Impact of urban environment features on the microclimates of Tartu

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Locations

1 - Kassitoome org

2 - Toomemägi

3 - Raekoja plats

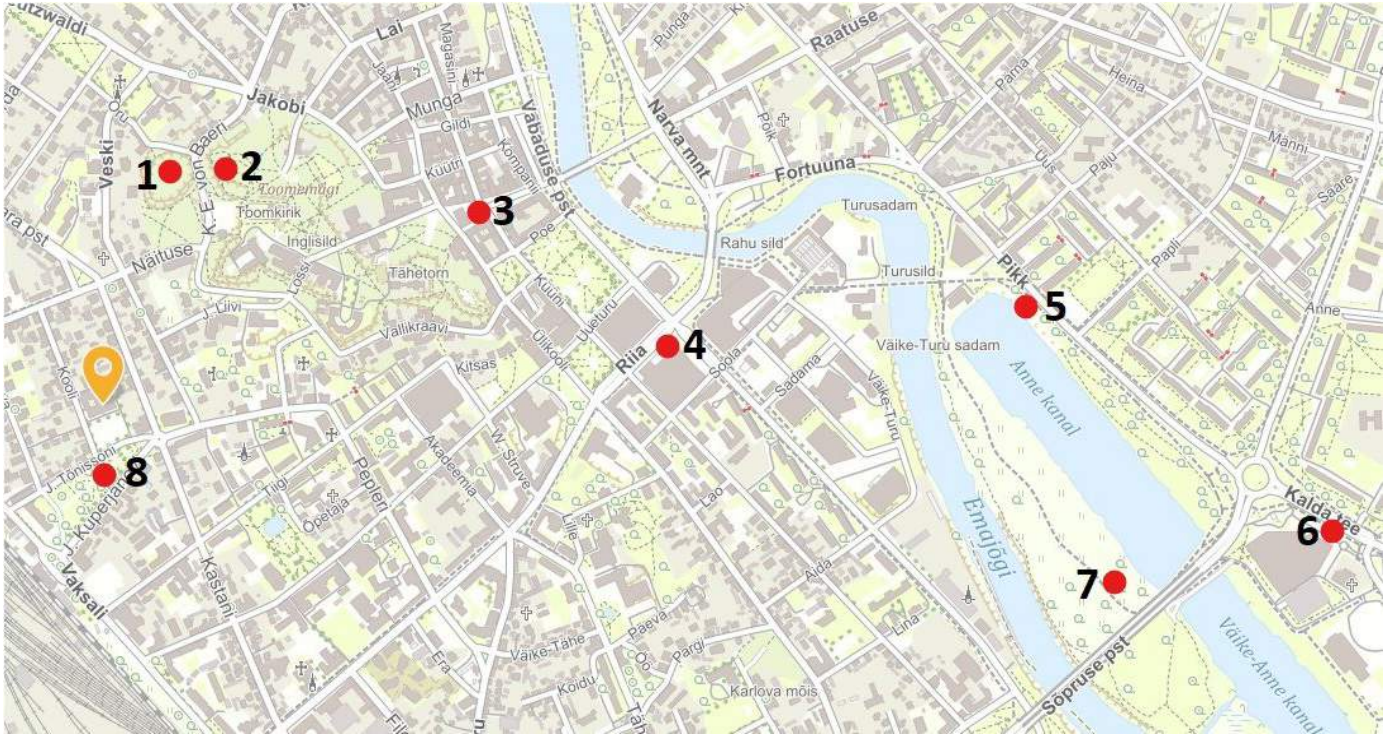
4 - Riia turu rist

5 - Anne kanal

6 - Eeden

7 - Sõpruse silla all

8 - Karupark



Research questions

1. Is there a difference of pressure between places at different elevations?
2. How does the abundance of vegetation impact temperature and humidity?
3. How does the distance to water bodies impact temperature and humidity?
4. Is there a temperature difference between technological and green areas?

Hypotheses

1. There is lower pressure at higher elevations.
2. There is higher humidity near water bodies.
3. The temperature is slightly higher near water bodies since there was a heatwave the day before.
4. Near technological surfaces (concrete, buildings), the temperature is higher and humidity lower compared to green areas.

