Air quality bioindicators

Primary School Banija, Karlovac

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Introduction

Air Quality Index?

- measuring concentration of air pollutants
- EU regulation- 12 air pollutants

Introduction

Foto: postaja Karlovac (©DHMZ)

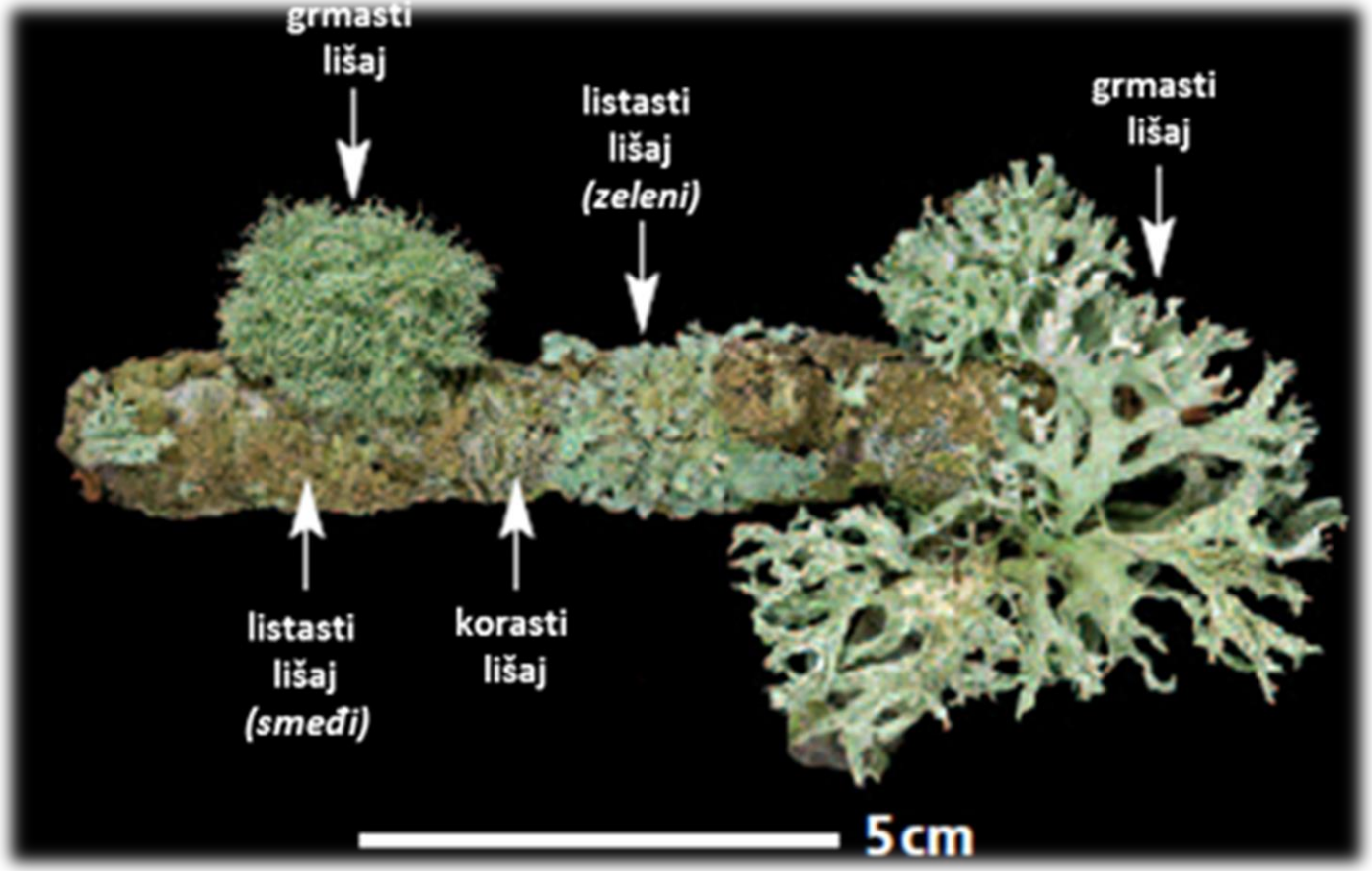
- automatic station of the DHMZ (Croatian Meteorological and Hydrological Service) in the city of Karlovac
- concentration of nitrogen oxides and ozone

Air quality assessment in the city of Karlovac?

