Prirodoslovna i grafička škola Rijeka

Marišćina - Waste or Garbage Management Center?

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The Marišćina County Waste Management Center is largest waste disposal for the city of Rijeka and its surroundings.
Due to the frequent complaints of the surrounding population on reduced environmental quality in 2018./2019. we investigated:

-air quality with regard to hydrogen sulphide and particulate matter,
-monitored pollutant concentrations in cooperation with the NZZJZ PGŽ
-monitored meteorological parameters, exceeded limit values of pollutants and wind direction in cooperation with Meteorological Station Kozala reported in ”What do inhabitants inhale?”

During 2019, the Ministry of Environmental Protection banned the work of Marišćina until the completion of the sanation works which would reduce environmental impacts

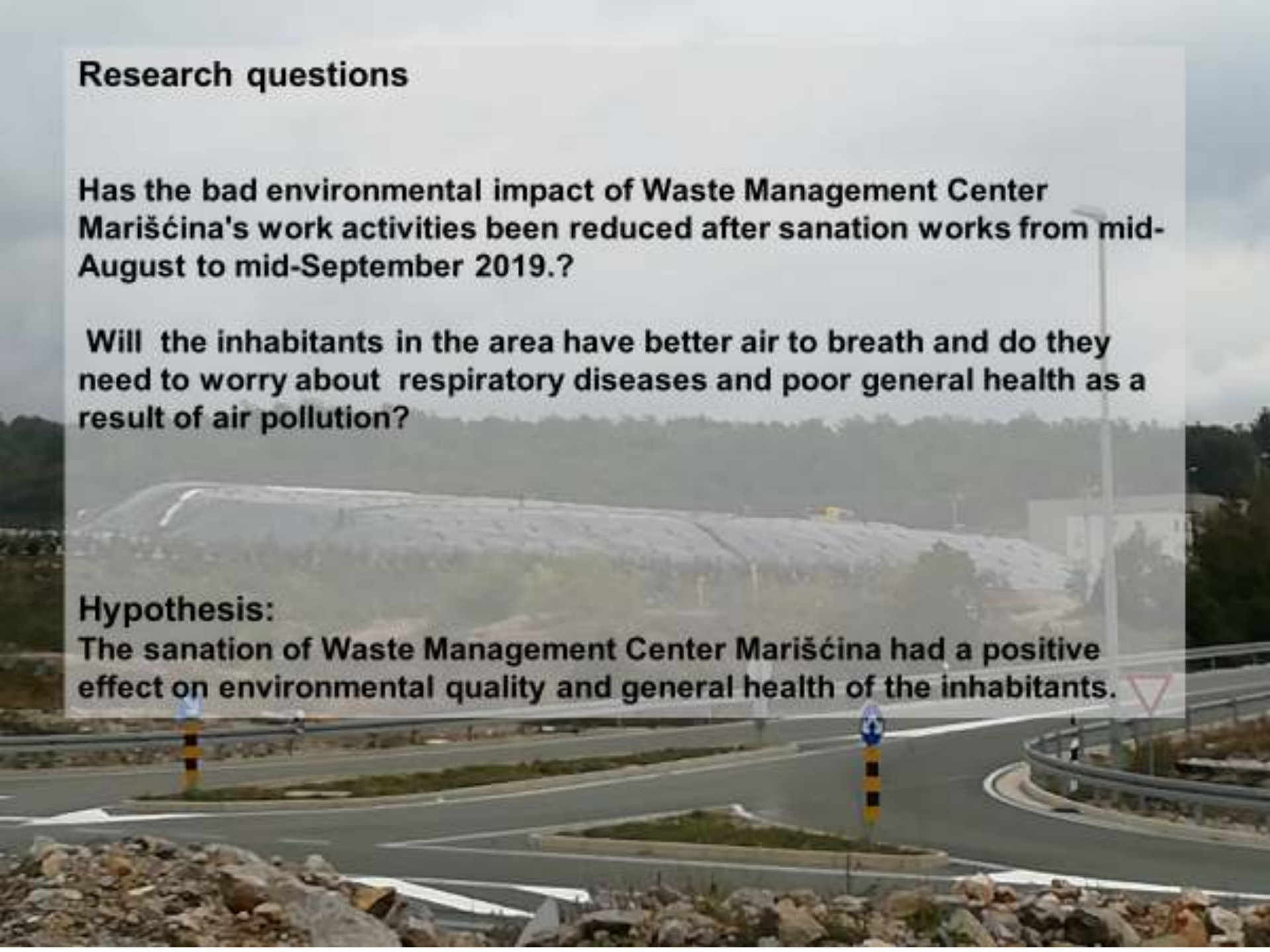
Research questions

Has the bad environmental impact of Waste Management Center Marišćina's work activities been reduced after sanation works from mid-August to mid-September 2019.?

Will the inhabitants in the area have better air to breath and do they need to worry about respiratory diseases and poor general health as a result of air pollution?

Hypothesis:

The sanation of Waste Management Center Marišćina had a positive effect on environmental quality and general health of the inhabitants.



