg $kg^{-1}day^{-1}$);
$CDIi = \frac{C \times EF \times ED \times ET \times \frac{1}{PEF}}{AT}$	CDI_i –chronic daily intake. inhalation exposure (mg m^{-3});
$CDId = \frac{C \times EF \times ED \times SA \times AF \times ABS \times CF}{AT \times BW}$	CDI_d –chronic daily intake. dermal exposure (mg $kg^{-1}day^{-1}$);
$HQ\ o = \frac{CDI\ o}{RfD}$	C – concentration of an element in soil (mg kg^{-1});
$Ro = CDI \times CSF$	IR – ingestion rate (100 mg kg^{-1});
$HQ\ inh = \frac{CDI\ inh}{RfC}$	EF – exposure frequency (214 day $year^{-1}$);
$R\ inh = CDI \times IUR$	ED –exposure duration (35 years);
$HQ\ d = \frac{CDI\ d}{RfDo \times GIABS}$	RBA – relative bioavailable factor (for As is 0.6.and for other elements. it is 1);
$Rd = CDI\ d \times \frac{CSF}{GIABS}$	BW –body weight of workers in the vineyard (80 kg);
$HI = \Sigma HQ$	AT –average exposuretime(365 day $year^{-1}$; 35 years for non-carcinogenic and 365 day $year^{-1}$; 70 years for carcinogenic);
	PEF –particulate Emission Factor ($1.4\times10^{9} m^3\ kg^{-1}$);
	ET – exposure time (8 h day^{-1}) ; SA – surface area (3527 $cm^2 day^{-1}$);
	AF –adherence factor (0.12 $mgcm^{-2}$);
	ABS –fraction of contaminant absorbed dermally from soil;
	CF – conversion factor (1×10^{-6} kg mg^{-1}).
	RfD – reference dose for ingestion exposure (mg $kg^{-1}day^{-1}$);
	RfC –reference dose for inhalation exposure (mg m^{-3});
	CSF – cancer slope factor (kg day mg^{-1});
	IUR – inhalation unit risk ($m^3\ mg^{-1}$);
	GIABS – Gastro Intestinal Absorption Factor.
health risk for grape consumers	
$DIR=\frac{Mc \times I_R}{BW}$	M_C−concentration of potentially toxic elements in the fruits (mg kg^{-1});
$THQ=\frac{Mc \times I_R \times EF \times ED}{RfD \times BW \times Atn}$	I_R−the ingestion rate of the fruits (0.1768 kg day^{-1} for adults and 0.0681 kg day^{-1} for children);
$\Sigma HI=THQ1+THQ2+\ldots+THQn$	*B*W −the average adult body weight (adults 80 kg and children15 kg);
$CDI = \frac{C \times I_{adj} \times CF}{AT_c}$	EF−exposure frequency(365days $year^{-1}$);
$I_{adj} = \frac{ED_{child} \times EF \times I_{R\,child}}{BW_{child}} + \frac{(ED_{adult} - ED_{child}) \times EF \times I_{R\,adult}}{BW_{adult}}$	ED−exposure duration (40 for adults and 6 for children);
	RfD−the reference dose of individual metal ($mgkg^{-1}day^{-1}$);
	Atn/ATc−average exposure time for noncarcinogens/carcinogenic worst-case(365 days $year^{-1}$ ×ED);
	CPSo−carcinogenic potency slope. oral

Table S8 Descriptive statistics (Median, Minimum–Min, Maximum–Max, Standard Deviation–SD) of pseudo-total element concentrations (mg kg^{-1}) in the soil samples

	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	Pb	S	Sb	Si	Sr	V	Zn
Organic soil layer O (0-5 cm)																										
Median	57061	19	64	316	3.4	0.27	66075	0.17	18	123	29	33206	2234	25	9775	771	23002	90	629	40	198	0.32	2487	145	80	84
Min	47246	16	43	279	3.1	0.24	33389	0.14	18	102	23	31373	2031	22	7857	635	15682	66	416	36	44	0.28	1901	97	70	73
Max	74121	23	1319	393	3.8	0.35	107325	0.24	22	138	49	38273	2967	35	12333	993	68647	123	1342	50	314	0.39	5781	224	95	103
SD	9359	3	590	41	0.2	0.03	23481	0.03	2	13	8	2165	262	4	1576	121	22744	18	273	4	88	0.04	1520	49	6	8
Topsoil A (0-30 cm)																										
Median	63524	22	47	290	3.3	0.27	64910	0.17	19	119	36	33445	1778	31	9635	783	11725	101	401	41	111	0.29	847	144	73	85
Min	49800	16	25	152	2.3	0.22	36565	0.15	17	84	23	26383	892	23	7546	562	5523	74	328	28	7	0.15	347	64	49	60
Max	73534	24	1176	447	4.1	0.35	114405	0.23	23	147	73	38663	2625	37	11110	980	52657	119	735	57	317	0.45	4604	248	93	95
SD	7024	3	292	81	0.4	0.04	25931	0.02	2	16	13	3297	486	4	1260	145	18458	15	136	7	99	0.08	1528	53	11	10
Subsoil/Control sample (30-60 cm)																										
Median	71968	23	44	222	3.1	0.24	77552	0.24	20	118	37	32905	1610	42	9252	710	10060	119	401	36	58	0.22	714	121	70	81
Min	56214	16	36	192	2.5	0.23	30355	0.14	17	90	22	27416	1354	29	7107	636	9233	103	297	30	19	0.19	566	87	56	63
Max	77306	25	51	314	3.6	0.32	109346	0.56	21	128	43	37819	2133	44	9792	970	15259	142	500	44	164	0.31	748	214	84	94
SD	8894	4	5	49	0.5	0.04	29536	0.17	2	16	8	4430	308	7	1080	152	2441	15	78	6	63	0.05	83	48	11	12
*MAC								3		100	100							50		100						300

Table S9 Correlation analysis between the elements' concentrations obtained in the soil samples

	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	Pb	S	Sb	Si	Sr	V	Zn
Al																										
As	0.75**																									
B																										
Ba		0.56*																								
Be		0.63*		0.84**																						
Bi		0.55*			0.67**																					
Ca						-0.66**																				
Cd						0.89**	-0.50																			
Co		0.54*			0.58*	0.74**	-0.69**	0.56*																		
Cr	0.52*	0.90**		0.76**	0.79**	0.61*	-0.23		0.52*																	
Cu						0.82**	-0.59*	0.82**																		
Fe		0.52*			0.76**	0.88**	-0.82**	0.72**	0.78**	0.55*	0.76**															
K		0.66**		0.91**	0.82**	0.51	-0.30			0.88**																
Li	0.87**	0.61*				0.68**	-0.44	0.67**	0.61*		0.53*	0.73**														
Mg		0.69**				0.61*	-0.25		0.58*	0.76**			0.70**													
Mn						0.84**	-0.67**	0.82**	0.77**		0.77**	0.85**		0.62*												
Na				0.90**	0.60*					0.65**			0.82**													
Ni	0.64*													0.63*												
P			0.54*			0.86**		0.84**	0.60*		0.64**	0.68**		0.60*	0.59*	0.77**										
Pb		0.64**		0.86**	0.95**	0.69**	-.540*	0.53*	0.57*	0.87**		0.65**	0.88**		0.60*		0.69**		0.52*						
S			0.54*			0.76**		0.78**			0.67**	0.56*		0.63*	0.53*	0.64**		0.53*	0.92**							
Sb		0.56*		0.99**	0.84**					0.76**			0.91**				0.90**			0.86**		1.00				
Si			0.53*	0.79**									0.73**				0.92**			0.56*		0.79**	1.00			
Sr		0.57*													0.60*		0.38					0.22	0.25	1.00		
V		0.65**		0.86**	0.95**	0.68**	-.617*	0.47	0.60*	0.84**		0.73**	0.92**		0.67**		0.65**		0.54*	0.93**		0.86**	0.56*	0.16	1.00	
Zn		0.53*		0.54*	0.76**	0.89**	-.813**	0.67**	0.80**	0.56*	0.67**	0.90**	0.63*	0.66**	0.57*	0.72**			0.76**	0.69**	0.67**	0.54*	0.13	-0.10	0.74**	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table S10 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of the element concentrations (mg kg^{-1}) extracted from the soil samples using different single extraction procedures and Mobility factor (MF%).