The presence of certain types of lichen in an area is confirmation of the exceptional purity of the air.

What are lichens?

- Lichen → a symbiotic partnership between fungi and either algae or cyanobacteria
- There are three main lichen body types: crustose, fruticose, and foliose
- Pioneers of vegetation
- We can often find them on tree bark and rocks.



- Air quality assessment at two city locations in the city of Karlovac:

1. location – Arboretum of the Forestry and Carpentry(Woodworkng) School

2. location - school park next to the school in the Banija district

Research questions and hypothesis

- Which tested location will have the highest biodiversity of lichens?

❑The Forestry and Woodworking School Arboretum will have the highest biodiversity of lichens

- What types of lichens will we find at both locations?

❑The composition of lichen species will be different at the tested locations

- What is the air quality at the tested locations according to the lichen species found?

❑The lichen species found will indicate the air quality of the tested locations

Research methods

- Silverleaf maple (Acer saccharinum L.) found at both surveyed locations
  On every location→ 3 individuals of silverleaf maple

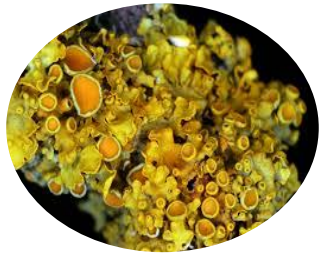
Location School park

Location Arboretum

- Grid consisting of 5 squares of 10x10 cm→lichen coverage
- For each quadrant → determination of lichens

Researcg methods

We divided the found lichen species according to the degree of eutrophication, which includes the deposition of dust and nitrogen compounds in the air and tree bark, into 3 categories:

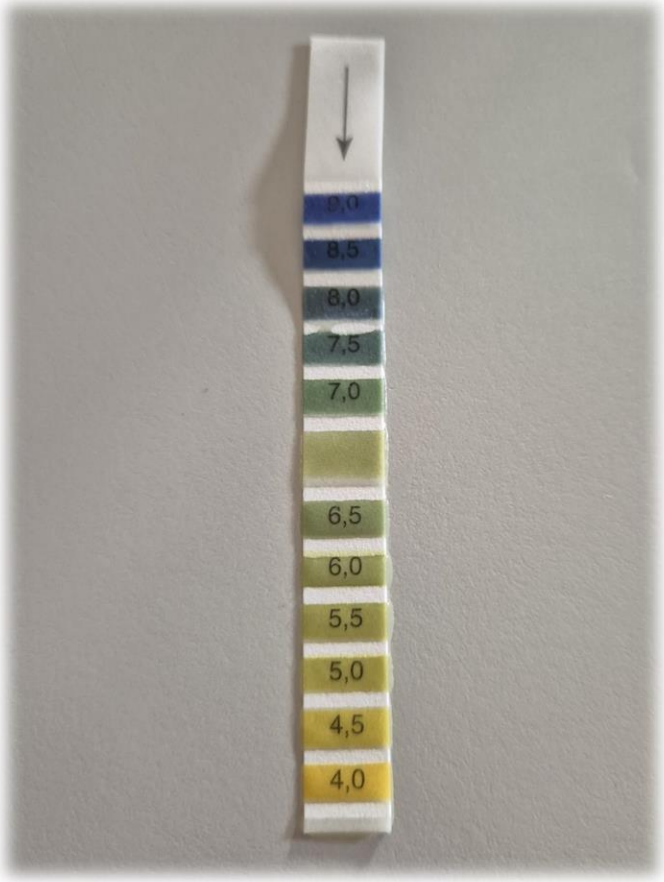


EUTROPHIC→ extremely tolerant to the presence of nitrogen compounds

MESOTROPHIC → medium tolerant to the presence of nitrogen compounds

OLIGOTROPHIC → extremely sensitive to the presence of nitrogen compounds

Research methods



- Bark pH measurement using universal indicator paper

<u>Measured pH values:</u>

School park → 5.5

Arboretum → 6.5

Data display and analysis

Table 1. Found lichen species and their representation per individual tree and cardinal directions at the Arboretum location

