

# COMPENDIUM 2020



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## NIDELVA WALKABOUT

**Suggested age:** 17-18 years

**Activity duration:** 45-90 minutes

**Connection to other subjects:** Social sciences, Physics, Biology, Natural sciences

## RAINWATER RETENTION IN URBAN AREAS

**Suggested age:** upper secondary school

**Activity duration:** 90 minutes

**Connection to other subjects:** Social sciences, Politics

## (EXTRA)ORDINARY WATER AND ME

**Suggested age:** 15-19 years

**Activity duration:** 3x45 minutes

**Connection to other subjects:** Biology, Geography, Ecology

## HOW TO HELP THE FORESTS TO SAVE THE PLANET FROM CLIMATE CHANGE

**Suggested age:** 15-19 years

**Activity duration:** 90 minutes

**Connection to other subjects:**

## WE CHANGE CLIMATE CHANGE!

**Suggested age:** 11-16 years

**Activity duration:** 45 minutes

**Connection to other subjects:** Biology, Chemistry, Physics, Geography, Social studies

## URBAN GREENING

**Suggested age:** 16+ years

**Activity duration:** 6h

**Connection to other subjects:** Chemistry, Biology, Physics, Environmental Science, Systems of Knowledge, Geography, English Language, Mathematics, Sociology, Economics

## PLACE BASED SCENARIO THINKING: MAPPING THE FUTURE INQUIRING WATER PROBLEMS FROM SPACE

**Suggested age:** 15-18 years

**Activity duration:** 3x60 minutes

**Connection to other subjects:** Geography



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EduChange is a short name for project titled „Making Knowledge Together - Addressing Climate Change Through Innovative Place Based Education and Blended Learning“.

Our aim is to innovate our way of teaching about Climate Change in both local and global perspectives via the field course methodology. Teaching and learning in the field is often rather traditional and teacher-led. Through EduChange we aim to transform field courses into innovative, creative learning environments in which teachers, students and pupils create knowledge together.

We believe that supporting innovation and creativity can easily be achieved via international partnerships and inter- and transdisciplinary approaches. Therefore, our consortium includes partners from various European countries (Czech Republic, The Netherlands, Norway and Malta) with various geography related backgrounds (environmental science, geography for teachers, urban geography, geoinformatics, biology, science teacher education, etc.) but with a common objective.

Our partnerships with local high-schools strengthen the role of higher education regionally as well as channel the knowledge from universities towards the public (i.e. with upper secondary school students). The place-based education adopted during the project assumes the creation of knowledge together – connecting scientific perspectives with local knowledge and daily experiences.

We strive for field courses that stimulate deeper learning. We achieve this by a student-centred approach and a well balanced mix of innovative teaching methods for field- and place-based education, such as blended learning or modern playful and multimedia methods. Our students experienced both roles – being students during the field-courses and being teachers during their local activities with upper secondary school students. These activities are presented in this compendium.

We believe that this mix of roles and experience will create an atmosphere where members of the project create knowledge together and experience innovative teaching methods from the perspective of the teacher and the learner.

All the teaching materials that will be created during the project by both teachers as well as students are published online under open licence (creative commons or Open Database License for geodata).

The EduChange Collective (Jiří Pánek, Vít Pászto, Tomáš Daněk, Jan Ketil Rød, Jakob Cyvin, Jardar Cyvin, Bouke van Gorp, Tim Favier, Paul Pace, Mark Mifsud, Martin Musumeci, Charles Bonello).

Design: Vít Pászto

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Making knowledge together - addressing climate change through  
innovative place based education and blended learning

2017-1-CZ01-KA203-035519



## NIDELVA WALKABOUT

*ScienceJam Compendium 2020*

**Authors:** *Henning Sjoelie, Rosemon Afra Bosompem*



Co-funded by the  
Erasmus+ Programme  
of the European Union



**THEME**

Learn about river erosion and quick clay.

**SUGGESTED AGE**

17 to 18 years

**ACTIVITY DURATION**

45-90 minutes

**SITE**

Around the Studentersamfundet building and the Nidelva River, Trondheim, Norway.

**RELATION TO CURRICULUM**

Effects of Climate change and river erosion studies.

**POSSIBLE CONNECTIONS TO OTHER SUBJECTS**

Social sciences

Physics

Biology

Natural sciences

**EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES**

The activity aims to provide students with practical experience and knowledge about river erosion and quick clay hazards, their amplification due to climate change, how to control them, as well as the challenges of doing so.

The activity will also give students an opportunity to have a firsthand observation of the topic being taught for easy understanding.



### **REMOTE PREPARATION**

This educational activity should ideally be placed after the students are taught about fluvial morphology, and quick clay. If not, the activity can be adjusted also to be an introduction to the subject.

### **PLANNING CONSIDERATIONS**

With the current situation with covid-19, students will be advised to maintain physical distance as much as possible throughout the walkabout. This situation and the government's demands change continuously, and will have to be met at the time. Students will be advised to take precautions as the activity will be carried out around the Studentersamfundet, which is close to the road and the Nidelva construction sites

### **RESOURCES REQUIRED**

Supplied folder for questions and writing equipment.



## OUTLINE OF THE EDUCATIONAL ACTIVITY

### ***Introduction***

The students and teacher(s) walk to the northern side of the Studentersamfundet building, where the teacher explains that there will be an extension to the building. The construction has already started, but maybe not in the sense you might expect. The construction has in fact started down-hill from the “actual” construction site. This construction is a reinforcement to the river wall of the Nidelva river. This reinforcement will prevent river erosion, and prevent a slide being triggered from the uphill pressure.

The teacher can prepare a folder with questions and room for answers. This folder can include maps of the area, risk assessment maps, models of the Studentersamfundet extension, etc.

### ***Development***

The students are given freedom to find this “secondary” construction site on their own, and wonder about why this is. After some time, the teacher will “reveal” the mystery. The students can be shown risk assessment maps of quick clay in their folder, if the teacher prepared one.

Next, the students and teacher will walk across the river, either over Elgeseter bridge, or Bybroen bridge, to an area between the cathedral and river (northern part of Marinen). Here, they will study past river reinforcements. First, they will be asked to look for similar reinforcements – this will be quite easy, as the river walls are completely covered with old buildings on poles – these poles can be seen as river wall reinforcements. In particular, there have been specific reinforcements built underneath these buildings in 2002, 2005, among others. This information can be found on NGU, following the links provided. Additionally, river erosion has begun to dig deep holes in the river bed. These holes are a potential hazard to quick clay, as they may disrupt it suddenly. These holes are not very well understood, but some theorize that they are caused by energy being diverted away from river wall erosion – this energy needs to be spent elsewhere, so holes are dug. There have been two such holes recently – in 2002 and 2015, one beneath Elgeseter bridge, and one in the river close to the second post the students are visiting. They were both filled with sand.

Next, students will be given a map of the Nidelva river today, and asked how they expect the river will look in the future, if the river is allowed to erode naturally. After some time, they may look at older maps of Trondheim, which gives an idea of the shape of the river. The oldest (still useful) map we have been able to find is one from 1658. It shows little sign of erosion having happened since then. Why is this?

Finally, the students will be asked the following question: Trondheim is expected to see an increase in precipitation in the near and far future. What do you think will be the implications of this?

### ***Conclusion***



The conclusion to this activity will be a summary of what we have learned so far, and what the students have observed.

### FOLLOW-UP ACTIVITY

There are plenty of maps showing variables like predicted precipitation increase in different areas of the country, quick clay content of the ground, and areas of reinforcement to combat slides and erosion. These can be given to students.

### BACKGROUND INFORMATION FOR TEACHERS

Quick clay risk map:

<http://geo.ngu.no/kart/arealis/?lang=Norsk&Box=-801707:6300000:1621707:9000000&map=Norges.vassdrags..og.energidirektorat:.Kvikkl eire...risikokart>

Information about Studentersamfundet extension:

<https://www.samfundet.no/nybygg>

Historical maps:

<https://kartverket.no/Kart/Historiske-kart/Historiske-kart-galleri/?fylkesnr=16&seriekortbeskrivelse=amt1#>.

### ADAPTATION

We assume learning difficulties are mainly relevant to take in mind when teaching the subject of fluvial morphology and quick clay, which will happen before this learning activity. The teacher is expected to encourage questions from students during this learning activity, to clear up any confusion students might have.

### EXTENSIONS

As stated earlier, there are plenty of maps of different variables, which can be used to future work in class. Any students particularly interested in researching the topic on their own can also be directed to these resources, and research them themselves.

### REFERENCES

### ACKNOWLEDGEMENT



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## RAINWATER RETENTION IN URBAN AREAS

*ScienceJam Compendium 2020*

**Authors:** *Unn Iveland Jacobsen, Selina Köstenberger, Ane Skottun*



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of the European Union



### THEME

Rainwater retention and stormwater

### SUGGESTED AGE

Upper secondary school

### ACTIVITY DURATION

90 minutes

### SITE

Anywhere inside (classroom or at home), alternatively partially outside around the school, if done during class hours, or around the students' homes/way to school, if done as homework (see "Adaptations").

### RELATION TO CURRICULUM

- The curriculum in geography has quite a few learning objectives which makes this activity relevant.
- The student should be able to use digital maps and geographical information system (GIS).
- The student should be able to explain conditions that determine weather and climate in Norway.
- The student should be able to gather and present geographical information by reading texts, pictures and static representation from digital sources.

### POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Social sciences

Politics

### EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

- The student should be able to explain what overwater is and reflect on solutions related to the problem.
- The student should be able to use a digital map-
- The student should be able to localize an "undeveloped area", "slightly developed area" and a "densely populated area" on the digital map.

### REMOTE PREPARATION

The activity does not require that much preparation if the students have basic knowledge about precipitation and water, which they probably have at this point of their education.