	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Si	Sr	V	Zn
deionized H_2O 2h																										
Median	1.93	8.5		0.5	0.002	290	0.0008	0.0054	0.028	0.24	3.88	15	0.044	20	0.34		8.7	0.07	2.06	0.06	6.63			0.75	0.02	0.01
Mean	1.92	11	<LOD	0.5	0.002	355	0.0008	0.0067	0.037	0.24	5.85	27	0.040	24	0.47	<LOD	15.1	0.08	3.15	0.07	8.74	<LOD	<LOD	0.89	0.03	0.55
Min	1.80	1.8		0.3	0.0004	191	0.0003	0.0009	0.007	0.01	0.86	5	0.009	9	0.17		1.2	0.02	0.80	0.004	1.45			0.40	0.01	0.00
Max	1.96	41		1.1	0.005	711	0.0026	0.0262	0.224	0.67	25.94	128	0.079	68	1.29		86.4	0.20	17.6	0.52	29.2			2.20	0.10	2.67
SD	0.03	8	/	0.2	0.001	141	0.0003	0.006	0.04	0.2	5.5	30	0.03	14	0.3	/	20.5	0.05	3.4	0.09	6.4	/	/	0.46	0.02	0.79
MF%	0.00013	/	/	0.002	0.00047	0.0057	0.0046	0.00037	0.00027	0.004	0.00012	0.00638	0.001	0.0028	0.00042	/	0.0006	0.0007	0.006	0.001	0.04	/	/	0.0045	0.00032	0.00002
deionized H_2O 16 h																										
Median	1.93	5.18		0.43	0.00145	394	0.0008	0.0036	0.022	0.14	2.42	13	0.038	25	0.36		9.5	0.06	1.76	0.05	6.28			0.94	0.02	0.501
Mean	1.93	5.91	<LOD	0.45	0.00160	414	0.0009	0.0061	0.022	0.19	2.87	27	0.040	28	0.44	<LOD	16.6	0.08	2.78	0.05	7.90	<LOD	<LOD	0.98	0.02	1.102
Min	1.77	2.61		0.14	0.00003	141	0.0006	0.0001	0.008	0.00	0.38	4	0.007	11	0.09		2.7	0.01	0.50	0.01	0.01			0.44	0.01	0.001
Max	1.99	21.03		0.92	0.00303	666	0.0014	0.0168	0.053	0.98	13.2	140	0.091	58	1.15		102.3	0.17	16.21	0.12	31.83			2.04	0.06	4.413
SD	0.04	3.60	/	0.19	0.00074	114	0.0002	0.0040	0.009	0.25	2.28	34	0.028	13	0.25	/	23.0	0.05	3.36	0.03	6.64	/	/	0.42	0.01	1.433
MF%	0.0001	/	/	0.0016	0.0004	0.0069	0.0046	0.0004	0.0002	0.0020	0.0001	0.0059	0.0009	0.0031	0.0004	/	0.0009	0.0006	0.0036	0.0011	0.0414	/	/	0.0053	0.0002	0.0077
0.01 mol L^{-1} $CaCl_2$																										
Median	2.48			2.15			0.0010		0.004		0.02	39	0.070	178	0.26		13.1	1.89	0.77		5.97			7.39	0.02	0.54
Mean	2.93	<LOD	<LOD	2.27	<LOD		0.0008	<LOD	0.006	<LOD	0.41	66	0.065	190	0.33	<LOD	23.0	0.06	1.40	<LOD	7.56	<LOD	<LOD	7.34	0.02	0.87
Min	1.02			1.52		/	0.00002		0.001		0.02	12	0.017	82	0.08		3.7	0.01	0.22		0.07			4.02	0.01	0.00
Max	8.64			3.14			0.0011		0.030		4.96	297	0.130	350	0.93		141	0.18	5.42		32.4			13.1	0.05	5.94
SD	1.52	/	/	0.44	/		0.0004	/	0.007	/	1.03	69	0.040	79	0.23	/	32.1	0.05	1.34	/	6.46	/	/	2.52	0.01	1.15
MF%	0.00005	/	/	0.00813	/		0.004	0.00009	0.00003	/	0.000001	0.022	0.0015	0.02	0.00036	/	0.00098	0.00045	0.0023	/	0.054	/	/	0.047	0.0003	0.006
0.1 mol L^{-1} $BaCl_2$																										
Median	0.18		0.21			6094	0.004	0.0097				76	0.12	403	0.58		11.6							23.7		
Mean	0.22	<LOD	0.38	<LOD	<LOD	6200	0.004	0.011	<LOD	<LOD	<LOD	143	0.11	367	0.53	<LOD	19.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	21.7	<LOD	<LOD
Min	0.06		0.01	<LOD	<LOD	4805	0.0002	0.00001	<LOD	<LOD	<LOD	11	0.04	171	0.07	<LOD	4.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	12.2	<LOD	<LOD
Max	0.79		2.68			7626	0.007	0.041				614	0.19	651	0.99		138.4							30.9		
SD	0.14	/	0.61	/	/	704	0.003	0.011	/	/	/	149	0.05	135	0.20	/	32.7	/	/	/	/	/	/	7.4	/	/
MF%	0.000003	/	0.0045	/	/	0.12	0.018	0.0006	/	/	/	0.0357	0.0025	0.0399	0.0005	/	0.001	/	/	/	/	/	/	0.12	/	/
1 mol L^{-1} NH_4NO_3																										
Median	3.89			30		3814			0.015	0.16	2.92	109	0.12	231	0.46		12.4	0.06	0.83	0.011	6.43			13.3	0.009	0.091
Mean	3.65	<LOD	<LOD	31	<LOD	3756	<LOD	<LOD	0.014	0.16	2.71	149	0.12	248	0.61	<LOD	21.3	0.06	1.21	0.013	7.44	<LOD	<LOD	13.8	0.012	0.15
Min	0.01			25		3169			0.003	0.04	0.33	25	0.05	111	0.17		3.6	0.02	0.18	0.008	2.97			8.1	0.009	0.0007
Max	12.74			41		5387			0.029	0.28	7.84	567	0.19	458	1.78		113.3	0.13	5.25	0.034	21.68			23.0	0.031	0.79
SD	2.85	/	/	5	/	444	/	/	0.007	0.08	1.85	123	0.05	106	0.41	/	26.8	0.03	1.15	0.005	4.43	/	/	4.7	0.006	0.18
MF%	0.0001	/	/	1.4	0.0004	0.91	/	/	0.0001	0.0047	0.0001	0.76	0.004	0.36	0.0007	/	0.0005	0.0007	0.0020	0.0003	0.0550	/	0.028	1.4	0.0001	0.0007
1 mol L^{-1} $NaNO_3$																										
Median	1.29		0.59				0.006	0.008	0.005	0.12	0.99	0.02	0.045	61	0.17			0.02	0.35	0.14	2.75		3.86	2.89	0.02	0.00
Mean	1.56	<LOD	1.60	<LOD	<LOD	850	0.010	0.021	0.011	0.42	1.30	8.60	0.040	65	0.25	<LOD		0.03	0.71	0.27	3.88	<LOD	4.05	3.06	0.03	0.10
Min	0.15		0.01			704	0.002	0.008	0.001	0.01	0.01	0.02	0.012	30	0.05		/	0.01	0.12	0.05	0.16		2.22	1.76	0.02	0.00
Max	5.28		8.33			1014	0.042	0.092	0.091	3.50	4.52	81.91	0.074	127	0.86			0.09	4.85	1.03	15.61		7.85	5.21	0.07	1.63
SD	1.23	/	2.12	/	/	78	0.010	0.023	0.016	0.80	1.11	17.75	0.021	28	0.22	/		0.03	1.01	0.30	3.63	/	1.38	0.97	0.01	0.31
MF%	0.00002	/	0.004	/	0.0008	0.014	0.033	0.0005	0.00005	0.003	0.00005	0.00001	0.001	0.006	0.0002	/		0.0002	0.0011	0.0031	0.018	/	0.0029	0.019	0.00032	0.00003
0.11 mol L^{-1} CH_3COOH																										
Median	0.0133		1.2	34.3	0.0255	28292	0.0470	0.12	0.059	0.025	5.30	204	1.04	1148	70		54.93	1.81	29	0.029	24.70		232.6	78.8	0.0133	0.3556
Mean	0.0077	<LOD	0.90	29.7	0.0045	29220	0.0403	0.04	0.048	0.217	1.95	130	0.61	943	64	<LOD	45.48	1.80	3.22	0.021	22.24	<LOD	175.1	60.7	0.0077	0.1956
Min	0.0001		0.002	0.001	0.0009	5483	0.0007	0.002	0.002	0.002	0.002	0.002	0.0003	20	4		0.07	0.06	0.02	0.004	0.07		0.0	0.0	0.0001	0.0010
Max	0.0494		4.5	148	0.25	107718	0.16	0.59	0.34	2.058	28	954	8.84	6354	357		255	5.48	408	0.127	163		1103	443	0.0494	2.1721
SD	0.0136	/	1.2	30.1	0.06	20906	0.04	0.17	0.070	0.395	7.41	229	1.82	1166	66	/	48.08	1.32	88	0.027	31.35		250.2	80.7	0.0136	0.5310
MF%	0.000001	/	0.01	0.12	0.001	0.48	0.19	0.004	0.0004	0.0006	0.0001	0.06	0.01	0.1	0.06	/	0.004	0.01	0.007	0.001	0.16	/	0.145	0.44	0.000098	0.001721
0.44 mol L^{-1} CH_3COOH																										
Median	147		3.01	46.9	0.12	3.32	0.08	0.38	0.50	0.75	31	201	0.47	1152	117		41.2	6.12	18	0.43	22	0.009	250	85.0	0.11	0.54
Mean	147	<LOD	3.10	47.8	0.13	3.68	0.09	0.53	0.49	0.96	31	260	0.45	1307	115	<LOD	57.3	5.53	41	0.49	24	0.022	192	90.0	0.12	0.94
Min	110		0.90	37.1	0.07	1.24	0.06	0.11	0.26	0.39	23	107	0.26	480	61		19.1	2.89	0.04	0.15	0.07	0.002	244	31.3	0.06	0.06
Max	200		6.19	60.3	0.19	9.24	0.12	1.91	0.83	3.00	41	797	0.75	2436	177		183	9.26	344	1.16	69	0.097	203	163	0.20	3.18
SD	25	/	1.38	6.8	0.03	2.07	0.01	0.41	0.17	0.55	4	164	0.15	589	33	/	39.2	1.90	78.	0.23	20	0.027	52	38.9	0.03	1.00
MF%	0.002	/	0.057	0.174	0.035	0.000	0.511	0.032	0.004	0.021	0.001	0.105	0.013	0.144	0.145	/	0.004	0.054	0.037	0.010	0.14	0.006	0.12	0.60	0.001	0.006
0.5 mol L^{-1} Na_2EDTA																										
Median	23		1.44	3.01	0.024	18267	0.07	0.53	0.028	6.50	46	6	0.20	264	65	0.016		3.08	0.14	3.31	0.75	0.07	56.2	18.1	0.13	1.04
Mean	35	<LOD	2.07	3.12	0.028	18251	0.08	1.02	0.027	8.61	47	34	0.19	319	90	0.016		3.75	7.25	3.84	2.52	0.09	61.4	19.7	0.15	1.22
Min	12		0.82	0.67	0.006	16576	0.03	0.12	0.003	1.01	18	0.1	0.11	184	28	0.015	/	0.94	0.14	2.16	0.72	0.07	41.3	11.8	0.02	0.01
Max	114		9.01	5.58	0.075	20653	0.14	2.96	0.074	27.65	91	236	0.30	566	257	0.040		12.4	105.02	6.78	22.40	0.26	98.9	32.7	0.72	6.16
SD	29	/	1.9	1.1	0.02	952	0.03	0.9	0.01	6.3	19	57	0.06	117	65	0.004		2.9	19.8	1.4	4.7	0.06	16.2	5.4	0.14	1.43
MF%	0.0003	/	0.03	0.01	0.007	0.32	0.37	0.036	0.0002	0.16	0.0014	0.0027	0.0054	0.033	0.068	/		0.025	0.0013	0.080	0.0056	0.22	0.034	0.12	0.0014	0.014

