Introduction

- . Lichen have no cuticle: absorb nutrients out of **the air** (Paoli, L., et al, 2015)
- . Mirror harmful effects from pollutants such as factories, cars, and wood boilers
- . Manganese, lead, and zinc found in wood boiler and industrial factory emissions (Carreras, H. A., et al, 2002) (Alves C, et al, 2011)
- . Gradient studies visually show the amount of elements in the air surrounding an epicenter (Sett R, et al, 2016)
- . Pollutants affect the <u>Air Quality Index (AQI)</u> (Samsudin, M. W., et al, 2012)
- . Quality decreases as the index number increases
- Particulate Matter <2.5 (μg/m³): easily bypass nose and lung filters (Szczepaniak, K.., et al, 2003)
- . High levels of heavy metals have been found near roads and incinerators (Samsudin, M. W., et al, 2012)
- . Air Quality Index and lichen have been used together to detect emission source (Pignata, M. L., et al, 2007)

Hypothesis

Using lichen and an air quality monitor, a gradient concentration map of heavy metals specific to wood burning, particulate matter and the AQI can be constructed by using a residential wood boiler as an epicenter in Hudson Falls, NY.

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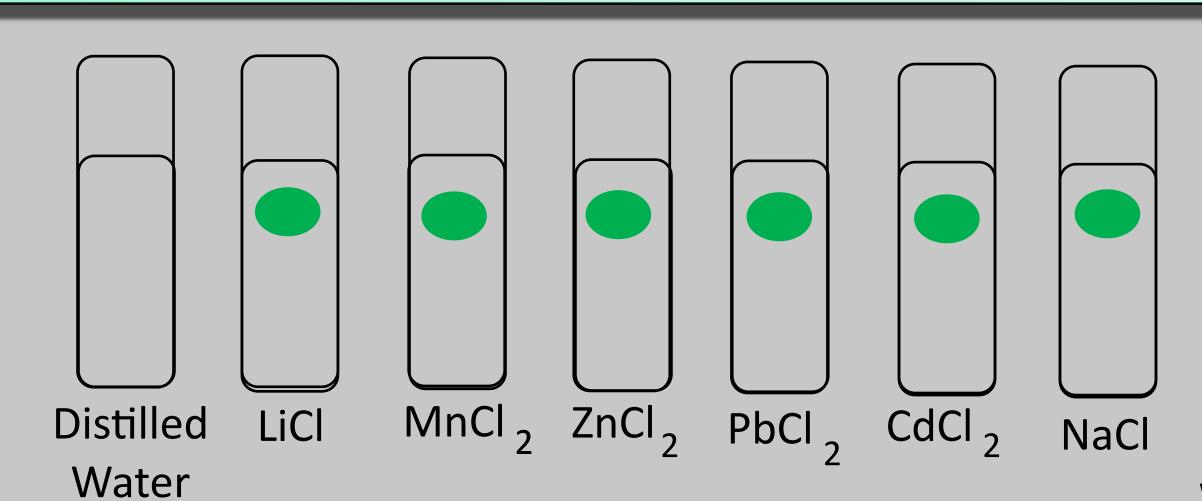
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Using Lichen to test Air Quality and Metal Content around a Wood Boiler Epicenter in Hudson Falls, NY

Methodology



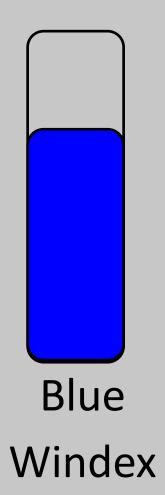
Assay Kit

- . 60 mL of six heavy metal solutions
- . Collected, dried and dyed samples
- . Methylene blue solution: cations are weaker than the catio each solution
- . The amount of that specific heavy metal in the lichen samp shown by the amount of blue leached out of the lichen
- Soaked for 30 minutes
- Rated on a 0-4 scale:
- . 0 is the color of distilled water, meaning no heavy metals in that sample
- . 4 is the color of Blue Windex, the maximum intensity possible for the sample