## PLANNING CONSIDERATIONS

We don't think any warnings are necessary. The topic is not the most controversial.

## RESOURCES REQUIRED

A computer with internet access.

## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Introduction

This exercise is based on the medium of the storymap. The Storymap contains three parts with 4 exercises for students in upper secondary school that will help them understand the problems related to overwater in the students' local surroundings and reflect on different solutions. The more general aim of the exercises is to help avoid the abstract bias, where issues seem irrelevant and hence too abstract since they are not recognised and experienced in one's everyday life. Before you start the lesson, make sure the students each have a computer with internet access available. The format of the Storymap is versatile, so they can use it individually - at home or in the classroom - or work in smaller groups. Going through the whole Storymap is estimated to take approximately 90 minutes.

### Development

The storymap starts with a short introduction on how climate change is going to affect precipitation in Norway.

The first part is dealing with stormwater in towns. Three videos are posted to watch for the students to understand the challenges related to stormwater in cities. Their first exercise asks them to apply this information to a figure in the map. They are asked to explain graphs with run-off intensities for areas of different degrees of development.

The second part takes the students on a virtual walk (via GoogleMaps) to their school. They are asked to look for areas with differing degrees of development and taking 'screen-snaps' of them. Those will be integrated into an interactive map on 'Padlet', where all the students post their snaps and give some information on them. They can also see the contributions of their fellow students.

The third part is dealing with sustainable solutions. The students watch another video and then list some of the 'Sustainable Urban drainage' systems they just learned about. In this exercise, students, who finish early can also be encouraged to look for more solutions on the internet themselves.

### Conclusion

The Storymap provides students with information on rainwater retention in Trondheim. It can be adapted to other towns in Norway and globally. It is an exercise that can be used in homeschooling (therefore corona-friendly) but also within the classroom, provided that there are computers available



## FOLLOW-UP ACTIVITY

In-class discussion with the teacher. Debrief and sum up.

## BACKGROUND INFORMATION FOR TEACHERS

How to create an interactive map on padlet:

1. Open [www.padlet.com](http://www.padlet.com)
2. Choose: “make a padlet”
3. Choose the map-function, and share the link to the padlet you made with your students.
4. Now you can start using the padlet! Let the students know which area to focus on. For example a city.
5. Now the students can set a pin on different areas and describe it with a few sentences. They can also include pictures from google street view or google earth in the pin.

You should also be familiar with google maps and how to take screenshots of parts of the screen (For pc: snipping tool app. For Mac: shift+command+4).

## ADAPTATION

Doing the tasks in pairs or small groups will make it easier to understand for students who might have difficulties with reading. Alternatively: Students could, after watching the videos, go outside and take pictures of the ground in places around the school where they think it's either difficult or easy for water to permeate (asphalt, grass, gravel etc.).

## EXTENSIONS

Write a letter to your local government, requesting them to take action for more retention areas in your town. Make some recommendations on how they could develop such areas of Sustainable Drainage. As a larger extension: Invite someone from the local government to the school and do a presentation on how the city should plan in the future.



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## (EXTRA)ORDINARY WATER AND ME

*ScienceJam Compendium 2020*

**Authors:** *Mariia Shestakova, Marie Ambrozková and Michal Mikulec*



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of the European Union



**THEME**

Climate change and water supplies

**SUGGESTED AGE**

15 – 19 years

**ACTIVITY DURATION**

135 min. (3 x 45 min.)

**SITE**

Classroom

**--- PART A ---****FRESH WATER INTO DRINKABLE****POSSIBLE CONNECTIONS TO OTHER SUBJECTS**

Biology

Geography

Ecology

**EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES**

The students become aware of importance of water for everyday life.

The students can describe characteristics of drinkable water and how it is produced.

**REMOTE PREPARATION**

Activity is an introduction to a topic, need to be prepared on topic of climate change and things connected to it in a way of knowledge

**PLANNING CONSIDERATIONS**

The aim of this activity is to work with possibility of students thinking fresh water is already drinkable.

**RESOURCES REQUIRED**

Projector, internet connection (to show photos/video) or without it – teacher can draw schemes on the whiteboard.



## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Introduction

Teacher asks students if the water from river or stream is clean enough to drink (yes/no/why?). Can we find it out also by using only simple observation? Did you ever experience a lack of water (e.g. in a well, cottage, at your grandparents)? Do you think that climate change affects water cycle? If so, how? If you learned students already about climate change, you know their knowledge background. If not, try to find out what do they already know about climate change and its' causes. You can play them a video about climate change on youtube: <https://youtu.be/4UAWtQMDimo> (or any other similar video you know).

Teacher gives a task: *Imagine that you are in the forest (in the middle of nowhere) and you have the lack of drinkable water. There is a stream/river nearby. What should you do with water to make it safe to drink?*

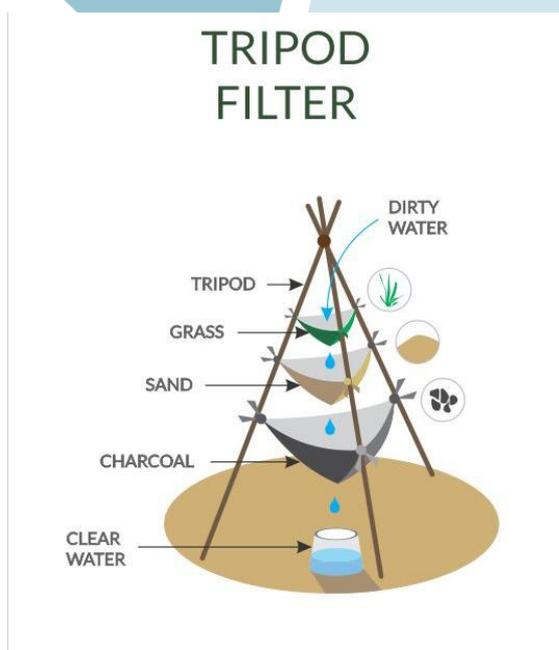
(Give students 5 min. to make some suggestions.)

Teacher collects students' opinions and suggestions, tell his/her opinion and discuss with students. Then it is possible to mention these 3 possible solutions (if not mentioned already by students). Yet, do not recommend using these procedures if not necessary (water could still contain some micro biotics and bacteria or particles of heavy metals!)

### Solutions:

1. To boil the water, if ever possible. Notice that it will kill some bacteria, but will not clean water from impurity (sand, clay, minerals).
2. Make a DIY filter. There are instructions step by step below (teacher can show a picture or to draw the scheme on the whiteboard; no need to construct filter by yourself). You will need: sticks and the good water-permeable fabric (e.g. a cotton T-shirt). Instructions:
  - Make a tripod from sticks.
  - Tie the cloth in 3 tiers as in the picture.
  - Put a bunch of grass in the 1<sup>st</sup> tier.
  - Put some river sand in the 2<sup>nd</sup> tier.
  - Put the coal (for example from the bonfire) in the 3<sup>rd</sup> tier.
  - Put a bowl under the DIY filter
  - Pour the water into 1<sup>st</sup> tier and wait until filtration is done.





Source: <https://www.vicharoo.com/environment/water/low-cost-water-purification-methods-1/#tripod>

Explanation: the bunch of grass will filter parts of leaves, plants and flower pollen. Sand in the 2<sup>nd</sup> tier is a great natural sorbent, that will capture mechanical impurities and clean water from ions of Fe and Mn. The coal in the 3<sup>rd</sup> tier will neutralize harmful organic compounds. This method will not kill bacteria in the water. To destroy them you should boil the water or use solar disinfection (SODIS) – let water on straight sunshine at least for 6 hours or other way of disinfection.

If you combine these 2 methods, you will get a portion of safe drinkable water.

3. Use a banana peel (also as a theoretical part). Instructions:

- Take a banana peel and let it gets dry (few hours in the sun should be enough).
- Chop a banana peel (as small pieces as possible).
- Then filter the river water through the dried chopped peel (even better to use it together with coffee filter or some cloth) at least several times.

Explanation: molecules in a chopped peel acquires a negative charge that attract positively charged molecules (carboxylic acid) and ions in the water (e.g.:  $\text{Cd}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{U}^{3+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ).

### Conclusion

Teacher provides a discussion why drinkable water is valuable (lack of water in many countries, process of water treatment if difficult and consists of many different operations - adding chemical reagent into the water, water sedimentation, filtration, ozonation, disinfection by Cl).



## BACKGROUND INFORMATION FOR TEACHERS

[https://www.youtube.com/watch?v=kcu\\_DoXkAzU](https://www.youtube.com/watch?v=kcu_DoXkAzU)

<https://www.vicharoo.com/environment/water/low-cost-water-purification-methods-1/>

Pictures of DIY filter: <https://bit.ly/2yx1bE1> ; <https://bit.ly/2zppXnU>

## --- PART B ---

### RICH, WATER-SUSTAINABLE OR BALANCED?

## DURATION

45 minutes

## RELATION TO CURRICULUM

One of components of Czech curriculum is environmental education, which belongs to intersubjective topics, mainly for natural sciences – biology and geography. This topic is suitable for topic of water cycle, global or regional climate or ecology

## POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Mathematics (basic counting, percentage)

Biology (water cycle in nature, plants' relationship to water, ecological structure of coniferous and deciduous forests)

History (historical development of cultural landscape in the vicinity of our location)

## EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

The students become aware of importance of water for everyday life.

The students can describe basic impact of climate change on water cycle.

The students can explain and analyse how infiltration & storage of rainwater works in different landscapes. The students can describe characteristics of drinkable water and how it is produced.

The students can describe how much water different activities need and different reduction measures.

## REMOTE PREPARATION

You need to prepare material for making gamefields. You should try to make each of them approximately the same size. To avoid the need of too big game desk, we recommend cutting pieces for gamefields to maximum size of 4x4 cm. So, you can cut sponge into halves, sponge towel into quarters, paper towel into  $\frac{1}{9}$ .



