Assessment:	7 – 8 (14 – 15 years old)
Subject:	United in Biodiversity - **Invasive Species**
Lesson n°:	**3**
Subject:	"Strangers Among Us" – analysis of the occurrence and impact of invasive plant and animal species on ecosystems based on statistical data available on the websites of government organizations
Lesson topic and general objectives:	The aim of the lesson is to familiarize students with the issues of invasive species and to analyze statistical data related to the subject of invasive species. Students will work with numerical data, percentages, fractions, graphs, and tables, as well as perform calculations and word problems related to invasive topics. By participating in the lesson, students will understand that invasive species are those organisms that have been moved by humans to areas where they did not exist before and threaten native species and ecosystems, while mathematics provides the tools to study and monitor biodiversity, analyze data, and make conclusions to protect wildlife from them. Another important aspect of the lesson is to make students aware that each of them can have a positive impact on global problems and that the best way to fight invasive alien species is to prevent their spread.

Training objectives	**Objectives:**
	You will learn:
	    Perform mathematical calculations for analysis and comparison present the collected data and analyses in the form of tables, charts, graphs
	    formulate conclusions
	
	You will expand your scientific knowledge in areas such as:
	    You will learn about what invasive species occur in nature and what impact they have on biodiversity
	    You will learn examples of invasive species in your country
	    You will learn to use ICT tools for presentations
	
	You will also improve your skills:
	    Communication
	    Organizational
	    Critical thinking
	    Effectiveness in solving problems
	    Conscious participation in environmental protection

Materials	- tablets or smartphones with access to the INTERNET – if there are such possibilities at school - table for data collection - Desktop computer or laptop – if there are such options at school - applications and computer programs needed to collect, process and present statistical data (MS Office – Excell, Word, Power Point; Canva, Genially, etc.) – if there are such opportunities at school - programs for creating QR codes to distribute prepared materials (QR.io, Online QR generator, etc.)
Structure and activities	**Before the lesson** , the teacher recommends that students learn about the problem of the occurrence of invasive species and find out what this problem is, recommends reading articles or watching films on the Internet, e.g. https://www.youtube.com/watch?v=gYNAtw1c7hI **Lesson No. 1 - practical (45 minutes):** 1. A short conversation with students about invasive species – do students know any examples, can they determine their impact on biodiversity? **(5 minutes)** 2. 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 summarizes the students' work **(2 minutes)** 3. In the first lesson, students are instructed to work in pairs. They choose one invasive species to work with. Their task will be to fill in the table received from the teacher, in which they are to collect as much information as possible, including numerical data on the selected invasive species and native species associated with it. For this purpose, they can use smartphones or tablets with INTERNET access. *If the school does not have access to the INTERNET or appropriate equipment for students (tablets, laptops, computers) or students do not have their own smartphones with access to the INTERNET, then it is the teacher who should collect the appropriate data on the invasive species occurring in a given country, collect it in tables and then prepare it in printed form and provide it to students so that they can analyze this data and perform calculations, and then draw and formulate conclusions **(20 minutes)** 4. Students join together in larger groups to form 4 - 5 groups. Within the groups, they exchange the information they have collected. Each group should have a different set of species, so that students exchange information with each other and the whole class has the opportunity to

learn about the many invasive species found in their country. **(15 minutes)**

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

Lesson No. 2 - practical (45 minutes):

1. A short reminder of the information from the previous lesson on invasive species and the effects of group work **(5 minutes)**

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

3. Students work in the same groups as in the previous lesson. Each group appoints a leader who will watch over the group's work and assign tasks to group members **(5 minutes)**

4. Each group is asked to prepare a presentation **(30 minutes)** on the invasive species of their choice and (if possible) the native species associated with them, according to the following criteria:

    a. Each group develops at least 3 invasive species and 3 native species

    b. It presents general data on the species in question (from which kingdom they come: plants or animals)

    c. They perform analyses and comparisons between invasive species and related native species

    d. They make diagrams or charts (if possible) showing the comparisons made

    e. Students formulate conclusions and recommendations on what can be done to prevent the spread of invasive species

    f. If possible (school conditions allow it), students make a multimedia presentation, e.g. in Power Point or Canva or in Genially or other available and familiar to students. Invasive species knowledge quizzes are also welcome, especially the examples discussed in the presentation. In addition, each presentation should have a generated QR code containing a link sharing that presentation.

    g. If the school and students do not have the opportunity to make a multimedia presentation, then they prepare a presentation in paper form, e.g. on a poster, containing all the necessary data and analyses, as well as conclusions and recommendations

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

Lesson No. 3 - summary (45 minutes):

1. A short reminder of the information from the previous lesson on invasive species and the effects of group work **(5 minutes)**