	TREE 1				TREE 2				TREE 3			
SPECIES/CARDINAL POINTS	S	J	I	Z	S	J	I	Z	S	J	I	Z
Parmelia sulcata	0	2	5	0	0	5	5	4	5	5	5	1
***Lepraria* sp.**	2	2	1	1	4	3	5	5	3	5	2	3
Physcia tenella	0	2	0	2	0	0	0	0	0	0	0	0
***Melanelixia* sp.**	0	0	0	0	0	0	0	2	4	0	3	0
Physconia grisea	0	0	1	2	0	0	0	0	1	0	0	0
Flavoparmelia caperata	0	0	0	0	0	0	0	0	0	0	1	0
Evernia prunastri	0	0	0	0	0	0	0	0	3	3	0	3

Data display and analysis

- **Table 2. Found lichen species and their representation per individual tree and cardinal directions at the School park location**

	TREE 1				TREE 2				TREE 3			
SPECIES/CARDINAL DIRECTIONS	S	J	I	Z	S	J	I	Z	S	J	I	Z
Parmelia sulcata	0	0	0	0	0	0	0	0	5	5	4	4
Hyperphyscia adglutinata	2	0	0	3	5	5	0	0	5	5	5	5
Physcia tenella	5	0	0	2	5	5	0	0	5	5	2	0
***Melanelixia* sp.**	0	0	0	0	0	0	0	2	4	0	1	3
Physconia grisea	0	0	0	2	0	0	0	0	1	0	0	0
Flavoparmelia caperata	0	0	0	0	0	0	0	0	0	0	2	0
Candelaria concolor	0	0	0	0	0	0	0	0	2	3	0	3
Punctelia subrudecta	0	0	0	0	0	0	0	0	0	2	2	2
Lecidella elaeochroma	0	0	0	0	0	0	0	0	0	0	1	1
***Lecanora* sp.**	0	0	0	0	0	0	0	0	0	0	1	1
Xanthoria parietina	1	0	0	1	0	0	0	0	1	0	1	1

Data display and analysis

Table 3. Distribution of found lichen species depending on the degree of eutrophication at the Arboretum location

OLIGOTROPHIC	MESOTROPHIC	EUTROPHIC
Evernia prunastri	*Parmelia sulcata*	*Physconia grisea*
	Melanelixia sp.	*Physcia tenella*
	Flavoparmelia caperata	

Data display and analysis

Table 4. Distribution of found lichen species depending on the degree of eutrophication at the School park location

OLIGOTROPHIC	MESOTROPHIC	EUTROPHICA
	Parmelia sulcata	*Xanthoria parietina*
	Melanelixia sp.	*Candelariella* sp.
	Flavoparmelia caperata	*Physcia tenella*
		Punctelia subrudecta
		Lecidella elaeochroma
		Hyperphyscia adglutinata

Discussion and conclusions

- Presence of lichens on all trees at both locations
- Higher biodiversity of lichens in the Arboretum of the Forestry and Woodworking School

Location Arboretum

Location School park

Examples of lichen species found depending on eutrophication

Oligotrophic lichen

Evernia prunastri

Location Arboretum

Mesotrphic lichen

Melanelixia sp.