## PLANNING CONSIDERATIONS

Make sure you read the rules and understand it before you play this game with students so you could help them with the rules if needed. Also, might be harder to watch over more groups and students might be not willing to play in some groups. Prepare some quick option, how to divide students into groups as well.

It would be better to have already prepared sets for each group at the beginning of this activity to save time.

## RESOURCES REQUIRED

Sprayer, paper towels, sponges, sponge towels, small cork plates, small thick paper plates, hardbound for drawings or wooden desk (or any material with similar qualities), water (about 50 ml per group), measuring jug, dice, boxes or books for underlying the game desks, trays.

## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Introduction

In this activity students try to create a landscape on a game board (hardbound for drawings or wooden desk or anything similar) which will be able to hold as much water as possible and will be economically profitable in the same time.

### Development

This activity has two phases – dry and wet.

- Dry phase

Students are divided into groups of 4-6 people (depends on the number of students in class) with maximum 6 groups in class (for better organisation). Each group gets its game board (hardbound for drawings, wooden desk or so) and a set of gamefields. Game area is 4x4 gamefields, where students can combine those gamefields according to rules of this game. Types of material used for each type of gamefield is only recommended. You can use any other material (cloth, cotton, cardboard...) with similar abilities to retain water. Students will obtain gamefields (they made them themselves during art lesson or it was created by some other class earlier) at the beginning of the activity. Before the game starts, the dice is thrown for settling the type of terrain – numbers 1 and 2 represents flat terrain, 3 and 4 hilly terrain, 5 and 6 mountainous terrain. Follow the following instructions according to which type of terrain is settled. According to type of terrain you underlay game desk on one side with book or some box of 5 cm for hilly terrain or 10 cm for mountainous terrain. Then the dice is used again, when students are ready with their landscapes. In this case numbers 4 and 6 represents years of natural disasters (floods/droughts), so you count values of tiles with using value of susceptibility.



Give students about 5 minutes to read the rules and information about gamefield types and their abilities and then about 10 minutes to create countryside on the game desk in their groups.

The list of gamefield types:

- 1) Meadow/grassland – represented by piece of thin paper towel. Holds water quickly, but only in limited amount.
- 2) Built-up area – plain game desk, represents area with high building density (housing, services or industry). It has almost none ability to hold water.
- 3) “High production” field – classic agriculture field (monoculture) with draining land improvements and no bosks. Represented by small cork plate – can badly retain water.
- 4) “Smart” field – agriculture field with bosks and no draining improvements. Represented by a small thick-paper plate. Can slightly retain limited amount of water.
- 5) Deciduous forest – healthy deciduous forest represented by a sponge. Can hold huge amount of water and it has great ability to cope with droughts and floods.
- 6) Coniferous forest – represented by piece of sponge cloth. Has good water-retain ability.

Rules:

1. You can combine gamefields on your game desk as you wish.
2. You cannot use more than 16 gamefields or put more than one gamefield on each “slot” (no putting gamefields one to another).
3. According to type of terrain you can use limited number of some gamefields without penalty. Using more of them will change attributes of those gamefields. (E.g. there was number 5 on a dice, so terrain was settled as a mountainous terrain. Your group decided to have 6 built-up areas slots. 3 of them are without any penalty. Another 2 are for low penalty – adding extra one point to each attribute except of profitability. The last one is even with high penalty – adding extra 3 points to each attribute except of profitability. Also, in this type of terrain you can built no more than 9 built-up areas in total, in case your group would decide to have even more of this type of tiles.)



Table 1B

Gamefield	Number of tiles without penalty/ low penalty*/ high penalty**		
	flatlands	Hilly terrain	Mountainous terrain
Meadow/grassland	unlimited		10/ 4*
“Smart” field	unlimited	8/ 4* / 2**	4/ 3* / 4**
“High production” field	10/ 6*	6/ 6* / 2**	3/ 2* / 4**
Coniferous forest	12/ 4*	unlimited	10/ 4*
Deciduous forest	unlimited		10/ 2*
Built-up area	6/ 4* / 4**	4/ 3* / 4**	3/ 2* / 4**

4. You cannot use more gamefields of some type, than it's sum of them for each type of terrain shown in table 1B (e.g. in hilly terrain you can have 12 tiles with “smart field” gamefields, out of which would be 8 without penalty, 4 with low penalty and 2 of them with high penalty).
5. Gamefields have to be put as close together as possible. Try to avoid any gaps between them.

Gamefields have these abilities:

- Profitability – financial profit created by this gamefield.
- Purchase costs – a price for creating this gamefield (construction price). They are counted only first game year. Next game years you count only with maintenance.
- Maintenance – a cost of operation and maintenance of each game field for one game year.
- Susceptibility – ability to cope with effects of drought or flood. The higher is value of susceptibility, the worse is ability to cope with the effects. In case of drought or flood is the value of susceptibility subtracted from the value of profitability. Final value is the height of profitability during unfavourable game year.

After completion of game countryside, you count values of profitability of each gamefield. Then you subtract values of purchase costs and maintenances from it. Final value is the profit your team gains from your game desk in that game year. Then you can throw a dice (as mentioned above) and in case you throw number 4 or 6 (or as you decide), you reach a game year with natural disaster. In that case you count value of profit during period of



drought/flood by subtracting value of susceptibility and maintenance from value of profitability (you do not subtract values of purchase cost anymore). You can “play” for example 5 of game years.

Quickly compare final values of profit you reached between each team (max. 5 minutes for that). The winner here is team which has the highest profit (even with unfavourable game year/s).

- Wet phase

students use sprayer to apply water onto game desks. There is a known volume of water at the beginning (we advise 50 ml) in sprayer. Students apply water evenly as possible onto game desk with at least 20 cm distance between sprayer and a surface of the desk. When it starts to be complicated to spray the water out of sprayer (it is almost empty), measure volume of water left in sprayer, so we know volume applied on game landscape. Take each gamefield out of the game desk - carefully, one after another, so all the extra water (use no extra force to extract water out) which can't be hold by gamefield runs down on a game desk. Carefully run the water down from game desk into some bowl or tray, so you can measure the final volume. Approximately 10 minutes for that, so you have some time for final discussion.

How to count the final volume:

*(volume of applied water) – (volume of runned-down water) = volume of water retained by gamefields.*

The winner here is team which built landscape with the highest ability to retain water.

Compare results of second activity with results of first one. Is there any difference? Was the landscape, which had the highest profits also the one with the highest ability to retain water? Why yes/ why not? Why there are penalties settled (you can explain, that for example if students want to build “city” everywhere, they need to build then even on not suitable places (steep hills, bad geology underground...), provide it with water, food, electricity, services...)? Why there is difference between deciduous and coniferous forest...

You can also work only with values for disastrous years – how would we need to recreate landscape to handle such a situation?



## Conclusion

Time management of this activity:

Table 2B

Activity	Time needed (minutes)
Making groups and distribution of material	5
Reading the rules and information about game	5
Creating game landscape in groups	10
Counting the profits of game landscapes	5
Discussion about results	5
Wet phase of game	10
Comparison of results of dry and wet phase, discussion	5

### FOLLOW-UP ACTIVITY

Students can observe / analyse landcover in their neighbourhood, near by school or their home. Can they find some places of water accumulation? Did they experience flash-floods? If so, where (why it was on that place? Could it be connected also to landcover?).

### ADAPTATION

Hopefully this activity is very visual and understandable even for these students.

### EXTENSIONS

they may try to do enquiry – is there nearby your home some project for helping a landscape to retain water? Does it have some effect? Can you see differences between eco-farming and classical farming for the highest production?

### --- PART C ---

#### WATER CONSUMPTION AND HOW TO DECREASE IT

### POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography



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### EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

The students become aware of importance of water for everyday life.

The students can describe how much water different activities need and different reduction measures.

The students realise the importance of reducing their water consumption.

The students can create a plan of reducing water consumption in their household.

### REMOTE PREPARATION

Teacher should go through followed information, try to know your own consumption or some interesting information not mentioned here.

### PLANNING CONSIDERATIONS

Students might not be willing to discuss or cooperate in groups. Might help to give students evaluation in the end (to evaluate classmates), try to stimulate discussion.

### RESOURCES REQUIRED

Table 1C printed out (at least 4 times depending on the number of students) and cut on the two columns; papers and pens for students; buckets, water, measuring jug.

### OUTLINE OF THE EDUCATIONAL ACTIVITY

#### “Water in a household”

##### Introduction

This activity is focused on our own water consumption, water consumption in general and how can we improve our water management to save water. To show students it is not so common and almost priceless article as they could think. What can cause the change of our daily behaviour?

Brainstorming: For what activities do you need water at home? The teacher can write students' answers on a whiteboard.

##### Development

##### Activity:

Students are in groups of 5. For the first round, the teacher gives them the first column from table 1C. Students have to plan their ideal/typical week - how many of the mentioned activities (you can also add your own based on the brainstorming) will they “use” during one week and how many times?



After they have the week planned, the teacher provides students with the second column and they count how much water they spent during the week.

For the 2<sup>nd</sup> round, every “household” has a bucket with 2 litres of water. 1 ml of the real water is equal to 1 litre for their “household”, so every household has 2000 litres for one week. The students must now plan their week and “pay” with the water in the bucket to the teacher.

Then they would count how much money do they spend for water (if there is known price for 1 m<sup>3</sup> (1000 l) and how much money would they save by using water-saving behaviour.