Research Methods and Materials

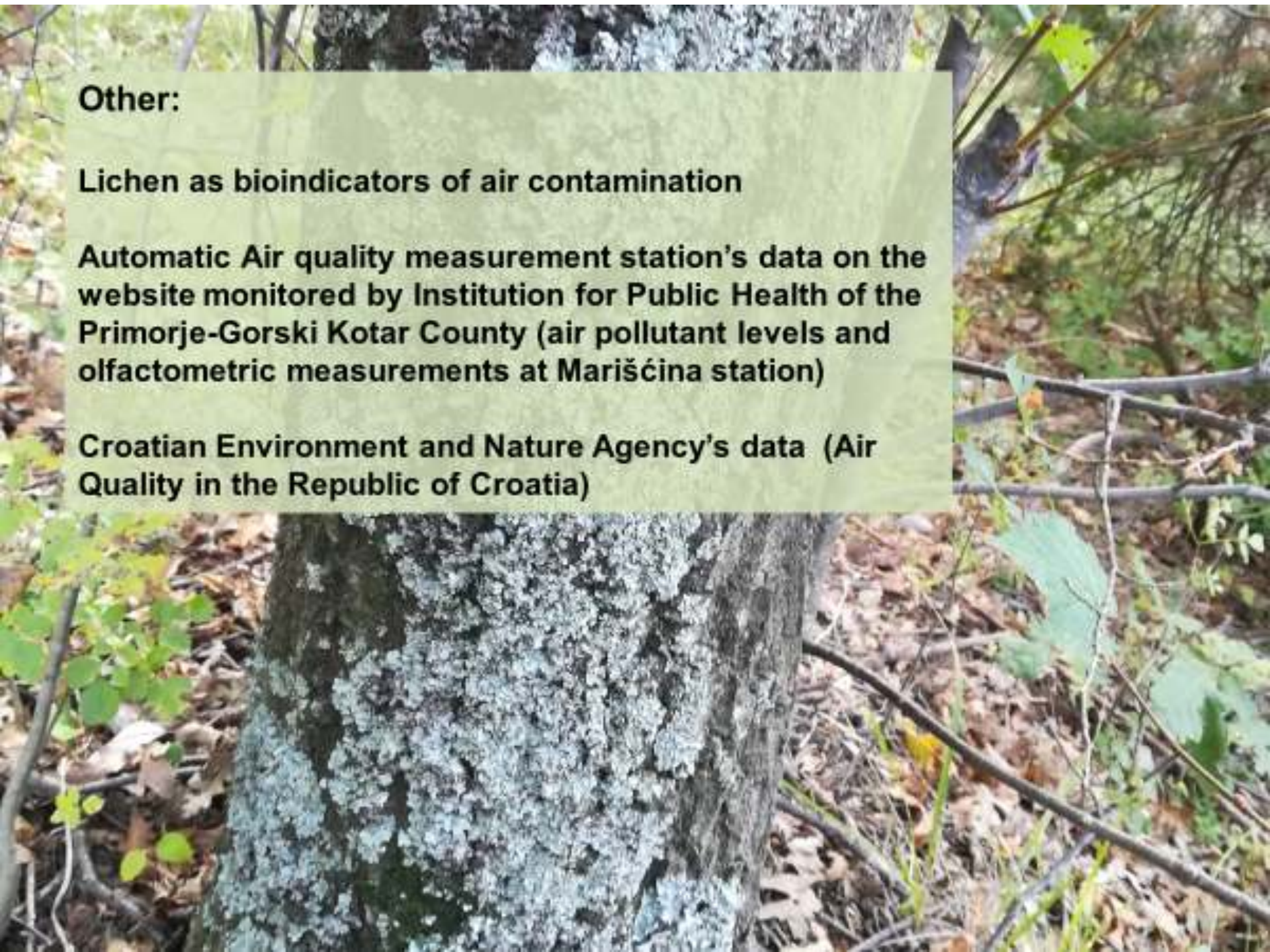
GLOBE protocols:

Atmosphere:

Air temperature (Daily Average Temperature-Digital Thermometer),
Precipitation (Rain Gauge)
Humidity(Digital Hygrometer)
Air pressure (Digital Barometer)
Air pressure (Digital Barometer)
Aerosols (Photometer)

Biometry

Tree height and circumference(50 m measuring tape, clinometer,GLOBE observer app)



Other:

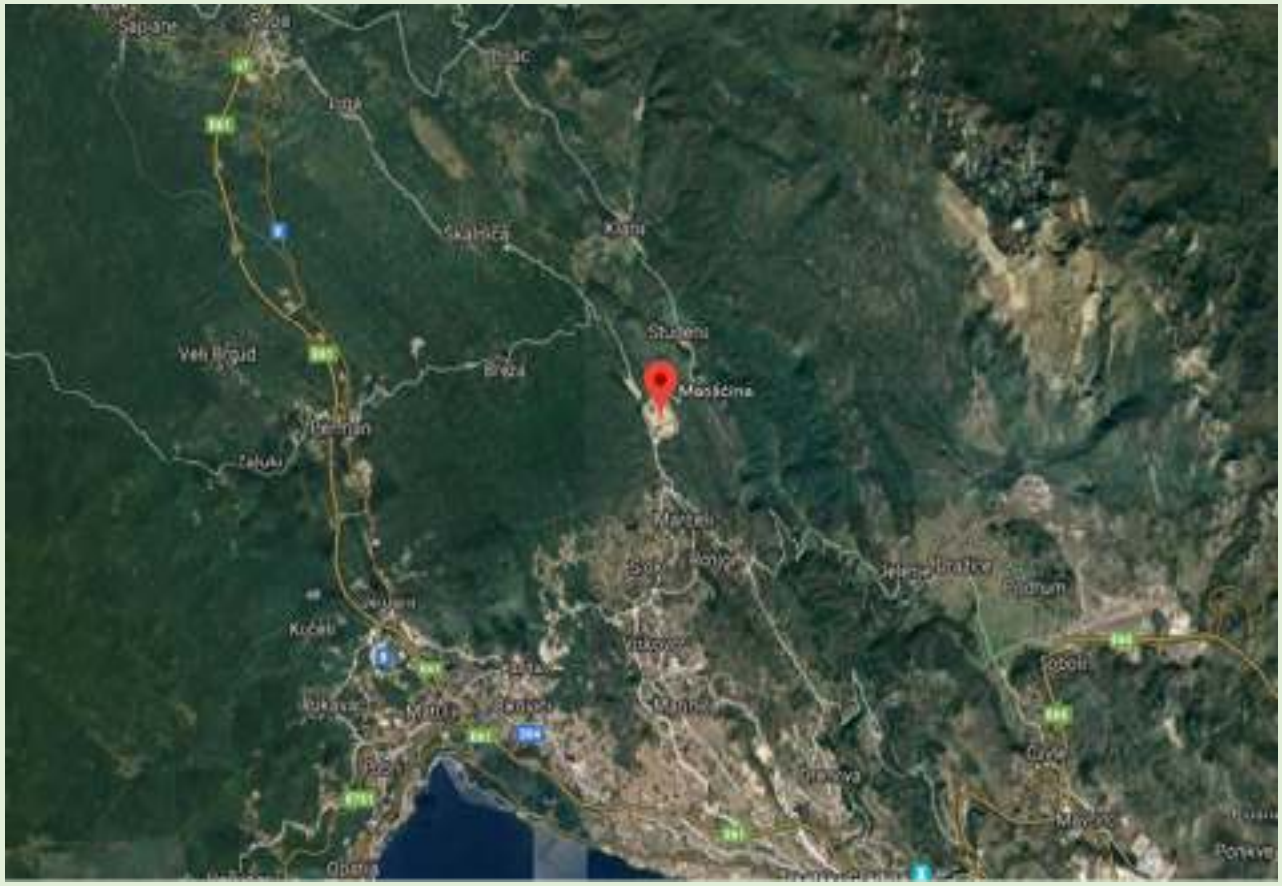
Lichen as bioindicators of air contamination

Automatic Air quality measurement station's data on the website monitored by Institution for Public Health of the Primorje-Gorski Kotar County (air pollutant levels and olfactometric measurements at Marišćina station)

Croatian Environment and Nature Agency's data (Air Quality in the Republic of Croatia)

Location: Marišćina

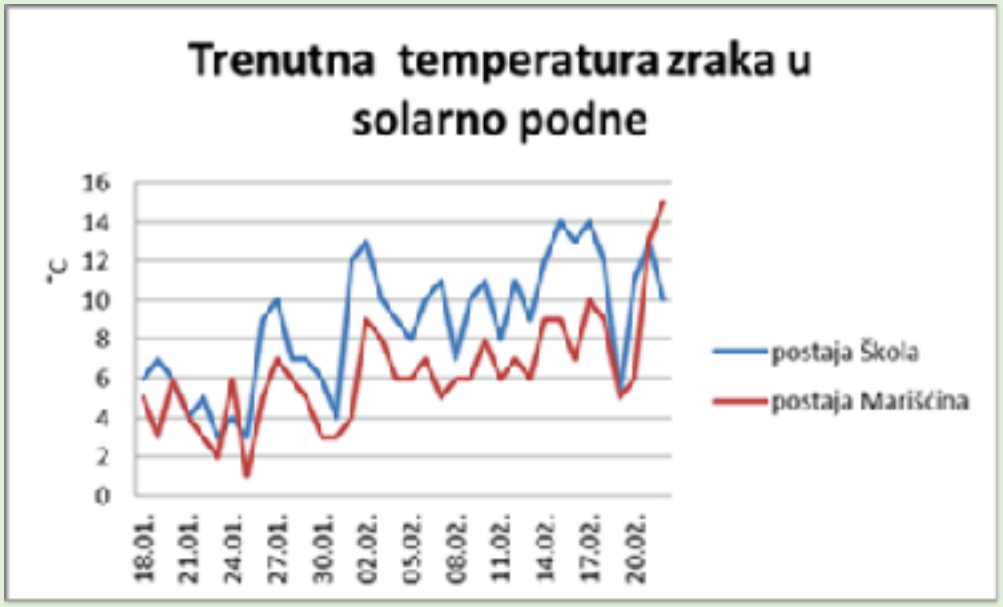
Coordinates N45°24'08" E14°23'18" elevation 447 m



