Exploring Geospatial Analysis and Conservation Strategies

Grade Level: Upper Middle or Secondary Students

Lesson Focus: Students will delve into advanced technologies used in wildlife conservation with a focus on elephants in the Mara ecosystem. They will learn about geospatial analysis and its pivotal role in monitoring and safeguarding wildlife. Additionally, the lesson will highlight how these conservation efforts impact both the local communities and the broader ecosystem. By engaging in this curriculum, students will develop an understanding of technological applications in ecological monitoring and the interconnectedness of technology, conservation, and community welfare.

Standards:

Next Generation Science Standards:

- Middle School (Grades 6-8)
  - MS-LS2 Ecosystems: Interactions, Energy, and Dynamics
  - MS-ESS3 Earth and Human Activity
  - MS-ETS1 Engineering Design
- High School (Grades 9-12)
  - HS-LS2 Ecosystems: Interactions, Energy, and Dynamics
  - HS-ESS3 Earth and Human Activity
  - HS-ETS1 Engineering Design

Common Core State Standards (CCSS):

- English Language Arts Standards for Science & Technical Subjects (Grades 6-12)
  - CCSS.ELA-LITERACY.RST.6-8.1 & CCSS.ELA-LITERACY.RST.9-10.1/11-12.1
  - CCSS.ELA-LITERACY.RST.6-8.2 & CCSS.ELA-LITERACY.RST.9-10.2/11-12.2
  - CCSS.ELA-LITERACY.RST.6-8.7 & CCSS.ELA-LITERACY.RST.9-10.7/11-12.7
  - CCSS.ELA-LITERACY.RST.6-8.9 & CCSS.ELA-LITERACY.RST.9-10.9/11-12.9
- Mathematics Standards
  - CCSS.MATH.CONTENT.6.SP.B.5 & CCSS.MATH.CONTENT.HSS.IC.A.1
  - CCSS.MATH.CONTENT.7.RP.A.2 & CCSS.MATH.CONTENT.HSF.IF.B.6
  - CCSS.MATH.CONTENT.8.F.B.4 & CCSS.MATH.CONTENT.HSF.LE.A.2

Canadian Curriculums Ontario and BC: *(The plan can be modified to suit Provincial Curriculum Standards in ALL Provinces in Canada.)*

Ontario Science Curriculum Standards

Grades 7-10

- Understanding Life Systems
  - Grade 7 (Interactions in the Environment)
  - Grade 9 (Sustainable Ecosystems)
- Understanding Earth and Space Systems
  - Grade 10 (Climate Change)

Grades 11-12:

- Biology
  - Grade 11 (Diversity of Living Things)
  - Grade 12 (Biology)
- Environmental Science
  - Grade 11 (Environmental Science)

British Columbia (BC) Science Curriculum Standards

- Science Grade 9 (Big Idea): The biosphere, geosphere, hydrosphere, and atmosphere are interconnected, as matter cycles and energy flows through them.
- Science Grade 10 (Big Idea): The development of technologies has led to significant changes in human use of natural resources.
- Environmental Science 11 (Big Idea): Human practices affect the sustainability of ecosystems.
- Life Sciences 11 (Biology 11): Evolution by natural selection provides an explanation for the diversity and survival of living things.
- Geography 12 (Big Idea): Human and physical processes interact in complex, and often unexpected, ways.

Materials Needed:

- Computers with internet access.
- Access to online resources about the Mara Elephant Project and conservation technologies.

Warm-Up Activity

Virtual Tour and Discussion

- ***Activity:*** Students will take a virtual tour of the Mara Elephant Project's website, focusing on their mission, the technology used in conservation (like EarthRanger and elephant collars), and their impact on conservation.
- ***Discussion:*** Lead a discussion on how technology can aid conservation efforts and the importance of protecting elephants in the Mara ecosystem.