Table S11 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of the biogeochemical index (BGI) calculated for all measured elements in the soil sample; BGI is dimensionless-unit (-).

	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	Pb	S	Sb	Si	Sr	V	Zn
BGI O soil layer/A soil layer																										
Median	0.90	0.91	1.18	0.95	1.00	0.99	0.93	0.95	0.96	1.00	0.92	0.99	1.03	0.89	0.99	0.98	1.04	0.95	1.38	1.01	1.86	0.95	0.91	0.93	1.02	0.99
Mean	0.99	0.90	14.1	1.01	0.99	0.99	0.92	1.00	0.97	1.01	0.90	0.99	1.25	0.91	1.00	0.99	3.25	0.94	1.42	0.97	2.81	1.01	4.84	0.99	1.06	1.01
Min	0.85	0.76	0.48	0.74	0.87	0.94	0.70	0.88	0.88	0.87	0.67	0.95	0.96	0.81	0.88	0.82	0.34	0.82	1.04	0.79	0.46	0.74	0.44	0.77	0.93	0.94
Max	1.37	1.03	48.3	1.36	1.11	1.05	1.18	1.21	1.06	1.21	1.14	1.05	2.07	1.05	1.17	1.13	11.21	1.04	2.02	1.18	7.89	1.36	12.87	1.51	1.31	1.08
SD	0.17	0.10	18.0	0.26	0.09	0.03	0.15	0.11	0.05	0.11	0.12	0.03	0.38	0.07	0.09	0.09	3.76	0.07	0.26	0.14	2.52	0.26	5.50	0.21	0.12	0.05

Table S12 Descriptive statistics (Median, Minimum–Min, Maximum–Max, Standard Deviation–SD) of the contamination factor (CF) and pollution load index (PLI) calculated for PTE in the soil sample; CF and PLi are dimensionless-units (-).

	Al	As	B	Ba	Be	Bi	Cd	Co	Cr	Cu	Fe	Mn	Ni	Pb	Sb	Sr	V	Zn	*PLI*
CF O layer																			
Median	0.92	0.91	1.46	1.43	1.10	1.07	0.81	0.96	1.12	1.00	1.06	0.98	0.70	1.16	1.43	1.00	1.24	1.06	*1.02*
Mean	0.91	0.94	14.13	1.38	1.11	1.06	0.76	0.99	1.12	1.01	1.05	0.99	0.74	1.12	1.38	1.12	1.20	1.05	*1.12*
Min	0.61	0.70	1.06	0.90	0.90	0.87	0.24	0.89	0.87	0.72	0.91	0.90	0.60	0.90	0.90	0.80	0.94	0.84	*0.86*
Max	1.14	1.33	32.75	1.58	1.28	1.17	1.39	1.12	1.32	1.32	1.16	1.12	0.89	1.21	1.58	1.86	1.37	1.19	*1.35*
SD	0.18	0.19	15.39	0.22	0.12	0.09	0.36	0.08	0.13	0.18	0.09	0.07	0.11	0.10	0.22	0.33	0.14	0.11	*0.19*
CF A layer																			
Median	0.90	0.97	1.00	1.18	1.05	1.03	0.85	0.99	1.03	1.12	1.02	0.99	0.83	1.05	1.18	1.11	1.04	1.00	*1.02*
Mean	0.92	1.02	2.51	1.25	1.07	1.04	0.78	1.00	1.05	1.10	1.03	1.00	0.82	1.09	1.25	1.18	1.07	1.00	*1.02*
Min	0.67	0.78	0.68	0.79	0.90	0.92	0.26	0.90	0.87	0.63	0.91	0.80	0.65	0.91	0.79	0.53	0.87	0.84	*0.88*
Max	1.09	1.38	23	1.93	1.36	1.19	1.15	1.16	1.34	1.72	1.17	1.24	0.97	1.49	1.93	1.67	1.43	1.14	*1.19*
SD	0.11	0.17	5.67	0.36	0.15	0.08	0.30	0.06	0.14	0.26	0.09	0.13	0.11	0.19	0.36	0.31	0.15	0.09	*0.09*

Table S13 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of the environmental risk calculated for PTEs (ErAs, ErCd, ErCr, ErCu, ErNi, ErPb and ErZn) and total risk (RI) according to concentrations measured in the vineyard soil; Eri and RI are dimensionless-units (-).

