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THE EFFECTS OF SOIL DUST IN AIR QUALITY OF ALBANIA STUDIED BY MOSS BIOMONITORING

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Moss survey 2020-2025

2021 Delivery:

Periodic call for data for the 2020-22 moss survey (postponed collection due to Coronavirus)

Monitoring manual

HEAVY METALS, NITROGEN AND POPs IN EUROPEAN MOSSES: 2020 SURVEY

MONITORING MANUAL

International Cooperative Programme on Effects of

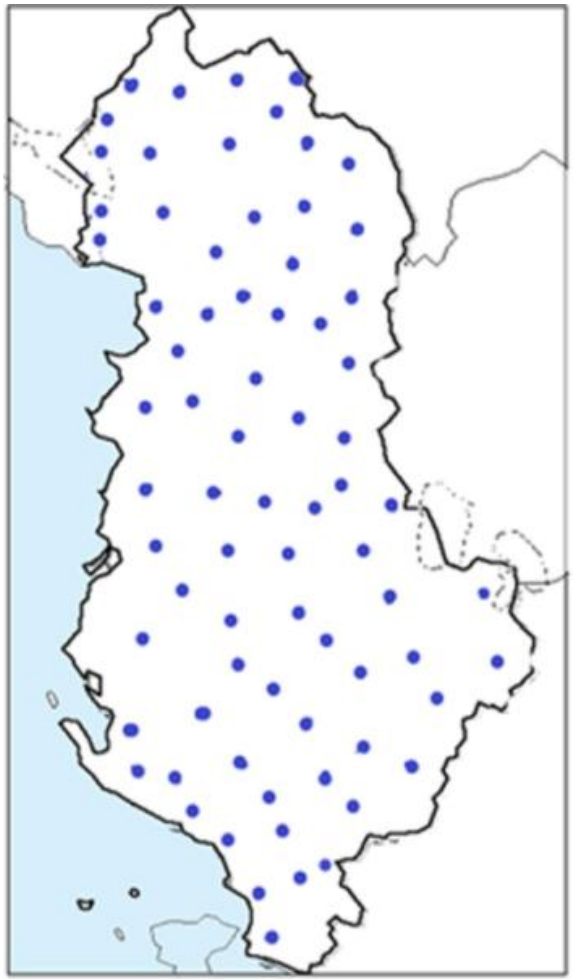
Members

Countries already participating in moss survey 2020-2022				
Albania	Germany	Kazakhstan	Russia	Vietnam
Armenia	Greece	Latvia	Slovakia	Switzerland
Georgia	Italy	North Macedonia	Sweden	UK
Netherlands				

UK Centre for Ecology & Hydrology

ICP VEGETATION

Moss Sampling



- 75 sampling sites
- distributed over the territory of Albania,
- Period: Summer, 2021

(*Hypnum cupressiforme)*

Sample Preparation & Chemical Analysis

- Moss samples (0.3–0.5 g) were digested in PTEF digestion vessels by a Speedwave Xpert, Berghof microwave by applying a four-step program.

- Digested materials of moss samples were quantitatively transferred into 50-ml calibrated flasks and then filled up to the volume with diluted HNO_3 (2%).

- Blank samples were digested in parallel to moss samples by using the same digestion method as moss samples.

- Digested solutions were directly injected for the measurement of trace elements.

Sample Analysis

- **EQUIPMENT**: The inductively coupled plasma-mass spectrometry (ICP-MS) (Agilent, 7800)

- **Nr of analyzed elements:** 11 elements (Al, Ba, Ca, Fe, K, Li, Mg, Mn, Na, Sr, and V)

- **Laboratory:** "TENUIS Laboratories", a private laboratory located in Maminas, Durres, Albania.

TENUIS
LABORATORIES

Quality Control

- Quality control of sampling and analytical methods:

performed by applying a complete control scheme using sampling and analytical duplicates, reference materials, and reagent blanks simultaneously analyzed with moss samples.

Elements	IAEA 336*	IAEA 336**
Al	983	947.5
Ba	8.78	8.41
Ca	4606	4350
Fe	628	664
K	2837	2634
Li	0.47	0.44
Mg	2542	2817
Sr	13.2	14.8
V	3.15	2.93

IAEA 336 Rezults of current reasearch (mg/kg)*

*IAEA 336** Declared Rezults (mg/kg)*

Data Processing and Statistical Analyses

- **Descriptive statistical:**
  - were assessed the level and variability of the data.

