

## Teachers' Guidelines

### Title of the package: Life of glaciers

#### Information about the package:

**Brief Description:** The package is dedicated to glacier's life cycle and life blooming in and on the glaciers.

**How does the package relate to STEAM education:** The package mainly focuses on science with technology elements. The package presents knowledge from various scientific disciplines using interactive educational materials. Their goal is to involve students in their independent search and understanding of the connections existing in the natural environment.

**Keywords:** Arctic, Antarctica, glaciers, GLIMS, cryoconites, microbiology, habitat

Age Range: 12-14

Didactical Hours: 4

#### Learning objectives:

The student will:

- learn about the distribution of glaciers on Earth;
- learn about importance of glaciers for the Earth System;
- learn about glacier's life cycle;
- understand an importance of glaciers as a habitat for various species.

#### Content of the package:

Link to the package: <https://graasp.eu/s/5yu1t4>

The package is divided into 4 sections:

#### 1. Glaciers of the World

- Video material "Glaciers" (4 minutes) about glaciers basics and the importance of the glaciers for the Earth System (National Geographic): <https://youtu.be/WJgpDyP9ewQ>
- Exercise 1. Match the terms and definitions – based on the video material
- Interactive map (GLIMS Glacier Viewer) of the World's glaciers' outlines (<http://www.glims.org/maps/glims>)
- Exercise 2. Please check if there are any continents without glaciers
- Please answer the questions: Are there any glaciers in your country? If YES, what's their importance for the environment and society? If NO, would it make a difference if they exist?

Project office: Księcia Janusza 64, 01-452, Warsaw, Poland [edu-arctic2.eu](http://edu-arctic2.eu) [edukacja@igf.edu.pl](mailto:edukacja@igf.edu.pl)

EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland and Norway receives a grant of ca. 240 000 EUR received from Iceland, Liechtenstein and Norway under EEA funds. The purpose of the EDU-ARCTIC 2 project is to: enhance the knowledge about nature, geography, natural resources, political specificities concerning polar regions and increase awareness of environmental issues and climate change, increase of interest in pursuing STEM education and careers due to enhancement of knowledge about scientific research, and their place in the modern world, familiarizing young people with scientific career opportunities; introduce innovative tools by way of an e-learning portal and effective methods of teaching science in schools.

## 2. Glacier's life cycle

- Text introduction on the glacier's life cycle
- Video material "Build a Glacier out of Ice Cream!" (3 minutes) about glacier's formation and movement. Includes instructions on building your own glacier out of ice cream and toppings <https://youtu.be/sc-w0dZZykY>
- Activity: Build the "ice cream glacier", observe it's movement and take a photo or video to document it
- PhET Glacier Simulator – interactive glacier model. Model can be run in the graasp environment or in the browser <https://phet.colorado.edu/sims/cheerpi/glaciers/latest/glaciers.html?simulation=glaciers>
  - sliders can be used to change the average air temperature and snowfall
  - toolbox includes: thermometer (surface temperature), green box (accumulation and ablation rates), ablation poles (to show glacier velocity), scale (glacier thickness), drill (ice velocity lines at different depths), GPS (elevation and distance from the accumulation area).
- Exercise 3. Use the sliders to set the air temperature to 15C and average snowfall to 0.3 m. How many years does it take to grow glacier 5000m long? Change the average snowfall to 0.2 m. What is happening?
- An essay about OK Glacier in Iceland – first glacier considered to be "dead" (<https://earthobservatory.nasa.gov/images/145439/okjokull-remembered>).
- Exercise 4. Summarize the essay, as you would describe it to friends or family members.

## 3. Living on the edge

- Video material „What lives on glaciers and perennial snow?“ (4 min) about life blooming on glaciers' surface ([https://youtu.be/kgjPK\\_UK60c](https://youtu.be/kgjPK_UK60c))
- Video material „Blood Falls“ (3 min) about microbial communities living under the Taylor glacier in Antarctica
- Exercise 5. Please answer the question: Why water flowing out of Blood Falls is red coloured?
- Video material "Iceworms" (2 min) about only organism that spend its whole life on the glacial ice ([https://youtu.be/mm98P2\\_MSb0](https://youtu.be/mm98P2_MSb0))

## 4. Summary

- Exercise 6. Please fill up the crossword to learn what's the biggest threat for the glaciers.
- Exercise 7. Please write short essay on glacier species you have found most interesting.

### Guidelines for teachers:

## 1. Glaciers of the World

Learn about geographical distribution of the glaciers and their role in the Earth System – watch video "Glaciers", check the interactive GLIMS Glacier Viewer for

glaciers' distribution, check the definitions in the Polarpedia Ice&Snow section (<https://polarpedia.eu/en/category/all-articles/ice-snow/>) and do the exercises 1 and 2.

## 2. Glacier's life cycle

Read the introductory text and ask students to check the terms: ablation, accumulation, firn, glacier mass balance and cryosphere in the Polarpedia. Watch the video "Build a Glacier out of Ice Cream!" and follow the instructions to build the "ice cream glacier".

Next part is the follow up of the "ice cream" experiment. This time it will be modelling approach. Read the introductory text for "Glacier Simulator". Run the model (can be run in the browser). Ask students to play with precipitation and temperature sliders. Do the exercise 3.

Ask students to read the essay about OK glacier in Iceland. Discuss the impact of Climate Change on glaciers. Do the exercise 4.

## 3. Living on the edge

Read the introductory text. Watch the video materials: „What lives on glaciers and perennial snow?", "Blood Falls" and "Iceworms". Discuss the effects of extreme environmental conditions on the living biota. Do the exercise 5.

## 4. Summary

This section is intended to check the knowledge of the students. Please do the exercises 6 and 7.

Additional resources and links, references:

### Additional resources:

- Essay: What lurks in glaciers and permafrost, <https://edu-arctic.pl/en/articles/what-lurks-inglaciers-and-permafrost>
- Essay: Life in the glacial soup, <https://edu-arctic.pl/en/articles/life-in-the-glacial-soup>
- Article: Svalbard glaciers much more vulnerable to warming since mid-1980s <https://edu-arctic.pl/en/articles/svalbardglaciersvulnerable>
- Essay: What stirs in the ice? A brief introduction to mysterious creatures living on glaciers <https://edu-arctic.pl/en/articles/whatstirsintheice>
- Essay: An introduction to Glacier Mass Balance <http://www.antarcticglaciers.org/glacier-processes/mass-balance/introduction-glacier-mass-balance/>
- Essay: The Wide View of a Shrinking Glacier: Retreat at Pine Island <https://earthobservatory.nasa.gov/features/pine-island>
- Essay: Melting Beauty: The Icefields of Patagonia <https://earthobservatory.nasa.gov/features/Patagonia>
- Definitions from Polarpedia – an online encyclopedia of the Arctic – Ice & Snow section: <https://polarpedia.eu/en/category/all-articles/ice-snow/>
- Blood Falls wikipedia [https://en.wikipedia.org/wiki/Blood\\_Falls](https://en.wikipedia.org/wiki/Blood_Falls)