Assessment:	7-8 (14 – 15 years)
Subject:	United in the fight for biodiversity – **climate change**
Lesson n°:	3
Subject:	"Climate – hot potato" – analysis of the impact of climate change on biodiversity based on statistical data.
Lesson topic and general objectives:	The aim of the lesson is to address to students issues related to climate change and human impact on these changes, and thus the impact on biodiversity. Students will work with numerical data, percentages, fractions, graphs and tables, as well as perform calculations and related to the subject of climate change on Earth. By participating in the lesson, students will become aware of the scale of the changes taking place and what impact they can have on reducing them. In addition, they will learn how mathematics contributes to the study, analysis and forecasting of climate change, and thus to global climate and biodiversity action and initiatives.
Training objectives	**Objectives:** *You will learn:* Read and interpret data Perform mathematical calculations for analysis and comparison Performing statements, analyses, comparisons in the form of tables, charts, charts formulate conclusions plan their own climate protection measures *You will expand your scientific knowledge in other fields such as biology, geography, ICT:* You will learn about climate change and its impact on biodiversity You will understand why climate change is dangerous for life on Earth You will learn about the effects of climate change in the world You will be able to characterise both the direct and indirect effects of climate change Compare ways to reduce climate change You will realize that you are co-responsible for climate change You will learn to use ICT tools for presentations *You will also improve your skills:* Communication Organizational Critical thinking creativity in problem solving conscious participation in environmental protection

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Materials	- Desktop or laptop - access to the INTERNET - smartphones or tablets with INTERNET access - Worksheets for students with prepared tables and diagrams - Calculators or smartphones with calculator - A4 and A3 sheets of paper - Geometric Tools - crayons, markers, markers - Applications and computer programs
Structure and activities	**Lesson 1 (45 minutes):** 1. Before the lesson, the teacher recommends students to learn about the issue of climate change, recommends reading articles or watching videos on the Internet, e.g. https://www.nationalgeographic.com/search?q=climate%20change&location=srp&type=recommended https://www.youtube.com/watch?v=G4H1N_yXBiA 2. A short conversation with students about climate change – do students know what this phenomenon is and what its effects are? **(5 minutes)** 3. The teacher gives the topic and objectives of the lesson, informs the students that the topic will be discussed in 3 lessons, the first and second is practical, and the third is a summary of the students' work and the presentation of posters and conclusions prepared by them **(2 minutes)** 4. In the first lesson, the teacher divides the students into groups (the teacher makes sure that there are students with different levels of knowledge and skills in each group and that each group chooses a leader who will be able to watch over the students' work in the group) and asks the students to take a designated place to work in the classroom, (Students will work in the same groups during lesson 2) **(3 minutes)** 5. The teacher distributes prepared materials on climate change and tasks to be performed on this data to the groups – asks them to read their content **(5 minutes)** 6. Students will work in groups and complete a series of calculations (tasks) that will generate insights into climate change and biodiversity loss. The effects of their calculations, presented on charts and the conclusions resulting from them, will be placed on posters, which they will present during the summary lesson **(25 minutes)** 7. Short summary of the lesson **(5 minutes)** **Lesson 2 (45 minutes):** 1. Previous lesson reminder – brainstorming **(3 minutes)**

2. The teacher gives the topic and objectives of the lesson **(2 minutes)**

3. Students work in the same groups, continue with calculation tasks, and then prepare posters on climate change, which will contain information collected and developed by them during the current and previous lesson **(35 minutes)**

4. Lesson Summary **(5 minutes)**

Lesson 3 (45 minutes):

1. Previous lesson reminder – brainstorming **(5 minutes)**

2. The teacher gives the topic and objectives of the lesson **(2 minutes)**

3. Each group of students presents the posters they prepared together in the previous lesson and the conclusions they drew while analyzing and compiling the figures on climate change. Each group also presents their proposals for climate protection behaviour **(30 minutes)**

4. Students prepare a poster gallery together **(5 minutes)**

5. Lesson Summary **(3 minutes)**

Example tasks for groups

Task 1

1. The teacher displays a table with data on the average global surface temperature and the level of carbon dioxide emissions in the atmosphere in the years 1880-2020 (data from NASA report1). The teacher **starts a discussion** with the students about the data presented in the table. He asks questions:

