ENGINEERING - LESSON PLAN

Grade:	5th grade and up (11 years old and up)
Subject:	United in Biodiversity – Habitat Fragmentation
Lesson n°:	**1 & 2**
Topic:	DIY Wildlife Crossings 
Lessons focus and goals:	The STEAM activity "DIY Wildlife Crossings" aims to educate elementary school students about the impact of habitat fragmentation on wildlife and to foster their creativity and problem-solving skills in designing solutions to mitigate this issue. The focus and goals of this activity include: **Understanding Habitat Fragmentation**: Students will learn about the concept of habitat fragmentation and its consequences for wildlife populations. They will explore how roads, urban development, and other human activities can disrupt habitats and isolate wildlife populations. • Online Resource: https://earth.org/how-does-habitat-fragmentation-affect-biodiversity/ • PowerPoint:https://kbsgk12project.kbs.msu.edu/wp-content/uploads/2014/12/Connecting-Landscapes-Lesson-Plan-Fegan-and-Dittmar.pdf **Learning about Wildlife Corridors**: Students will learn about the importance of wildlife corridors in reconnecting fragmented habitats and facilitating the movement of animals between isolated areas. They will understand how wildlife crossings, such as bridges or tunnels, can help wildlife safely navigate across roads and other barriers. • Online Resource: https://www.pbslearningmedia.org/resource/wildlife-corridors-and-border-barriers-video/ecosense-for-living/

	Engineering Design Principles: Through hands-on design and construction, students will apply engineering design principles to create their own wildlife crossings. They will consider factors such as size, shape, materials, and placement to ensure the effectiveness and safety of their crossings for different animal species. • YouTube video: https://youtu.be/qex3hGxSEBc?si=W4iJNkXpHuw1bLEZ • Online Resources: https://ssec.si.edu/sites/default/files/images/WildlifeCrossingActivity2-.pdf **Environmental Awareness and Conservation:** Through this activity, students will develop a deeper appreciation for wildlife and their habitats. They will learn about the importance of conservation efforts in protecting biodiversity and preserving natural ecosystems. • YouTube video: https://youtu.be/nAiPV7yLtKM?si=m5E9MBRL_A52KHZv
Learning objectives:	You will learn to: ➢ Understand the concept of habitat fragmentation and its effects on wildlife. ➢ Learn the importance of wildlife corridors in biodiversity conservation. ➢ Design and build model wildlife crossings using engineering principles. ➢ Reflect on interdisciplinary connections between engineering, biology, and environmental science.
Materials	Materials can include a variety of items that allow students to design and build their own wildlife crossings. Here's a list of suggested materials: • **Cardboard**: Cardboard can be used as a sturdy base for constructing the structure of the wildlife crossing. It can be easily cut, folded, and shaped to create tunnels or bridges. • **Popsicle Sticks**: Popsicle sticks can be used to reinforce the structure of the wildlife crossing and create support beams. They can also be used to build railings or fences along the edges of bridges. • **Clay or Modelling Dough**: Clay or modelling dough can be used to add texture and detail to the wildlife crossing, such as creating realistic terrain features like rocks or vegetation. It can also be used to model animals that might use the crossing. • **Pipe Cleaners**: Pipe cleaners can be used to create vegetation, bushes, or small trees that can be placed around the wildlife crossing to mimic natural habitat. • **Craft Paper**: Craft paper can be used to add colour and decoration to the wildlife crossing, such as painting patterns or

	designs on the surface of bridges or tunnels. • **Scissors and Utility Knives**: These tools are essential for cutting and shaping materials like cardboard and Popsicle sticks to construct the wildlife crossing. • **Glue, Tape, or Adhesive**: Glue, tape, or other adhesives are needed to assemble the different components of the wildlife crossing and hold them together securely. • **Markers or Paint**: Markers or paint can be used to add finishing touches to the wildlife crossing, such as adding signage or painting realistic details like animal tracks. • **Rulers and Measuring Tools**: Rulers and other measuring tools are useful for ensuring that the dimensions of the wildlife crossing are accurate and to maintain consistency in the design. • **Optional**: Small Toy Animals: Small toy animals can be used to test the functionality of the wildlife crossing and demonstrate how different species might use it to safely cross roads or other barriers.
Structure and activities	Lesson 1 (45 minutes): Understanding and Designing Introduction (5 minutes): • Teacher explains habitat fragmentation using visuals and examples. • Discuss wildlife corridors and their role in reconnecting habitats. Guided Design Phase (15 minutes): • Students sketch designs of wildlife crossings on graph paper. • Templates/examples provided to guide initial ideas. • Emphasize factors like animal size, habitat needs, and structural stability. Building Phase (25 minutes): • Students use materials like cardboard, Popsicle sticks, and clay to construct their designs. • Teacher circulates to offer guidance and ensure safety. Lesson 2 (45 minutes): Testing and Reflection Testing Phase - optional (20 minutes): • Use toy animals or models to simulate wildlife crossing usage. • Introduce challenges like steep slopes or blocked paths to test functionality. • Students document results and suggest improvements.

	Presentations (20 minutes): • Each group presents their model, explaining its features and benefits. • Highlight any design adjustments made during testing. Reflection (5 minutes): • Discuss the broader impact of wildlife crossings on communities and ecosystems.