Table 1C

<b>Hygiene</b>	
Toilet	3/6 litres
Shower	10 litres / a minute
Bath	80 litres
Washing hands	2 litres
Brushing teeth	5 litres
<b>Cleaning/washing</b>	
Dishwasher	12 litres
Dishwashing by hand	63 litres
Washing machine	75 litres
Mopping the floor	20 litres
Washing car	130 litres
<b>Food &amp; drink</b>	
Cooking	1 litre
Drinking	1,5 litres
<b>Other</b>	
Watering the garden	250 litres

### Conclusion



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A discussion follows: How did you save water? Would you do anything of that at home? Are you taking any of these measures at your household already?

Teacher also asks if there are any other ways (except for household) how we can save water. The teacher adds information about water hidden in consumption and lifestyles (see “Background information for teachers”).

### FOLLOW-UP ACTIVITY

The students ask their parents how much water they use per week in their household and how much does it cost. Those who want, can take a challenge of spending only 500 l per person per week in their household.

### BACKGROUND INFORMATION FOR TEACHERS

<https://www.watercalculator.org/how-to-save-water/>

#### Actions connected to water

- Close the taps while brushing teeth
- Take quick showers
- Fix any leaky taps at home
- Don't pour excess drinking water in the sink
- Wash fruits in a bowl of water: cleaning fruits and vegetables may take up more water than you intend to use. Wash fruits in a bowl of water and use it later for your plants.
- Collect rainwater: this water can be used later for washing utensils or watering plants.
- Use your garbage disposal sparingly. Garbage disposals use a lot of water to get rid of the garbage, so try not to use it very often.

#### Daily life (Change your lifestyle)

- **Eat and buy locally.** If your food, clothing, or other goods had to travel a long distance to get to you, it probably used a lot of water in doing so. The production of gasoline uses many gallons of water, so try to purchase local foods and merchandise to reduce your water footprint.
- **Eat less meat and dairy.** Cut down on the amount of processed foods you eat.
- cut out sugary foods (too bigger water footprint)
- Drink water. All those other beverages — wine, tea, soda, juice — took water to produce too.



- **Carpool, bike, or use public transportation.** By carpooling to school, biking to work, or taking a bus to run errands, you'll cut down on energy use as well as water use. As stated earlier, it takes many gallons of water to produce one gallon of gasoline, so do your part and try to drive less.
- **Reuse or recycle products.** It takes hundreds of gallons of water to produce everything from a t-shirt to a ream of paper. Donate old clothes, furniture, or any other household items to charities or donation centers, and recycle your paper, plastics, and metals. Reduce, reuse, recycle is usually the best policy when it comes to the environment, and trying to save water is no exception.
- **Use cold water instead of warm water.** It takes water to create energy, and energy is needed to heat up your water. By choosing to wash your clothes in cold water, you'll save water *and* energy.
- **Dry your clean clothes on a drying rack.** This may not be possible to do with all of your clothes, but try to hang-dry as many dresses, shirts, pants, etc. as possible.
- **Do less laundry.** This will not only save water, but will save wear and tear on your clothes
- **Load your dishwasher to its full capacity.** Similar to your washing machine

### Garden

- Know how to adjust your sprinkler and irrigation timer settings for the seasons. Water less or not at all during wetter, cooler weather.
- Don't over-water, and don't water any faster than the soil can absorb the water. If water is running off the lawn onto the sidewalk, cut the watering time or divide it into two smaller segments to allow time for the water to absorb.
- **Don't cut your grass too short.** In terms of water-saving strategies, growing long grass is better than cutting it too short. Grass can grow deeper roots when it's longer, allowing it to be watered less often. Raise the height of your mower blade to avoid mowing your lawn too short.
- If you live in an area with infrequent rain, consider not planting grass and instead using plants from your area that don't need as much attention and water.
- **Use grey water to water your lawn.** Grey water is any water that's been used after running the dishwasher, shower, washing machine, or sink in your house. If watering plants, don't use grey water on anything you might eat, as the water could be contaminated. The easiest way to use grey water is to link it directly from the indoors to the outdoors using piping, and then use the water on your garden or yard.
- **Use mulch** on your garden to retain moisture. Covering the soil around your plants with mulch will not only prevent water from evaporating, but it will keep your soil healthy and prevent weed growth.



You want to find mulch that is organic - it'll improve your soil as it breaks down. The most common types of mulch are wood chips and bark.

- Instead of using sprinklers dig holes on the yard where you can have a little pond and use the water from there to water the lawn.

### Street

- **Don't wash the driveway or sidewalk with a hose.** If you need to clean your sidewalk or driveway, use a broom, rake, or leaf blower to remove dry matter. If the driveway or sidewalk still needs additional cleaning, use a bucket of water or let the rain do the rest. Using a hose with waste water only.
- Use a bucket and sponge to clean the car!

(Sources: <https://www.wikihow.com/Save-Water>, <https://www.chrysalishigh.com/blog/teaching-water-conservation-10-ways-children-can-save-water/>, <https://www.projectwater.info/100-ways-to-conserve-water.html>)



Making knowledge together - addressing climate change through  
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## HOW TO HELP THE FORESTS TO SAVE THE PLANET FROM CLIMATE CHANGE

*ScienceJam Compendium 2020*

**Authors:** *Rozálie Hovořáková and Kristýna Šťastná*



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## THEME

Climate change and forests

## SUGGESTED AGE

15-19 years of age; high school students

## ACTIVITY DURATION

90 minutes

## SITE

It would be nice to teach this lesson directly in the places about which they're learning – outdoors – for example in the woods. If it's not possible, the lesson can take place in the classroom. At that moment, however, it is good to include at least some multimedia aids – videos, VR, maps, etc.

## EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

- the students should realize the importance of every tree
- to learn how to use trees /forests to change the local climate and thus influence (mitigate) the progress of climate change
- to be aware of the specific effects that climate change has on the environment in which we live
- to learn about the value of the forest
- to realize, that every individual can somehow contribute

## RESOURCES REQUIRED

Phase 1

a) medals (see attachment 1), string, scissors, puncher

b) papers (see attachment 2)

c) pictures (see attachment 3, 4, 5 and 6)

Phase 2

a) working sheets (see attachment 7), materials for expert groups (see attachment 8, 9, 10, 11, 12)

Phase 3

a) tree printed on A2 or A3 paper (see attachment 13), pictures (see attachment 14) according to the number of students, colorful papers (blue, brown, white, green), paper gum.



## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Phase 1

- evocation → knowledge, and preconceptions are determined

#### a. Medals (10 min)

- The students will get each one medal on a string on their back, where will be a definition or a name of a term (f.e. global warming- ...is a long-term increase in the average temperature of the Earth's climate system. – see attachment 1)
- The task for the students will be to find the right pair always from one term and definition. The students themselves don't know, what is written on its medal, they don't go after, what they are. If somebody finds a pair, they send them on a given spot (*which the teacher determines at the beginning of the activity*), where the inspection takes place.
- There they can turn the medals from the back forward and consult with each other. However, if they find that this is not the case, they return the medal on their backs and continue their search.
- Finally, students can stand in pairs (term – definition) in a circle and introduce/repeat the terms. It is also possible to ask additional questions and elaborate on the terms.

*\*Medals should contain general concepts that students already know for previous lessons and should remind or repeat the through this activity (due to the fact that these concepts will appear in the lesson.)*

*\*It is possible to have more or fewer medals, according to the number of students. In our case, we have 20 students – 10 pairs of medals.*

*\* It is possible to give students a little advice and guide them in the right direction.*

#### b. Papers (20 min)

- Each student will receive a set of ten papers (see attachment 2), which will contain some facts/information related to the topic. Each student may have different cards, some may be repeated or there may be groups or pairs with the same sets.
- The first task of the student will be to divide the cards into those that he thinks are true and those that are not.
- If they think they have already finished, they will have it checked by their classmates or teacher.
- The second task for them will be to work with „false“ papers. For those papers with a numerical value, their task will be to decide whether the actual value is



higher or lower. For those who have incorrect information, their task will be to correct this information.

*\* It's good to walk around the students and check on them frequently.*

*\* If some pairs or group of students have the same papers, they can control each others' work or discuss it.*

*\* It's good to have those papers laminated – the work with them is easier. It's also possible to use two cups marked True x False or More x Less.*

### **c. Dividing into groups using pictures (10 min)**

- In annexes (see attachment 3,4,5,6) are pictures and information for each working group – city, village, forest, and mountains. Each student gets one picture or a piece of information.
- The student's task is to figure out how to logically divide into four groups of five members using pictures/information.
- Then they have the task of figuring out what their group might be called.

*\* There can be more or fewer groups. The same goes for the number of group members. We chose 4 groups of 5 members.*

*\* Ideally, the pictures should correspond to the place where the lessons are taught (the city where the students live, the nearby village, as well as the forest and nearby mountains). It's better for students to learn about the places they know. This will make the topics more tangible and more attractive to them.*

*\* Pictures/information is again better to have laminated.*

*\* After dividing into groups, students can also do a quick brainstorming about the content of the place and the topics of the lesson.*

## **Phase 2**

**- awareness of meaning → searching for new information and comparison with the original**

### **c. Jigsaw puzzle learning → expert and home groups (20 + 20 + 15 min)**

- Each group of students shares numbers 1 to 5.
- Each group will receive their worksheets (see attachment 7). In the worksheet, the individual tasks are again divided under numbers 1 to 5 (students with number 1 refer to sector 1 → they will become experts for this part...). Students will receive the worksheet.
- Each student is sent from his home group to an expert group, of which there is the same number as students (in our case 5).



- Each expert group has its focus – 1. drought, 2. increase in average temperature, 3. extreme precipitation, 4. loss of woody plants, 5. what trees bring. Expert groups will receive materials (see attachment 8,9,10,11,12) on their topics and their task will be to find, memorize, and learn important information for their group.
- In expert groups, they can discuss, ask questions, and help each other. Each expert is responsible for the part with their topics.
- Then all the experts will return to their home groups, where they work out tasks and answer questions from the worksheet.
- Finally, the experts can go back for a while to the materials from the expert groups and add what they may have forgotten.
- Students choose one speaker for each group, who summarizes the content of their work to the other groups.