Year	Temperatura (°C)	CO2 (ppm)
1880	13,73	290,8
1890	13,75	294,6
1900	13,74	296,4
1910	13,63	300,4
1920	13,79	303,9
1930	13,92	308,8
1940	14,08	311,1
1950	13,97	313,2

1960	13,99	316,9
1970	14,01	325,7
1980	14,23	338,7
1990	14,39	354,2
2000	14,51	369,4
2010	14,64	389,8
2020	14,88	412,5

1.1. "Do you think our climate is changing? What is the trend of these changes?

1.2. "How has the average temperature on Earth changed over the last 140 years? And how has the CO2 level indicator changed during this time?"

1.3. "Which decade had the highest average temperature and which had the highest CO2 index?"

1.4. "Which decade had the lowest average temperature and which had the lowest CO2 index?"

1.5. "Are there any trends or patterns in temperature changes and CO2 levels? At the turn of which decades there was a large increase in average temperatures on Earth, and when did there be a large increase in CO2 levels?"

1.6. "Can you guess why there was a significant increase in both components during this time?"

Task 2

2. The teacher gives students a table with data on the average global temperature on Earth and the level of carbon dioxide emissions in the atmosphere in the years 1880-2020 (data from NASA report1) and questions to be developed (calculations and conclusions) for groups referring to the data presented in the table:

2.1. Calculate how many degrees the average global temperature on Earth increased in 2020 compared to 1880. How much did it increase? Round the result to 1.

2.2. Calculate by what percentage the Earth's CO2 levels increased in 2020 compared to 1880. Round the result to 1.

2.3. Calculate the differences in temperature on Earth between the successive years shown in the table (decades). Present this data in a table and then in a chart.

2.4. Calculate the differences in the CO2 level index between the consecutive years shown in the table (decades). Present this data in a table and then in a chart.

2.5. Take a look at the prepared temperature change chart. Given the pattern of temperature change, try to predict what the average temperature on Earth will be in 2050 and what will be the average temperature in 2100? Write down your conclusions.

2.6. On the basis of the CO2 level pattern, try to predict what the level of CO2 on Earth will be in 2050 and what it will be in 2100? Write down your conclusions.

Task 3

3. The teacher gives the students a diagram showing the level of CO2 emissions broken down by type of passenger transport and questions to be developed (calculations and conclusions) for groups referring to the data presented in the diagram:

Carbon emissions from passenger transport

One measure of our environmental impact is the level of carbon dioxide emissions per passenger-kilometre.
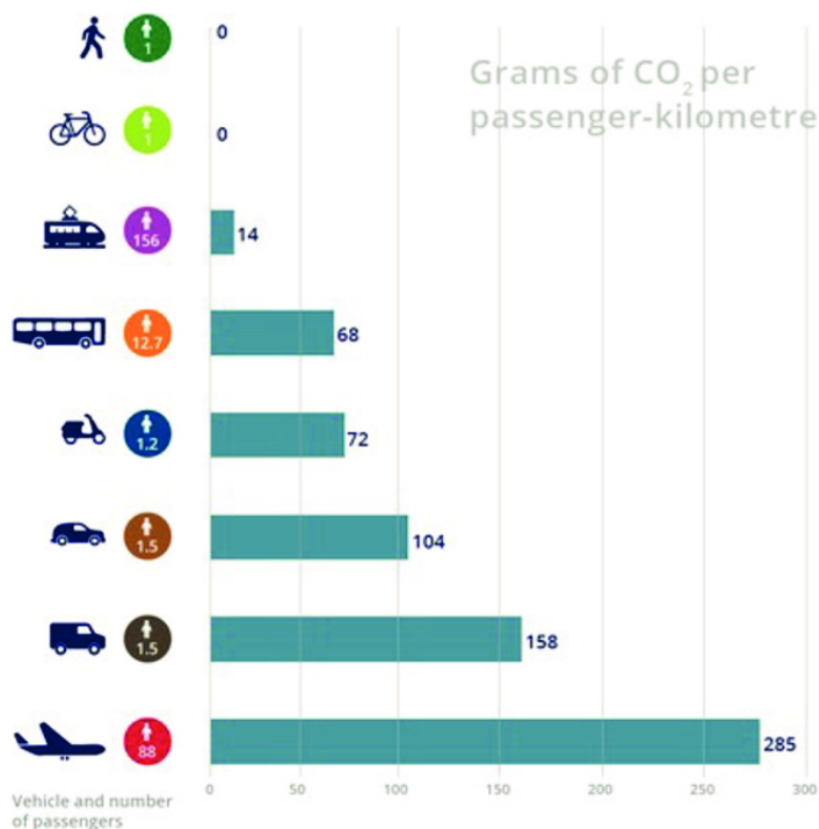
Note: CO2 emissions *are calculated as an estimate of* CO2 *per passenger-kilometre. Different modes of transport were taken into account, taking into account the average number of passengers for each mode of transport for the purpose of the estimate. As the number of passengers in a vehicle increases, so does the total carbon dioxide emissions of the vehicle, with emissions per passenger-kilometer being lower.*

