

The background features a stylized, colorful version of the Estonian coat of arms. It includes a sun with a human face at the top, a central shield with a red hat on a pole, two hands shaking, and a wreath of green leaves with red berries. The shield is flanked by blue banners and crossed spears with golden tips.

# SOIL SAMPLES FROM THE BANK OF ĚMAJÕGI AND THE PARK OF ÜLEJÕE

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# HYPOTHESIS

- Soil under the trees is colder.
- Moisture near the river is higher than near the road.
- Next to the road there is soil with traces of human activity.

# RESEARCH QUESTIONS

- How does soil water content change between sites?
- How are soil moisture and temperature related with air temperature?
- Does the river affect soil temperature?

# SOIL PROTOCOLS

- Soil temperature protocol
- Soil characterization protocol
- Soil moisture protocol
- Soil pH protocol

## Gravimetric Soil Moisture Protocols



### **Purpose**

To measure soil water content by mass

### **Overview**

Students collect soil samples with a trowel or auger and weigh them, dry them, and then weigh them again. The soil water content is determined by calculating the difference between the wet sample mass and the dry sample mass.

### **Student Outcomes**

Students will be able to collect soil samples from the field, then measure their soil moisture, record and report soil moisture data.

Students will be able to relate soil moisture measurements to the physical and chemical properties of the soil.

### **Science Concepts**

#### **Earth and Space Sciences**

Earth materials are solid rocks, soil, water, biota, and the gases of the atmosphere.

Soils have properties of color, texture, structure, consistence density, pH, fertility; they support the growth of many types of plants.

The surface of Earth changes.

Soils consist of minerals (less than 2 mm), organic material, air and water.

Water circulates through soil changing the properties of both the soil and the water.

#### **Physical Sciences**

Objects have observable properties.

Relate mass, volume and density.

#### **Scientific Inquiry Abilities**

Identify answerable questions.

Design and conduct an investigation.

Use appropriate tools and techniques including mathematics to gather, analyze, and interpret data.

Develop descriptions and explanations, predictions and models using evidence.

Communicate procedures and explanations.

### **Time**

5-10 minutes preparation before sampling

10-15 minutes to collect samples\*

5 minutes to weigh wet samples

5 minutes to weigh dry samples

Samples dry under heating lamps for 2 days or in a drying oven overnight.

\*Some sample collection methods may require additional time

### **Level**

All

### **Frequency**

Daily or every two-to-three days.

Alternatively, twelve or more times per year for the same site at daily, weekly or monthly intervals.

### **Materials and Tools**

Soil Drying Method (select method most appropriate):

1) 250 Watt infrared heating lamp, 1 or 2 bulbs, that reach temperatures of 65 – 90 °C for 2-3 days)

2) Soil drying oven or other oven capable of maintaining a temperature not exceeding 105 °C. Thermometer capable of measuring to 110 °C (only if using a drying oven)

Balance or scale with 0.1 g sensitivity (600 g capacity recommended, 400 g minimum capacity required)

Hot pad or oven mitt

Soil sample containers:

Sealable plastic bags (e.g. zip lock bag) OR

Soil sample cans or other metal cans such as empty and clean cat food, tuna or small pineapple cans