	ErAs	ErCd	ErCr	ErCu	ErNi	ErPb	ErZn	RI
O layer								
Median	4.58	24.29	2.21	4.96	3.52	5.76	1.05	44.4
Mean	4.69	23.18	2.20	4.94	3.72	5.52	1.04	45.3
Min	3.49	7.29	1.73	3.58	3.02	4.52	0.84	31.2
Max	6.66	41.73	2.64	6.58	4.47	6.04	1.19	63.8
SD	0.90	10.12	0.26	0.89	0.55	0.50	0.11	9.1
A layer								
Median	4.84	25.61	2.05	5.60	4.17	5.26	1.00	47.0
Mean	5.12	23.35	2.11	5.51	4.10	5.45	1.00	46.6
Min	3.92	7.82	1.74	3.16	3.25	4.56	0.84	31.6
Max	6.91	34.56	2.69	8.59	4.86	7.46	1.14	57.2
SD	0.84	9.13	0.29	1.32	0.55	0.94	0.09	7.8

Table S14 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of bioavailability risk assessment calculated for the soil samples using element concentrations extracted by Na_2EDTA (regular equation); The $BRAI_{probable}$ (using concentrations of As, Cd, Cr, Cu, Ni, Pb and Zn) and $BRAI_{apparent}$ (using concentrations of As, Cd, Co, Cr, Cu, Mn, Ni, Pb, V and Zn); BRAI is dimensionless-unit (-).

	$BRAI_{probable}$	$BRAI_{apparent}$
Median	2.94	1.68
Mean	2.96	1.72
Min	1.00	0.84
Max	4.43	2.59
SD	0.76	0.38

Table S15 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of health risk index (non-carcinogenic risk; HI) and carcinogenic risk (R) assessed for the workers in the investigated vineyard; HI and R are dimensionless-units (-).

	HIo	HIi	HId	*ΣHI*	Ro	Ri	Rd	*ΣR*
Median	0.24	0.0049	0.0065	*0.25*	3.4E-05	7.2E-07	1.47E-06	*3.61E-05*
Mean	0.24	0.0051	0.0063	*0.25*	3.26E-05	7.06E-07	1.42E-06	*3.47E-05*
Min	0.19	0.0043	0.0049	*0.20*	2.41E-05	5.13E-07	1.09E-06	*2.57E-05*
Max	0.28	0.0062	0.0077	*0.30*	4.04E-05	8.87E-07	1.73E-06	*4.30E-05*
SD	0.02	0.0006	0.0009	*0.03*	4.08E-06	9.01E-08	2.03E-07	*4.36E-06*

Table S16 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of the element concentrations (mg kg^{-1}) in the grapevine parts (seed, pulp, skin, whole berry, petiole and leaf)

	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Si	Sr	V	Zn
													seed														
Median	3.6	0.05	11.7	2.3	0.0010	0.06353	2312	0.040	0.044	0.05	5.7	6.2	1543	0.007	536	7.3	0.08	100	0.8	1.1	0.99		0.0264		7.6	0.02342	15.5
Mean	3.4	0.05	12.8	2.3	0.0025	0.08777	2261	0.041	0.046	0.05	6.5	6.1	1579	0.008	579	7.2	0.09	99	1.7	1.2	1.00	<LOD	0.0280	<LOD	7.8	0.02380	15.0
Min	0.3	0.04	5.8	1.7	0.0010	0.04268	2046	0.037	0.036	0.04	5.1	4.5	1368	0.001	503	5.0	0.07	78	0.1	1.0	0.93		0.0236		5.1	0.01995	9.3
Max	6.4	0.07	20.7	2.9	0.0098	0.19579	2401	0.050	0.059	0.09	10.5	7.7	1854	0.019	700	9.2	0.12	123	7.1	1.5	1.07		0.0389		10.5	0.02851	20.4
SD	2.0	0.01	6.3	0.5	0.0036	0.05708	143	0.005	0.009	0.02	2.1	1.1	182	0.008	85	2.1	0.02	16	2.7	0.2	0.05		0.0055		2.0	0.00284	3.8
													pulp														
Median	5.3	0.0191	15.7	0.6	0.0007	0.01292	734	0.013	0.019	0.02	1.7	4.6	10438	0.002	428	1.2	0.028	122	0.05	0.64	0.85		0.0108		1.4	0.01230	1.32
Mean	6.8	0.0196	15.7	0.6	0.0007	0.01344	763	0.014	0.018	0.02	1.7	4.6	11961	0.003	413	1.2	0.029	127	0.10	0.60	0.74	<LOD	0.0113	<LOD	1.2	0.01509	1.26
Min	3.6	0.0168	11.4	0.3	0.0005	0.00846	579	0.011	0.013	0.01	1.1	2.9	3804	0.001	352	0.6	0.026	109	0.00	0.31	0.00		0.0099		0.4	0.00820	0.00
Max	13.4	0.0245	20.5	0.9	0.0010	0.01966	959	0.017	0.021	0.03	2.1	5.8	20249	0.009	454	1.8	0.036	156	0.38	0.75	1.08		0.0139		1.7	0.02583	3.17
SD	3.8	0.0027	3.7	0.2	0.0003	0.00360	147	0.002	0.003	0.01	0.4	1.0	6116	0.003	38	0.4	0.004	17	0.14	0.17	0.39		0.0016		0.5	0.00655	1.17
													skin														
Median	3.9	0.0097	8.5	0.57	0.0005	0.00351	957	0.0032	0.009	0.01	1.9	4.7	5910	0.001	507	2.0	0.017	88	0.00	0.68	0.30		0.0045		2.2	0.00881	1.5
Mean	9.4	0.0092	8.5	0.66	0.0007	0.00373	960	0.0033	0.009	0.01	1.9	5.0	7060	0.001	505	2.0	0.024	89	0.11	0.67	0.53	<LOD	0.0042	<LOD	2.2	0.00985	1.5
Min	1.2	0.0035	7.3	0.40	0.0005	0.00013	856	0.0030	0.007	0.00	1.0	3.5	4793	0.001	475	1.6	0.010	71	0.00	0.60	0.25		0.0022		1.4	0.00551	0.7
Max	37.9	0.0154	9.6	1.04	0.0010	0.00905	1107	0.0042	0.012	0.03	2.8	7.2	11526	0.003	531	2.6	0.049	105	0.61	0.73	1.74		0.0053		3.2	0.01825	2.4
SD	14.0	0.0049	0.9	0.26	0.0002	0.00339	85	0.0004	0.002	0.01	0.7	1.4	2779	0.001	23	0.4	0.016	12	0.24	0.04	0.59		0.0011		0.6	0.00476	0.7
													whole berry														
Median	1.5	0.00028	3.8	0.44	0.0005	0.00013	1495	0.0002	0.0001	0.00032	1.4	2.4	7784	0.00074	536	2.9	0.000	8.5	0.00	0.92			0.0001		2.0	0.000063	0.0028
Mean	1.4	0.00028	3.9	0.50	0.0006	0.01603	1468	0.0002	0.0005	0.00031	1.5	2.8	8109	0.00072	534	3.0	0.004	9.4	0.07	0.91			0.0001		1.9	0.000061	0.0027
Min	0.3	0.00025	1.1	0.25	0.0005	0.00012	1130	0.0002	0.0001	0.00029	0.9	2.0	4366	0.00065	437	1.4	0.000	6.1	0.00	0.57	<LOD	<LOD	0.0001	<LOD	0.8	0.000056	0.0024
Max	2.3	0.00029	6.1	0.90	0.0008	0.09551	1810	0.0002	0.0024	0.00033	2.1	4.3	12415	0.00076	638	4.6	0.017	14.1	0.31	1.21			0.0001		2.6	0.000065	0.0028
SD	1.0	0.00002	1.9	0.26	0.0001	0.03894	241	0.00001	0.0009	0.00002	0.5	0.9	2905	0.00005	66	1.2	0.007	3.4	0.12	0.23			0.0000		0.7	0.000004	0.0002
MAC		0.1						0.05													1						
													petiole														
Median	6.7	0.0006	19	21	0.0021	0.00028	15361	0.0004	0.0868	0.01	6.1	6.4	10620	0.023	3971	26	0.143	62.7	0.47	1.21			0.0002		67	0.006	11
Mean	5.6	0.0020	17	19	0.0041	0.05720	13597	0.0021	0.0878	0.08	7.4	5.5	11992	0.037	5773	43	0.168	88.8	0.79	1.14			0.0005		76	0.009	12
Min	0.5	0.0006	6	10	0.0011	0.00027	3679	0.0004	0.0009	0.00	3.8	0.1	4247	0.002	773	8	0.001	28.3	0.00	0.26	<LOD	<LOD	0.0001	<LOD	39	0.0001	0
Max	9.7	0.0122	22	26	0.0108	0.56824	22995	0.0154	0.1929	0.37	14.1	9.5	28301	0.155	14731	119	0.633	195.9	2.10	2.06			0.0030		139	0.02	25
SD	3.9	0.0036	5	6	0.0038	0.17956	6849	0.0047	0.0613	0.13	3.4	3.1	7333	0.048	4723	37	0.188	64.3	0.84	0.53			0.0009		32	0.01	7
													leaf														
Median	59	0.05	50	9.7	0.0053	0.00090	47337	0.0067	0.0420	0.25	9.5	92	12718	0.005	4501	115	0.072	23.1	1.85	3505	0.37	3.5	0.03		61	0.07	21
Mean	80	0.06	51	11.4	0.0093	0.00089	45497	0.0146	0.0459	0.31	21.5	101	13176	0.008	5875	128	0.098	47.0	2.17	3594	0.82	3.6	0.03		75	0.12	25
Min	35	0.03	26	4.0	0.0034	0.00082	23077	0.0008	0.0001	0.15	3.9	70	7749	0.005	1845	48	0.011	1.0	0.76	2572	0.22	2.6	0.01	<LOD	20	0.01	12
Max	260	0.14	94	30.0	0.0309	0.00093	73021	0.0420	0.1061	0.89	116.1	197	24452	0.032	12763	264	0.282	114.0	4.37	5848	2.26	5.8	0.10		135	0.46	57
SD	52	0.03	18	5.9	0.0078	0.00003	14698	0.0133	0.0328	0.19	26.9	31	4098	0.008	3110	58	0.068	43.1	1.08	724	0.70	0.7	0.02		38	0.11	13