Activity Ideas: In developing this lesson plan, we've intentionally included various activities to accommodate the diverse technological resources available across different schools. We understand that access to technology can vary widely, from advanced GIS software to basic internet connectivity. By offering a range of activities that span from hands-on, low-tech projects like creating model elephant collars using craft supplies to high-tech tasks involving geospatial analysis with GIS software, we aim to ensure that all students have the opportunity to engage deeply with the subject matter. This approach allows educators to select and adapt activities that best fit their classroom's access to technology, ensuring a rich educational experience for every student, regardless of their school's resources.

Activity 1: Geospatial Analysis Exploration

Objective: Introduce students to basic geospatial analysis concepts to explore elephant habitats, migration patterns, and conflict zones within the Mara ecosystem.

Materials Needed:

- Computers with internet access.
- Google Earth or simple GIS software.
- Hypothetical data or case studies from the Mara Elephant Project's website.

Activity Steps:

- ***Introduction to Geospatial Analysis:***
  - Briefly explain what geospatial analysis is and its importance in conservation efforts.
  - Demonstrate how to use Google Earth or GIS software to view the Mara ecosystem.
- ***Hands-on Task:***
  - Divide students into small groups and provide them with hypothetical data or actual case studies related to elephant movements.
  - Guide them through mapping out elephant movements, highlighting key areas like habitats, migration paths, and conflict zones.
- ***Analysis and Presentation:***
  - Ask each group to analyze the patterns they've mapped and hypothesize reasons for them, considering factors like resources, human presence, and geographical barriers.
  - Each group presents their findings to the class, sharing insights into elephant behavior and conservation challenges within the Mara ecosystem.

Activity 2: Create Your Own Elephant Collar

Objective: Engage students in a creative task to design a model of an elephant tracking collar model, incorporating features that aid conservation efforts.

Materials Needed:

- Basic craft supplies (cardboard, markers, glue, scissors).
- Reference materials on elephant collars and their functionalities.

Activity Steps:

- ***Research and Design:*** Provide a brief overview of how tracking collars are used in wildlife conservation, focusing on features like GPS units and data transmission devices. Students research additional features of real elephant collars and brainstorm other functionalities that could enhance conservation efforts.
- ***Creative Task:*** In teams, students use craft supplies to design and create their model elephant collars, incorporating both researched features and their innovative ideas.

- ***Collar Showcase and Discussion:*** Students present their model collars, explaining the purpose of each feature and how it contributes to tracking and conservation. Discuss the feasibility and potential impacts of the features proposed by the students, encouraging critical thinking about real-world applications.

Activity 3: Role-Play: Mitigating Human-Elephant Conflict

Objective: Engage students in developing conservation solutions for local and global wildlife conflicts, applying strategies inspired by the Mara Elephant Project to address issues ranging from human-elephant interactions to regional wildlife challenges, fostering a comprehensive approach to wildlife conservation.

Materials Needed:

- Scenario descriptions of human-elephant conflicts.
- Role cards (local farmers, conservationists, Mara Elephant Project managers, etc.).
- Local wildlife conservation issues descriptions
- Information on current technologies used in wildlife conservation, including GPS tracking and community alert systems

Activity Steps:

- ***Local Context Introduction and Role Assignment:***
    - Start with a discussion on various local wildlife conservation issues, highlighting examples such as bear encounters in urban areas.
    - Divide the class into small groups, providing each group with a description of a local wildlife conservation challenge and assign roles relevant to the scenario (e.g., local conservation officers, affected community members).
- ***Strategy Development:***
    - Students use the Mara Elephant Project as a case study to inspire their strategies. They are encouraged to think creatively about how technology (like GPS tracking devices for wildlife) and community engagement practices could be adapted to address their local wildlife conservation issues.
    - Each group develops a comprehensive plan to mitigate their assigned conservation problem, considering the effectiveness of their solutions in both local and global contexts.
- ***Innovative Solution Presentation and Global Connection Debate:***
    - Groups present their solutions, detailing how they would implement their strategies, the technologies they would use, and the expected impact on local wildlife conservation.
    - After presentations, engage the class in a debate focusing on the scalability of the proposed solutions to global conservation challenges. Discuss how strategies for local issues, like bear encounters, can offer insights into broader conservation efforts, emphasizing the interconnectedness of local actions and global environmental health.
- ***Extension Opportunity:***
    - Encourage students to research real-life instances where technology has been used to solve similar wildlife conservation problems in other parts of the world, fostering a deeper understanding of global conservation efforts and the role of innovation in addressing environmental challenges.

