



EDUCATIONAL COMPONENTS -> DELIVERABLES 2019

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WP2 Scientific coordination, mentoring and education

Educational activities

IGF PAS is a leader of:

Task 2.2. Promote Arctic and climate change issues in education

Sub task 2.2a. To promote polar issues by providing educational resources within school organisations (local conferences etc.), brochure, video, newsletters for teachers

Sub-task 2.2d. Feedback on INTERACT educational resources

3 CAWI surveys designed to collect feedback from teachers and support the development of new educational resources

- (a) teachers' expectations and needs,
- b) the usefulness of INTERACT's materials, and
- c) recommendations for future development of educational resources)



Previously reported

D2.1 1st CAWI survey – exploring teachers' needs

The new educational materials would be used mainly on geography, nature, and biology lessons;

Among the suggested topics, the most interesting one for teachers was “Climate change – causes and consequences”;

Many teachers and educators are willing to use English, even if it's not their mother tongue;

The most desirable types of new educational materials were “Multimedia presentations – PowerPoint”, “Movies”, and “Graphics and schemes”;

Respondents found “Websites/ web portals” as the most useful way of communication between educational projects and teachers

D2.6 1st Newsletter issues for teachers



NETWORKING

H2020 funded projects:

**Community for Science Education in Europe
– SCIENTIX**

EDU-ARCTIC



2019 activities and results

D2.7 2nd Newsletter issues for teachers

D2.13 – Promotional brochure and video clip

D2.3 2nd CAWI survey report

INTERACT RESOURCES: EDUCATIONAL TOOL-KITS

PROMOTIONAL ACTIVITIES – increasing teachers' network:

- Scientix webinar dedicated to ,PERMAFROST' educational tool-kit – 13 March 2019 <https://youtu.be/oHBoju96KvA>
- PEI (Polar Educators' Forum) Cambridge
- 2 workshops for teachers within STEM Discovery Week 2019 (Warsaw, Poznań)
- Distribution of brochures - Educational Fair, Lublin, March 2019



D2.13 – Promotional brochure

COMPREHENSIVE EDUCATIONAL MATERIALS BASED ON ACTUAL RESEARCH ON POLAR STATIONS

Hands-on Activities
Current Topics
Use of Scientific Data

Educational TOOL-KIT

ARCTIC ISSUES

critical thinking
problem solving
global awareness
environmental literacy

multimedia

webinars with experts

students
13 - 19 years old

STEM learning
game-based learning
virtual learning
project-based learning

47 institutions
83 research stations


Polish Polar Station Hornsund Svalbard

The NIBIO Svanhovd research station Norway

The Faroe Islands Nature Investigation

eu-interact.org

This project (INTERACT) has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement No. 730938



Each TOOL-KIT contains:



- Syllabus**
(introduction, 5 basic concepts to remember, mind map, glossary, extra resources)
- Materials for teachers**
Basic material – topic in a nutshell, research methods, advanced material, 5 fun facts
- Lesson plan**
subject, topics, link to EU trends, 21st century skills, activities with timeline, preparation and homework
- Worksheet**
(with extended version for teacher)
Various hands-on activities, working with scientific data
- Presentation**
Ready to use
PowerPoint presentation
- Recording of webinar**
Topic presented by expert in ca.15 min video
- Experiment**
Scenario of feasible activities without special equipment
- Animations**
Detailed, graphic presentation of processes

TOPICS INCLUDE
Permafrost ● Glaciers ● Climate change in the Arctic



D2.13 – Promotional video clip



INTERACT EDUCATIONAL
RESOURCES BRING YOU
CLOSER TO THE ARCTIC -
AND SCIENCE!

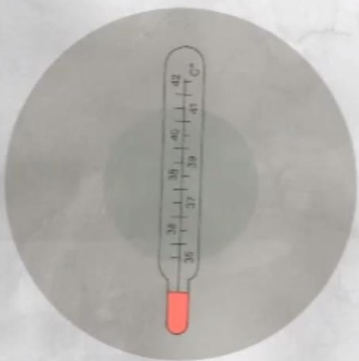
CREATED BY
DERFOREST.COM



They're available for free,
online, and always ready to use

CREATED BY
DERFOREST.COM

<https://youtu.be/Pn6CMTdXals>



... influence environment and
human kind ...