*\* It is good to print materials for expert groups more than once*

*\* After completing the worksheets, the teacher can ask questions to make sure, that the students understand everything correctly.*

*\* Students can also share problems, questions, solutions with their places.*

### Phase 3

- reflection → classification, consolidation, and systematization of knowledge

#### d. Tree (10 min)

- In the appendix (see attachment 13) you will find a tree that is good to print on the largest possible format (eg. A3 or A2). In the appendix, you will also find (see attachment 14) a set of pictures - droplets, bark, flowers and fruits (pears). It is good to print them on colored paper to work with them better (droplets - blue paper, bark - brown paper, flowers - white paper, and fruits on green paper).
- Each student will receive one from each picture (each student will have 1x drop, 1x bark, 1x flower, and 1x fruit).
- The student writes in a drop: an experience or something new, which he/she learned from this lesson.
- *At the tree, we start from the roots. The roots are the base of the tree, it is something that gets moisture and nutrients into the tree. Thanks to the roots, the tree can grow, develop, and grow stronger. For us, this experience is the moisture of the tree, so **each student has the task to write in his droplet what he/she knows**. It may be an experience, something new, that he/she learned in this lesson or already knew. It is important that it has something to do with the topic of the lesson and therefore helps the tree to grow properly.*



- **Students write in the bark: what we can do**, specific steps, ideas, and actions that society/individual can do to slow down climate change.
- *The next step is the tribe. The tribe holds us firmly above the ground and moves us up to the heights. Its bark protects us from everything bad and allows us to strengthen. The trunk of our tree will be an imaginary path to change and should consist of what we can do for ourselves. Therefore, **students should write in the picture of the crust specific steps, ideas, and actions** that either society or themselves can do to slow down climate change. Students can focus on the specific impact of climate change, or on the whole problem as a whole or how to help trees.*
- **Students write in bloom: their own, individual goal, resolution**, or idea of how they could slow down climate change.
- **Students write in the fruit of the pear: what all this activity will bring us, what it will give us, what is the specific goal.**
- *The third main part of the tree is its crown. The crown into which each of us is trying to climb, something we are trying to achieve. Something behind it will be a reward in the form of an incredibly beautiful view. The task of the students will be to write to the pear fruit what to give us, this whole activity will bring what it will give us, what is the desired goal/peak. At the same time, however, flowers also appear in the crown, which will represent their individual efforts. Students can write their own goal, resolution, or idea for the flower, how they themselves could contribute to the growth of our tree.*

The moment each student has information written in their pictures, they can be glued to our tree with the help of paper gum or glue (*droplets to the roots, bark to the trunk, flowers, and fruits to the crown*).

The teacher then ends the lesson by mentioning interesting or often recurring points. For some, he/she may stop more and repeat or recall parts of the lesson.

*\* There is also a cavity in the tree where students can write what could stand in the way of their goal.*

*\* It is good to hang a tree somewhere in the classroom after the lesson so that the students can return to it individually. They can return to it with a passage of time and internally reflect on their shift, new knowledge, goals achieved...*

*Tree = individual → everyone can do something, but together as a team (forest) we are stronger, but we also need to cooperate...*

*Life is like a tree. The first roots, trunk, twigs, and leaves grow from the seed. Gradually time, when a tree thrives, it grows into beauty. It is tall, with a strong trunk and a rich, flowering crown full of fruit. The longer and wider our roots, the greener our tree is.*

*Each tree consists of the same parts, in which all the trees are similar, of course, each has branches grown differently, each is*



*differently tall, may have a different leaf color, bark, size trunk, and living conditions, but it is always a tree with roots, trunk and branches - as well like people. Do you see the form in that? What else can you look for in that?*

Comment:

It is necessary for each region to adapt the lesson to its own conditions. Each country has a more dominant different impacts of climate change, and this should change the topics of the expert groups. It's also a good idea to use pictures and information from the region to teach students about impacts and solutions in places they know.

This lesson is prepared for example on the example of the Czech Republic. The main impacts of climate change were selected - drought, an increase in average temperature, extreme precipitation, as another problem was chosen the loss of trees and the last expert group deals with what the tree brings. The groups were divided according to the conditions of the Czech Republic into a city, a village, a forest, and a mountain area.

A three-phase learning model - EUR - was chosen as the framework for the lesson. As the name suggests, it consists of three parts. The first phase is called evocation - in this phase, the teacher finds out how much students already know about the topic and what preconceptions they have. At this stage, motivation, self-thinking and independent problem solving are important. The second phase is called awareness of the importance of new information/contexts - in this phase, students look for new information and compare it with the original. It is simply the learning phase. At this stage, it is necessary to maintain the interest of students and build cognitive bridges between old and new knowledge. The last, third phase is called reflection - in this phase, students sort, consolidate, and systematize knowledge. In the last phase, it is important to learn to express ideas, use your own words, and discuss. In this phase, students will evaluate what they are taking away from the lesson on the topic and the teachers will make sure that they have understood everything correctly?

## ATTACHMENTS

Attachments needed for this activity are available for download at:  
[http://tiny.cc/EDC\\_activity\\_forests](http://tiny.cc/EDC_activity_forests)



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**WE CHANGE CLIMATE CHANGE!**

*ScienceJam Compendium 2020*

**Authors:** *Ditmar Degiorgio*



Co-funded by the  
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### THEME

Back to basics on what climate change is to younger generations, that is, the generations of tomorrow.

### SUGGESTED AGE

11 - 16 year olds

### ACTIVITY DURATION

45 minutes

### SITE

Preferably these activities should be done in a yard.

### RESOURCES REQUIRED

Two bags with 10 blankets each

Chalk

Paper and pencils

### CONNECTIONS TO OTHER SUBJECTS

Biology

Chemistry

Physics

Geography

Social studies

### EDUCATIONAL OBJECTIVES & LEARNING OUTCOMES

Students will be able to practice their communication and teamwork skills

Students will be able to use their quick thinking abilities to solve problems/formulate solutions.

Students will understand the primary causes of global climate change

Students would be aware of both global and local solutions

Students will be able to use the theoretical knowledge gained in the lesson and apply it to their everyday lives

Students will gain awareness on their impact on this earth



## REMOTE PREPARATIONS

None required as the lesson will be carried out and based upon what the children already know.

## PLANNING CONSIDERATIONS

Ensure that the area outside where the class is to take place is free from any hazardous objects

Ensure that every child has the opportunity to partake in the activities prepared.

## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Introduction

Asking questions. (Discussion)

- “What is climate change?” or “What do you understand by the term climate change?” This is done to check what previous knowledge they have or any preconceptions regarding climate change.
- Being that students most likely will notice the effects/impacts due to climate change initially rather than the causes, ask about what might be a consequence of climate change: “What can you see/What do you think that is a result of climate change?”, “Can you mention 2 effects caused by climate change?”
- After that students will be asked what they think are the contributors (i.e. what causes) of climate change: “What do you think causes climate change?”, “Can you name 2 examples of which?”
- Finally ask them what could be done to mitigate climate change: “What can we do as students in order to help reduce climate change?”

After the asking of the questions, the concept of climate change is then explained to them, with its causes and effects and on ways on how to mitigate it.

Quick Writes: Then they are asked to write what they just learned (listened to) in order for the students to properly formulate their thoughts, and by actually trying to write it down (essentially explaining what they have just listened to, to themselves) students tend to learn, understand and remember more.

This activity also gives the opportunity for the teacher to go round and see what the students are writing, and if the teacher a student who does not participate as often (or as much the others) writing a really good answer or point, the teacher should tell the student “I want you to share that with the class” this will give confidence in such students allowing for them not to ‘stay back’ but to not be afraid to say what they think and take initiative. Giving verbal affirmation will boost their confidence, thus increasing the contribution by less participating students.



Pair and share:

- This activity is aimed towards younger students.
- The students raise their hands and find a partner within a span of 30 seconds.
- They decide who will be “A” and “B”.
- A- answers the question (90 seconds)
- B- fills any missing information or repeats what A said.  
Teacher walks around and listens to what the students are saying.
- Have a small 3 - 5 min break
- Students share out.
- They finally write what they learned.

### Development

The aim of the discussion is to become aware of what the students are knowledgeable about climate change and to clear up any misconceptions

To build upon the discussion the clothing game will be carried out in order to give the students the opportunity to apply what they’ve recently learnt

### Clothing game

- Divide into two groups
- Bring 2 bags of blankets
- Every right question means you take a blanket
- Wrong answer = no blanket
- Maximum right answers = e.g. 5
- Once one team reaches, for example, 5 points one of the students will put on the blankets as an analogy for global warming.
- start asking questions about solutions to climate change. Every right answer will remove a blanket.
- Whoever saves their ‘planet’ (the kid with the blankets) wins.
- At the end of the game ask the two students who were covered with blankets whether they felt cold/hot and relate to the actual situation of climate change.



After ensuring proper knowledge of the facts of climate change, the line game will be carried out in order to observe what the students' opinions on climate change are

### Line game

- Place the entire class in one straight line. On either side of the line the floor will be divided by the levels of agreeing and disagreeing
- Say statements.
- For every statement the child will be asked to take a step to the left or the right.
  - Left = don't agree
  - Right = agree

Then debate and have a discussion after each answer to see the students' opinion about the subject.

### **Conclusion**

Finally the students will be given a multi-part activity to do at home. The activity starts at home and will be "monitored" throughout multiple days.

### Home activity:

- What carbon footprint means should be first explained to the students.
- The students are then shown how a carbon footprint calculator works and how they can calculate their own carbon footprint.
- A couple of students are then selected to fill the carbon footprint calculator with you as an example and then assigned to do the same at home and try to come up with ways to reduce their carbon footprint.