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

3. Each group presents the results of its work on the forum **(30 minutes)**

4. Short Lesson Summary **(3 minutes)**

Example tasks for groups

A table for collecting data for students working in pairs / or for the teacher in case students do not have access to the INTERNET (* This is only an example of what information can be obtained)

Category	Invasive species	Native species
Name		
Kingdom: plants or animals		
Living environment		
Distribution area		
Since when has it been in your country?		
What area of the country does it occupy?		
Multiplicity		
Rate of species dispersal over the years (changes in abundance)		

Degree of invasiveness			
Spreading method			
Threats			
Data E.g. combat/conservation costs			
Data E.g. Impact on the economy			
Impact on human health			
Impact on biodiversity			
Other			

Examples of invasive species in Poland to choose from for students to work in pairs:

1) Sosnowski's hogweed vs. hogweed
   - Sosnowski's hogweed
2) Canadian goldenrod vs. goldenrod
   - Canadian goldenrod
3) Knotweed
   - Asian knotweed
4) American cherry vs. bird cherry
   - American bird cherry
5) Naked snail vs native snail
   - Naked snail in the garden
6) Asian Ladybug vs Biedronka Poland
   - Asian ladybug
7) Raccoon dog vs common dog
   - Raccoon dog
8) Raccoon vs Badger

- Raccoon
9) Gray Squirrel vs Red Squirrel
- Squirrel
10) Golden Jackal vs Wolf
- Golden jackal
11) Striped Cancer vs Native Cancer
- Striped crayfish
12) Snapping turtle vs native turtle
- snapping turtle

When making comparisons between invasive species and native species, students can seek answers to the following questions (where available):

1. What area or what percentage of your country is occupied by a given invasive species and what percentage of it is a native species?

2. How many representatives of a given invasive species are there in your country, how has this number changed over the past years? Compare this data with the data for the native species.

3. How many representatives of a given invasive species are there per 1 km^2 in your country, and how many are native species?

4. What is the ratio of the invasive species to the native species in your country?

5. What part of the annual budget for nature conservation of a commune/county/country is allocated to the control of a given invasive species?

Students can look for answers to such questions or others related to invasive species.

Examples of computational tasks:

Task 1. Calculate what percentage of Polish area is occupied by a given invasive species and what percentage is occupied by a native species. Plot the results on a pie chart.

Task 2. How has the number of invasive species in your country changed over the years? Plot this data in a bar chart. Compare it with the data on the representatives of the native species – also present this data on a bar chart.

	Task 3. Based on the population data of the selected invasive species over the last 10 years, create a line graph and describe the trends. What conclusions can be drawn from this data? **Task 4.** Based on the analysis of the spread data of a given invasive species, create a simple mathematical model showing the impact of the population of an invasive species on the native population of a given plant species.
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 invasive species. By analysing the available statistical data related to this issue, students will understand how this data contributes to investigating, analyzing, 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 clarifies the instructions for individualised support as needed. **Creating integration groups:** During classes, students work in groups, 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. 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 applying mathematics by monitoring and analysing data on the environmental impact of invasive species;

Assessment:

#1 Practical exercises using numerical data and the tools offered by mathematics in monitoring invasive species

	Initiating	Developing	Perfect
Performance Description	Can collect or search websites or textbooks for information on invasive species. He can give examples of invasive species found in his country. He may have problems with data analysis, drawing and formulating conclusions.	It can obtain data from various sources and interpret the collected information. It can collect numerical data on invasive species and analyze them. He can compare them, draw up a diagram or diagram of the course of data change. Can discuss, draw and draw conclusions about invasive species.	Based on the data analysed, it can draw far-reaching conclusions about the spread of invasive species and suggest actions that can be taken to limit the spread of alien and sinister species in its environment. Demonstrates proficiency in the use of mathematics and ICT tools in researching, analysing and formulating conclusions and proposing solutions to emerging problems.
Sample Student Response	"I can look for basic information on the INTERNET, numerical data on invasive species"	"I can read information from the data collected. I can compare them by doing percentage calculations, and I can represent them in a chart or diagram."	"I can draw and formulate conclusions about invasive species, their spread in the natural environment and the threats they pose"