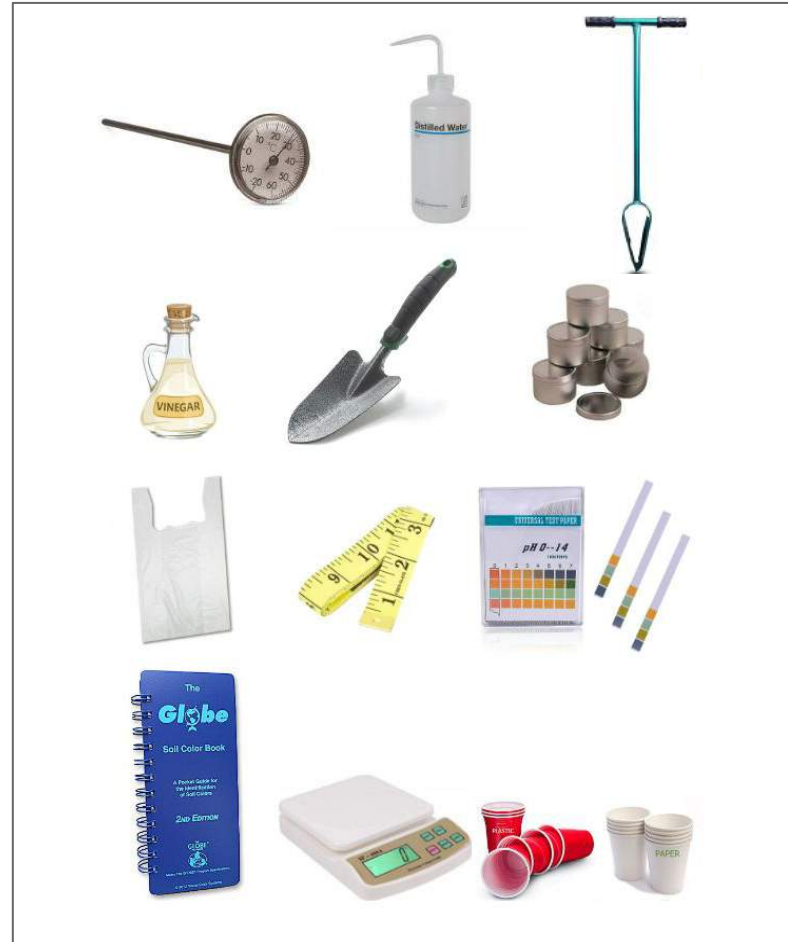
Plastic wrap and rubber bands to seal cans without lids

Meter stick

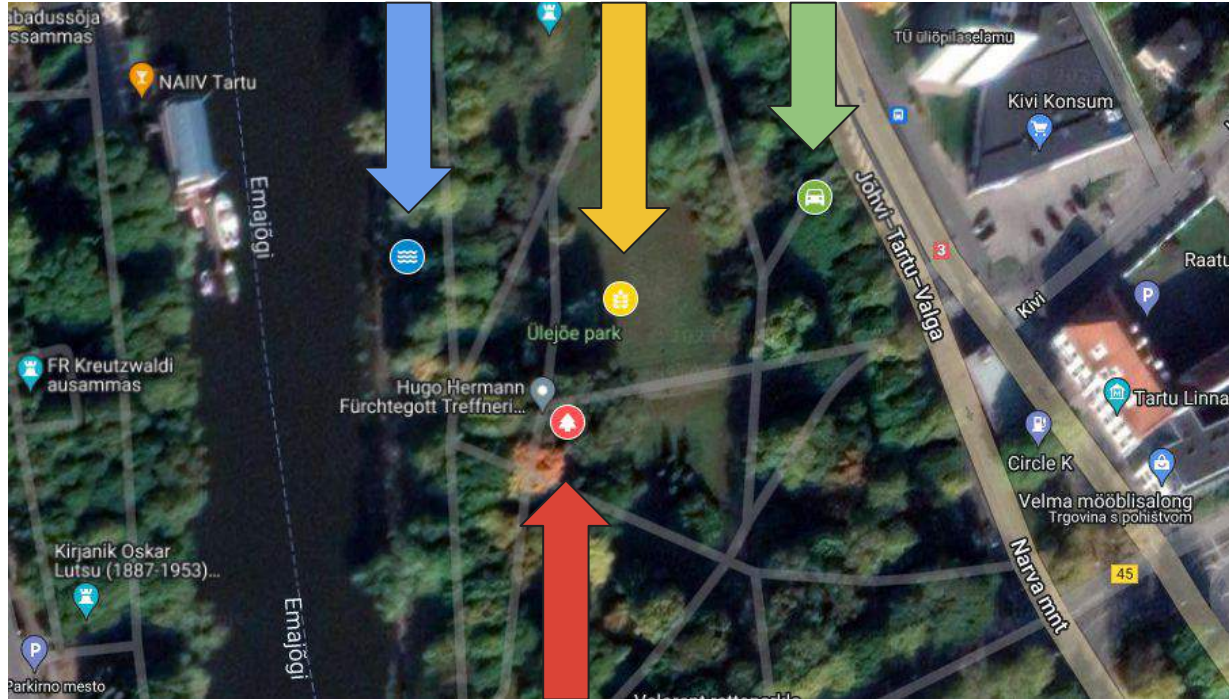
Trowel

# EQUIPMENT

- Soil drill
- Distilled water
- Vinegar
- Cups (paper and plastic)
- Soil thermometers
- Plastic bag
- Shovels
- Metal cups
- Measuring tape
- pH indicator strips
- Soil color book
- Scale



