

Teachers' Guidelines

Title of the package: Snow in the Arctic ecosystem

Information about the package:

Brief Description: Educational toolkit is focusing on snow cover research and its influence on the environment. The materials explain what influences the structure of the snow cover and how various organisms are adapted to living in the cold Arctic environment.

How does the package relate to STEAM education: Package combines knowledge from different science disciplines through interactive learning resources. Its aim is to engage students in explaining various environmental processes on their own.

Keywords: snow cover, snow research, climate change, avalanches

Age Range: 12+

Didactical Hours: 3 didactical hours

Learning objectives:

Student:

- learns how snowfall is formed and what is going on after its deposition on the ground
- gets acquainted with the methodology of snow cover research
- analyzes the impact of climate change on snow ecosystems
- learns about organisms living on, in and under the snow and about their adaptations to life in this environment

Content of the package:

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

1. Formation and metamorphosis of snow crystals
 - Short video about the formation and variety of snowflakes
 - Diagram with interactive elements presenting the relationship between atmospheric conditions and shape of snowflakes
 - Scheme with description demonstrating the two main types of snow metamorphism that takes place in snowpack.
 - Exercise: match the names of snow grains to their microscopic photos.
 - Interactive diagram showing the typical structure of snow cover in different climatic zones.
2. Snow survey
 - Infographic explaining why snow cover research is important
 - Interactive presentation about main properties of snow that are measured by scientists, together with the examples of the instruments used by them.
3. Snow and the environment
 - A photo with a brief description explaining the snow cover influence on Arctic flora.
 - Link to an animation showing changes in snow cover extent over the past 20 years, obtained from the analysis of satellite images

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EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland, Norway and Iceland receives a grant of ca. 245 000 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

- Link to the website with archival data on the extent of snow cover in the Northern Hemisphere in individual months since 1967
 - Exercise on the interpretation of archival snow cover extent data. Student task is to analyze seasonal variability and describe how the snow cover extent changes in the context of climate change.
 - Exercise in which the student is to write a text about expected climatic and environmental consequences of changes in the snow cover regime.
 - Exercise in which the student completes the text using given missing words. The text is about the impact of rain-on-snow events on herbivores population.
4. Life in the snow
 - Link to article in polarpedia about watermelon snow.
 - Video about springtails known commonly as snow fleas.
 - Video presenting winter life in Canadian taiga
 - Video presenting a special hunting technique used by foxes to catch rodents hidden in the snow cover
 - An interactive card with the task of counting the rock ptarmigans hidden in the photo and some interesting facts about these birds overwintering in the Arctic.
 5. Wrap-up
 - Crossword puzzle with words related to the snow cover topic.
 - Snow knowledge quiz.

Guidelines for teachers:

1. Formation and metamorphosis of snow crystals

Diagram contains interactive elements that are able to see after clicking icon „show interactive elements”. Most of them are displayed when you hover the mouse over them. Time-lapse movie presenting the snowflake growth is run after additional click on the link.



Name the frame exercise has its own help available after clicking on „?” symbol. After correctly matching the names to the frames and clicking the first button from the top left, you should see additional information next to each photo, which is worth reading.

Last chart in this section contains interactive elements that can be seen by clicking on the colourful icons next to the biomes names.

2. Snow survey

Infographic at the top of the page is available for download in pdf format.



Presentation has 17 slides with interactive elements; slides can be changed using arrow near the edge of window. Some of interactive elements can be seen immediately on a mouse hover, but others require an additional left-click to see the content.

3. Snow and the environment

Link to NASA Earth Observatory website may need to be opened in a new window if the browser reports an error.

On the NOAA webpage with archival data about snow cover extent there is an option to choose region that is presented on the chart. You can select: the entire Northern Hemisphere, Eurasia, North America alone or together with the Greenland. You can also choose the month and parameter fields - the package is focused on snow cover, so the parameter field should always be set on "snow cover". In case of changes, the data in the chart and in the table below will only update after clicking on the "Plot" button! If the button is active (blue color) it means that the introduced changes have not been drawn yet. If the plot button is gray, it means that the graph and the table show the data that are currently displayed in the "Parameter", "Region" and "Month" fields.

Parameter: Region: Month:

In „Observations” tool new observations can be added by clicking the plus sign in the upper left corner and by typing text into newly appeared windows.

In „Fill in the blanks” exercise drag the appropriate words from the list into the empty fields in the sentence. After filling in all the fields, it is possible to check the correctness of the word matching by clicking on the "check mark" on the left side. Correctly selected words will be surrounded by a green frame, in case of a wrong match, the frame will be red. Incorrect matches can be corrected at any time by dragging other words to the

same place. There is also a possibility to clear all selections by clicking the eraser icon in the upper left corner.

4. Life in the snow

On the interactive card at the end of the section, the student can try to count the birds hiding in the photo. This should be done before clicking on any point in the photo. Clicking will turn the card over and display the answer.

5. Wrap-up

In a crossword available on educaplay, you can choose the order in which you guess words by clicking on different fields. In the same way, you can decide which letter will be discovered after pressing the "show letter" button. The letters are entered from the keyboard and they can be corrected at any time. You can also check the correctness of your entries at any time by clicking the "Check" button at the bottom.

All close-ended questions in the quiz are single-choice (only one answer is correct), the first open-ended question requires entering only one number, while the last one requires a single-sentence answer.

Additional resources:

National Snow & Ice Data Center website with most important information about snow cover:

<https://nsidc.org/cryosphere/snow>

Articles on edu-artic.pl website:

- About potentially dangerous microorganisms that hibernate in ice

<https://edu-arctic.pl/en/articles/what-lurks-in-glaciers-and-permafrost>

- About discoveries of new animals species in Spitsbergen area

<https://edu-arctic.pl/en/articles/new-animal-species>

Video for kids presenting advantages of staying under the snow during winter

<https://www.youtube.com/watch?v=rdG3bqGiQo8>

Videos used in the package:

How Do Snowflakes Form?

<https://www.youtube.com/watch?v=-6zr2eLpduI>

Snow Fleas: The Unsung Heroes of the Natural World

https://www.youtube.com/watch?v=8BOIpiua_z4

This owl is a great listener

<https://www.youtube.com/watch?v=us11h1mEww0>

Arctic Fox Fails

<https://www.youtube.com/watch?v=9UaX4RBITHI>