	Results																		
	Intensity											Sample	Date	Lat/Long	PM2.5	Mean PM2.5	AQI	Location	
Solution	(0-4 scale)											1	9/18/19	(43.31312 <i>,</i> -73.55096)	+ $+$ $+$ $-$	3.215428	14.16666	on top of wood boiler	
Sites	1	2	3	4	5	6	7	8	9	10	11			·					Gro
LiCl	0.5	0	0	0.5	0.5	0	0	0.5	0.5	0	0.5	2	9/19/19	(43.31308, -73.551)	4.9234303	3.457936	18.00685	south of wood boiler in a tree	poi
MnCl ₂	2	0.5	0.5	2	2	1.5	3	0.5	1.5	0.5	1	2							. H i
ZnCl ₂	3	0.5	1	1	3	2	0	1	1.5	1									. Le
PbCl ₂	2	1	2	2	2	3	3	3.5	3.5	1	2	6	10/28/19	(43.31312 <i>,</i> -73.55096)	126 280334	20.48855	78.34612	on top of wood boiler	. Le
CdCl ₂	1.5	1	1	1.5	1	2	1	1	1	1	1			· · · · ·					-
NaCl	1	0	0.5	0	0.5	0.5	0.5	0.5	1	0	0		10/28/19	(43.31306 <i>,</i> -73.55091)	19.232044	46.09518	39.36286	south of	W
Avg.	1.66	0.5	0.83	1.17	1.5	1.5	1.25	1.17	1.5	0.58	0.9	7						wood boiler in a tree	. Si
																			W
	Table 1 is a qualitative chart that numerically shows the intensity levels of the										10	11/13/19	(43.31312 <i>,</i> -73.55096)		1.822441	5.439244	on top of wood boiler	. Ta	

different solutions resulting from the assay kit.

The data for the ZnCl₂ was inconclusive (Hogan, 2019)





Lichen sample locations (Hogan, 2019)

	Pocketlab Air Quality Sensor					
ons in	. AQI					
	. PM >2.5 micrograms per cubic					
ple is	meter					
	. Real-time data					
	. Took points every second					

Table 2 numerically shows the Pocketlab Air quality sensor results (Hogan, 2019)

= wood boiler was not running = wood boiler was running

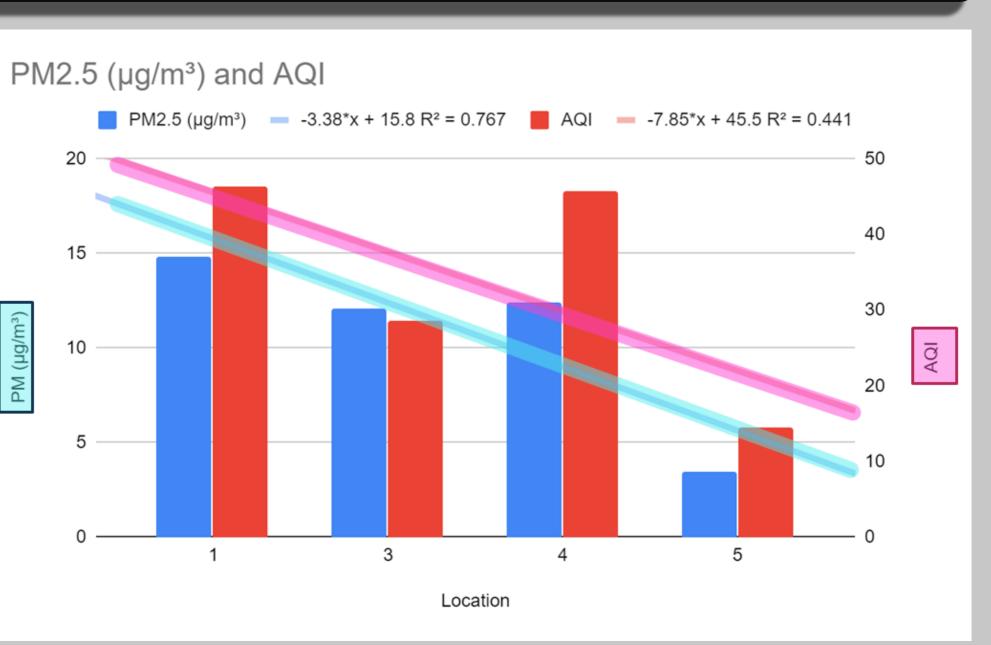
Gradient Maps



Figure 1: *An intensity* map showing the results of the assay kit (Hogan, 2019)

Figure 2: This intensity map showing the Pocketlab Air Quality Index (AQI) data (Hogan, 2019)

Figure 3: The intensity map shows the Pocketlab particulate matter < 2.5 (µg/m³) (Hogan, 2019)



Discussion

raph 5 shows the AQI and PM 2.5 (μ g/m³) results as the location oint distance increases from the epicenter (Hogan, 2019)

lighest levels at epicenter

evels decreased moving away from the epicenter

ead Chloride, Zinc Chloride, Manganese Chloride vere highest over all

imilarities between Figures 2 and 3 suggest they were affected by the same agent

Take more points

. Add to gradient maps

. Weather and season