#2 – Presentation and Dissemination

	Initiating	Developing	Perfect
Performance Description	It uses basic digital tools to create presentations. May have trouble using visuals. He may have problems with organizing his work. He presents his work with the help of other people in the class.	They are able to use mathematics and digital tools, resulting in an interesting presentation with a lot of information and well-chosen visual material. He presents his work on his own in front of the class.	Demonstrates advanced proficiency in mathematics and digital tools, creating a polished and visually appealing presentation. The presentation presents the discussed issues in an extensive and interesting way. She distributes her presentation to the wider school community by sharing a QR code through the virtual school newspaper.
Sample Student Response	"Invasive species are harmful to the environment. They can pose a threat to locally occurring species. Here's a simple presentation slide with information about invasive species."	"Invasive species are a type of alien species that harm the environment, people and biodiversity. Invasive species are introduced as a result of voluntary and involuntary human activities and are also linked to other biodiversity problems such as wildlife trafficking, climate change and habitat loss.	"Invasive species pose a serious threat to biodiversity. In my presentation, I discussed the issue extensively, illustrating it richly and using data visualizations. I also discussed the importance of strategies for early detection of invasive species, monitoring their spread and effectively preventing further

		Mathematics is an essential tool for monitoring invasive species and helps to construct strategies and tools to combat already widespread invaders."	spread."

1. Online Resources :

behind. **National Geographic:** National Geographic is a website that offers rich content on science, nature, culture, travel, the environment, and facilitates a better understanding of the world https://www.youtube.com/watch?v=gYNAtw1c7hI

b. **GBIF -** Global Invasive Species Database is a free, web-searchable source of information on species that have a negative impact on biodiversity. GISD aims to increase public awareness of invasive species and facilitate effective prevention and management efforts by disseminating the knowledge and experience of professionals to a wide audience around the world. It focuses on invasive alien species that threaten native biodiversity and includes all taxonomic groups, from microorganisms to animals and plants.
https://www.gbif.org/dataset/search?publishing_org=cdef28b1-db4e-4c58-aa71-3c5238c2d0b5

c. **U.S. Department of the Interior -** The U.S. Department of the Interior protects and manages the natural resources and cultural heritage of the country; provides scientific and other information on these resources;
https://www.doi.gov/blog/invasive-species-finding-solutions-stop-their-spread

d. **EASIN – European Alien Species Information Network –** This website provides the websites and contact details of the competent authorities of the EU Member States responsible for the implementation of Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species. Local authorities, managers, stakeholders and citizens can find information on monitoring and reporting on intrusion security services, responsibilities and management measures in their language.
https://easin.jrc.ec.europa.eu/easin/MSCAuthorities

Quantitative Evaluation Department:

Criterion	Initiator (1p – 3p)	Developing (4p – 6p)	Excellent (7p – 10p)
Performance Description			
Understanding the topic			
Understanding the topic	The student has a basic understanding of invasive species, but may have trouble identifying them.	The student is able to identify invasive species and knows what impact they have on the ecosystem.	The student has a full understanding of the topic and can accurately describe the impact of

			invasive species on the ecosystem.
Correctness of calculations			
Correctness of calculations	The student has problems with performing basic mathematical calculations.	The student can do basic calculations, but can make mistakes.	The student performs all calculations correctly and without errors.
Analysis Skills			
Analysis Skills	The student has difficulty analyzing data and formulating conclusions.	The student can analyze data, but the conclusions may be incomplete.	The student analyzes the data precisely and formulates complete, coherent conclusions.
Presentation Evaluation Criteria			
Substantive content	The presentation contains basic information, but it may be incomplete.	The presentation contains important information, but some details may be omitted.	The presentation is rich in content, contains all the relevant details and is comprehensive.
Structure and organization	The presentation is chaotic and not very clear.	The presentation is partially organized, but there may be legibility issues.	The presentation is well-organized, clear, and easy to understand.
Communication and presentation	The student has difficulty conveying information in a clear and understandable way.	The student can convey information, but there may be problems with the clarity of the message.	The student conveys information in a clear, understandable and effective way.
Use of ICT tools	The student has difficulty using digital tools.	The student is able to use digital tools, but there may be problems with effectiveness.	The student is proficient in using digital tools to create visually appealing presentations.
Criteria for assessing engagement in the group			
Contribution to the work of the group	The student participates in the group's work to a minimal extent.	The student participates in the group's work, but his or her contribution may be limited.	The student actively participates in the group's work and makes a valuable contribution.
Collaboration and communication	The student has difficulty communicating and collaborating with other students.	The student can cooperate and communicate with others, but problems may occur.	The student cooperates and communicates perfectly with other students.
Assignment and responsibility	The student does not show initiative in assigning tasks.	The student can assign tasks, but may have difficulty with responsibility.	The student shows initiative and responsibility in assigning tasks.
Conflict resolution	The student has difficulty resolving conflicts in a group.	The student can resolve conflicts, but may need support.	The student efficiently resolves conflicts and takes care of a positive atmosphere in the group.

Calculating the total points:

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

Scoreboard: Social inclusion and social diversity – INVASIVE SPECIES

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.