CREATED BY
DERFOREST.COM



... long term and WORLDWIDE!

CREATED BY
DERFOREST.COM



EDUCATIONAL MATERIALS

EDUCATIONAL TOOL-KITS

POLAR TOPICS – GLOBAL

GLACIERS

CLIMATE CHANGE

+CLIMATE CONTEXT
IN EACH TOOL-KIT!

PERMAFROST

RESEARCH- BASED content

21st century skills
<http://www.p21.org/our-work/p21-framework>

Trends
<http://www.allourideas.org/trendiez/resources>

Each TOOL-KIT contains:



COMPREHENSIVE EDUCATIONAL MATERIALS BASED ON ACTUAL RESEARCH ON POLAR STATIONS

Hands-on Activities

Current Topics

Use of Scientific Data

Arctic Issues

multimedia

critical thinking
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Structure and content

Each educational tool-kit contains:

- **SYLLABUS** – table of content with basic information and resources, links to crucial definitions, **mind map**
- **MATERIAL FOR TEACHERS** – comprehensive and reliable resource – „topic in a nutshell“, illustrations, Basic facts, Advanced material, **Research methods (!), 5 fun facts**
- **LESSON PLAN** – detailed, yet easily adaptable description of suggested activities (minute-by-minute) with **homework, preparation, goals, evaluation**
- **WORKSHEET** – hands-on activities for students, **based on actual research results + version for teachers** – with answers and explanation; online activities (**Educaplay, Kahoot**)
- **EXPERIMENT SCENARIO** – easy DIY, **engaging activities** without special equipment
- **PRESENTATION** – **PowerPoint**, ready to use for teacher as introduction
- **WEBINAR** – **recording** of 15 min lecture by an expert-scientist
- **ANIMATIONS** – narrated, illustrative explanations of phenomena



Active Layer

Thaws and refreezes every year
From ca 10 cm to ca 3 m thick

Permafrost

Always frozen
From ca 10 cm to ca 1400 m thick

Unfrozen material

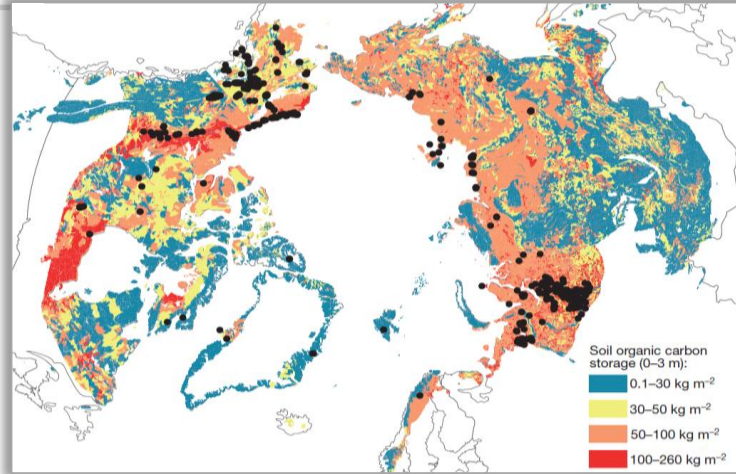
TOPIC 1: PERMAFROST



Thawing permafrost = unstable ground



Why should we care about what is going on with the permafrost?



Carbon release

Anthrax outbreak in Siberia in 2016

SYDSVENSKAN

Forskare varnar för jättemammutvirus

Dödliga virus har frigjorts i samband med att den ryska permafrosten tinat. Nyligen dog ett barn och 1 200 renar i mjältbrand. Forskare varnar nu för spridning av mammutvirus, mjältbrand och smittkoppor.