# 4 STUDY SITES



- River Emajõgi
- Field
- Road
- Trees

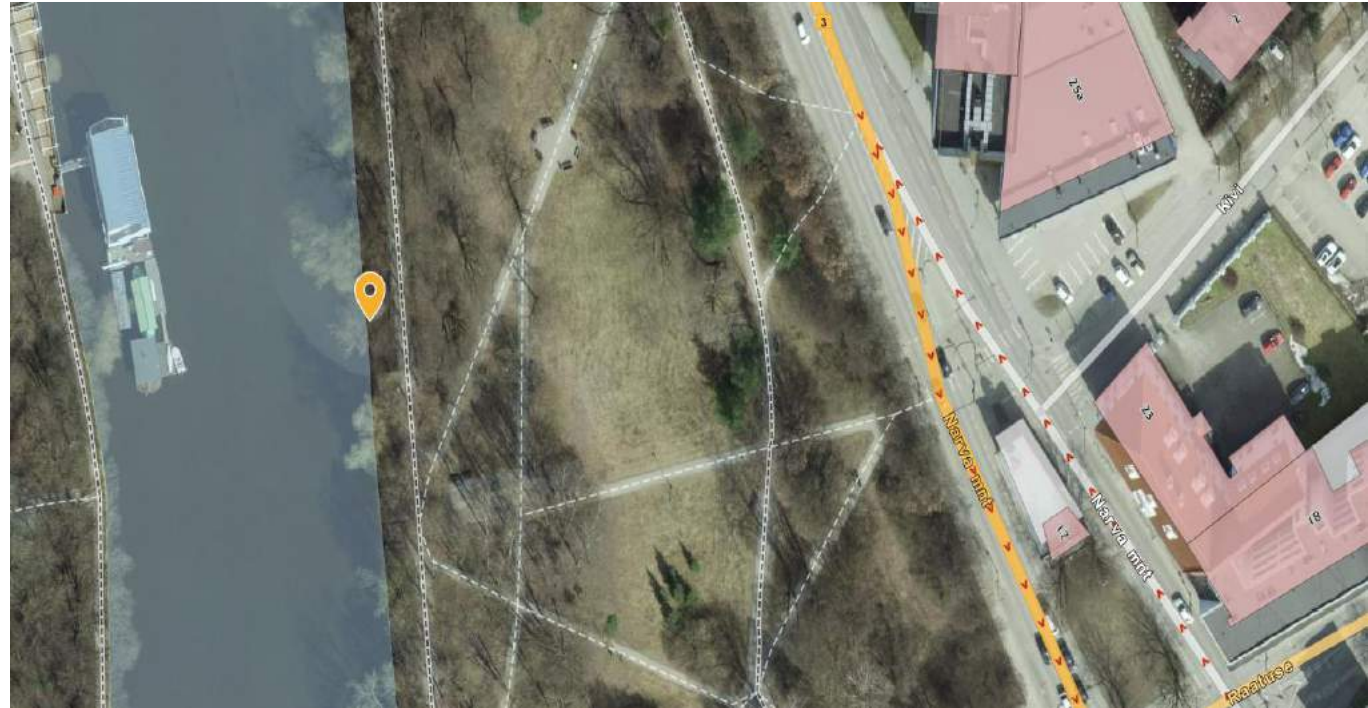


# STUDY SITE: RIVER EMAJÕGI

Coordinates:

X:  $58.382242^{\circ}$

Y:  $26.726133^{\circ}$



Location



North



East



South



West





Loose

7,5YR 2,5/1



# STUDY SITE: ROAD

Coordinates:

X:  $58.382366^\circ$

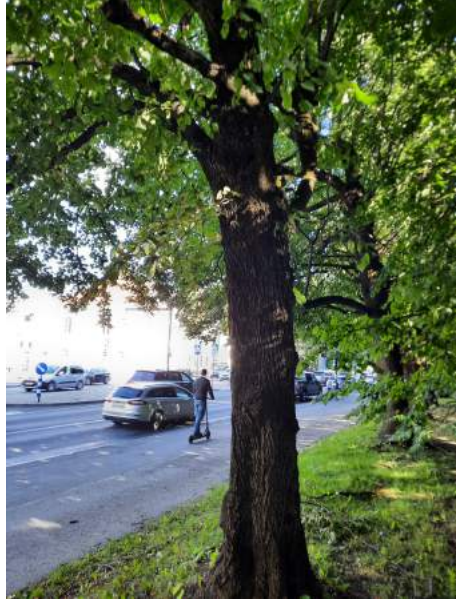
Y:  $26.727741^\circ$



Location



North



East



South



West





Loose

10YR 2/2

10YR 3/3



# STUDY SITE: FIELD

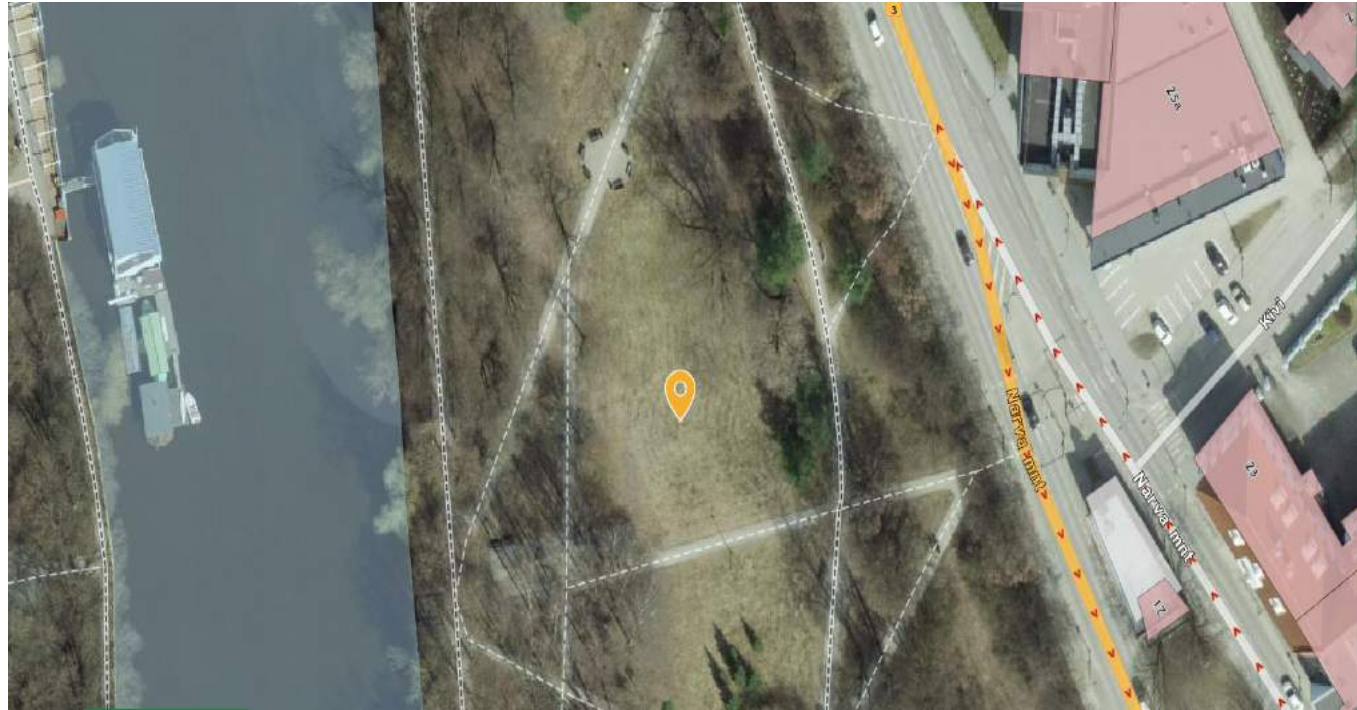
Coordinates:

X:  $58.382156^\circ$

Y:  $26.726975^\circ$



Lucky student



Location



North



East



South



West





Loose

We couldn't  
define the colors  
by the color  
book.