Measurements

- Coordinates and elevation
- Temperature
- Humidity
- Pressure
- Cloud types and coverage

Equipment

- Thermometer
- Psychrometer
- Barometer
- Compass
- Mobile phone with GPS
- GLOBE cloud chart
- GLOBE Observer app

Location 1 - Kassitoome org (valley)

58°22'51"N 26°42'42"E elevation: 46.5m

Location 2 - Toomemägi (hill)

58°22'52"N 26°42'48"E elevation: 70m

Location 3 - Raekoja plats (town square)

58°22'49"N 26°43'22"E elevation: 38m

Location 4 - Riia turu rist (big crossroads)

56°22'41"N 26°43'43"E elevation: 36m

Location 5 - Anne kanal (canal)

58°22'35"N 26°44'45"E elevation: 33m

Location 6 - Eeden (shopping centre)

58°22'26"N 26°45'4"E elevation: 34m

Location 7 - Sõpruse sild (bridge)

58°23'6"N 26°43'22"E elevation: 33m

Location 8 - Karupark (park)

58°22'20"N 26°44'39"E elevation: 64.5m

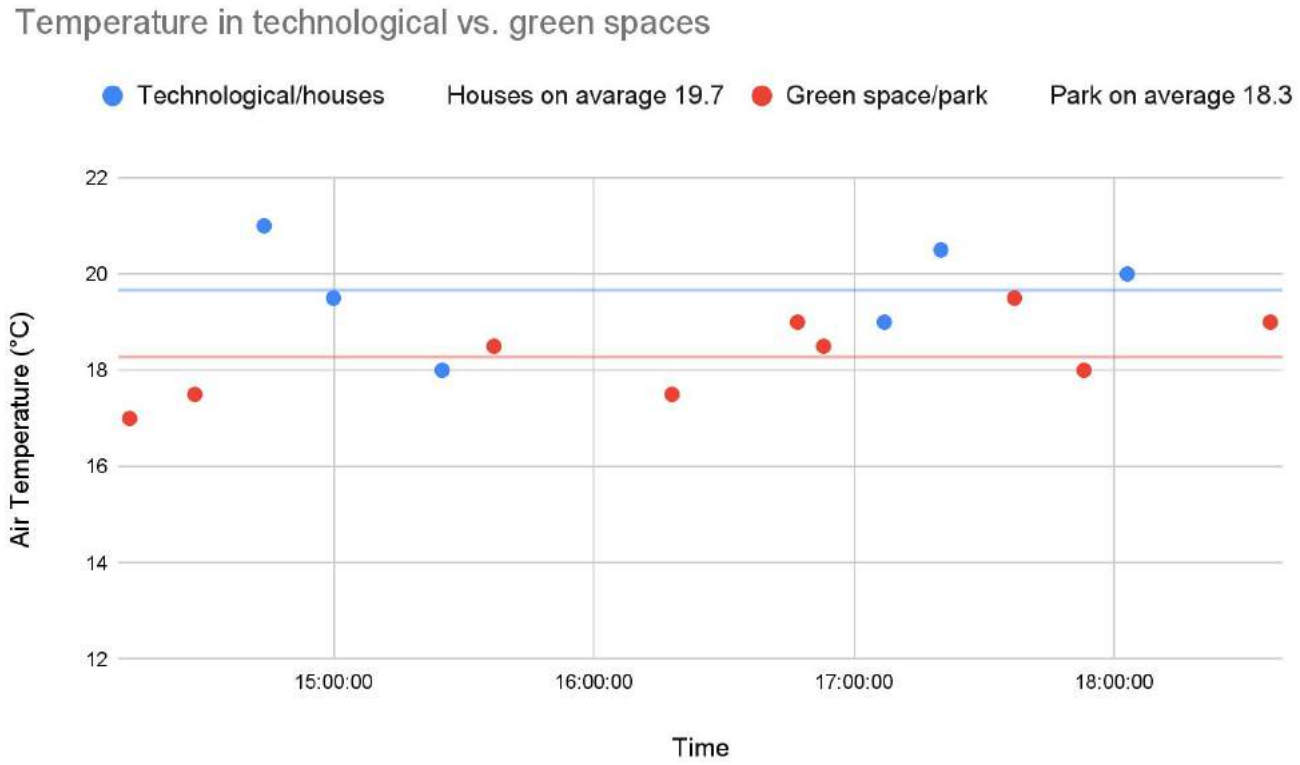
Expedition

- Total: 16 sets of measurements
- Fastest time for 1 set: 3min 13sec
- About 15 000 steps in total
- 10 km travelled
- Time spent: 4,5h

Results

Temperature in technological Vs. green spaces

There is lower temperature in places with more vegetation.