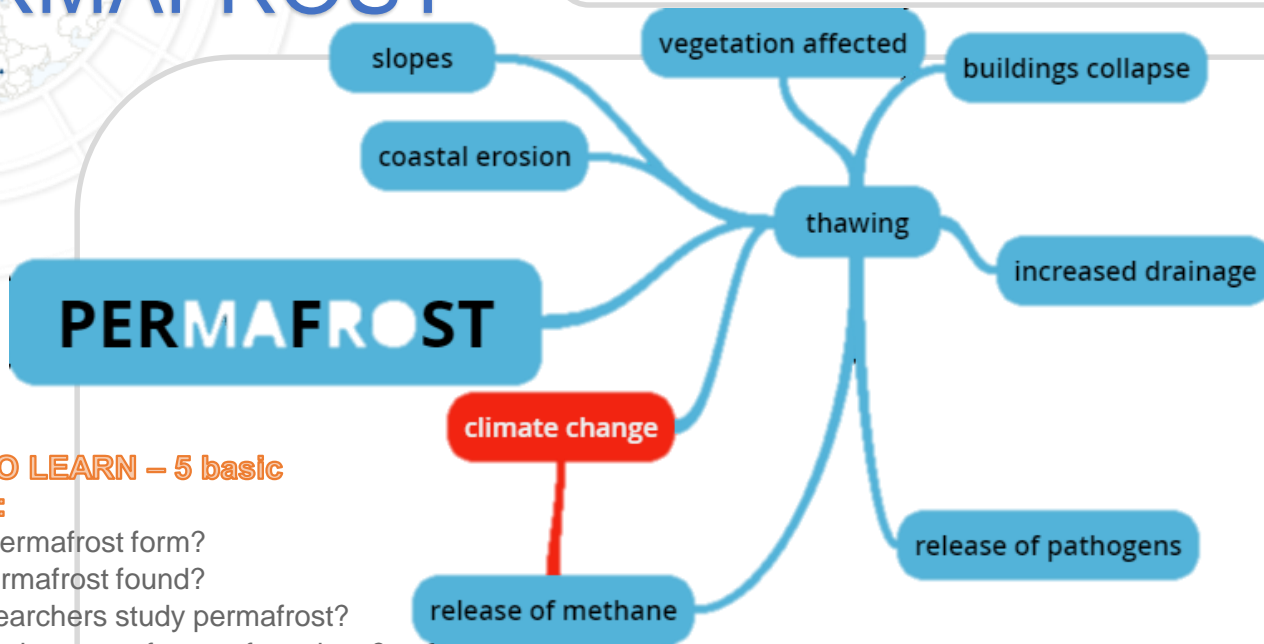
Photo: T. Maximov

Drunken forest

INTER⇌ACT

ARCTIC ISSUES: PERMAFROST

SYLLABUS



THINGS TO LEARN – 5 basic questions:

- How does permafrost form?
- Where is permafrost found?
- How do researchers study permafrost?
- What are the impacts of permafrost thaw?
- How do we know where permafrost is?

WHERE IS IT STUDIED?

EXAMPLES OF POLAR STATIONS WITHIN INTERACT NETWORK:

[RESEARCH STATION SAMOYLOV ISLAND](#)

[CHOKURDAKH SCIENTIFIC TUNDRA STATION](#)

[BARROW ARCTIC RESEARCH
CENTER/ENVIRONMENTAL OBSERVATORY](#)

[POLISH POLAR STATION HORNSUND](#)

GLOSSARY

[PERMAFROST](#)
[SUBSEA PERMAFROST](#)
[PERMAFROST CARBON CYCLE](#)
[PALSA](#)
[ACTIVE LAYER](#)
[CRYOTURBATION](#)
[ZAA](#)
[PILE DRIVING RIG](#)
[YEDOMA](#)
[BATAGAIKA CRATER](#)
[TALIK](#)
[ALASS](#)
[THAWING PERMAFROST](#)
[THERMOKARST](#)

BASIC FACTS

PERMAFROST IN A NUTSHELL

COULD PERMAFROST BE USED BY HUMANS?

Indigenous people of the Arctic used properties of permafrost for food storage and as a freshwater resource.

Athabascan (Alaskan native) Elder Robert Charles reports:

Our people have always used permafrost for storage of food. The method used was to build a birch bark basket out of the oldest birch tree that had a thick, heavy bark. You pattern it into a 3x4 feet square container, enough to hold food and berries and white fish. Then you dig down to where the ground is frozen, and even a foot into the frozen ground, for storage. Another significant use of permafrost areas is water. When we were out hunting in higher elevations, where water could be hard to find, we would find a spot where the ground was wet and chop away the tundra to make a hole. Soon you would notice very cold water seep upward from the permafrost.