They could come back the following days with their ideas and their carbon footprint could be calculated together again.

### **FOLLOW UP ACTIVITY**

Get feedback regarding the results noted by the students when using the carbon footprint.

Calculating carbon footprint.

### **BACKGROUND INFORMATION FOR TEACHERS**

<https://www.carbonfootprint.com/calculator.aspx>

### **ADAPTATIONS**

Make use of simple vocabulary during explanations and multiple choice questions during the various activities and discussions.



Some students could get help from their parents to fill in the carbon footprint questionnaire.

### **EXTENSION**

When carrying out the discussion or even the clothes game, interuse multiple choice questions with specific ones in order to further stimulate creative thinking.

Some students could make a guideline of how they changed their lifestyle to achieve a smaller carbon footprint.



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## URBAN GREENING

*ScienceJam Compendium 2020*

**Authors:** *Mariosa Caruana, Marika Tabone & Maureen Vella*



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### THEME

The implementation of urban greening to mitigate the causes and effects of climate change in relation to air quality and water catchment.

### KEYWORDS

Climate change, tree planting, green areas, air pollution, transport, over-urbanisation, sustainable landscaping.

### SUGGESTED AGE

16+ (Post-secondary students)

### ACTIVITY DURATION

2 weeks 1hr lesson slots each, 3 lessons a week (6 hrs in all)

### SITE

School Campus; Outdoor activities:

1. Woodlands (Buskett)
2. Busy road (no trees).

### RESOURCES REQUIRED

ArcGIS application

Data loggers per group

Electronic device with internet access e.g. laptop

### CONNECTIONS TO OTHER SUBJECTS

Chemistry

Biology

Physics

Environmental Science

Systems of Knowledge

Geography

English Language

Mathematics

Sociology



## EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

### Education Objectives

- To bring out the correlation between urbanisation, road infrastructure, urban greening and climate change
- To understand how international mitigation methods can be applied in the local scenario
- To promote active citizenship

### Learning Outcomes

- This activity will help students to:
- Define the term 'climate change'
- Identify the benefits of urban greening on air quality
- Use data loggers and ArcGIS to collect data
- Interpret the results given by data loggers
- Analyse the current situation related to air quality in different local sites
- Evaluate critically the observations made during the site visits
- Give examples of good practices related to urban greening
- Recognise the importance of sustainable urbanisation
- Communicate their concerns and mitigations suggestions addressed to higher governmental institutions or other political channels.

## PREPARATION FOR TEACHERS

Teachers should be:

- well-informed about climate change, global warming, greenhouse gases and air pollution
- trained in using data loggers and ArcGIS
- familiar with the sites to be visited and prepare risk assessments
- accompanied by an adequate number of teachers
- well-informed about international green urbanisation methods.

## PREPARATION FOR STUDENTS

Students should:

- Have a device that can connect to the internet (at least one device per group)
- Have experience using data loggers and ArcGIS
- Wear comfortable attire and face masks with air filters during the site visits.

## OUTLINE OF THE EDUCATIONAL ACTIVITY

### Activity 1: Introduction

Introduction:



A brainstorming activity will take place by producing two separate web diagrams about the following:

- Effects of climate change in Malta
- Urbanisation

The web diagrams will be built separately and consecutively.

After this brainstorming activity, a group discussion will take place integrating the two issues through proper questioning techniques.

This activity will be concluded by asking the students to construct a concept map interconnecting the two web diagrams. Students will be asked to discuss their concept map in peer groups.

### **Activity 2: Research**

Students are divided into four groups and asked to focus on air quality and urbanisation.

They will be given time to research and discuss the topic. The following keywords will be provided to aid students: green urbanisation, sustainable urban planning, sustainable landscaping, exhaust emissions.

In groups, students will then be informed that they will be visiting two different sites where they could carry out a simple investigation related to the issues discussed through the use of ArcGIS and apparatus such as data loggers. The students themselves will come up with a method of investigation, however, the teacher will be constantly providing guidance and support.

### **Activity 3: Investigation (Outdoor Activity)**

Students will carry out a site visit in one of the following:

1. Woodlands (Buskett)
2. Busy main road (no trees)

Each site will be investigated by two groups of students.

The students will observe, analyse and think critically about the characteristics of the site. They will also record data using data loggers and photographs. The students will then upload their records using ArcGIS.

### **Activity 4: Pooling and evaluation of results**

The pooling of results will take place in the classroom. Using the pooled results from ArcGIS, each group will discuss their findings.



A whole group discussion will then take place, where students are encouraged to voice their concerns and opinions. Through proper questioning, students are also asked about the role that they think they have as citizens in bringing about change.

### **Activity 5: Conclusion and Evaluation**

The class will be divided into two groups, each group will be provided with two different local articles relating to infrastructure works, particularly road widening and subsequent uprooting of trees. Participants in each group will be assigned a particular role e.g NGO activist, taxi driver, representative of the Ministry of Transport, Infrastructure and Capital Projects, citizens living in the specific locality and parents/guardians living in the main road, an individual having respiratory difficulty living in the locality and the road construction tender winner. The students will be encouraged to think and take up their assigned role and engage in a debate and exchange opinions. At one point in the debate, the roles of the students will be swapped, and the debate continues.

For evaluation and feedback purposes, the students will then reflect on their concept map and continue to build further links with newly acquired knowledge and conceptions. The teacher will then collect these concept maps to evaluate the learning that took place and address any misconceptions.

### **FOLLOW-UP ACTIVITY**

In groups, the students will discuss their concerns, as well as ways to address these concerns. They are encouraged to back their suggestions with their findings and further research, including examples of good practices used in other countries.

The students will then be encouraged to choose an appropriate political channel (e.g. governmental institutions, local councils etc...) and voice their concerns and their suggestions through a medium of their choice, such as a formal letter, emails, newspaper article, etc.

### **BACKGROUND INFORMATION FOR TEACHERS**

Teachers should have prior knowledge of the students' backgrounds to adapt according to the students' needs.

### **ADAPTATION**

Students are encouraged to devise a similar investigation using the newly acquired skills to explore other issues related to lack of urban greening and its relation to climate change e.g. water catchment.

### **REFERENCES**

Local Article Option 1:

[https://www.maltatoday.com.mt/news/national/89555/santa\\_luija\\_road\\_tunnels\\_get\\_planning\\_permit#.XrWavpZR36Y](https://www.maltatoday.com.mt/news/national/89555/santa_luija_road_tunnels_get_planning_permit#.XrWavpZR36Y)



Local Article Option 2: <https://timesofmalta.com/articles/view/workers-clear-trees-to-make-way-for-central-link.782201>

Local Article Option 3:

<https://www.independent.com.mt/articles/2020-01-07/local-news/55-million-investment-Work-on-Central-Link-project-starts-today-6736218099>

Local Article Option 4:

<https://www.maltatoday.com.mt/environment/townscapes/89334/addolorata-and-talbarrani-road-works-will-see-loss-of-14589-sqm-of-agricultural-land>



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Making knowledge together - addressing climate change through  
innovative place based education and blended learning

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## PLACE BASED SCENARIO THINKING: MAPPING THE FUTURE

*ScienceJam Compendium 2020*

**Authors:** *Annechien Tabak, Patrick Meerman & Loes Albert*



Co-funded by the  
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### THEME

Designing the safest future-scenario for a specific region in the Netherlands (Gelderse Vallei) that is threatened by increased risk of flooding due to consequences of climate change.

### SUGGESTED AGE

15-18 years old

### ACTIVITY DURATION

3 times 60 minutes, 180 minutes in total

### SITE

The activity is specifically about a valley-region behind a river dike (Gelderse Vallei) in the Netherlands.

### RELATION TO CURRICULUM

The activity fits within the geography curriculum, especially with a topic like water management. In the Dutch geography curriculum students are taught about the water management policy of the Netherlands. The activity is a way of engaging with such policy plans.

### POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Might be further designed to make it more cross-curricular in general. Subjects like economics and history can be included to create a broader picture of the future.

### EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

After this lesson series, students are able to:

#	Learning objective	Cognitive Domain
1.	...explain the impact of climate change on the discharge of a river system.	Understanding
2.	...explain how important dikes are for water safety in the Netherlands.	Understanding
3.	...explain the principles of the Dutch water safety policy (risk approach and <i>Meerlaagsveiligheid</i> ).	Understanding
4.	...identify the risks of the current state of the <i>Grebbedijk</i> in combination with climate change.	Applying



5.	...discuss the likeability of water safety measures, considering the different spatial impacts of these measures and the different interests of stakeholders.	Evaluating
6.	...create a map of the future based on the principles of the <i>Meerlaagsveiligheid</i> -policy (multi-layered safety).	Creating
#	<b>Learning objective</b>	<b>Affective Domain</b>
7.	...be aware of their own feelings of hope and fear concerning future climate change and spatial interventions in the students' personal living environment.	Valuing / Communicating
8.	...realize the importance of the cooperation between humans and nature to improve the livelihood / liveability of the personal living environment.	Valuing

### REMOTE PREPARATION

Students are expected to understand the basic concepts related to river systems, such as river basin, peak discharge, floods etc. Besides, students are expected to understand the Room for the River policy (Dutch water management policy) and students are able to name several measurements that are part of this policy. Students are also expected to understand the causes and consequences of climate change. At the start of the activity students will be refreshed of their knowledge on these topics.

### PLANNING CONSIDERATIONS

Students might not be aware that they live or go to school in an area that is threatened by a risk of flooding. This should be especially be taken into consideration in the introduction part of the activity.