LOD-limit of detection

MAC-maximum allowable concentrations in the fresh fruit (National Gazette of Republic Serbia. prescribed values for fresh fruit)

Table S17 Median values of the biological accumulation formula (BAC) calculated for each element; BAC is dimensionless-unit (-).

M	seed/soil 0-5 cm	seed/soil 0-30 cm	pulp/soil 0-5 cm	pulp/soil 0-30 cm	skin/soil 0-5 cm	skin/soil 0-30 cm	berry/soil 0-5 cm	berry/soil 0-30 cm	petiole/soil 0-5 cm	petiole/soil 0-30 cm	leaf/soil 0-5 cm	leaf/soil 0-30 cm
Al	6.39E-05	5.68E-05	8.5E-05	7.54E-05	6.65E-05	5.73E-05	2.58E-05	4.05E-05	1.40E-04	1.30E-04	0.001	9.00E-04
As	0.0027	0.0023	0.001	8.60E-04	5.20E-04	4.60E-04	1.59E-05	1.18E-05	3.42E-05	2.77E-05	0.042	0.04
B	0.16	0.21	0.25	0.3	0.19	0.16	0.09	0.09	0.33	0.31	1.01	1.07
Ba	0.007	0.006	0.001	0.001	0.002	0.002	0.001	0.0009	0.08	0.064	0.05	0.04
Be	3.00E-04	3.00E-04	2.00E-04	2.00E-04	2.00E-04	1.00E-04	2.00E-04	0.0001	6.00E-04	6.00E-04	0.0011	0.0011
Bi	0.3	0.28	0.047	0.047	0.014	0.014	5.20E-04	0.001	0.001	0.001	0.012	0.013
Ca	0.039	0.036	0.016	0.014	0.014	0.013	0.024	0.026	0.39	0.35	0.86	0.73
Cd	0.26	0.24	0.09	0.082	0.021	0.018	0.0013	0.0011	0.0029	0.0026	0.01	0.01
Co	0.002	0.0024	9.22 E-04	0.000877	0.000438	0.000463	5.54E-06	5.21E-06	0.006	0.006	0.004	0.004
Cr	4.00 E-04	3.47 E-04	1.36 E-04	1.18 E-04	4.45E-05	3.87E-05	2.76E-06	2.32E-06	6.01E-06	5.53E-06	0.0018	0.0017
Cu	0.18	0.16	0.05	0.04	0.05	0.04	0.04	0.04	0.26	0.25	0.15	0.13
Fe	0.000164	1.71 E-04	0.000134	1.27 E-04	1.33 E-04	1.34 E-04	6.89E-05	6.60E-05	2.00 E-04	1.72 E-04	0.003	0.002
K	0.71	0.7	4.01	3.91	2.57	2.57	3.39	2.79	5.72	5.71	6.18	5.92
Li	6.34E-05	5.61E-05	3.28E-05	3.07E-05	3.11E-05	2.86E-05	2.87E-05	2.37E-05	/	/	2.00E-04	2.0 E-04
Mg	0.07	0.06	0.044	0.042	0.055	0.05	0.055	0.052	372	325	0.77	0.68
Mn	0.01	0.01	0.0015	0.0014	0.0026	0.0024	0.0038	0.0034	0.008	0.0071	0.16	0.17
Mo	/	/	/	/	/	/	/	/	2.20E-04	2.20E-04	/	/
Na	0.005	0.002	0.007	0.003	0.004	0.002	3.28 E-04	1.78 E-04	0.004	0.001	2.50 E-04	0.0002
Ni	0.012	0.012	0.001	0.001	2.86E-05	2.57E-05	2.69E-05	2.51E-05	0.0033	0.0033	0.019	0.02
P	0.002	0.003	7.80E-04	0.0012	0.001	0.0016	0.0014	0.0019	0.0019	0.003	6.02	9.61
Pb	0.025	0.022	0.022	0.018	0.007	0.006	/	/	/	/	0.009	0.008
S	/	/	/	/	/	/	/	/	8.22E-07	/	0.021	0.025
Sb	0.085	0.067	0.035	0.029	0.015	0.011	2.34 E-04	01.73 E-04	0.02	0.013	0.061	0.051
Sr	0.049	0.044	0.007	0.006	0.013	0.012	0.009	0.008	0.63	0.57	0.6	0.54
V	2.98 E-04	2.93 E-04	1.44 E-04	1.34 E-04	8.63E-05	8.17E-05	7.6E-07	7.04E-07	6.13E-05	5.72E-05	7.23E-04	6.84 E-04
Zn	0.17	0.16	0.01	0.01	0.02	0.02	3.06E-05	3.01E-05	0.15	0.15	0.18	0.17

Table S18 median values of the Ratio Factor (RF) calculated for each element; RF is dimensionless-unit (-).

Median	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Li	P	Pb	Sb	Se	Sr	V	Zn
RF leaf/pulp	11.77	2.28	2.78	14.02	17.26	0.07	40.82	1.81	0.04	0.15	10.14	0.01	1.55	0.00	3039.64	3688.39	0.00	4343.05	786.34	7.78	1.53	338.34	4.34	33.63	6.28	12.46
RF leaf/seed	23.97	0.77	4.95	3.30	16.49	0.01	13.15	0.61	0.02	0.05	3.18	0.01	9.11	0.00	517.29	1420.96	0.00	125.30	1223.66	3.63	1.39	132.72	0.78	4.34	3.28	1.15
RF skin/pulp	0.60	0.33	0.45	1.02	0.95	0.27	1.29	0.23	0.48	0.35	1.25	0.98	0.55	1.17	1.61	0.58	0.71	0.18	0.26	1.06	0.34	0.38	0.97	1.55	0.62	1.75
RF skin/seed	1.56	0.23	0.72	0.26	0.49	0.05	0.42	0.08	0.20	0.12	0.26	0.61	3.62	0.94	0.28	0.25	0.94	0.01	0.51	0.62	0.29	0.16	0.07	0.27	0.35	0.10
RF petiole/pulp	0.68	0.03	1.02	43.49	2.28	0.02	26.28	0.03	7.84	0.06	4.68	21.60	1.85	22.57	58.75	7.65	0.53	7.90	32.41	2.37	/	0.01	1.79	82.56	0.43	14.60
RF petiole/seed	1.88	0.01	1.19	11.21	1.08	0.00	8.34	0.01	2.89	0.02	1.22	15.98	8.06	19.24	8.60	2.79	0.73	0.10	25.89	1.23	/	0.01	0.16	10.62	0.22	1.05