Source: <http://www.arcticclimatemodeling.org>

BASIC FACTS:

What is permafrost?

How is it formed?

Where can we find it?

What is thawing? How is it different from melting?

How does climate change affect permafrost?

What are the consequences of thawing permafrost?

Is permafrost the same everywhere?

What are main landforms related to permafrost?

Could permafrost be used?

RESEARCH METHODS:

How do scientists study permafrost?

What can we learn from permafrost

ADVANCED MATERIAL:

Subsea permafrost

Fire vs permafrost

Yedoma

Batagaika Crater

MATERIALS FOR TEACHERS

WHAT IS THAWING? HOW IS IT DIFFERENT FROM MELTING?

'Melting' describes a physical phase change during a temperature increase when a solid substance is transformed into a liquid state. (like sea ice).

When something 'thaws' it warms up slowly and changes gradually from a frozen state to a temperature above freezing point. (think of defrosting meat).

Permafrost THAWS, while ice MELTS. Permafrost doesn't totally change into liquid state, as it contains soil, organic material, rocks, sediments.

Permafrost acts like a lid, locking frozen carbon deposits deep below ground. The upper layer of permafrost thaws and re-freezes naturally each year. As the organic matter thaws, microbes degrade it – a process that releases carbon dioxide and methane.

HOW DOES THE CLIMATE CHANGE AFFECT PERMAFROST?

Increase of temperature ignites permafrost thawing, and that creates a vicious circle.

Extra warming thaws more permafrost, leading to further warming – and so on.

Scientists call a self-reinforcing warming cycle like this a **positive feedback loop**.

Permafrost degradation has occurred many times throughout geological history, but the rate of climate change, presence of substantial population, and diverse economic and land use activities in the Arctic, make contemporary permafrost degradation a unique process. The impacts of permafrost degradation are diverse and range from local to global, such as the potential enhancement of climatic change through emission of greenhouse gases. Observational data on permafrost characteristics are limited, but show permafrost temperature is increasing, whereas the active layer is progressively thickening in the majority of regions. Although climate change is the main driver of permafrost changes, other environmental characteristics may significantly alter these general trends.

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MATERIALS FOR TEACHERS



FUN FACTS

From frozen ground to space exploration

Studying environments
that are similar to Mars helps to prepare
biologists to identify traces of life in outer space.

“Exploding hills”

Volcano? Military action? UFO? Mysterious craters in Siberia startled the public

Frozen Pleistocene animals

Siberia is known for discoveries of well preserved carcasses of extinct animals, like The Selerikan pony, The Kolyma woolly rhinoceros, The Yukagir bison, or, most famous – Woolly Mammoth

Don’t die in Longyearbyen!

The town’s graveyard stopped accepting new inhabitants in 1950’. Why?

ICE PRINCESS

Permafrost enables natural preservation of archeological artefacts. In some cases, well preserved mummies can be found.

Creating mind map, team work, worksheet)

LESSON PLAN

	Name of activity	Procedure	Time	Resources
BEFORE THE LESSON A	1 PREPARATION ACTIVITY FOR ALL STUDENTS	Students watch video recording with presentation by permafrost expert, 2 animations and try to fill in the worksheet	45'	Video recording, animations, Worksheet for students
	2 PREPARATION ACTIVITY for 10 students	10 students prepare short (3') oral presentations regarding 5 following topics (FUN FACTS about permafrost)-2 students per topic: <ul style="list-style-type: none"> Don't die in Longyearbyen Meet the ICE PRINCESS Frozen mammoths From (frozen) ground to space Mystery of exploding hills 	25'	Materials for teachers PAGE 9 Additional resources (research by students)
DURING THE LESSON B	1 Checking level of knowledge	EDUCAPLAY WORDSEARCH activity solved together, with necessary clarifications	5'	WORDSEARCH (find 7 terms related to permafrost) https://www.educaplay.com/en/learningresources/4213699/permafrost_interact_education.htm
	2 Working with resources	Students are divided into 10 groups (1-3 students per group) each group obtains a topic to work on and a set of materials: WHERE CAN WE FIND PERMAFROST, IS IT THE SAME EVERYWHERE?	15' (15')	Materials for teachers, chosen sections from pages 2, 3 and 6 Animations