### RESOURCES REQUIRED

- Powerpoint slides containing information about the river, the dike, the policy of multiple safety layers and climate change and its consequences for the region.
- Booklets for each student-group with useful resources that guide them in creating (part of) an image of the future.
- Blank maps (A1 or A0 format) of the *Gelderse Vallei* and markers to draw the image of the future.
- In case a digital map is preferred, some digital mapping tools are required.

### OUTLINE OF THE EDUCATIONAL ACTIVITY



The outline of the lesson series is described below, specifying the duration and content of the various lesson activities. However, the duration of the various activities may differ depending on the emphasis placed on the learning objectives.

### Schedule of the lessons

#### Lesson 1 - Orientation

Phase	Duration	Activities	Description
Orientation	10 min.	Introducing new subject and activating prior knowledge.	<p>During the orientation phase, students will be confronted with the fact that they're living in an area that's potential in risk of flooding. This confrontation can be shaped by means of a quiz in which misconceptions of the students are made clear. In addition, this quiz can help students to activate their prior knowledge.</p> <p>To ensure that students start with the same basic knowledge, this part of the lesson can be used to recap the missing knowledge about concepts and policies.</p>
Instruction	10 min.	Lecture about local case and Dutch water safety policy.	<p>This lecture will be used to give students a different view on their own living environment. The increasing risk of flooding will be linked to climate change and will be visualized by using maps and a flood simulation application (<i>addressing learning objectives 1, 2 &amp; 4</i>).</p> <p>Besides, students will be introduced to the way the Dutch government tries to protect its inhabitants against flooding, but also how they prepare them for flooding. This is the multi-layer safety approach (<i>addressing learning objective 3</i>).</p>
Applying	30 min.	Instruction on assignment and expert panels on multi layer safety policy.	<p>From this part on, the activities will be more student-driven. The class will be divided into four groups of approximately 4-6 students. Every group will become an expert panel on one of the layers of the Dutch multi-layer safety policy.</p> <p>The groups will be given a handout in which the specific layer is further elaborated, including some concrete examples of spatial interventions. Each group member has to read 20 minutes about one specific example. The group members then tell each other the advantages and disadvantages of this measure in one</p>



			<p>minute. Thereafter, all group members should be experts of their own layer.</p> <p>In case the lesson is conducted in a BYOD-class, students are also able to go further than the handout and find more information about their layers themselves.</p>
Verification	5 min.	Debriefing of expert panels.	The outcomes of the four expert panels will be debriefed in class. All groups will share some of their research outcomes.
Recap & Preview	5 min.	Recapitulation and short preview of next lesson.	<p>At the end of the first lesson it's possible to verify if some of the former misconceptions are clarified.</p> <p>Finally, a short preview is given of the students activities during the next lesson.</p>

## Lesson 2 - Creation

Phase	Duration	Activities	Description
Orientation	2 min.	Brief review of the previous lesson.	Short recap of the flooding risk of the students' living environment and the different layers of the multi-layer safety policy.
Instruction	3 min.	Instruction on assignment.	During the first lesson, the students studied the various measures associated with one of the layers of multi-layer policy. During the second lesson, students will apply those measures to create an image of the future in the form a map.
Applying	35 min.	Mapping the future of the local environment..	<p>The main goal of this lesson is to create several scenarios of the future concerning the spatial design of the Gelderse Vallei. The students will work on a blank map (A1 or A0 format) of the Gelderse Vallei and they will fill it in with the different measures resulting from the research during the former lesson (<i>addressing learning objective 6</i>).</p> <p>The students should take several aspects into account when filling in the map. Which measures are possible? Where should these measures take place? What are the advantages</p>



			<p>and disadvantages of this measure? Are the measures effective?</p> <p>The teacher has an important role in this part of the lesson series. The teacher has to stimulate the students to think critically without judging the creativity of the students. They are free to create their own image of the future, but at the same time they should consider the consequences of their future measures (<i>addressing learning objective 5</i>).</p>
Verification	15 min.	Presentations of created maps.	<p>After creating the four maps, the four groups will present their maps to each other. In doing so, they explain the measures chosen, the locations chosen to perform the interventions and the considerations that have played a role in this. After a one minute presentation, the other students will have the possibility to ask some questions.</p>
Recap & Preview	5 min.	Sum-up and preview of next lesson.	<p>Finally, a short sum-up of the different scenarios will be presented, including some interesting topics to discuss. With the created scenarios in mind, the students have to think about their opinion about those images of the future. How likeable is this future? This assignment can be given as homework and the results can be used to shape the discussion in the third lesson.</p>



### Lesson 3 – Evaluation and Discussion

Phase	Duration	Activities	Description
Orientation	10 min.	Mind mapping feelings about the future.	<p>In preparation for the lesson, the teacher can make a mind map of the feelings about the future that were mentioned by the students in the homework assignment. This mind map will be the starting point for the further discussions during this lesson.</p> <p>A number of feelings can be highlighted and students can be asked to briefly explain their feelings.</p>
Applying	15 min.	Discussing statements about the future.	<p>During this part of the lesson, the opinion forming of the students will be stimulated with an activating learning activity. This activity is called <i>Four Corners</i>. The four corners of the classroom will be assigned with smileys on a scale of <i>strongly agree, agree, disagree to strongly disagree</i>. The centre of the classroom will be assigned as <i>Don't know</i>.</p> <p>Then the teacher read out a number of statements about the images of the future. The students have to position themselves within the classroom. Afterwards they're asked to explain their opinion. Finally, they have the opportunity to change their position in the classroom before proceeding to the next statement. The guiding role of the teacher is extremely important during this activity as emotions amongst students could lead to heated discussions. The teacher should judge whether the social climate in the classroom allows for this activity to be helpful to students. If not, this activity can easily be transformed into an questionnaire-format that students can fill in by themselves.</p>
Applying	20 min.	Group discussion about feelings of hope and fear.	<p>After the first two activities, students have a broad view of the possible attitudes towards the future and they're aware of their own feelings of hope and fear (<i>addressing learning objective 7</i>). Then they will discuss in class which images of the future are the most likeable / desirable.</p> <p>In order not to leave the students with the feeling that this scenario is not feasible, it is important to work towards concrete actions to be taken during the discussion. This will be part of the answer on the question: How do we achieve our most desired scenario for the future?</p>



Verification	10 min.	Group reflection on changed visions.	Recap of the entire lesson series. Rethink the misconceptions and allow students in this way to see how they have learned. Let the students position themselves within the case of increasing flood risk of their own living environment due to climate change ( <i>addressing learning objective 8</i> ). Are they aware of their own role in this case? Has this role changed since the beginning of the lesson series?
Synthesis	5 min.	Final conclusions and perspectives of action.	Make students realize that they play a role in this issue. Empower them with the thought that together they might achieve their most likeable future.

### BACKGROUND INFORMATION FOR TEACHERS

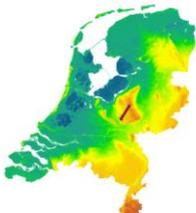
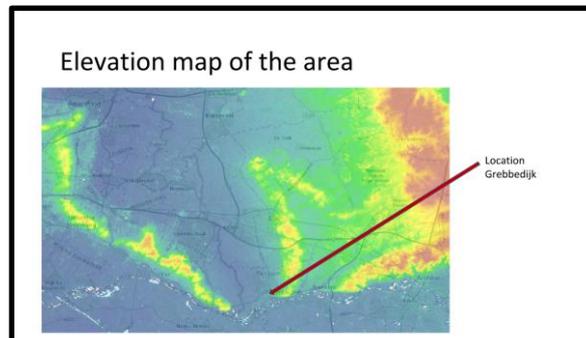
The next few slides can be used as, or be the inspiration for, the slides in the lessons. They contain the important information that needs to be told. In between the slides there is additional notes about the content, what will need explanation or attention and some suggestions to make it more interactive.



You could do a small quiz in advance, and ask the students who knows what the Grebbedike is, where it is, who has been there, what it looks like. And final question, how

More important than you think?

- Length: 5,5 km
- Location: between 2 Dutch mountains
  - Wageningse berg
  - Grebbeberg
- Function: protecting the valley behind it against water from the Neder-Rijn

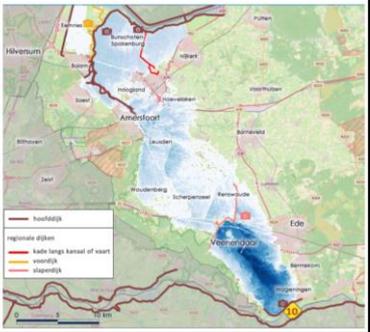
high above sea level we are at the moment?



Use the link <https://waterophetschoolplein.nl/portaal/overstromingsrisicoatlas/wsvv-west/> to show the animation of the flooding.

**Protection**

- **Protected area**
- 250.000 inhabitants in the floodarea
- Major cities: Veenendaal, Amersfoort




**Norm**

- Accepted flood risk in the Netherlands is 1:100.000 per year
- Grebbedijk has a chance of 1:280 per year (SOURCE: Waterschap Vallei & Veluwe)
- That is the projected floodrisk until 2023, without taking climate change into account



Figuur 1.2 Normfrequenties voor de primaire waterkeringen. Dit betreffen in dit geval de ondergrens maximaal overstromingsgevaar of het risico dat door bij het beschermingsniveau dat voor i desbetreffende object bestaand wordt geacht.

Chances and risks are always complicated, for everyone. So a small explanation on what a chance is, and what the terms in the Netherlands mean and are used for.

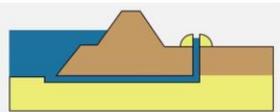
SO: 1:1000 chance = 1x in 1000 year

- But the context changes, so the chances can change per year
- And if the chances stay 1:1000, even if it has just happened, you still keep the same chance it will happen again

Floodchance in the Netherlands means the possibility that the dike breaks uncontrollable, and the area behind the dike is flooded with water.