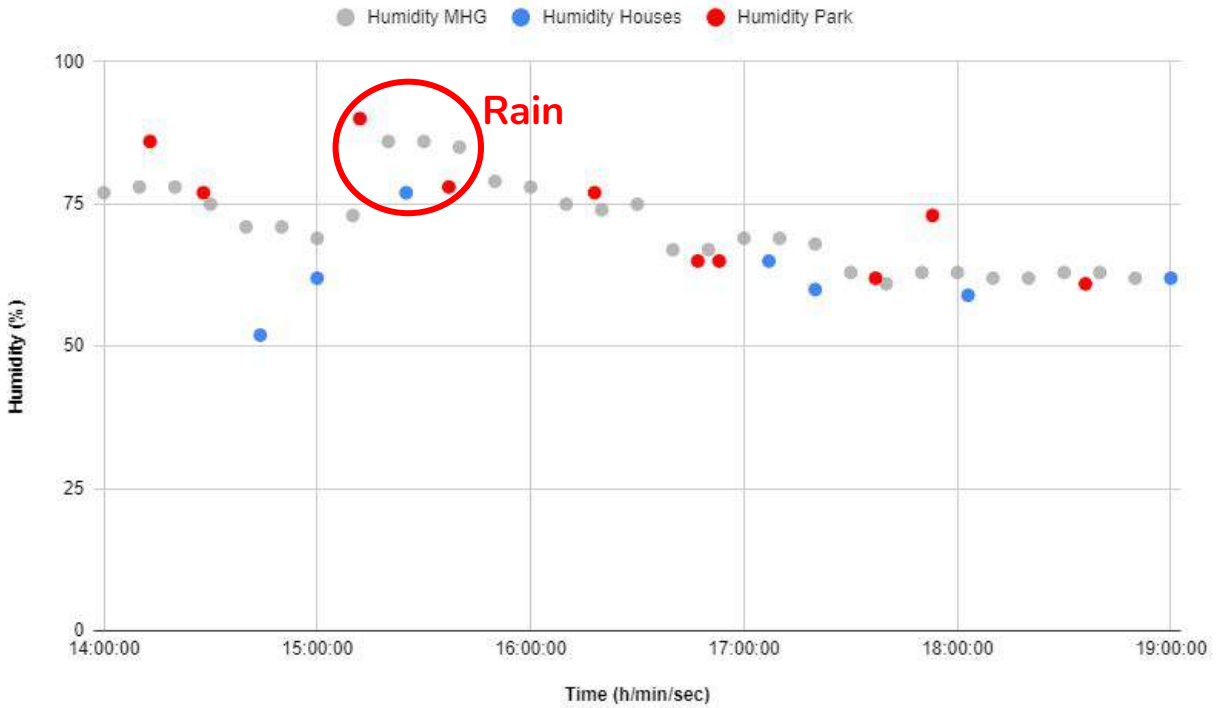


Humidity in technological and green spaces

Technological area average: 62.5%

Green area average: 71.6%

Humidity in green spaces tends to be higher than in technological areas.