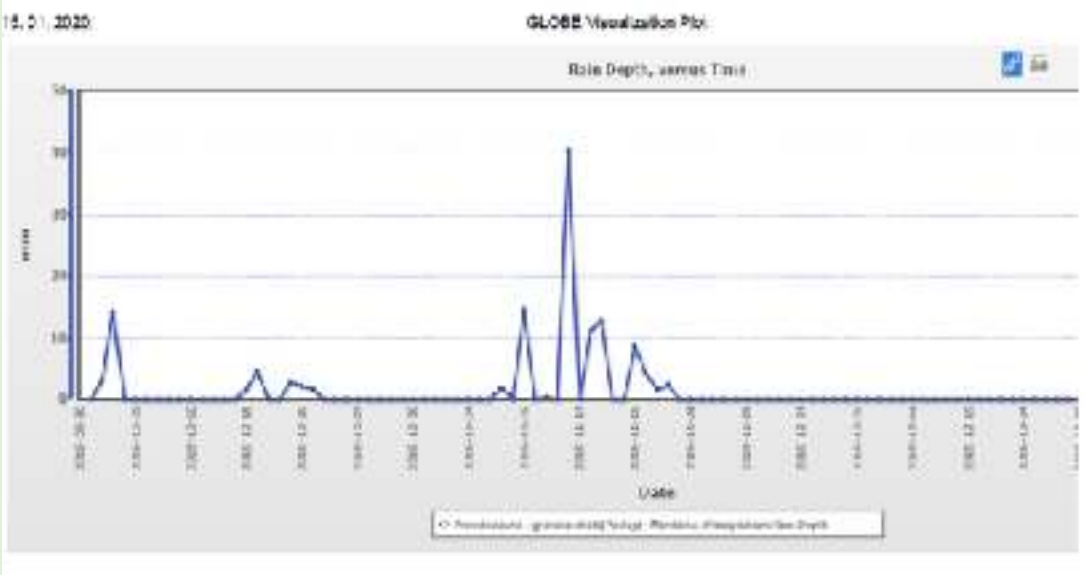
Results
GLOBE Data
Temperature

Tempeature measured from 30.09.2019. to 29.12.2019. on Marišćina site

Temperature measured from 18.01.2019. to 20.02.2019.
on Marišćina site and Prirodoslovna i grafička škola site

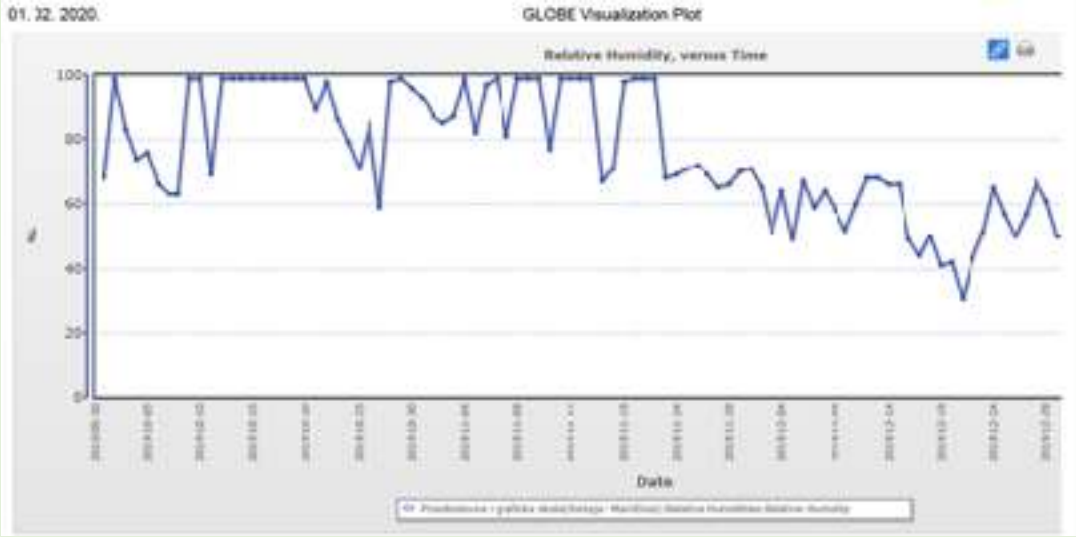


Rain Depth



Rain depth measured from 30.09.2019.to 29.12.2019.
Higher rain rates,higher aerosol abundance
School's photometer can measure only with less than 45% cloud coverage

Humidity



Relative Humidity measured from 30.09.2019.to 29.12.2019.
Indoor air quality depends on temperature and humidity

No data could be find for outdoor dependence

Aerosol Optical Thickness

2020.
Aerosol Optical ThicknessThickness on Marišćina site measured from 17.01.2020. to 27.01.2020.
Lower Optical Thickness in 2020. could be the result of sanation works on the Plant.

2019.
Aerosol Optical Thickness on Marišćina site measured from 18.01.2019. to 22.02.2019.
Aerosol Optical Thickness on Marišćina site is significantly higher.