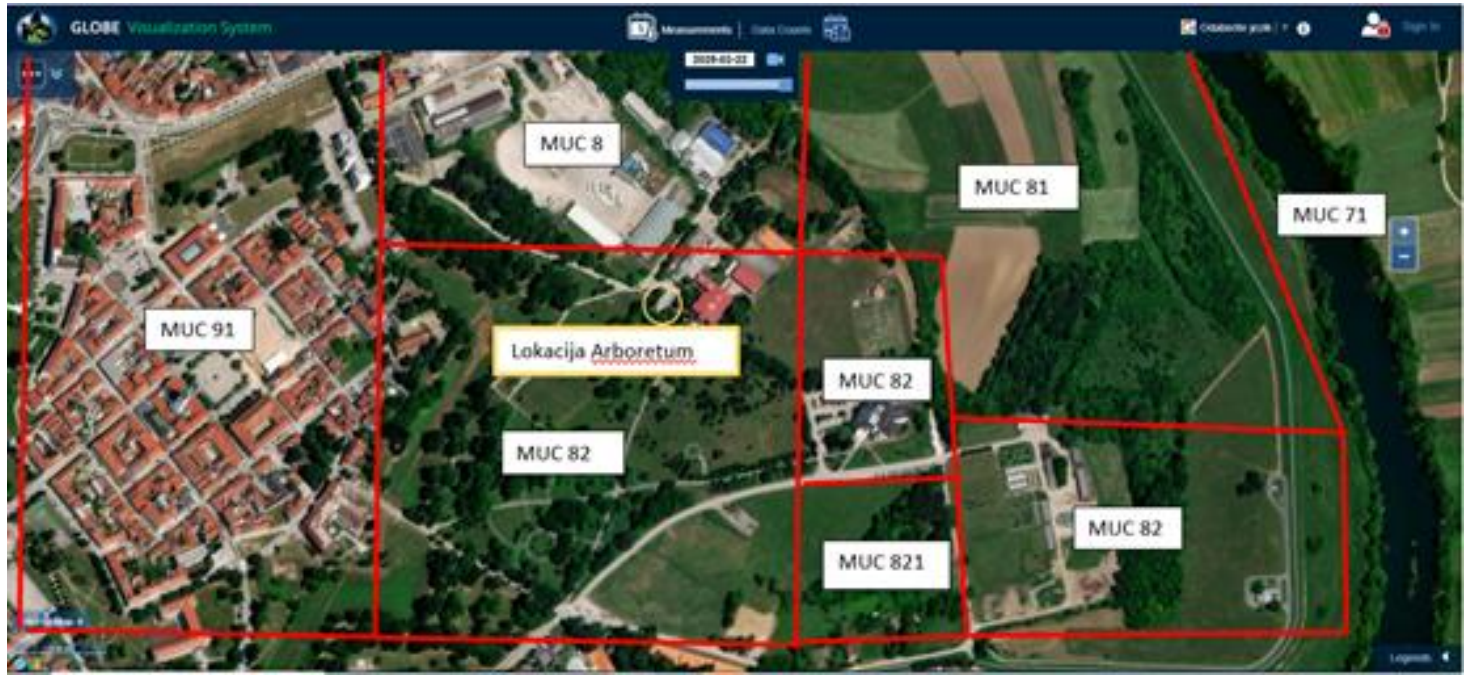
On both locations

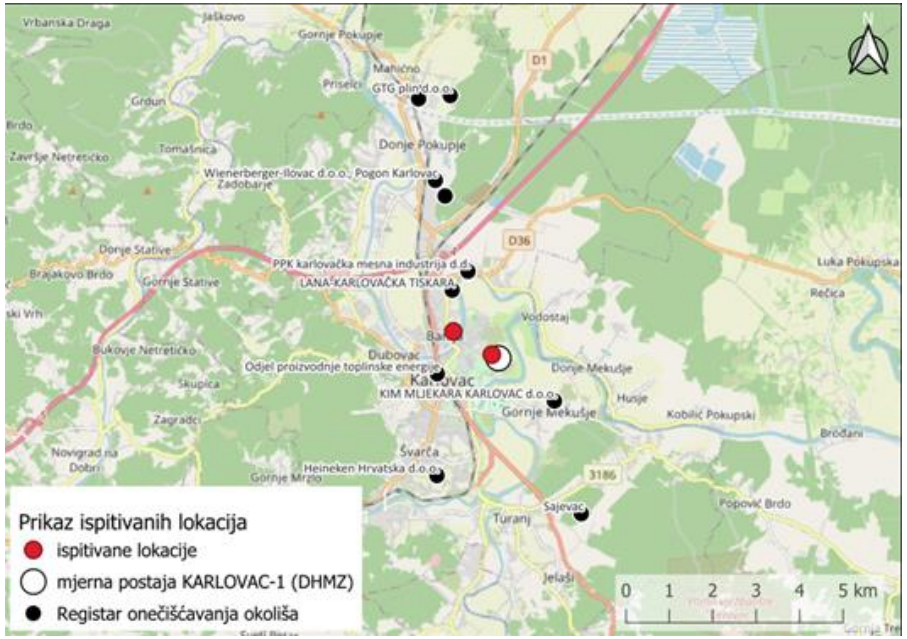
Eutrophic lichen