- **Correlation and factor analysis (FA):**
  - Investigate the relationships among the elemental content in moss and to determine the potentially influencing environmental factors

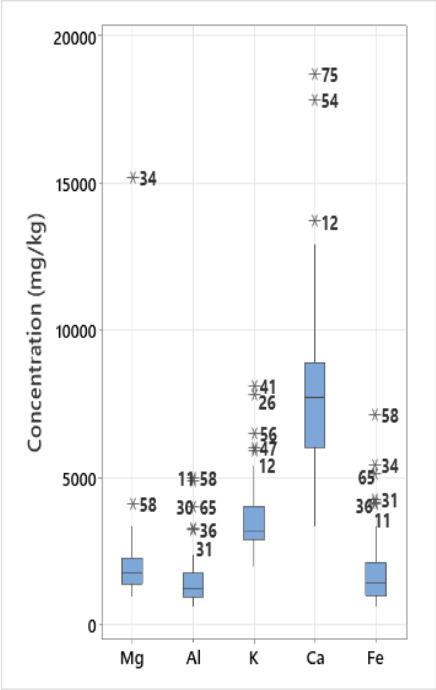
- **Software used**: MINITAB 21 software package.

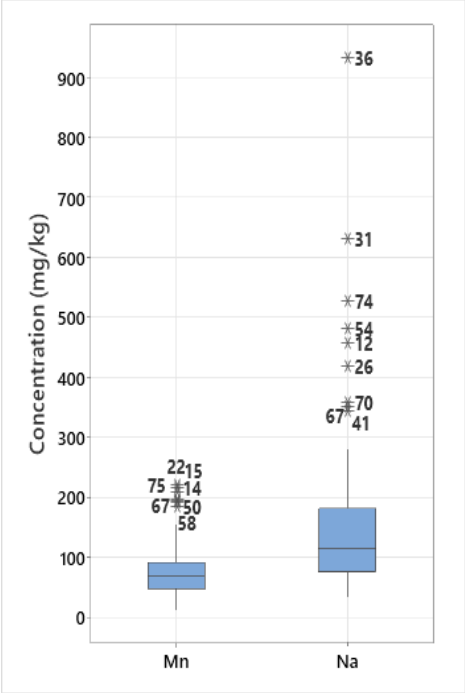
RESULT: Descriptive statistical

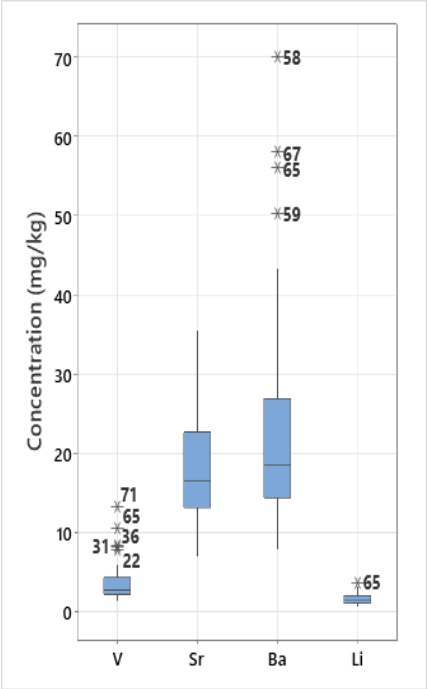
Variable	Mean*	StDev	CV%	Min*	Q1*	Median*	Q3*	Max*	Skewness	Kurtosis
Al	1506	896	60	602	957	1240	1757	4965	2.2	5.2
Ba	21.9	11.6	53	7.82	14.4	18.6	26.9	70.0	1.9	4.8
Ca	7752	2719	35	3327	6020	7712	8894	18704	1.66	4.6
Fe	1796	1181	66	589	996	1444	2125	7130	2.2	6
K	3558	1196	34	2009	2898	3204	4027	8120	1.73	3.7
Li	1.6	0.68	43	0.534	1.1	1.4	2.1	3.70	0.78	0.37
Mg	2047	1648	**81**	958	1386	1775	2275	15174	**6.93**	**55**
Mn	81	48.4	60	12.08	48	68	92	220	1.42	1.4
Na	162	149	**92**	33	76	114	181	934	**2.8**	**9.8**
Sr	18.2	6.23	34	7.022	13.2	16.6	22.7	35.6	0.62	-0.04
V	3.51	2.058	59	1.308	2.26	2.81	4.39	13.2	2.36	7.3

- **CV**:
  - Concentration data of all elements, (except Mg and Na) showed moderate variations
  - CV% varied between 25% - 75% and was affected by a few outlier values
- **Skewness and Kurtosis:**
  - Relatively high values of Skewness and Kurtosis, with the exception of Li, Mn, and Sr.
- **Median**: The distribution order of the median concentrations of the elements in moss samples was **Li < V <Sr< Ba <Mn< Na < Al < Fe < Mg < K < Ca**

Box-plot Diagram







Observation:

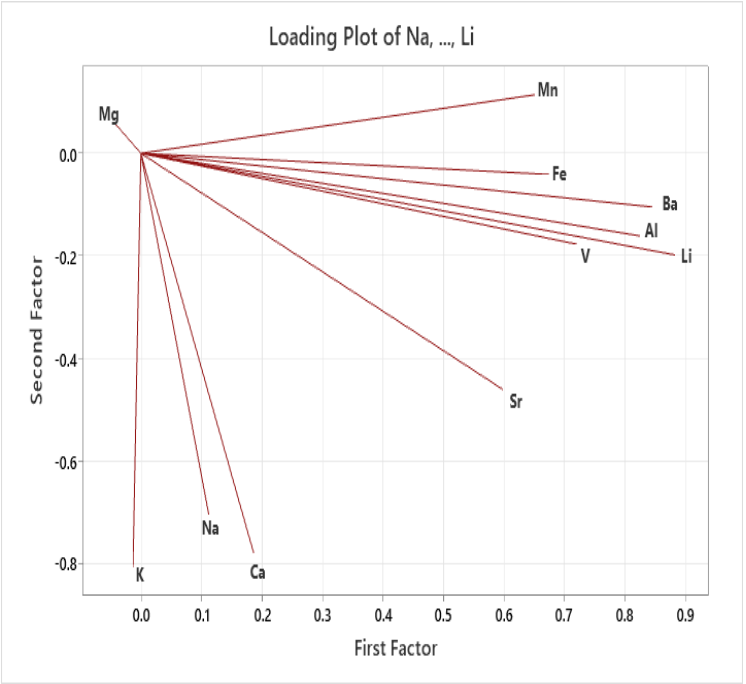
- concentration of elements varies due to certain outlier values.
- it is usually caused by the differences in lithology and grain size of the parent dust emitting source of the elements.

Pairwise Pearson Correlations

Sample 1	Sample 2	N	Correlation	95% CI for ρ	P-Value
Fe	Mg	75	0.545	(0.364, 0.686)	0.000
V	Al	75	0.678	(0.535, 0.784)	0.000
Fe	Al	75	0.785	(0.681, 0.859)	0.000
Sr	Al	75	0.424	(0.219, 0.592)	0.000
Ba	Al	75	0.596	(0.428, 0.724)	0.000
Li	Al	75	0.812	(0.718, 0.877)	0.000
Ca	K	75	0.474	(0.278, 0.632)	0.000
Sr	Ca	75	0.466	(0.269, 0.626)	0.000
Fe	V	75	0.514	(0.326, 0.663)	0.000
Ba	V	75	0.441	(0.240, 0.607)	0.000
Li	V	75	0.640	(0.485, 0.756)	0.000
Ba	Mn	75	0.511	(0.322, 0.660)	0.000
Li	Mn	75	0.456	(0.257, 0.618)	0.000
Ba	Fe	75	0.530	(0.346, 0.675)	0.000
Li	Fe	75	0.652	(0.500, 0.765)	0.000
Ba	Sr	75	0.652	(0.500, 0.765)	0.000
Li	Sr	75	0.522	(0.337, 0.669)	0.000
Li	Ba	75	0.754	(0.637, 0.837)	0.000

FA Analysis

Variable	F1	F2	F3	Communality
Li	0.883	0.000	0.000	0.829
Ba	0.846	0.000	0.000	0.727
Al	0.826	0.000	0.000	0.769
V	0.721	0.000	0.000	0.560
Mn	0.652	0.000	0.000	0.441
Sr	0.599	0.460	0.000	0.586
K	0.000	0.807	0.000	0.659
Ca	0.000	0.778	0.000	0.653
Na	0.000	0.702	0.000	0.551
Mg	0.000	0.000	0.910	0.834
Fe	0.675	0.000	0.691	0.934
Variance	3.984	2.085	1.472	7.541
% Var	0.362	0.190	0.134	0.686



F1: Li, Ba, Al, V, Mn, Sr, and Fe

F2: K, Ca, and Na

F3: Fe and Mg

CONCLUSION

- This study realized in period 2021 has this conlusion:

  - Mosses are highly sensitive to metals in atmospheric deposition and are very good monitoring tools for metal screening in atmospheric deposition.

  - The presence of lithofile and crustal elements is mostly associated with the local and long-term emission of wind-blown soil dust, which is considered one of the main emitting sources of trace metals in atmospheric deposition in Albania.

  - Pearson correlation and FA(Factor Analysis) are good tools to identify the most significant association between the elements and their probable sources of origin that represent the atmospheric deposition of elements associated with mineral dust and industrial local emissions.

THANK YOU FOR YOUR ATTENTION!