Table S19 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of health riks index (non-carcinogenic risk for adults and children; HI) and carcinogenic risk (adjustable; R) assessed for the grape consumers; HI and R are dimensionless-units (-).

	adults	children	TR adjustable
	ΣHI	ΣHI	ΣR
parcel 1	0.21	0.29	3.76E-07
parcel 2	0.13	0.17	4.23E-07
parcel 3	0.26	0.35	3.69E-07
parcel 4	0.22	0.32	4.12E-07
parcel 5	0.25	0.38	4.21E-07
Median	0.22	0.32	4.12E-07
Min	0.13	0.17	3.69E-07
Max	0.26	0.38	4.23E-07
SD	0.05	0.08	2.57E-08

Table S20 Descriptive statistics (Median, Mean, Minimum–Min, Maximum–Max, Standard Deviation–SD) of element concentrations (mg kg^{-1}) measured in the moss bags (*Sphagnum girgenshonii*) exposed during 2 months (2M) and 4 months (4M) in the organic vineyard and relative accumulation factor (RAF); RAF is dimensionless-unit (-).

	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sr	V	Zn
Initial	89	0.04	0.47	7.53	0.004	0.001	5028.50	0.06	0.07	0.16	2.06	88	15221	0.003	2317	361	0.11	73	2.03	2.41	0.80	2.41	0.02	5.78	0.22	12
2M *Sphagnum girghenshonii*																										
Median	177	0.08	3	14	0.00	0.001	6364	0.16	0.15	0.57	3.48	194	5083	0.001	2289	452	0.12	50	1.35	0.97	1.14	0.97	0.07	9.10	0.61	50
Mean	183	0.08	17	14	0.01	0.077	6490	0.15	0.16	0.55	3.88	198	5250	0.01	2236	482	0.13	56	2.41	0.97	1.15	0.97	0.14	9.87	0.61	58
Min	149	0.05	2	8	0.00	0.001	5594	0.07	0.12	0.40	2.47	164	2200	0.001	1668	365	0.09	35	0.56	0.91	0.87	0.91	0.05	6.52	0.47	19
Max	242	0.11	129	23	0.02	0.759	7924	0.30	0.25	0.80	6.05	261	7837	0.05	2773	680	0.26	113	9.96	1.05	1.50	1.05	0.50	17.78	0.86	132
SD	31	0.02	39	5	0.01	0.240	816	0.07	0.04	0.13	1.28	29	1847	0.02	300	110	0.05	24	2.89	0.05	0.18	0.05	0.16	3.39	0.12	38
RAF 2M	0.99	1.30	6.30	0.81	0.11	0.10	0.27	1.70	1.19	2.58	0.69	1.21	-0.67	0.89	-0.01	0.25	0.11	-0.31	-0.34	-0.60	0.43	-0.60	2.59	0.57	1.76	3.02
4M *Sphagnum girgenshonii*																										
Median	263	0.16	1.6	14	0.01	0.001	7285	0.12	0.22	0.71	3.01	329	2308	0.00	2886	511	0.09	43	2.33	0.88	1.62	0.88	0.10	9.39	0.89	31
Mean	278	0.14	1.8	14	0.01	0.001	7542	0.12	0.22	0.72	4.09	380	2753	0.01	2866	525	0.10	48	3.49	0.88	1.94	0.88	0.18	8.96	0.86	34
Min	160	0.08	0.9	9	0.00	0.001	5983	0.08	0.16	0.40	1.33	190	1211	0.00	2590	395	0.07	34	0.90	0.80	1.03	0.80	0.07	5.64	0.51	17
Max	377	0.21	3.1	16	0.03	0.001	9261	0.19	0.29	1.09	8.24	570	5012	0.04	3183	671	0.14	75	10.16	0.96	4.29	0.96	0.57	10.64	1.20	65
SD	81	0.04	0.7	3	0.01	0.000	1011	0.03	0.05	0.25	2.19	147	1545	0.02	208	91	0.02	13	3.20	0.05	0.99	0.05	0.17	1.71	0.27	17
RAF 4M	1.95	3.24	2.37	0.84	0.41	0.11	0.45	1.01	2.31	3.45	0.46	2.75	-0.85	0.91	0.25	0.42	-0.14	-0.40	0.15	-0.63	1.03	-0.63	4.38	0.63	3.03	1.53

Figures

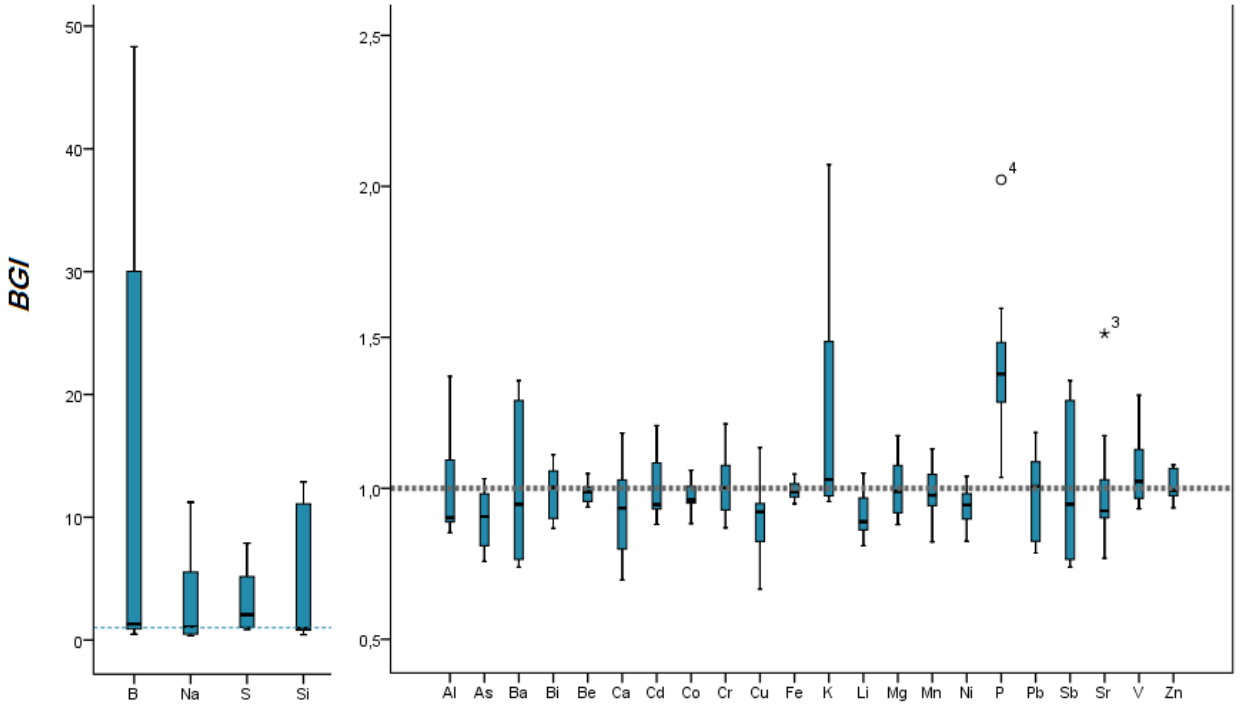

Figure S1 The biogeochemical index (BGI) calculated for each element in O soil layer; BGI is dimensionless-unit (-).