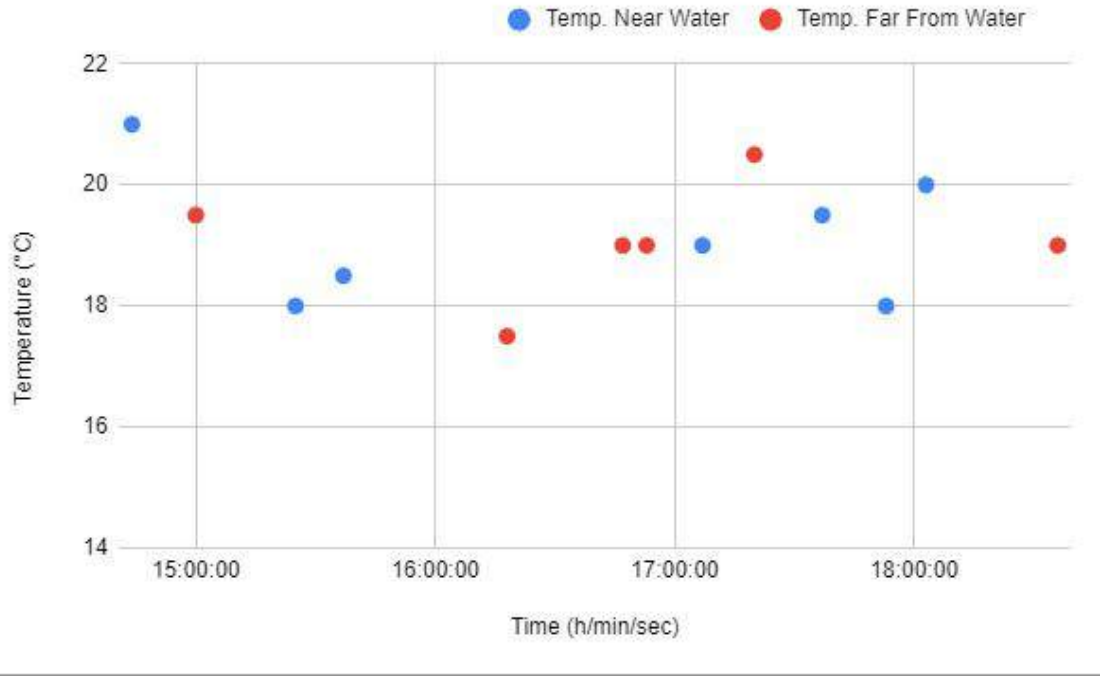


Temperature near vs. far from water

Near water average: 19.1°C

Far from water average: 19.1°C

Based on the data we collected, we couldn't determine whether the distance to water bodies impacts temperature.

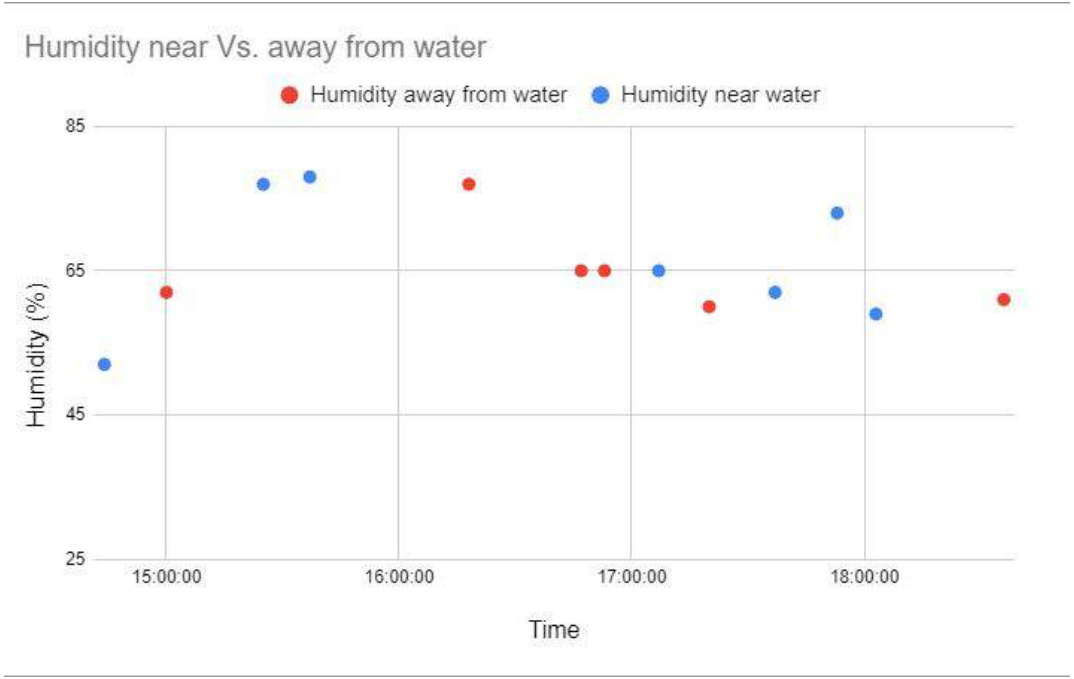


Humidity near vs. far from water

Near water average: 66.6%

Far from water average: 65.0%

Due to weather conditions we couldn't gather comprehensive data to prove that the air is more humid near water bodies.



Pressure change between elevations

Time	Kassitoome org (46.5m)	Toomemägi (70m)	Difference
14.13-14.28	1007.5 mbar	1006.5 mbar	1 mbar
16.47-16.53	1010 mbar	1007.5 mbar	2.5 mbar
Average difference			1.75 mbar

Our hypothesis was confirmed: there is lower pressure at higher elevation.

p = Pgh - formula of pressure P - air density (1.14 kg/m^3 according to MHG weather station), g - gravitational acceleration (9.81 m/s^2)

Which means that the height h = p/(Pg)

After converting the pressure to pascals and putting in the values, we get that the height difference should be h = 15.7m. Difference in reality - 23.5m. Quite close!

Conclusion and discussion

We found out:

- There is lower temperature and more humidity in green areas - importance of nature in urban environments.
- Pressure change can be used to roughly measure elevation.

- Temperature data came from the psychrometer.
- Rain affected our measurements.
- For better results more data is needed.
- Should do these measurements in other seasons.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Sources

- https://www.globe.gov/do-globe/globe-teachers-guide/atmosphere GLOBE atmosphere protocols
- https://xgis.maaamet.ee/xgis2/page/app/maainfo maa-amet map
- Photos taken by authors


Thank you for your attention!