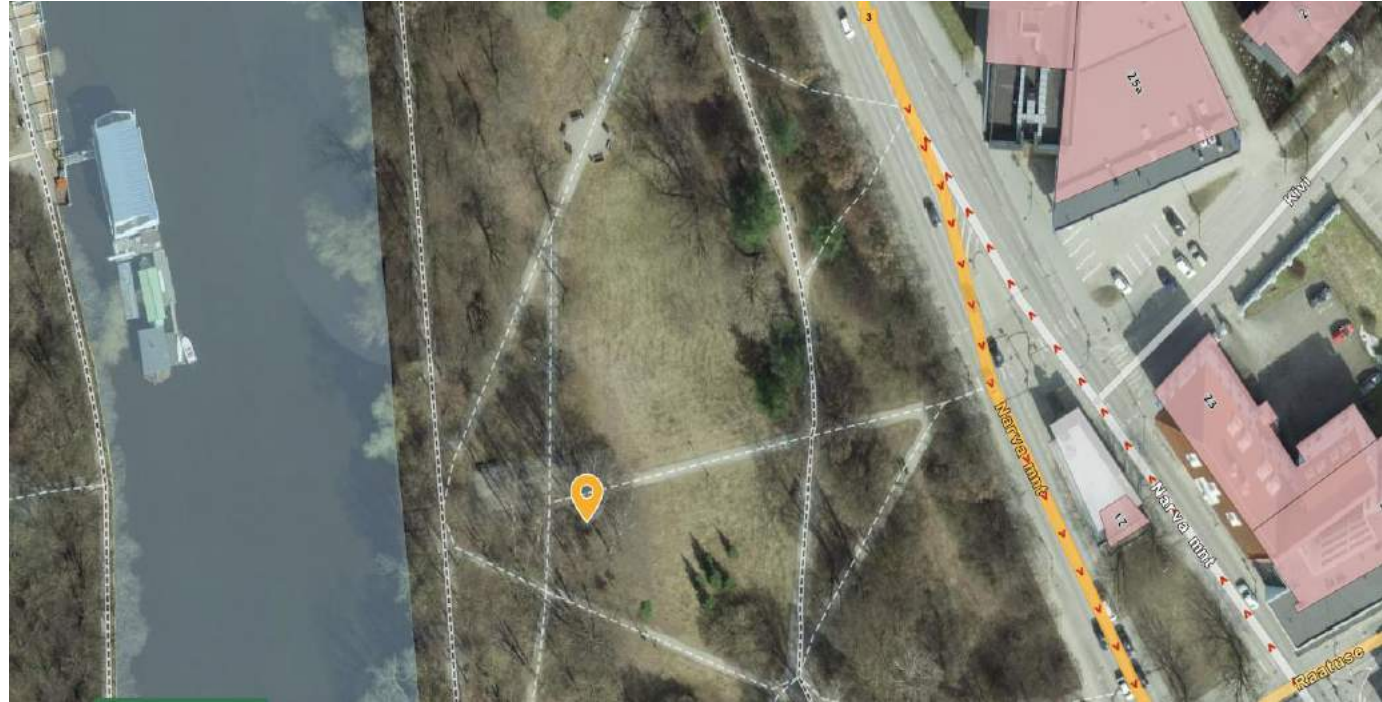


# STUDY SITE: TREES

Coordinates:

X:  $58.381898^{\circ}$

Y:  $26.726764^{\circ}$



Location







North



East



South



West



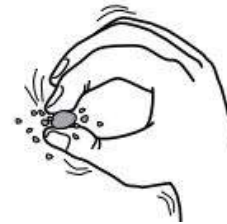


Loose

10YR 5/4

10YR 4/3

10YR 2/1



Friable

7,5YR 2,5/2



Firm

7,5YR 2,5/1

## FIELD AND TREE SITE DIFFERENCES

- Field site had less horizons.
- Field site had a rocky base and more rocks in the soil.
- Field site pH was 6 and trees was 4.5-5.
- Tree site had almost no carbonate reaction, field site had very strong reaction.

## FIELD AND TREE SITE SIMILARITIES

- Both of these sites had moist soil.
- Structure was granular.
- Consistency was loose, but tree site had friable and firm bottom layers.

## RIVER EMAJÕGI AND ROAD DIFFERENCES

- The soil is drier by the road.
- pH beside road is 5-5.5 and by the river it is 7.
- By the river there are more rocks and stronger carbonate reaction.
- By the road we were able to drill deeper.