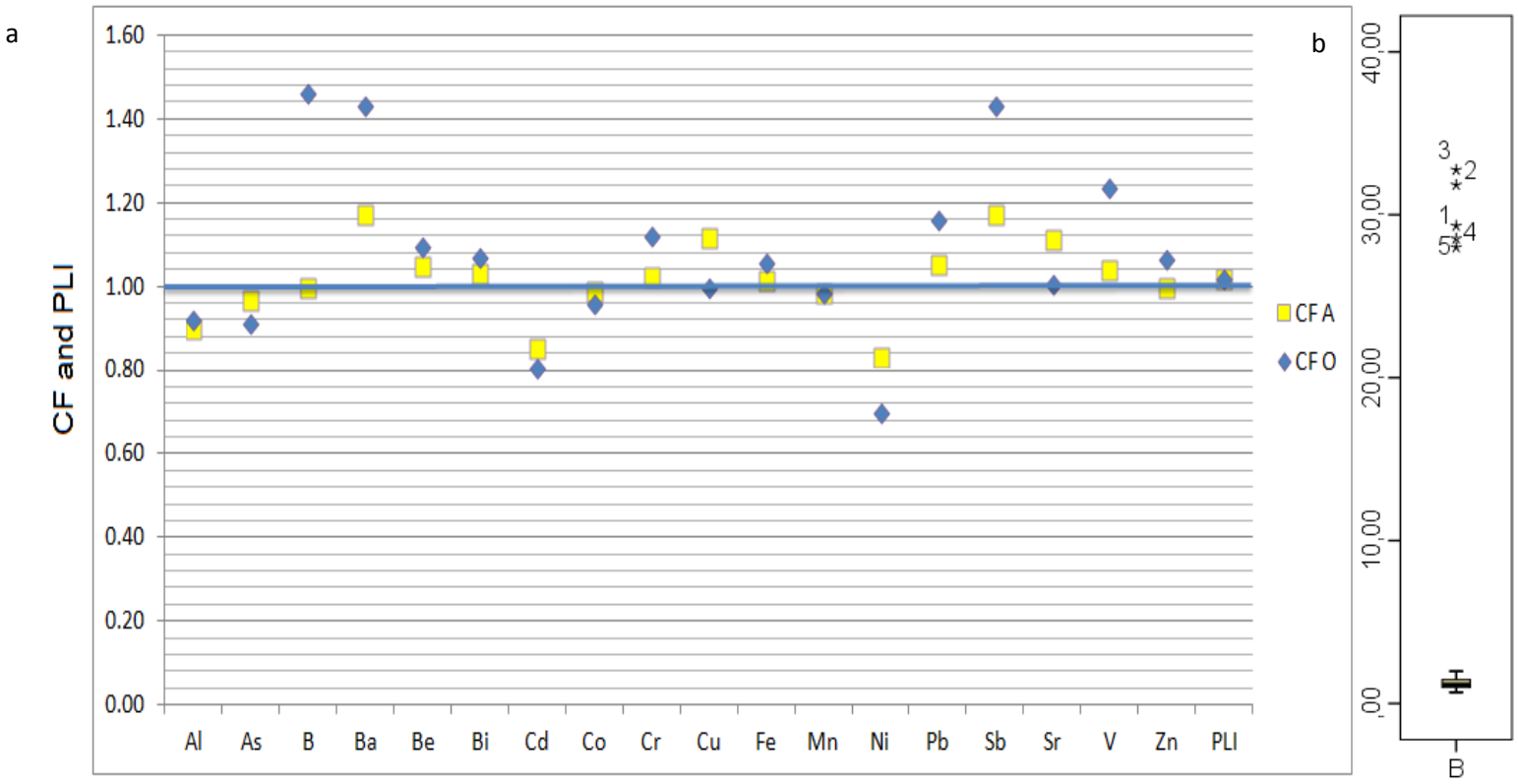

Figure S2 a) The median values of contamination factor (CF) for all measured elements in the O and A soil layer; b) CF for all samples for B; CF is dimensionless-unit (-).

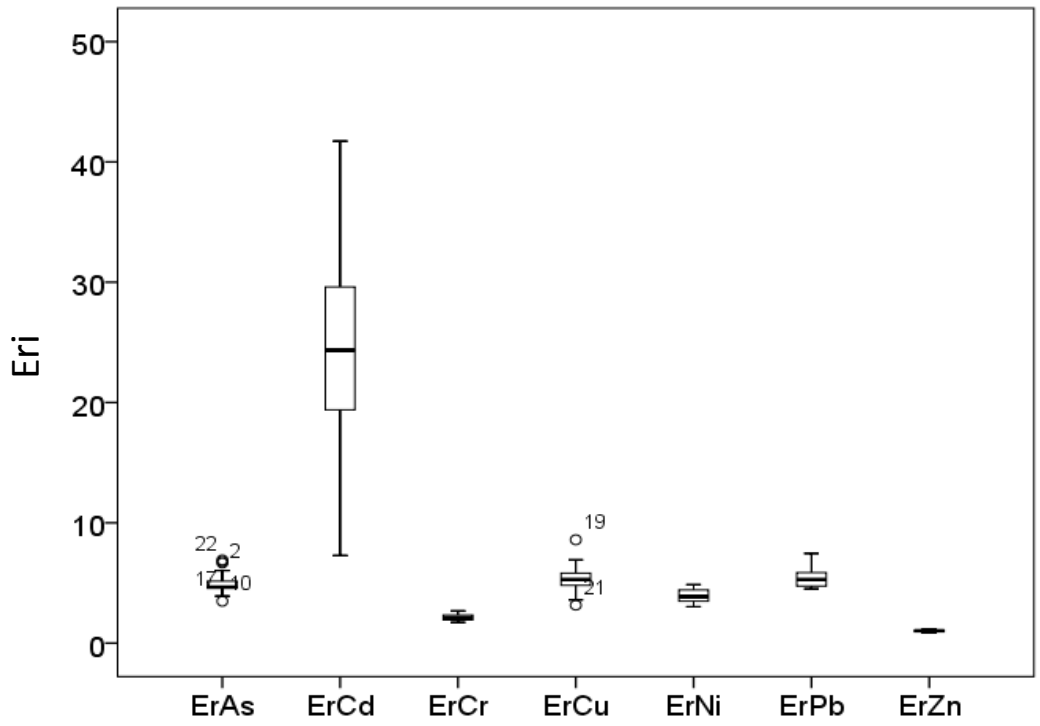

Figure S3 Environmental risk (Er) for toxic elements (As, Cd, Cr, Cu, Ni, Pb, and Zn); Eri is dimensionless-unit (-).