LESSON PLAN

TRENDS:

STEM learning
 GAME-based learning and gamification
 Virtual learning assistant
 Project-based learning
21st century skills
<http://www.p21.org/our-work/p21-framework>
 Critical thinking and problem solving
 Global awareness
 Environmental literacy

ONLINE ACTIVITIES:

Educaplay: **WORDSEARCH** (find 7 terms related to permafrost)
https://www.educaplay.com/en/learningresources/4213699/permafrost_interact_education.htm

Kahoot.it: **QUIZ** (7 questions, 20 seconds for an answer, individual or team mode) – smartphones/tablets/computers required
<https://play.kahoot.it/#/k/3e04e142-1c03-4502-a3d1-537ad8c9e241>

WORKSHEET (+answers)

TASK 7 Explore active layer thickness in different parts of the Arctic

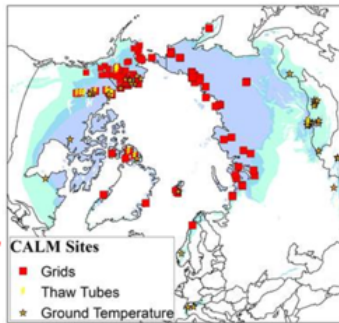
Visit the Circumpolar Active Layer Monitoring web site <https://www2.gwu.edu/~calm/data/data-links.html>

Click on **northern hemisphere**

CALM-North

Distribution of CALM sites in the Northern Hemisphere.

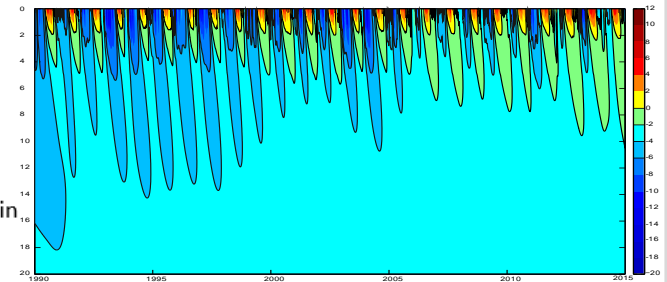
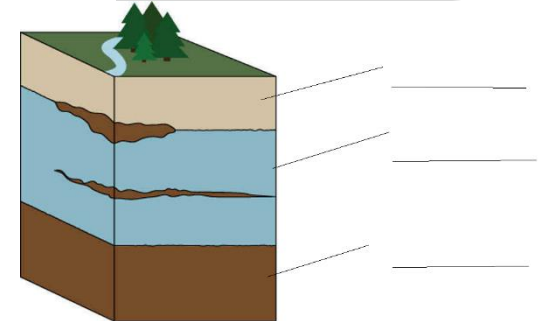
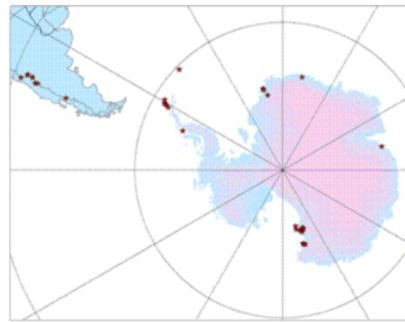
Click on map to access the data



CALM-South

Distribution of CALM sites in the Southern Hemisphere.

Click on map to access the data



Download the data in .XLS format – what unit is used? What is „annual end-of season depth“? Find following 2 locations **R21**, **G1** and compare 2 datasets. Fill in the table. What might influence in differences how data sets developed for 2 sites? Which site shows more obvious consequences of climate change?

	<u>Name of site</u>	<u>Location (Country, region)</u>	<u>The biggest annual end of season thawing depth [cm]</u> <u>Year</u>
R21	<u>Lake Akhmelo</u>	<u>Russia, Kolyma</u>	<u>113 cm, 2005</u>
G1	<u>Zackenberg;</u> <u>ZERO CALM 1</u>	<u>Denmark (Greenland)</u>	<u>85 cm, 2016</u>

Is this sentence TRUE or FALSE? (underline the correct answer)

Active layer is a thin layer of soil that forms below permafrost.