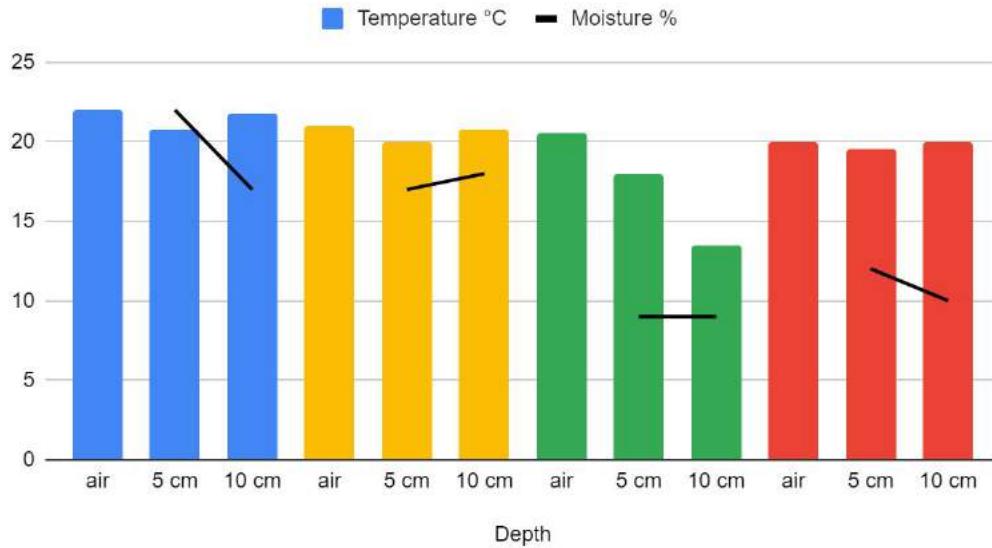
## RIVER EMAJÕGI AND ROAD SIMILARITIES

- Consistency is loose.
- Structure is granular.
- Few roots.
- Both of them have clay sand, but road also has sand.