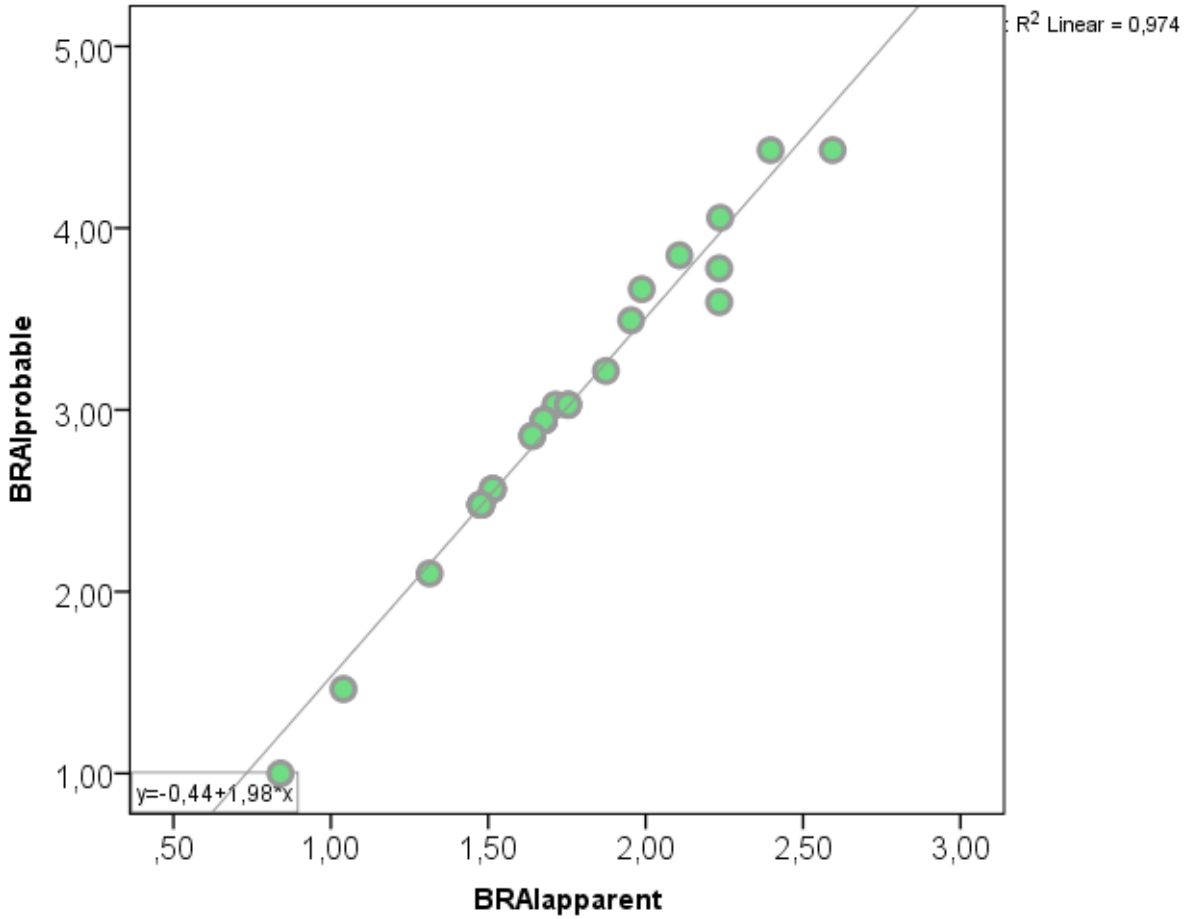

Figure S4 The regression between the $BRAI_{probable}$, and $BRAI_{apparent}$; BRAI is dimensionless-unit (-).

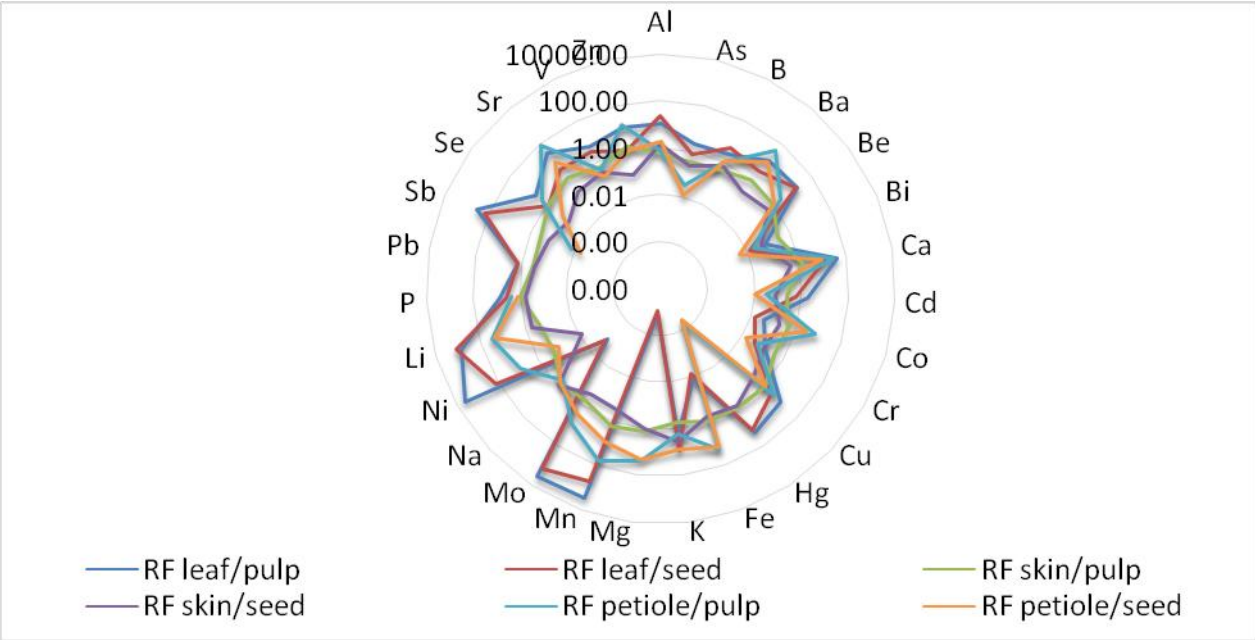

Figure S5 Ration factor (RF) calculated for outer grapevine parts (leaf, skin and petiole); RF is dimensionless-unit (-).

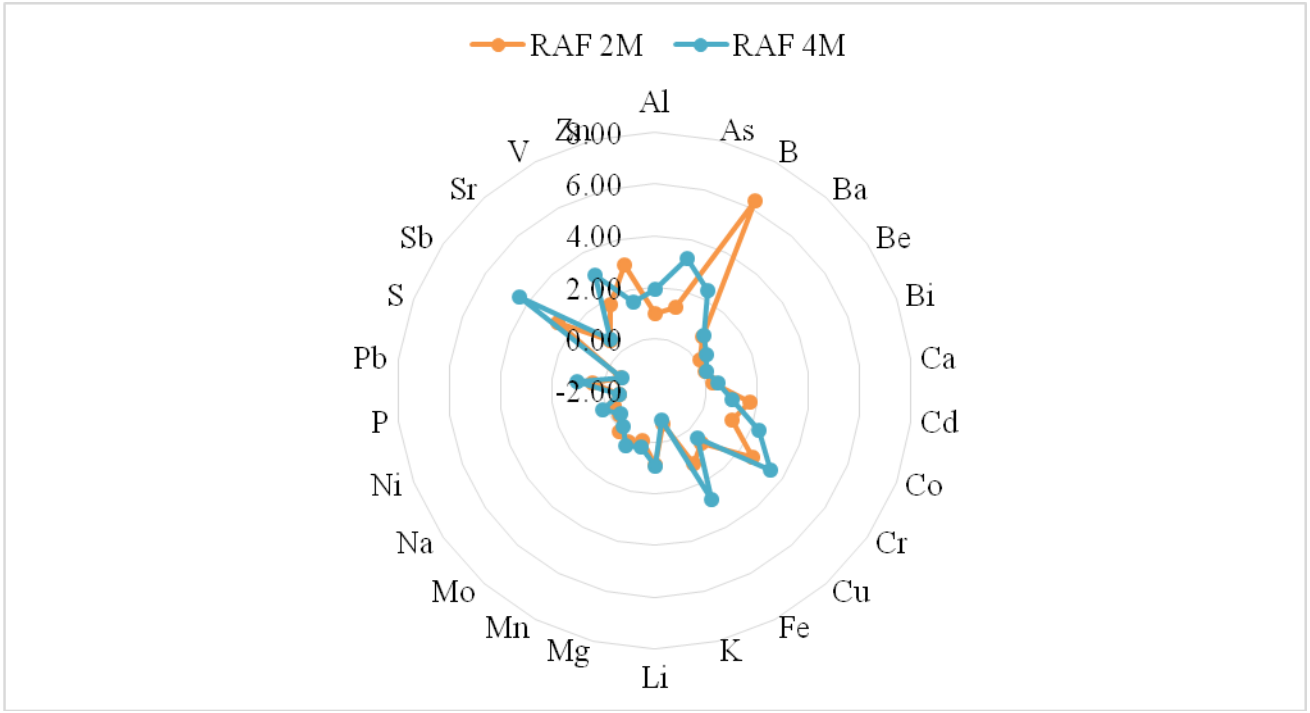

Figure S6 Relative accumulation factor (RAF) calculated for mosses exposed during 2 and 4 months; RAF is dimensionless-unit (-).

Theoretical part

S2.2 Data processing

SOM algorithm constructs neurons in such a way that those similar neurons are associated with closer nodes, whereas less similar neurons are separated (Kohonen, 2013). SOM network consists of input and output layers. Each neuron is represented by n-dimensional weight vectors (m=[m1, …, m_n]), and output map unit consists many components as number of input variables. SOM algorithm calculates Euclidean distances between vector of data and all of weight vectors that arrange data with similar properties close each to other.

SOM inputs were calculated indexes values (6 in total) in soil samples (N= 150 – 155). Input values were normalized to range of 0−1. The following parameters were chosen: a number of neurons in output layer (map) was 36 (6×6), aiming for at least 5−10 samples per node when choosing map size; hexagonal grid and iterations process was optimized until the distance from each node's weights to samples represented by that node reached a minimum plateau (Wehrens and Kruisselbrink, 2017).