Activity 4: Data Visualization and Analysis Challenge

Objective: Students will use mock data from elephant tracking devices to visualize elephant movements, analyze patterns, and predict elephant behavior and habitat use.

Materials Needed:

- Computers with internet access.
- Spreadsheet software (like Excel) or a basic GIS (Geographic Information Systems) tool.
- Mock elephant tracking data (can be created based on general elephant movement patterns or downloaded if available).

Activity Steps:

- ***Introduction to Data:*** Present the mock tracking data to students, explaining what each data point represents (location, time, perhaps health or behavior indicators).

- ***Data Visualization Task:*** Students will use spreadsheet software or GIS tools to create visual maps of elephant movements. They should identify patterns such as migration routes, watering holes, and potential human-elephant conflict zones.
- ***Analysis and Prediction:*** Based on the visualized data, students will analyze elephant movement patterns and predict future behaviors and habitat uses. They could also identify potential areas of conflict with human activities.
- ***Presentation:*** Each team presents their findings to the class, explaining the patterns they identified and their predictions about elephant behaviors and conservation needs.

Activity 5: Understanding RADAR and GPS in Conservation

Objective: Explore the science behind RADAR and GPS technologies and understand their application in wildlife conservation efforts.

Materials Needed:

- Access to online resources for research.
- Presentation tools (PowerPoint, Google Slides, or poster board and markers).

Activity Steps:

- ***Research Phase:*** Divide students into groups and assign each group to research either RADAR or GPS technology. They should focus on how these technologies work and their applications in wildlife conservation, specifically in tracking and monitoring animals like elephants.
- ***Tech Talk:*** Each group creates a brief presentation or poster explaining their technology, how it works, and its importance in conservation efforts.
- ***Discussion:*** After the presentations, lead a class discussion on the advantages and limitations of using RADAR and GPS for wildlife conservation. Encourage students to consider how these technologies could be improved or combined with other tools for better conservation outcomes.

Activity 6: Conservation Tech Innovation Challenge

Objective: Work in teams to develop a conceptual technology solution that could assist in elephant conservation efforts.

Materials Needed:

- Creative materials for prototyping (paper, markers, cardboard, etc.).
- Access to information on current conservation technologies for inspiration.

Activity Steps:

- ***Idea Generation:*** In teams, students brainstorm challenges faced by elephants and conservationists, using information learned from previous activities and their own research.
- ***Technology Solution Design:*** Each team selects one challenge to focus on and designs a new technology solution that could help address this issue. This could be a new tracking device, a community alert system, habitat analysis software, etc. Teams sketch their designs and outline how their technology would work and its impact on conservation.
- ***Innovation Fair:*** Teams set up a "booth" (desk or table) where they present their technology solution to the class. They should be prepared to explain the problem their technology addresses, how it works, and its potential impact on elephant conservation.
- ***Feedback Session:*** After all presentations, conduct a feedback session where students can discuss the proposed technologies, considering their feasibility, potential impact, and any challenges they might face in real-world applications.

Wrap-Up Activities

Wrap up the day by focusing on the importance of conservation technology and community involvement in protecting wildlife. Highlight the role of students and the younger generation in promoting and participating in conservation efforts.

- ***Reflective Writing:*** Students write a brief reflection on what they learned about the use of technology in conservation, the challenges of human-wildlife coexistence, and their thoughts on how communities can work together for conservation.
- ***Class Discussion:*** Share reflections and discuss how students can contribute to conservation efforts in their own communities or through the support of projects like the Mara Elephant Project.