Determination of air quality by lichen

Type of tree: Quercus pubescens (oak), north side of the trunk

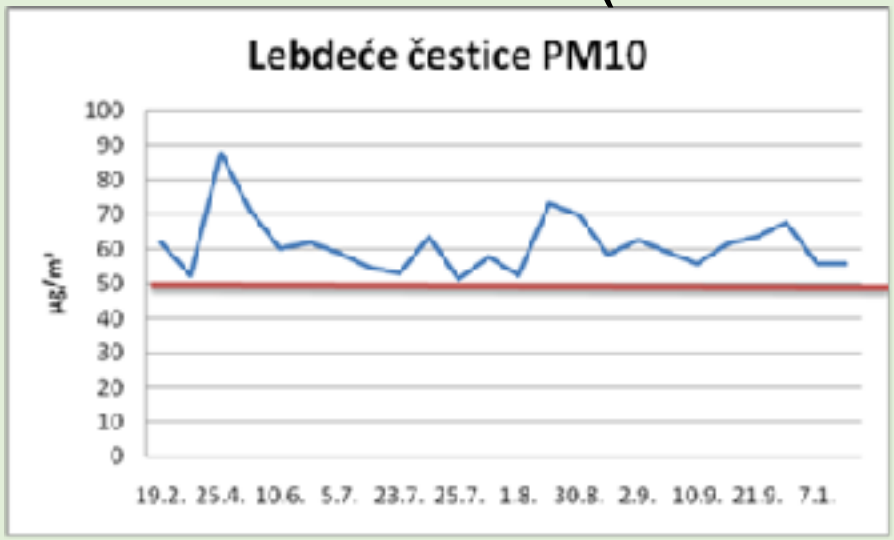
Biometry

TREE NUMBER	COORDINATES N	E	HEIGHT	CIRCUFERENCE
1.	45° 20´9,5″	14°25′32.3″	25 m	165 cm
2.	45° 24´42″	14°23′26,5″	22,4 m	127 cm
3.	45° 24´49″	14°23′30,9″	37 m	66 cm
4.	45° 24´41,5″	14°23′12,7″	18 m	46 cm
5.	45° 24´39,1″	14°23,5′9″	8,6 m	79 cm
6.	45° 24´41,2″	14°23′5,7″	15,6 m	67 cm

STEMS FREQUENCY			COVERAGE			Atmosphere Purity Index
						IAP
a_1	a_2	a_3	c_1	c_2	c_3	
1	3	1	1	2	1	9
0	0	0	0	0	0	0
3	2	0	3	1	0	9
0	1	0	0	1	0	2
0	1	1	0	1	1	4
1	0	1	1	0	1	4
	CLASS: 2/3 Contaminated / moderately polluted air		AVERAGE IAP: 4,6		Σ IAP	28

According to lichen coverage and stems frequency we deter mined that air quality on the site is between contaminated an d moderately polluted class 2/3.

Particulate matter P10 (data from NZZJZ PGŽ pages)

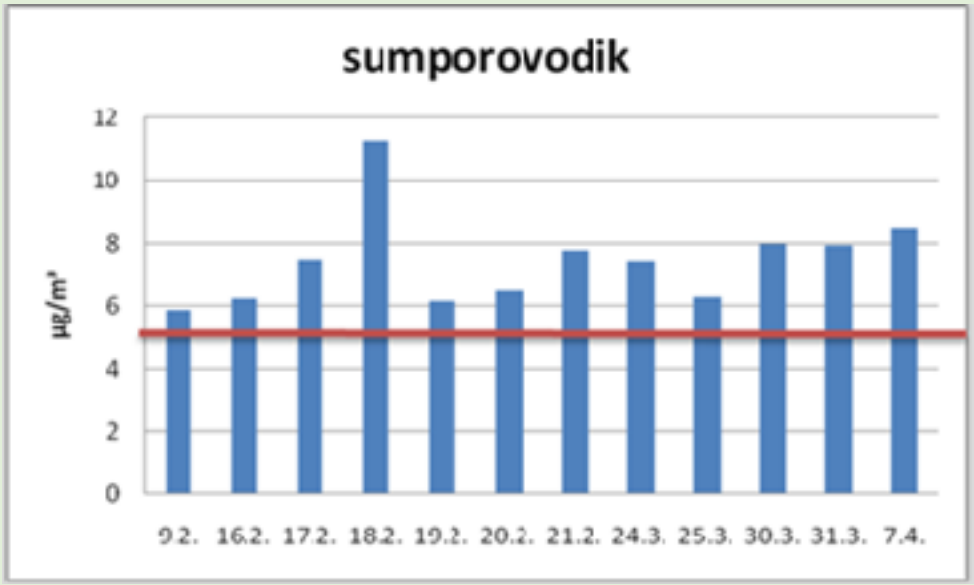


Exceeded limit values (GV = 50µ / m3) for particulate matter during 2019./2020.

Based on source data for particulate matter (source: Croatian Environmental and Nature Agency)
25 daily exceedings in 2019
According to the Regulation on the amount of pollutants permissible number of annual exceedances for particulate matter is 35.
The air in Marišćina area is of the 1st quality from 19.02.2019. to 07.01. 2020. concerning PM10 particles.

Our photomether data shows decreased aerosol optical thickness in 2020.and our measurement data is in accordance with NZZJZ PGŽ data.