Assessments:

#1 - Design and Construction
Objective: Evaluate students' ability to design and construct wildlife crossings.
Rubric: Design and Construction

	Initiating	**Developing**	**Excelling**
Description of performance Design Creativity: Demonstrates creativity and originality in the design of the wildlife crossing	Design lacks creativity or originality.	Design shows some creativity and originality.	Design is highly creative and original, incorporating innovative features.
Structural Integrity: Constructs a wildlife crossing with sturdy and stable structure	Structure is weak or unstable, lacking proper support.	Structure is mostly sturdy and stable, with some areas needing improvement.	Structure is robust and well built, ensuring stability and durability.
Attention to Detail: Pays attention to detail in construction, considering aesthetics and functionality	Construction lacks attention to detail, with sloppy workmanship.	Construction shows some attention to detail, but improvements are needed.	Construction demonstrates meticulous attention to detail, with high-quality workmanship.
Wildlife Accessibility:	Crossing design impedes wildlife	Crossing design allows for basic wildlife	Crossing design effectively facilitates

Designs and constructs the wildlife crossing to facilitate safe passage for animals	movement or safety.	passage but lacks optimization.	safe passage for a variety of wildlife species.
Sample student response	**Design Creativity**: The student constructs a basic wildlife crossing using cardboard and popsicle sticks. The design lacks creativity, with a simple rectangular structure without any additional features or embellishments. **Structural Integrity**: The student's wildlife crossing is unstable, with flimsy cardboard walls and weak support beams made from popsicle sticks. The structure is prone to collapsing under minimal pressure. **Attention to Detail**: The student demonstrates minimal attention to detail in construction, with uneven edges and sloppy glue application. The crossing lacks aesthetic appeal and functionality. **Wildlife Accessibility**: The wildlife crossing design impedes wildlife movement, with narrow passages	**Design Creativity**: The student creates a wildlife crossing with a slightly more elaborate design, incorporating curves and angles to mimic natural terrain. However, the design lacks innovation and originality, resembling a basic tunnel structure. **Structural Integrity**: The student's wildlife crossing is relatively stable, with improved support beams and reinforced walls. However, there are still areas of weakness, particularly around the joints and corners. **Attention to Detail**: The student demonstrates some attention to detail in construction, with smoother edges and more precise assembly. However, there are still minor flaws such as uneven paint application and inconsistent textures. **Wildlife Accessibility**:	**Design Creativity**: The student displays exceptional creativity in their wildlife crossing design, incorporating unique features such as simulated vegetation, textured surfaces, and naturalistic colour schemes. The design reflects careful consideration of wildlife habitat preferences and aesthetic appeal. **Structural Integrity**: The student's wildlife crossing is exceptionally sturdy and well built, with robust support structures and reinforced walls. The structure is resilient to external forces and capable of withstanding environmental conditions. **Attention to Detail:** The student demonstrates meticulous attention to detail in construction, with flawless craftsmanship and

	and inadequate clearance. It fails to provide a safe and effective means for animals to cross the road.	The wildlife crossing design allows for basic wildlife passage, with adequately sized openings and sufficient clearance. However, there may be some areas where improvements could be made to optimize accessibility for different animal species.	precision in every aspect of the crossing. The structure exhibits seamless integration of materials and finishes, resulting in a polished and professional appearance. **Wildlife Accessibility**: The wildlife crossing design effectively facilitates safe passage for a variety of wildlife species, with carefully engineered features to accommodate different movement patterns and behaviours. The structure provides a seamless transition between fragmented habitats, ensuring minimal disruption to wildlife populations.

#2 - Collaboration and Presentation
Objective: Evaluate students' collaboration and presentation skills
Rubric: Collaboration and Presentation

	Initiating	Developing	Excelling
Description of performance Team Collaboration: Works effectively with team members, contributing ideas and	Demonstrates minimal participation or teamwork.	Participates in-group discussions and contributes ideas, but lacks collaboration.	Actively collaborates with team members, sharing ideas and supporting others.

supporting others			
Problem-Solving Abilities: Demonstrates effective problem-solving skills in overcoming challenges during construction	Struggles to address challenges or adapt to unexpected issues.	Addresses some challenges with moderate success, but improvements are needed.	Successfully overcomes challenges with creative solutions and adaptability.
Use of Resources: Makes efficient use of time, materials, and resources during the design and construction process	Uses resources inefficiently, resulting in wasted time or materials.	Uses resources reasonably well but could be more efficient.	Makes optimal use of resources, maximizing efficiency and minimizing waste.
Sample student response	**Team Collaboration**: The student participates minimally in group discussions and activities, often working independently and contributing few ideas. They show little interest in collaborating with team members and may prefer to work alone. **Problem-Solving Abilities:** The student struggles to address challenges encountered during construction, relying heavily on others to solve problems. They	**Team Collaboration**: The student participates in group discussions and activities, contributing ideas and opinions to the team. However, they may struggle to communicate effectively with peers and may occasionally dominate conversations or fail to listen to others' perspectives. **Problem-Solving Abilities**: The student demonstrates moderate problem-solving abilities, successfully addressing some	**Team Collaboration**: The student actively collaborates with team members, listening to their ideas and providing constructive feedback. They communicate effectively and respectfully with peers, contributing to a positive and productive team dynamic. **Problem-Solving Abilities**: The student demonstrates exceptional problem-solving abilities, effectively addressing challenges

	may become frustrated when faced with obstacles and may require significant assistance from peers or the teacher. **Use of Resources**: The student uses resources inefficiently, wasting materials and time during the design and construction process. They may overlook important instructions or fail to follow the guidelines provided, leading to delays and setbacks.	challenges encountered during construction. However, they may require occasional guidance or support from peers or the teacher to overcome issues that are more complex. **Use of Resources**: The student use resources reasonably well but could be more efficient in their use of materials and time. They may occasionally waste materials or overlook important instructions but generally follow the guidelines provided.	encountered during construction with creativity and resourcefulness. They work collaboratively with peers to find innovative solutions to complex problems. **Use of Resources**: The student makes optimal use of resources, maximizing efficiency and minimizing waste during the design and construction process. They carefully follow instructions and guidelines, demonstrating a thorough understanding of project requirements.