TRUE/FALSE

FALSE (it's above permafrost – or an upper layer; this is where vegetation is present)

EXPERIMENT SCENARIO

Offline:



FOR THE EXPERIMENT	Large bowl with flat bottom/large transparent lunchbox	Garden soil (1/2 L)
Water (cold and boiling)	Hair dryer	Toothpicks (8)
Access to freezer	Ice cube maker	Plastic cups (2)

Mix about $\frac{1}{2}$ l of garden soil with $\frac{1}{4}$ l of water in a large bowl with flat bottom/large transparent lunchbox. Put several ice cubes, preferably in different sizes into the soil. Put 5 toothpicks, marking how deep they're in the soil. (0,5 cm, 1 cm, 2 cm, 3 cm, 4 cm deep). Avoid ice cubes.

Freeze the container for at least 10 hours, -18°C .

Check if ground is frozen and if toothpicks are stuck in.

Take the container out at least 45 min before the lesson.

You can use the hairdryer to accelerate the process of thawing.

In 10 minute intervals check state of toothpicks.

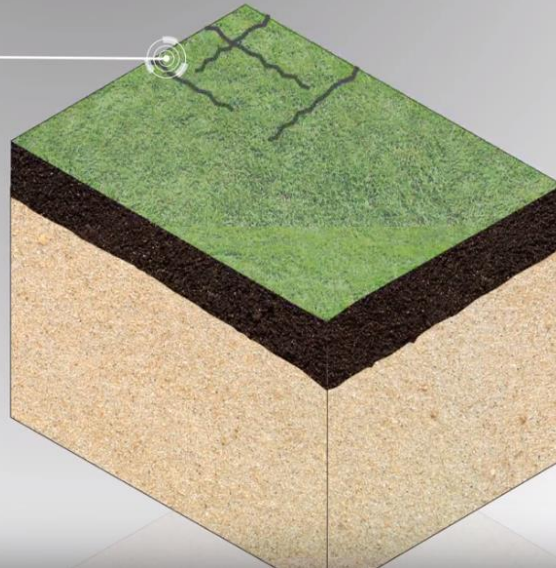
Pour boiling water into 2 plastic cups and place them on the surface in 2 opposite ends of the container, leaving the centre clear. Mark cups with marker: 1,2

Use new toothpicks to check every 5 minutes how deep you can put toothpicks. Mark toothpicks with marker, measure the depth and fill in the table. Use new toothpick for each measurement.



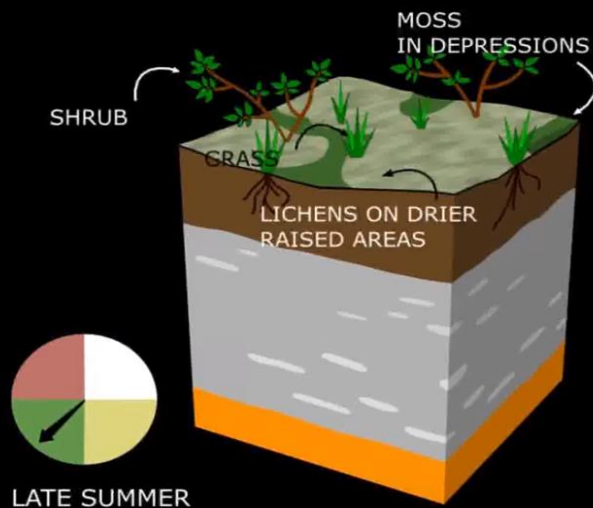
	Area CUP 1	Area CUP2	Centre area
5 minutes	e.g. 5 mm	e.g. 4 mm	e.g. 2 mm
10 minutes			

ANIMATIONS



Narrated by Terry
Calaghan

PERMAFROST
POLYGONS



LATE SUMMER

PRESENTATION+WEBINAR RECORDING

Permafrost in a changing Arctic




Photo: M. Johansson

Material compiled by Margareta Johansson, Lund University

INTER⇌ACT

Participants


Name	Joining time / Leaving time
Agata Goździk	11:11 / 11:31
Maggan	11:11 / 11:31
Wojciech	11:11 / 11:31

Table of Contents

Total duration: 00:16:36

Activity	Time
Recording Start	00:00:00
page 2	00:00:22
page 3	00:00:40
page 4	00:02:01
page 5	00:03:20
page 6	00:04:16
page 7	00:05:20
page 8	00:06:24

Video



Maggan

15 minutes
Expert: Margareta Johansson

Let's play!