Source: Estimates based on data from the TRACCS database (2013) and TERM 027

3.1. Which mode of transport emits **the least** CO2 and which **emits the most** (excluding walking and cycling)? How many times more? How much more? Round results to 1. Save the answers.

3.2. How many times more grams of CO2 are emitted into the atmosphere during the use of a passenger car than from a bus? Round the result to 0.1. How much more? Round the result to 1. Save the answers.

3.3. How many times more grams of CO2 are emitted into the atmosphere when using a passenger car than when using a train? Round the result to 0.1. How much more? Round the result to 1. Save the answers.

Task 4

4. Think together about the effects of such a rapid increase in the average temperature and carbon dioxide levels on Earth. Formulate and write down your conclusions.

4.1. Together, propose what each of you could do to protect the climate. Write down your suggestions. Create a cloud of ideas – you can use the Slido web app/ Mentimeter etc.

https://www.mentimeter.com/

Task 5 – for more advanced students

5. Students create a simple mathematical model that simulates climate change on Earth based on available data. They can use spreadsheets such as Excel to predict future temperatures and CO2 levels based on historical data.

Task 6 – for more advanced students

6. Students calculate their carbon footprint using an online calculator and analyze what actions they can take to reduce it. They then prepare a report presenting their results and proposals for action to reduce CO2 emissions.

https://calculator.carbonfootprint.com/calculator.aspx?lang=pl

	Task 7 – for more advanced students 7. Students jointly design an educational campaign on climate change, aimed at their school or local community. A campaign can include posters, presentations, videos, and social media activities.

Inclusion	**Explanation of the purpose and structure of the lesson:** This lesson is designed to engage students in learning about and understanding the problem of climate change. With the available statistical data related to this issue, students will understand how this data contributes to investigating and forecasting the scale of the problem and taking remedial measures. To ensure full participation in the lesson for all students with different learning styles, the structure of the lesson should be adapted to their needs. **Clear instructions, tailored to the needs of all students:** The teacher gives instructions to students in a clear and tailored way to the needs of all students. It makes sure everyone understands the instructions. The teaching materials used (videos, photos, other materials) will help students with different learning styles to understand the content. Repeats or explains support instructions as needed, especially for students with special needs. If necessary, it divides tasks into smaller, specific stages, which will allow for better work management. **Creating integration groups with diverse skills:** During classes, students work in groups with different skills, which will allow for cooperation and mutual learning. By dividing students into groups, the teacher takes care to create inclusive groups, consisting of students with different levels of knowledge, skills and backgrounds. After recognizing the strengths and interests of each group member, the teacher assigns tasks in such a way that each student can use their talents. The teacher motivates students to act and share their thoughts, appreciating each student's contribution. **Monitoring engagement and support interventions:** The teacher monitors the students' work on an ongoing basis, supports and advises, checks methodological and accounting correctness, and discusses the results with them. The teacher pays attention to what units and symbols are used in calculations, how to round numbers, how to read and create charts and tables, how to read with comprehension, how to solve word problems. He makes sure that all students actively participate in the work of the group. Responds sensitively to possible cases of exclusion or lack of involvement by undertaking discreet interventions consisting of encouraging participation in the group's work or providing additional explanations or modifying assigned tasks. stresses the importance of using mathematics in climate change data analysis and climate protection.

