# Eco-Friendly isn't Always Eco-Friendly

**Objectives:**
Students read an article from 2023 about eco-friendly road tar that mountain goats would eat, to realize how complex it is to make something truly eco-friendly. Students then identify a problem impacting bighorn sheep, either a specific issue such as getting hit on the road while crossing it, or larger issues such as climate change and design an eco-friendly model for reducing the problem while taking into account other implications that could come into play with their solution.

**Grade level:** Suggested K-12th
**Duration**: 2-3 class sessions
**Group Size**: Whole class/ small group
**Setting**: indoors
**Materials**:

- Article *Mountain Goats, Bighorn Sheep Caught Eating Pothole Filler Along Road to Mount Evans*
- Article *The Adverse Effects of Climate Change on Desert Bighorn Sheep*

**NGSS Standards:**

- **K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**
- **K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
- **3-5-ETS1-1Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- **3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **MS-EES3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**
- **MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**
- **MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**
- **HS-EES3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.**
- **HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**
- **HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**
- **HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.**

## Background:

With issues impacting our world negatively, humans try to create solutions. As we have progressed, often times scientists try to create more "eco-friendly" solutions to these problems. However, in doing so, secondary problems may be created. One example of this is in 2023 in Colorado when the Colorado Department of Transportation created a more eco-friendly road tar to patch cracks in the highway, which was made out of canola oil, soybean oil, palm nut extract oil and tallow. Using these as biodiesel, they were mixed with tar to patch road cracks.

However, mountain goats and bighorn sheep were soon found to be eating the road tar, attracted by the eco-friendlier ingredients. Yet, the tar was not ideal for their digestive system. COT quickly replaced the eco-friendly tar, going back to the old method until a better eco-friendly solution could be created.

**Focus**:
The primary focus of this lesson is to introduce the idea of how difficult it can be to create eco-friendly solutions for current problems without often times developing more problems in areas not originally thought of.

**Procedures:**
1) Either orally read or have students read the article *Mountain Goats, Bighorn Sheep Caught Eating Pothole Filler Along Road to Mount Evans.* Discuss how the Colorado Department of Transportation was trying to help the Earth with a more eco-friendly road tar that created a secondary problem not originally though about.

2) Students brainstorm a list of issues that impact bighorn sheep. These may involve:

- getting hit on the road by vehicles
- getting tangled in fences as they attempt to cross
- climate change (perhaps read article *The Adverse Effects of Climate Change on Desert Bighorn Sheep* and focus on creating more water holding areas to offset the drying climate)
- salting roads to melt winter snow ice which can attract sheep to the sides of the road for artificial "salt licks" and increasing chance of getting hit
- Increasing human population building in areas that are also good habitat for bighorn sheep

3) Individuals or small groups select an issue that they can come up with some sort of solution to. Creating an eco-friendly solution, they develop a drawn model. They include secondary possible problems that may arise through the use of their new eco-friendly solution and try to determine ways to reduce new problems developing (like the road tar attracted ungulates to eat it).

4) Groups present their problems/Solutions/Thought of Implications to the class. A writing project could also be included.

**Assessment:** Possible assessments:

- Oral presentation to class
- Model: Analyze their drawn components and written description, along with their thoughts on secondary implications that could come about and how they would try to mitigate or reduce these.

# Mountain goats, bighorn sheep caught eating pothole filler along road to Mount Evans

CBS NEWS COLORADO

BY SPENCER WILSON
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It's general knowledge that goats will eat just about everything. There are even stories of mountain goats in Colorado's high country eating something silly or licking the salt off your car. But this was a new one for us at CBS News Colorado.

The Colorado Department of Transportation confirmed they are no longer using an eco-friendly version of their pothole filler for asphalt along the road to Mount Evans after mountain goats and bighorn sheep were seen chomping down on the mixture after it was filled in.

Crews say they noticed the issue shortly before they opened the road up for the 2023 summer season and were able to quickly able to replace the filler with something the animals would not eat.

As for why they wanted to munch on this part of the road, the secret is in the ingredients.

"Some of the biological components they used to be more eco-friendly were, for example, canola oil, soybean oil, palm nut extract oil, and tallow, which is animal fat," Clear Creek County Commissioner Randy Wheelock said Tuesday. "So they used those as biodiesel to mix with the asphalt to try and make it more environmentally friendly, it was also apparently pretty tasty for the mountain goats up on the mountain."

Colorado Parks and Wildlife have said they have done recent surveys and all the herd populations seem healthy, and they had no reports of any of the animals being hit while on the road because of the tasty pothole filler, so this just got to be a pain-free lesson to CDOT it's not the best option where hungry goats and sheep might be snacking on their mixture.

From now on, CDOT said they will not be using that mixture in the high country or along the I-70 corridor where they could attract the animals again.

# The Adverse Effects of Climate Change on Desert Bighorn Sheep

Climate change has and will continue to have a negative impact on the population of desert bighorn sheep. For the remaining herds to survive, management may always be necessary. Protecting wild lands is key to the survival of these amazing animals.

The desert bighorn sheep ranges through the dry, desert mountains of eastern California, much of Nevada, northwestern Arizona, and southern Utah. They prefer a habitat of steep, rocky terrain for escape from predators, bedding, and lambing. Desert bighorn sheep zigzag up and down cliff faces with incredible ease. They use ledges only two inches wide for foot holds, and bounce from ledge to ledge over spans as wide as 20 feet. They can move over level ground at 30 miles per hour and scramble up mountain slopes at 15 miles per hour. They are aided by cloven hooves which are sharp-edged, elastic, and concave.

In 2010, the National Park Service (NPS) began to study the link between population declines of desert bighorn sheep and the effects of climate change. Climatic variables such as rising temperatures and decreased precipitation affect the availability of vegetation and dependable sources of spring water for the desert bighorn sheep. Water is critical to desert bighorn sheep survival. Lactating ewes need to drink almost every day. Animals like desert bighorn sheep also need large areas of land in which to mix herds. Desert bighorn sheep primarily live in small, isolated herds throughout the mountain ranges of the Sonoran, Mojave, and Great Basin deserts of the southwestern United States. There are ten national parks home to the majority of these groups, and the NPS plays a critical role in the conservation of this species.

https://www.nps.gov/articles/desertbighornsheepresearch.htm