# RESULTS

## Soil Moisture and Temperature in Different Sites



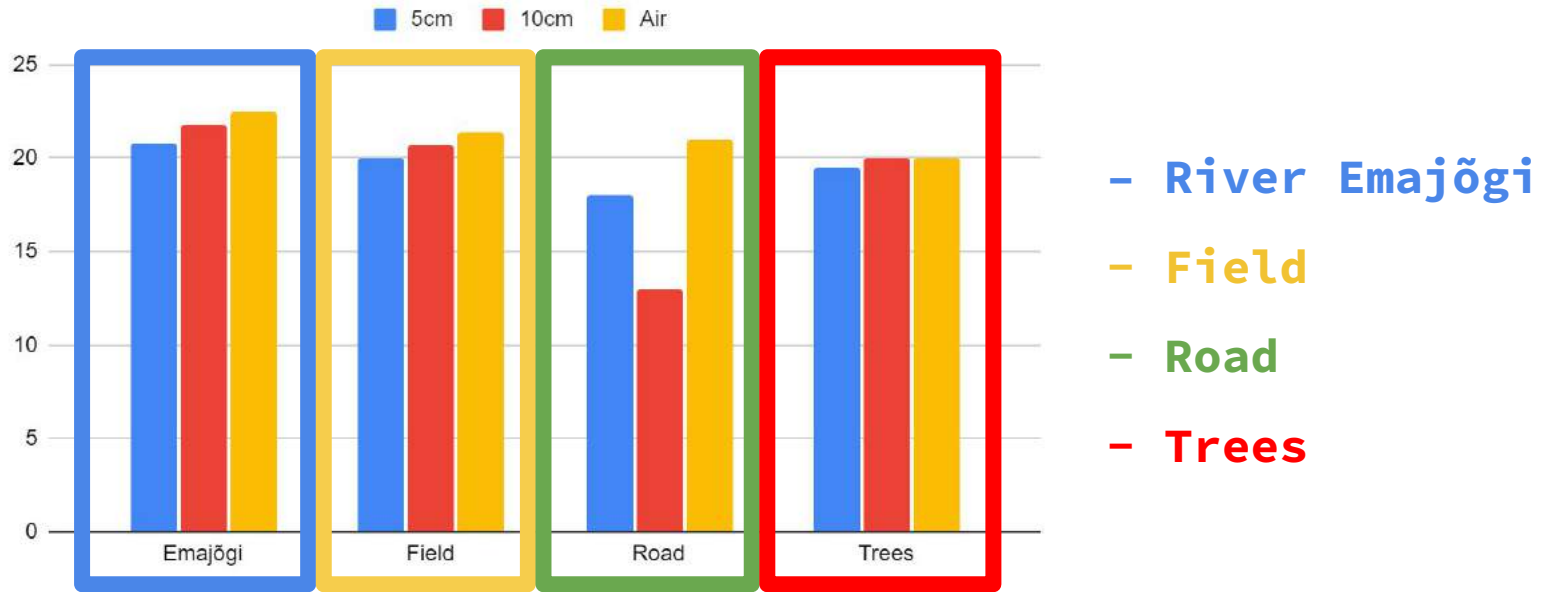
- River Emajõgi

- Field

- Road

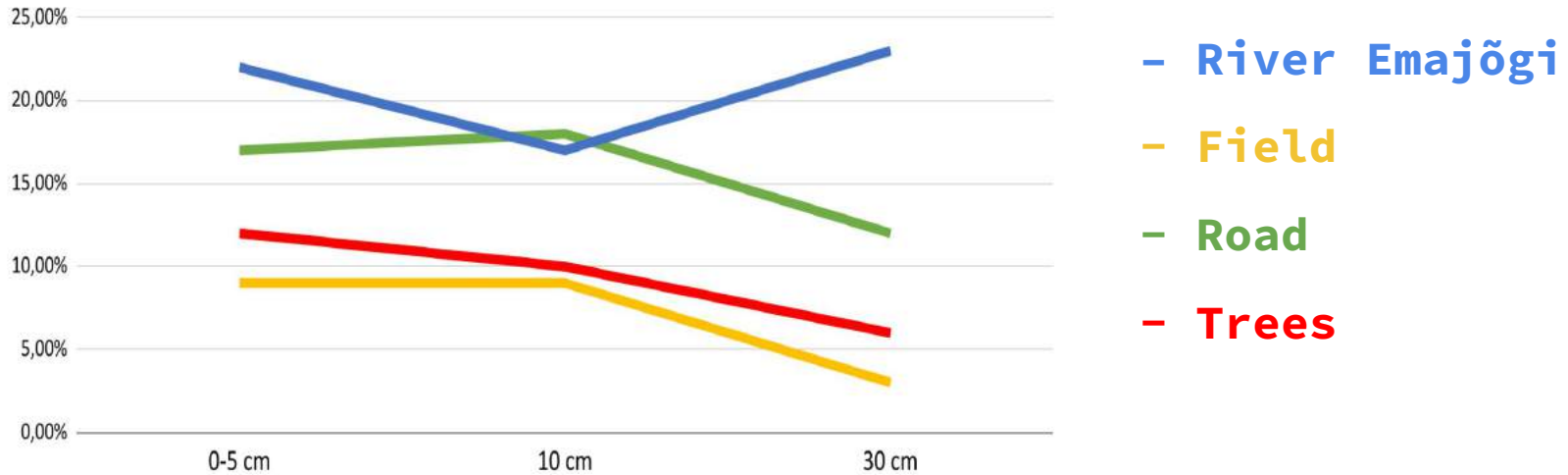
- Trees

## Soil Temperature in Different Sites



- Highest air temperature: **Emajõgi (22.5°C)**
- Lowest air temperature: **Trees (20°C)**
- Highest soil temperature at 5 cm: **Emajõgi (20.8°C)**
- Lowest soil temperature at 5 cm: **Road (18°C)**
- Highest soil temperature at 10 cm: **Emajõgi (21.8°C)**
- Lowest soil temperature at 10 cm: **Road (13°C)**

Soil Moisture in Different Sites



- Minimum soil moisture: **3% (Road site, 30 cm depth)**
- Maximum soil moisture: **23% (Emajõgi site, 30 cm depth)**
- As the depth increases, soil moisture decreases, except at the river, where groundwater level was measured at a depth of 12 cm.
- The soil next to the road was drier than the others. Maybe it's because the asphalt is dark and it absorbs more heat.

# USED REFERENCES

<https://xgis.maaamet.ee/xgis2/page/app/maainfo>

Soil protocols

The GLOBE Soil Color Book



Thank you for listening!