Assessment:

#1 Practical exercises using numerical data and the tools offered by mathematics in monitoring climate change

	Initiating	Developing	Perfect
Performance Description	It can read data on climate change. It can indicate the smallest or largest numerical values shown in the table. He may have problems with broader data analysis and formulating conclusions.	Can read, interpret and analyse climate change data. He can compare them, draw up a diagram or diagram of the course of data change. Can draw and formulate conclusions and discuss climate change in relation to the figures at their disposal.	It excels at reading, interpreting, and data on climate change, and is able to formulate far-reaching conclusions and design informed climate protection actions. Analysis Demonstrates proficiency in the use of mathematics, calculator and ICT tools in research, formulating conclusions and proposing solutions for climate protection. Analysis
Sample Student Response	"I can read data from a table and a chart or diagram. I can compare them, but I have trouble analyzing the entire data set, I can't draw conclusions. I can give you examples of the effects of climate change."	"I can read, interpret and analyse data. I can compare the data from the whole set. I can present them in the form of a diagram or a chart. I can compare them by doing percentage calculations. I can talk about climate change based on the data that I have developed."	"I can analyse data on climate change, I can formulate conclusions based on them. I know what I can do to protect the climate. I can plan broader actions for climate protection. I can prepare and present the collected information to a wider audience, I can make it available to a wider audience"

#2 – Presentation and Dissemination

3.	Initiating	Developing	Perfect
Performance Description	She prepares posters illustrating the issues raised regarding the	He can use statistical data, as a result of which interesting	He is proficient in using mathematics by creating visually

	causes and effects of climate change on Earth. They may have a problem with choosing the content presented on the poster so that it is legible for the recipients. He presents his work to the class.	posters are created that attract the attention of the recipient. He creates a gallery of posters, which he presents in the school hall on the occasion of "Earth Day". Analyzed	attractive posters that present the issues raised in an extensive, interesting and thought-provoking way. She creates a gallery of posters, which she presents to the wider local community during events and open festivals.
Sample Student Response	"Climate change on Earth is mainly caused by human activity. In this poster I present the causes and effects of climate change.	"Human activity on Earth, rapidly developing transport, progress and industrialization cause many direct and indirect effects on the environment, such as weather anomalies, melting glaciers or the spectre of armed conflicts. The poster presents a mental map grouping the effects of climate change, divided into those already noticeable and those that may appear in the near future. Mathematics is a basic tool for monitoring, for example, the changing content of greenhouse gases in the atmosphere. It also helps in constructing forecasting models, tools to prevent progressive changes. On the poster, I present the percentage of greenhouse gases that contribute to global warming. Urbanisat Io n	"Climate change on Earth is a very serious threat to the environment and its biodiversity. The extinction of one species, caused, for example, by the flooding of its habitat, entails the risk of extinction of other species with which it is associated, which in turn generates a mechanism of impoverishment of ecosystems and the genetic pool. It is estimated that a 1°C increase in the Earth's temperature will cause the extinction of at least 10% of the species living on our planet. Therefore, understanding the existence of these mechanisms of interconnection of living organisms is crucial for understanding the global consequences of climate change. Mathematics is an excellent tool for researching, analyzing, and monitoring a

			problem, and consequently provides the opportunity to make decisions and take action on a global scale to combat the problem of climate change.