Physcia tenella

On both locations

Location Arboretum

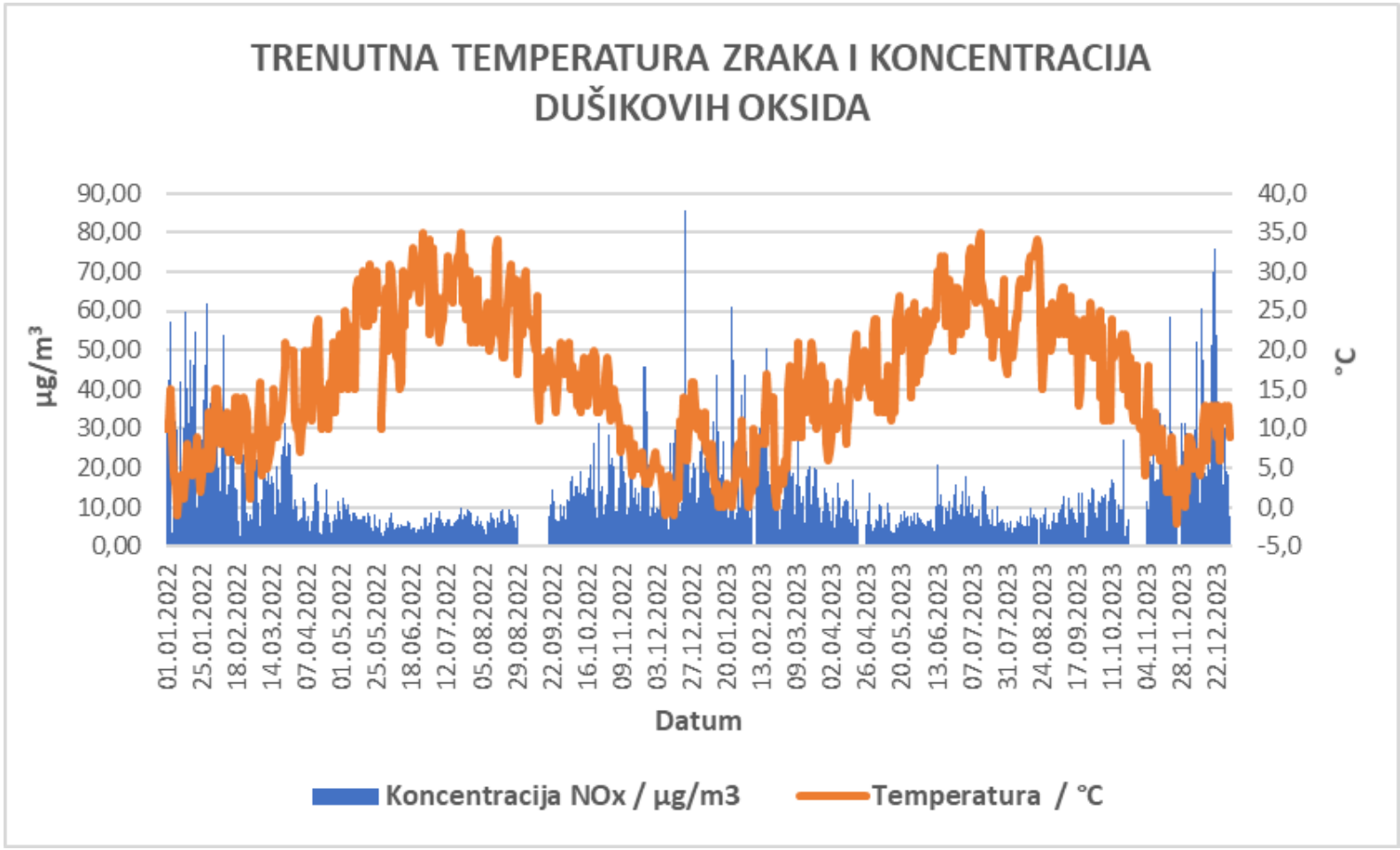