Hydrogen sulphide (data from NZZJZ PGŽ pages)



Limit values (GV = 5*µ* / m3) for hydrogen sulfide (daily source data) exceeding in 2019

From 07.04.2019. until 27.01.2020. - no exceeded daily values for hydrogen sulfide at the Marišćina station.

Exceeding in the period up to 7.4.2019. for 59 times (original data for hourly limit values)
According to Regulative: permitted daily excess is 7.
Concentration of hydrogen sulphide was higher 12 times daily

The air quality concerning hydrogen sulphide from 07. 04.2019. to 27.01.2020. is of the 2nd category-polluted.

Olfactory data

The presented data is for part of January 2020.

Mjerna točka : Ulaz ŽCGO

DATUM	VRIJEME	INTENZITET MIRISA	ODOR UNIT
23.01.2020.	20:00	slab	7,5
22.01.2020.	18:00	slab	4,9
21.01.2020.	21:00	srednje jak	44
21.01.2020.	08:00	slab	3,5
20.01.2020.	08:00	nema mirisa	0
17.01.2020.	08:00	izuzetno slab	3,5
16.01.2020.	21:00	slab	7,5
16.01.2020.	08:00	slab	4,9
15.01.2020.	18:00	nema mirisa	0
14.01.2020.	21:00	jak	29

NM = nemjerljivo (< 2 OU)

The NZZJZ PGŽ conducts olfactometric measurements (monitoring of the occurrence of unpleasant odors in the environment of the Marišćina MSc by dynamic olfactometer)

Unpleasant odors of hydrogen sulfide, as well as odor dispersion at the site of Marišćina were observed. (Source: NZZJZ PGŽ)

Positive trend:
After the Plant sanation, August / September 2019. daily pollution with hydrogen suflde is significantly reduced: only three original daily excesses: December 27.; January 22nd and 26th).

Negative trend

The total number of original overruns during the year of 2019 is 290.
Only 24 are allowed.

The reason for the decrease in the concentration of hydrogen sulphide is its combustion, where sulfur dioxide is produced:

$$2H_2S+3O_2 \longrightarrow 2SO_2+2H_2O$$

NZZJZ PGŽ Rijeka:No data for sulfur dioxide concentrations

Discussion

According to our local standards, there are two air categories in Croatia:
First Category 1-clean air
Second Category 2-polluted air

NZZJZ PGZ reports:
2015 and 2016. for all pollutants in Marišćina, the air is Category 1
From 2016. air quality is decreasing and for PM10 and Hydrosulfur is Category 2

Epidemiological field surveys:to determine the incidence of odors at three positions, additional surveys were conducted in the evening and night hours at three existing and two additional positions.
An odor that could occasionally be felt has a distinctive sour-sweet odor characteristic of municipal waste landfills consists of a complex mixture of organic and inorganic compounds, products created by aerobic and anaerobic biodegradation of waste, which at the level of several molecules can cause a repulsive odor.
No limit values are prescribed, although they cause a highly repulsive odor. Odor pollution can and is impairing the quality of life in and around the area of our Marišćina site.

We cooperate with a local board, MO Marčelji, the inhabitants living near the site and citizien's committee founded to fight for clean air and environment (Association for Eco Crisis Marišćina)

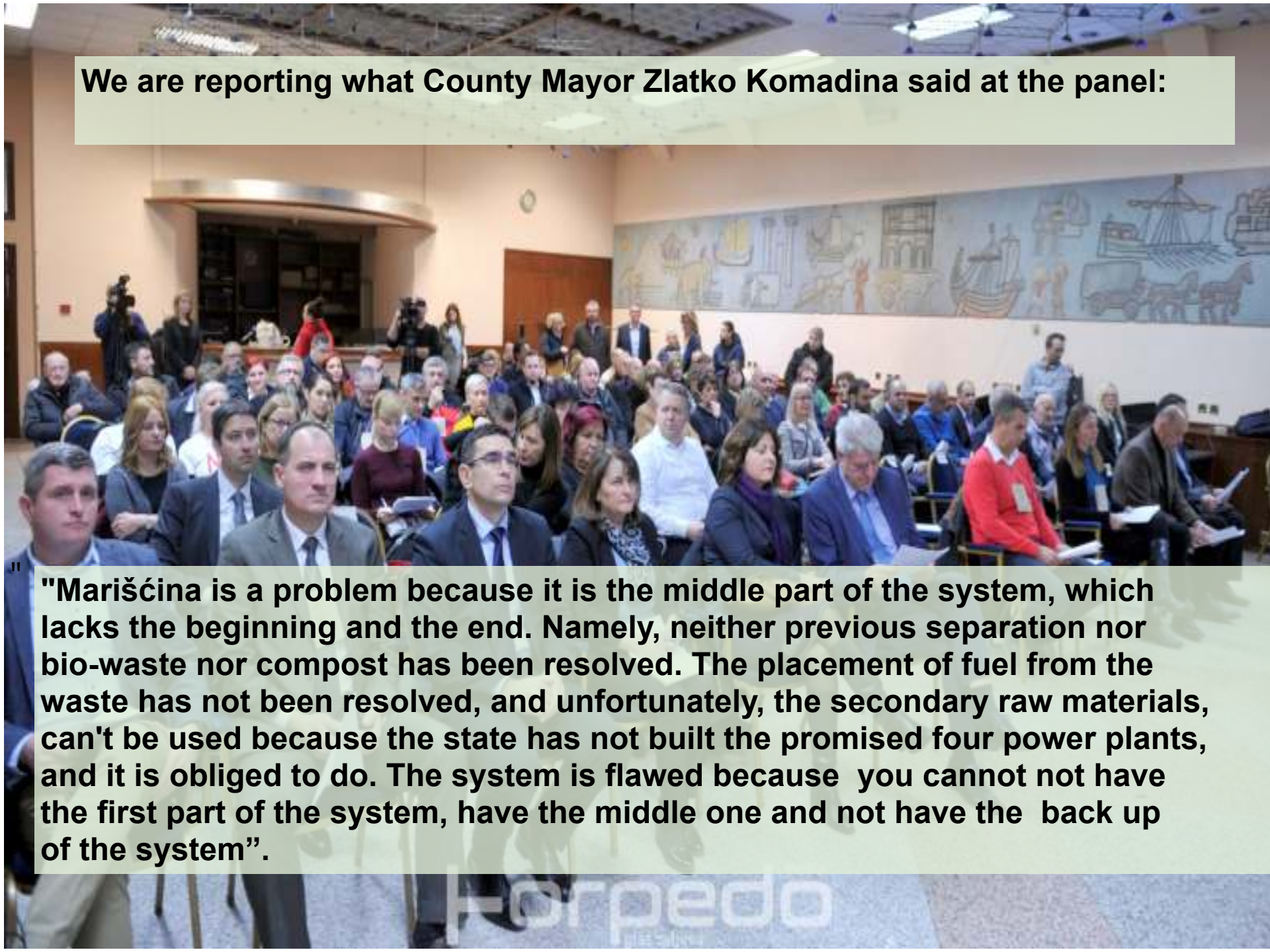
Last year we conducted a survey among residents living nearby Marišćina about what is the quality of life in their town. All responded that the smells are terrible and the air is of low quality. They fear lung problems and other health problems for them and their children.