Find 7 terms related to permafrost!

https://www.educaplay.com/en/learningresources/4213699/permafrost_interactive_education.htm

1	THAWING
2	METHANE
3	CLIMATE
4	ARCTIC
5	PINGO
6	PALSA
7	PEAT

D2.3 2nd CAWI survey report

The most important conclusions are:

- The most high valued materials **were-materials for teachers (topic in a nutshell with basic/advance information, research methods and 5 fun facts), and worksheet (hands-on activities for students)**; no significant critical remarks were given
- Overall answers regarding how clear and comprehensive the evaluated materials is are positive, however, lower answers combines with positive assessment of proposed tools show that the matter is complicated, not well known, and the **use of scientific data/results/language poses some difficulties to teachers/educators/students**
- Not all teachers had opportunity to test materials in time given, yet the general positive impact of those is assessed as high; also, it may indicate they have a **very limited time to introduce polar issues to their students**;
- Teachers are interested in further diverse topics, with a clearly dominant aspect of climate issues, which confirms results of first CAWI in 2017 - which they can conduct lessons about the Arctic; among then suggested topics, the most interesting one for teachers was **“Climate change – causes and consequences”**; also, **social sciences-oriented topics were suggested.**





Planned activities

D2.4 3rd CAWI survey report

D2.5 Recommendations to authors of educational resources

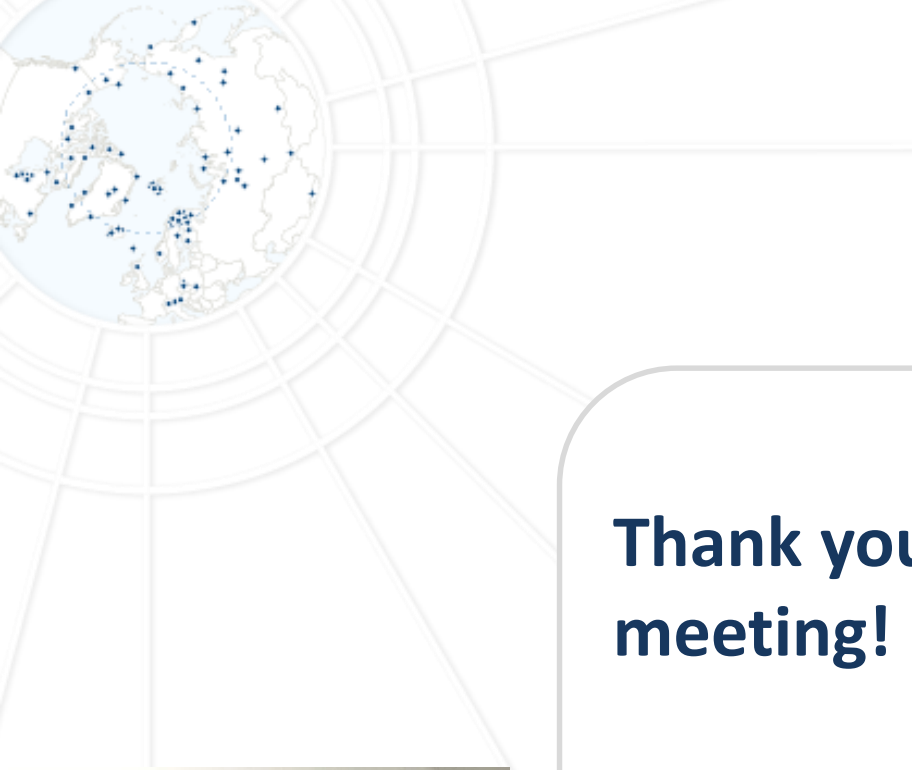
D2.8 3rd Newsletter issues for teachers



Cooperation with SCIENTIX AMBASSADORS from 5 countries
(Germany, Spain, Croatia, Sweden, UK+ volunteer from USA)

Workshops for teachers

New topics of educational tool-kits?



Thank you and have a fruitful meeting!

CONTACT:
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