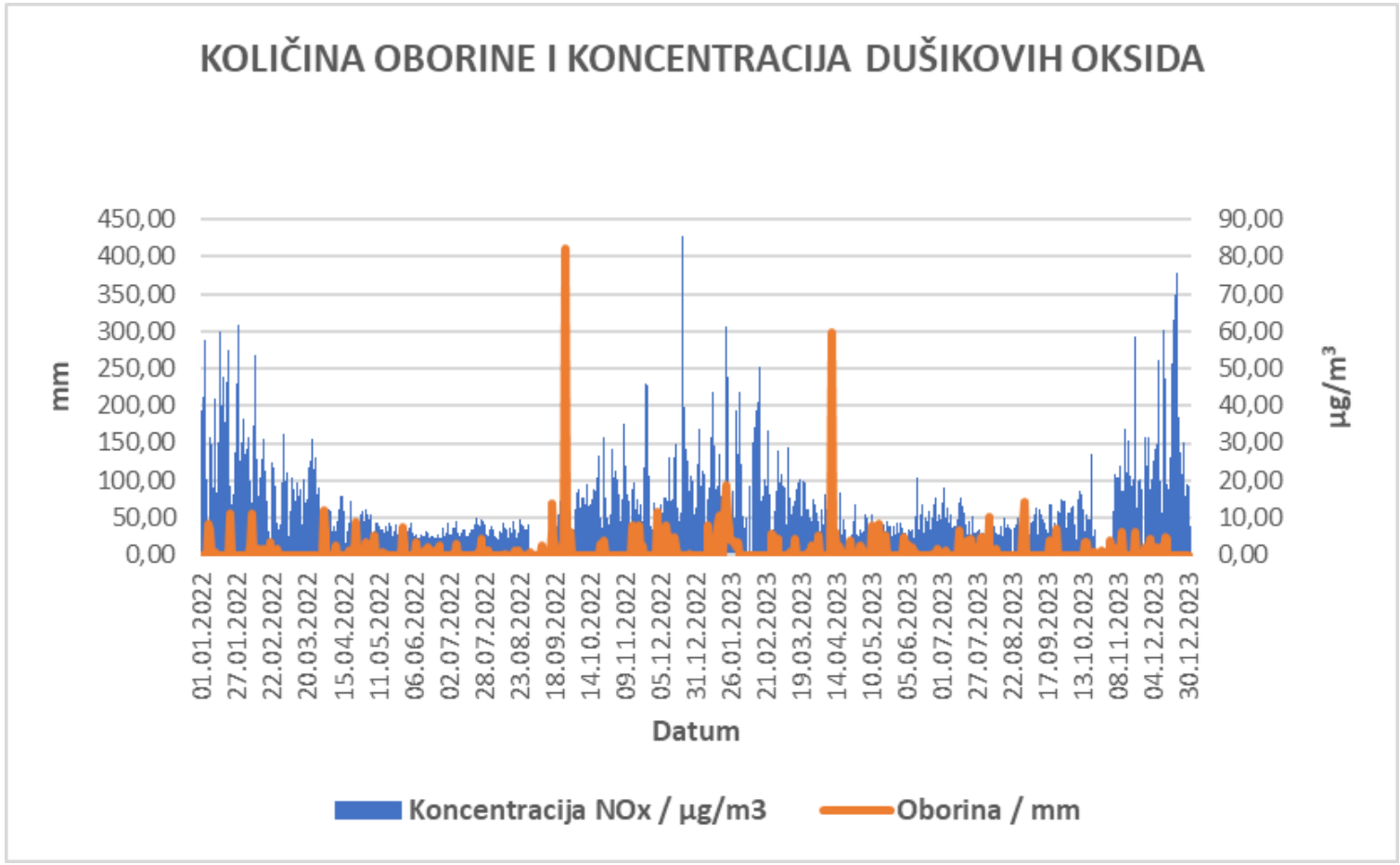
- Less populated area
- No commercial, industrial or road areas nearby

