Water retention ability of the landscape

Introduction

The landscape has a natural ability to retain water. We call it retention ability. Landscape elements such as forests, meadows, fields, waterbodies, parks, houses and roads, and others, greatly influence this ability. Each element "manages" water differently. Therefore, it depends on how they are deployed in the landscape, in what amount, or how big an area of the land they cover. The rainwater is absorbed differently by a forest than by a concrete road. Reducing the retention ability of the landscape may not only be directly related to climate change, but primarily to man-made landscaping. Recent findings show that intense and impetuous human interventions to the landscape are raising the risk and the frequency of floods and desiccation as well.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information on the water retention ability of the landscape. Also focus on the following questions:

- Do different surfaces have different permeability?
- How much water can one adult tree retain?
- What problems are large paved areas causing in cities?
- Where does rainwater flow from your school or residence?
- What is the importance of green areas in urban areas?
- How many green areas / elements are near your school or residence?
- Do you collect rainwater in the school yard?

Recommended resources

Source 1:
Natural water retention measures

Source 2:
Natural Water Retention Measures Platform

Verify the occurrence of a problem in your area with your own research

Goal

Students can identify different types of surfaces due to their permeability. They can calculate the approximate retention ability of chosen landscape. Students are aware of the difference between natural and artificial surfaces and understand the importance of water retention in the landscape.

Tools & Materials

- online maps with satellite imagery (e.g. Google maps)
- size area calculation tool (e.g. Google maps)
- a meteorological portal containing information on average daily rainfall
- a table for calculating the proportion of the landscape element in chosen territory
- recording card
- a board / flipchart / tablet or similar
- calculator
- camera / mobile to record activity

Implementation

At the beginning, choose the territory whose retention ability you want to calculate (e.g. school area, part of community / city). Print the satellite image of the selected area and draw a square grid across it. Be sure you write down the map scale. Go to the terrain with the satellite image and assign a surface type to each square. Think about which areas retain water and from which it quickly flows away. Also note for each square whether it is sloping or flat. In the class then use online maps to calculate the size of the area in square meters. Then, on the meteorological portal, find out the daily rainfall for that area during any rainy day. Alternatively, you can replace the daily rainfall with an average annual total. Precipitation data is usually given in millimetres be sure to convert it to litres per square meters (1 mm = 1 l / 1 m^2). If you have both data available, use the table for calculating the proportion of the landscape element in the chosen territory and recording card to calculate the water retention ability of the landscape.

Mapping process

First, identify the coverage of selected elements in the landscape:

- forests, parks
- meadows, lawn
- arable lands
- slack surface waters
- running surface waters
- hard surfaces

Look at each square of a square grid. Assign which part of the given square occupies the selected landscape element (whole, ½, ¾, ...). For forests, green fields and arable lands, identify the type of terrain (sloping or flat). Count the parts of selected elements and determine their coverage in the monitored area.

Transfer the calculated coverage to the recording card. Fill in the sum of precipitation and calculate other indicators according to the formula.

Analysis of results and proposal of solution

Interpret the calculated retention ability of your territory. Which surfaces prevailed? What is the ratio of retained and drained water? How could you use the amount of water that drained from the hard surfaces? Do you think that some measures can be taken to increase the amount of water retained? Try to think about solutions together. Write them down and choose the ones you can action.

Implementation of the solution and evaluation

Did you implement the selected solution? If so, what result did you get? Did your school, family or community help with implementation of the solution? How did they react to your initiative? Do you think there is a better / more effective solution to increase the retention ability of the landscape?

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Table for calculating the coverage of selected elements in the landscape					
Total land area (m^2): TA	1000	**The number of squares in the square grid: TNofS**	100	**Size of area in 1 square (m^2): S = TA / TNofS**	10
The number of squares covered by the landscape element NofS		**Calculation of covered size (X) X = NofS x S**		**Coverage share (C) C = X / TA**	
flat - forests, parks	30	300		0,30	
sloping - forests, parks	2	20		0,02	
flat - meadows, lawn...	10	100		0,10	
sloping - meadows, lawn...	3	30		0,03	
flat – arable lands	10	100		0,10	
sloping – arable lands	0	0		0,00	
slack surface waters	10	100		0,10	
running surface waters	5	50		0,05	
hard surfaces (houses, roads...)	30	300		0,30	

Recording card					
Class	9				
School	Elisabeth's Elementary school				
City	London				
Water retention ability of the landscape					
Total land area (m^2): TA	1000	**Rainfall (l/m^2/ rainy day): R**	10	**Volume of rainfall (liters): VR = TA x R**	10 000
Coverage share (C)		**Terrain coefficient (TC)**	**Recalculated share Y = C x TC**	**Retained rainwater RR = VR x Y (liters)**	**Drained rainwater (1) DR = VR x Y (2) DR = VR x C x (1-TC) (liters)**
flat - forests, parks	0,30	1	0,30	3000	X
sloping - forests, parks	0,02	0,9	0,018	180	(2) 20
flat - meadows, lawn...	0,10	0,9	0,09	900	X
sloping - meadows, lawn...	0,03	0,8	0,024	240	(2) 60
flat – arable lands	0,10	0,9	0,09	900	X
sloping – arable lands	0	0,7	0	0	(2) 0
slack surface waters	0,10	1	0,10	1000	X
running surface waters	0,05	1	0,05	X	(1) 500
hard surfaces (houses, roads...)	0,30	1	0,30	X	(1) 3000
Overall	1,00		**Total (Σ):**	6220	3580
Retention ability (%) Σ RR / VR * 100	**62,20 %**				

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TEACHING GREEN

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Recording card – Water retention ability of the landscape

Table for calculating the coverage of selected elements in the landscape					
Total land area (m^2): TA		**The number of squares in the square grid: TNofS**		**Size of area in 1 square (m^2): S = TA / TNofS**	
The number of squares covered by the landscape element NofS		**Calculation of covered size (X) X = NofS x S**		**Coverage share (C) C = X / TA**	
flat - forests, parks					
sloping - forests, parks					
flat - meadows, lawn...					
sloping - meadows, lawn...					
flat – arable lands					
sloping – arable lands					
slack surface waters					
running surface waters					
hard surfaces (houses, roads...)					

Recording card					
Class					
School					
City					
Water retention ability of the landscape					
Total land area (m^2): TA		**Rainfall (l/m^2/ rainy day): R**		**Volume of rainfall (liters): VR = TA x R**	
Coverage share (C)		**Terrain coefficient (TC)**	**Recalculated share Y = C x TC**	**Retained rainwater RR = VR x Y (liters)**	**Drained rainwater (1) DR = VR x Y (2) DR = VR x C x (1-TC) (liters)**
flat - forests, parks		1			X
sloping - forests, parks		0,9			(2)
flat - meadows, lawn...		0,9			X
sloping - meadows, lawn...		0,8			(2)
flat – arable lands		0,9			X
sloping – arable lands		0,7			(2)
slack surface waters		1			X
running surface waters		1		X	(1)
hard surfaces (houses, roads...)		1		X	(1)
Overall		**Total (Σ):**			
Retention ability (%) Σ RR / VR * 100					