**A dike doesn't break suddenly**  
A process called 'failing mechanism' happens over some time  
Possible failings mechanisms at the Grebbedijk

**Piping**



**Opdrijven**



**The higher the water:** the harder it presses against the inside of the dike, so the stronger the dike needs to be

A little video that explains piping can help, example:  
<https://www.youtube.com/watch?v=wNfW0rhzhkU>

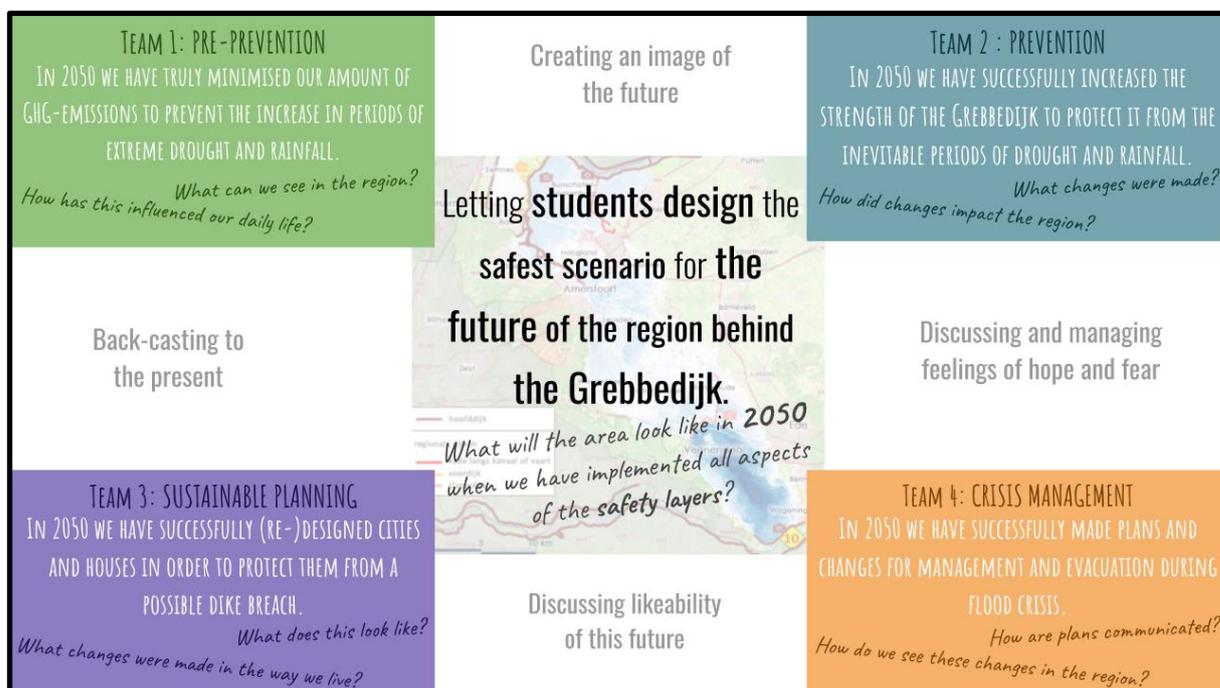


Important to note that the higher the water, the higher the pressure it puts on the inside of the dike, so the stronger the dike needs to be.

Then you could have another small group discussion about: why can climate change increase the floodrisk? You could let all students, or in couples, write down their ideas in cause-consequence form.

Possible answers:

- Rising temperature = more melting water upstream & more heavy rain events = higher discharge of the river = higher water levels in the river in the Netherlands
- Another topic, not related to climate change: urbanisation, more stone or more canalisation means faster transport of water



### The end of the project:

The goal of the research that the students do is to envision what the landscape would look like in the future in the safest scenario (with all layers of safety taken care of). The



envisioning could be in a drawing, a poster, presentation or other creative form (blog, vlog, video).

Then the real final goal is to start a discussion about the topic. After the students have prepared their own envisioning of their part of the scenario, it needs to be presented and shared with each other. They can learn from each others findings. This is important for example for the group that envisions the crisis management. They might have a pretty frightening topic to be thinking about all the time, so should at the end be mixed with more positive flood prevention and climate mitigation (pre-prevention) aspects of the project. After the presentations of sharing the discussion can be stimulated by asking questions like:

- what would be different about your own house or way to school in this scenario?
- what does it do to you to think about these topics?

what is the most interesting, scary or hopeful information you heard or found during the project?

### REFERENCES AND ADDITIONAL MATERIAL FOR TEACHERS

Subject	Link and description
<b>Flood simulation</b>	<a href="https://waterophetschoolplein.nl/portaal/overstromingsrisicoatlas/wsvv-west/">https://waterophetschoolplein.nl/portaal/overstromingsrisicoatlas/wsvv-west/</a>
	This is one of the most important websites that will be used. It is a very powerful image to see the large area that is flooded though. It is good to give the students room to express their thoughts or feelings after watching it. It might also be good to show them in the legend that most of the area is not flooded more than 1m (and even with 5m flood, people could sit in the attic of their houses to wait to be rescued). This way you can emphasise, to comfort the children, that by these kinds of floods people will not die. It has huge other consequences though, that you can think about together.
<b>Grebbedijk</b>	<a href="https://grebbedijk.com/het-project">https://grebbedijk.com/het-project</a>
	This website provides a lot of information about the project to strengthen the Grebbedijk before 2024. Useful to have a look at yourself before starting the lesson.
<b>Multi-layer safety policy</b>	<a href="https://www.h2owaternetwerk.nl/vakartikelen/anne-leskens-nelen-a-schuurmans">https://www.h2owaternetwerk.nl/vakartikelen/anne-leskens-nelen-a-schuurmans</a>



	<p>If you want to have more background information in what the layers of safety are from the new 'meerlaagse veiligheid' approach you can read this article. It is a concrete explanation and contains a case study in Friesland.</p>
<b>Failing mechanisms</b>	<p><a href="https://www.youtube.com/watch?v=lyOD2M2SqDI&amp;list=PLAA8yVxqwatype0RPwkBywvRyaDZ1K1gn">https://www.youtube.com/watch?v=lyOD2M2SqDI&amp;list=PLAA8yVxqwatype0RPwkBywvRyaDZ1K1gn</a></p>
	<p>These are several videos about the failing mechanisms of dikes in the Netherlands. It can be additional information for the students of higher ages or abilities to understand the issue better.</p>



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## INQUIRING WATER PROBLEMS FROM SPACE

*ScienceJam Compendium 2020*

**Authors:** *Kamiel Ogink, Emma Douven, Suzanne Kooistra*



Co-funded by the  
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of the European Union



**THEME**

Water management and climate change.

**SUGGESTED AGE**

15-16 years old

**DURATION**

160 minutes

**SITE**

Possible from home (online)

**RELATION TO CURRICULUM**

National water issues

**POSSIBLE CONNECTIONS TO OTHER SUBJECTS**

Social studies

ICT

**EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES**

- Recognize different means of watermanagement using satellite images.
- Relate landscape formation to natural, water-related processes.
- Think of different future scenario's and support these possibilities using subject knowledge
- Use Google earth for a multitude of mapping related skills..

**REMOTE PREPARATION**

The kids should have Google Earth downloaded beforehand. They should have prerequisite knowledge about the national water problems in order to be able to apply this knowledge in the exercises using Google Earth.

**PLANNING CONSIDERATIONS**

- Make sure the students are themselves responsible for saving their work.
- Plan enough time to familiarize the students with Google Earth.
- Ensure technical compatibility of the devices that will be used.

**RESOURCES REQUIRED**

Every student should have a laptop which is compatible with Google Earth and access to the internet. There should also be a basic text editor (such as Word) available.

## OUTLINE OF THE EDUCATIONAL ACTIVITY

### ***Introduction***

The main goal of the activity is to familiarize the students with national water-related problems through using Google Earth. This way the students get a deeper understanding of the issues as they have to apply pre-existing knowledge using satellite images. Additionally the students were asked to inquire data about the area surrounding their school. By also looking into local water issues the students should get a better understanding of how certain issues may personally affect them. The students are also asked to think about different scenarios for solving the water issues in relation to climate change.

The activity consists of a StoryMap produced using Arcgis. Through the Storymap the students encounter different kinds of exercises and resources containing additional information ( e.g. video, websites, graphs). The Storymap also provides extra guidance on how to use the Google Earth Interface and corresponding tools to perform certain exercises. Furthermore the activity consists of a working document in which the students can fill in their answers. Lastly there are Google Layers to be downloaded and used by the students through Google Earth.

<https://storymaps.arcgis.com/stories/d4d2e8861b034a5ba1cf791d93185c96>

### ***Development***

This activity can be developed by first determining which water issues the students should understand more thoroughly. For this selection of issues, it is important to check if it would be possible to view certain aspects of those problems clearly via Google Earth. Next you have to decide about the particular assignments and the additional resources that are required. Furthermore, the required Google Earth actions should be clarified using screenshots. Map layers can also be added to Google Earth in order to mark which areas are relevant to the exercises.

### ***Conclusion***

The students have a better understanding of how recognize certain geographical issues via digital information such as Google Earth Satellite images.



### FOLLOW-UP ACTIVITY

- Let the students inquire about water problems in other countries and let them compare the satellite maps and look for similarities.
- Let the students convert a future scenario to a city plan so they can deepen their understanding about what the consequences of a certain scenario would entail.

### BACKGROUND INFORMATION FOR TEACHERS

- Know how to work with Google Earth and typical problems that might surface.
- Know how to make a *StoryMap* (<https://storymaps.arcgis.com/>).

### ADAPTATIONS

The assignments can be done individually or in groups.

The amount of assignments can be reduced.

### EXTENSIONS

Let the students make a *StoryMap* themselves.

Let students explore the further possibilities of working with Google Earth such as making a Google Earth tour.