International Agency for Research on Cancer (IARC) determined that outdoor air pollution and particulate matter in outdoor air pollution (mixture) is carcinogenic to humans. In 2013, a study involving 312,944 people in nine European countries revealed that there was no safe level of particulates and that for every increase of 10 µg/m3 in PM10, the lung cancer rate rose 22%.

The smaller PM2.5 were particularly deadly, with a 36% increase in lung cancer per 10 µg/m3 as it can penetrate deeper into the lungs. Worldwide exposure to PM2.5 contributed to 4.1 million deaths from heart disease and stroke, lung cancer, chronic lung disease, and respiratory infections in 2016. Overall, ambient particulate matter ranks as the sixth leading risk factor for premature death globally.

We also participated in the panel "Ecological management of biodegradable waste - Bio Logic 2020" organized by the Association for Eco Crisis Marišćina in cooperation with the County of Primorje-Gorski kotar.

The panel aimed to encourage local self-government units from the County of Primorje-Gorski kotar, as well as local municipal companies, to jointly provide citizens with legal and logistical preconditions for the separation of waste.



We are reporting what County Mayor Zlatko Komadina said at the panel:

"

"Marišćina is a problem because it is the middle part of the system, which lacks the beginning and the end. Namely, neither previous separation nor bio-waste nor compost has been resolved. The placement of fuel from the waste has not been resolved, and unfortunately, the secondary raw materials, can't be used because the state has not built the promised four power plants, and it is obliged to do. The system is flawed because you cannot not have the first part of the system, have the middle one and not have the back up of the system".

Part of the local self-government units headed by the largest waste producer, the cit of Rijeka, do not apply the Law on Sustainable Waste Management and the Decree o Municipal Waste Management in the part related to the obligation of separate collection and disposal of bio-waste so their waste management is illegal.

PROBLEMS WE ENCOUTERED

-PHOTOMETER
After three months of measuring aerosols we could not download data
We continued measuring but had to write the data

-**GLOBE OBSERVER APP**
Measured Data was way out of range-we did not report it

-**OUR LECTURES**
Lectures we organized to promote recycling were poorly attended

WHAT WE DID when we realised the size of the problem:
-started organizing and organize panels for citizens with a PP presentation of how to collect waste
-in 2016. we organized a working presentation at the kindergarten we are cooperating with,a five year old girl told us "My mother doesn't listen to me, she puts all our waste in one bin!"
-organized a working presentation at the local elementary school

WHAT WE NEED TO DO
Show how people around Mariščina live (we are chemical and ecological technicians) and can produce a harmless bad smel during our presentation, we will take this project to the newspapers and find a way to present it on TV too.
We also plan to collect soil and air samples and in cooperation with NZZJZ PGŽ Rijeka,analyze collected partilcles and determine the quantity of P2,5 particles and what dangerous chemical compounds are expelled by the Plant

CONCLUSIONS

Air in Marišćina and its surroundings is polluted. Our data on air quality using lichen as bioindicators concurs with NZZJZ PGŽ data