Supporting documentation/resources:

1. Online Resources :

behind. **National Geographic:** National Geographic is a website that offers rich content on science, nature, culture, travel, the environment, and helps you better understand the world
https://www.nationalgeographic.com/environment
https://www.nationalgeographic.com/environment

b. **NASA Goddart:** NASA Goddard Space Flight Center is home to the nation's largest organization of scientists, engineers, and technologists who build spacecraft, instruments, and new technologies to study the Earth, the Sun, our solar system, and the universe.
https://www.youtube.com/@NASAGoddard

c. **Environment and Climate Change Canada –** Environment Canada is an online channel dedicated to environmental activism, protecting Canada's natural heritage, and providing weather and environmental forecasts to keep Canadians informed and safe.
https://www.youtube.com/@environmentcan

d. **European Environment Agency (EEA) –** The EEA is the European Union's agency that provides knowledge and data to support Europe's environmental and climate goals.
https://www.eea.europa.eu/en

e. **ClimateScience - Solve Climate Change:** A channel that enables the transition to a sustainable future. Reliable, easy to understand and beautifully illustrated. For students, teachers and professionals. It is a charity based in the United Kingdom, run by young scientists from all over the world. https://www.youtube.com/@ClimateScience

2. **Carbon footprint calculator**:
a. An international foundation dedicated to researching public awareness of the carbon footprint and its impact on consumer choices.
https://carbonfootprintfoundation.com/

Quantitative Evaluation Department:

Criteria	Initiator (1p – 3p)	Evolving (4p – 6p)	Excellent (7p – 10p)
Read and interpretation Data	Can read data but has difficulty understanding it and Analysis.	He can read and understand to some extent, but sometimes he has difficulty with their Analysis.	Can read, understand and accurately interpret climate change data.
Data analysis	Can perform Basic data analysis, but he has difficulties with pulling out Applications	Can carry out analyze data and draw conclusions, but sometimes they are imprecise	Can carry out Thorough data analysis and draw accurate conclusions.
Creation Visualization Data	Creates charts and tables, but there are they are incomplete or illegible.	Creates the correct charts and tables, but sometimes they lack clarity.	It creates a clear and Accurate graphs and tables that are easy to Understanding.
Formulating Applications	Formulates conclusions; but they are incomplete or erroneous.	Formulates correct conclusions, but sometimes lack precision or Fullness.	It formulates accurate, complete and precise conclusions on the data.
Exploitation ICT tools	Uses ICT tools but has difficulty with them correct use.	Uses ICT tools correctly, sometimes it has difficulties in fully Using.	Is proficient in using ICT tools, up to using their capabilities.
Creativity and innovativeness	It shows little creativity in of your works	It is shown that Creativity but sometimes it's missing Innovative Approach.	It shows high creativity and innovation in their works.
Involvement and cooperation	Engages occasionally and has difficulty working Team	He engages in group work, but sometimes lacks full cooperation.	Actively engages in group work and supports other students.
Presentation Results	Presents the results of the work, but they are incomplete or unclear	Presents the results correctly, but sometimes there is a lack of the clarity or detail of the	Presents the results of the work in a clear, complete and convincing

Calculating the total points:

- The total number of points for each criterion can be calculated by adding up the points awarded in each category.

Inclusion & Diversity – CLIMATE CHANGE Scoreboard

Criteria	Check
Information offered in multiple formats	
- Variety of educational materials provided	
- Textual, visual, auditory resources	

Integrative methodologies such as mutual learning	
- Opportunities for joint activities	
- Group discussions, peer teaching	
Use of ICT tools	
- Integrating technology into educational activities	
- Use of online platforms, interactive tools	
Overall inclusivity and diversity	
- Integration of different perspectives	
- Opportunities to engage students	
- Promoting equitable participation	

Explanation of the criteria:

- **Information offered in multiple formats:**

    o Assess whether the lesson plan includes learning materials in different formats such as text, visuals, and listening resources to cater to different learning styles.

- **Integrative methodologies such as peer learning:**

    o Assess whether the lesson plan includes inclusive methodologies such as peer learning, group discussions, and team activities to encourage student interaction and engagement.

- **Use of ICT tools:**

    o Determine whether the lesson plan uses ICT tools, such as online platforms and interactive resources, to improve the learning experience and accessibility.

- **Overall inclusivity and diversity:**

    o Summarize the overall assessment of inclusion and diversity in the lesson plan, considering the integration of different perspectives, opportunities for student engagement, and the promotion of equitable participation.