- One pollutant nearby

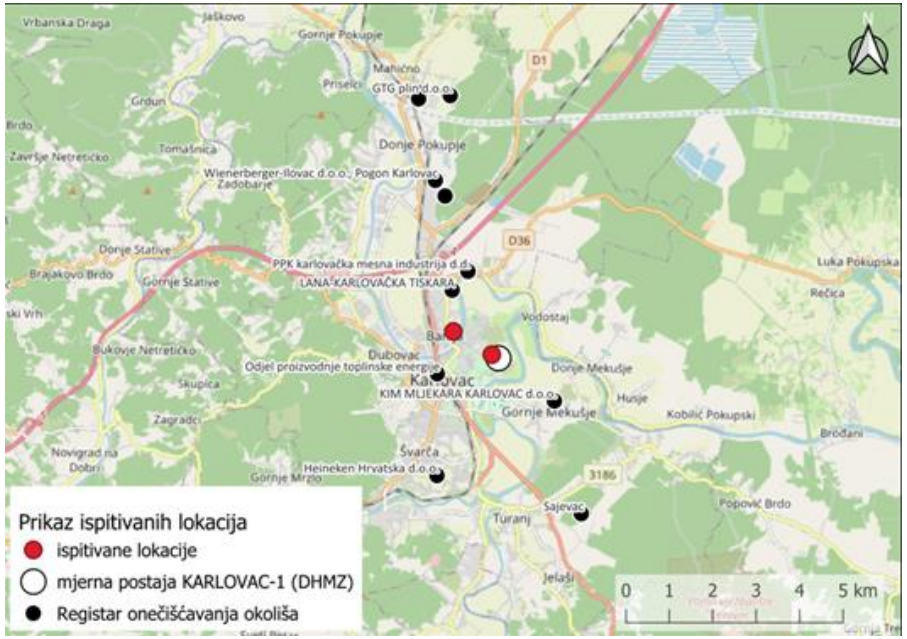
Comparison of the current air temperature measured at the atmospheric GLOBE station of the Banija Elementary School and daily validated data for the average concentration of nitrogen oxides NOx expressed as NO2 measured at the Karlovac-1 DHMZ station in the period from 1.1.2022 to 1.1.2024.



Comparison of the amount of precipitation measured at the atmospheric GLOBE station of the Banija Elementary School and daily validated data for the average concentration of nitrogen oxides NOx expressed as NO2 measured at the Karlovac-1 DHMZ station in the period from 1.1.2022 to 1.1.2024.