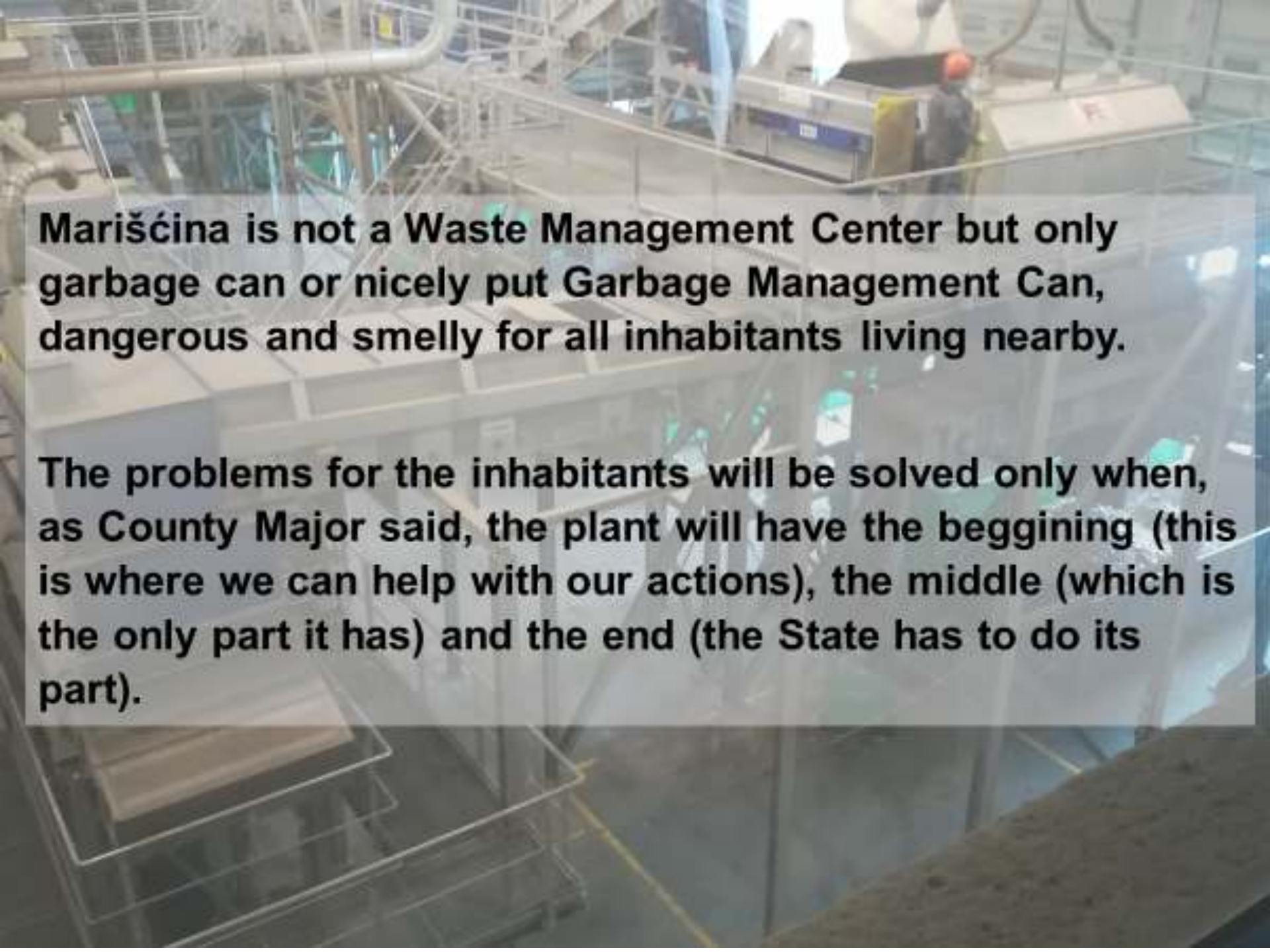
-Aerosols impact

Aerosols thickness was more pronounced in 2019. than in 2020.
We compared our measured data with Institute NZZJZPGŽ data
Optical thickness shows aerosols pollution on the site.

-Impact of Temperature on Aerosols

We compared atmosphere temperature and aerosol thickness data in our research in 2018./2019. and concluded that temperature does not influence aerosols concentration. We came to the same conclusion in our 2019./2020. research (according to our measurements).
Aerosols concentration depends on temperature but in this project temperature measurements are not relevant because we could not get day and night temperature oscillations (occurrence of temperature inversion and vertical airflow).

Outdoor air pollution and particulate matter in outdoor air pollution (mixture) are carcinogenic to humans.



Marišćina is not a Waste Management Center but only garbage can or nicely put Garbage Management Can, dangerous and smelly for all inhabitants living nearby.

The problems for the inhabitants will be solved only when, as County Major said, the plant will have the beggining (this is where we can help with our actions), the middle (which is the only part it has) and the end (the State has to do its part).

We thank all the STEM scientists from Institutions who helped us with the project :

-NZZJZ PGŽ Rijeka
For air monitoring equipment and data
-Institution „Priroda”
For helping with Tree types
-Museum of Natural Sciences
For determining Lichen
-County Waste and Recycling company
For explaining about waste collection and collection problems
-Prirodoslovna i grafička škola Rijeka
For teaching „Controling and managing the waste”