Location School park



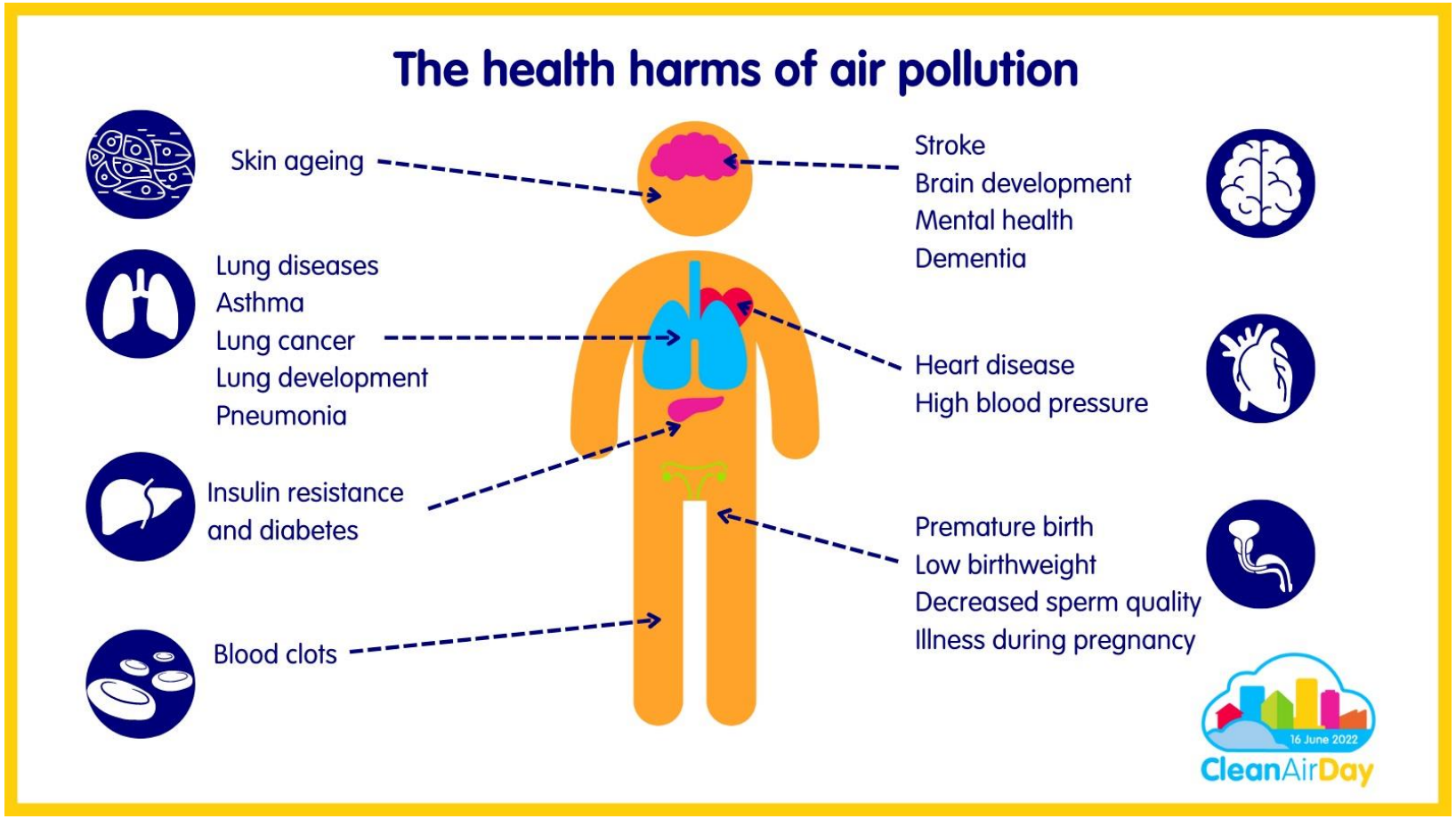
- immediate proximity to a road with high traffic densityhouseholds and commercial industrial area

- Two pollutants nearby

Discussion and conclusions

- The composition of lichen species is different in the investigated locations √
- The species of lichens found indicate the air quality of the investigated locations √
- The air quality in the Arboretum area is better than the air quality in the Banija district where the School Park is located √

Discussion and conclusions



Discussion and conclusions

One automatic station

Foto: postaja Karlovac (©DHMZ)

Discussion and conclusions

✗

- Small number of locations surveyed
- Small number of trees surveyed

√

- Continuation of research at multiple locations

Literature

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Thank You!