Beef Barriers  
*Middle School, Life Sciences*

**Task Overview**

### In this task, students will evaluate existing beef cattle production / industry practices and determine their impacts on water quality and biodiversity. Using scientific evidence for support, students will identify a potential solution that could improve key biodiversity variables among water ecosystems.

Students will evaluate data regarding harmful algal blooms in New York waterways and determine that livestock allowed to drink directly from waterways can have a negative impact on water quality. For this reason, physical barriers are often observed on cattle farms. Through their work, students will be able to identify the characteristics of healthy and unhealthy water ecosystems. Next, students will evaluate 4 common conservation management practices - managing beef lifecycle, filter strips / forested buffers, managing grazing, and fenced farm dams. After learning about these practices, students identify the solution that most improves water quality of New York water ecosystems.

**Next Generation Science Standards**

#### **Three-Dimensional Claim**

Students will identify potential causes of pollution among New York water ecosystems of existing beef cattle production / industry practices and their effects on water quality and biodiversity to explain a solution (or combinations of solutions) that could lead to improvement in key variables by using scientific evidence to support their explanation.

This task is intended to elicit student learning of the following **NGSS elements** for each of the three dimensions:

#### Disciplinary Core Ideas

*LS2.D: Social Interactions and Group Behavior (MS)*

* Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on – for example, water purification and recycling (secondary to MS-LS2-5)

*ETS1.B: Developing Possible Solutions (MS)*

* Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors (MS-ETS1-3)

#### Science and Engineering Practices

*Constructing Explanations and Designing Solutions (MS)*

* Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.
* Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.

#### Crosscutting Concepts

*Patterns (MS)*

* Patterns can be used to identify cause and effect relationships.
* Graphs, charts, and images can be used to identify patterns in data.

**Suggestions for Use**

This task is intended to be used for formative assessment purposes - to identify students’ strengths and needs with the above dimensions to provide feedback to students and guide shifts in instruction.

**Background Information**

There are a variety of solutions being implemented by beef cattle production that include industry practices aimed toward improvement of the causes of pollution in New York water ecosystems. Scientific evidence shows that best practices include any of the following solutions to mitigate the effects of pollution due to production. Each has a unique impact on the biodiversity of a water ecosystem. Using cover crops helps soil hold onto nutrients so they are not released into the ecosystem. Managing the life cycle of beef cattle and grazing practices by using a feedlot for a portion of cattle’s life cycle and reducing overgrazing helps maintain the local ecosystem. Buffers or filter strips can be used to help trap nutrients that would otherwise end up in the local water ecosystem. Fencing is a physical barrier that keeps water sources clean by blocking livestock access.

Note:

There are many solutions, but the background information is limited to those discussed in this transfer task.

**Assumptions**

Students should have engaged with instructional experiences that ask them to read and analyze information from graphs and data tables to evaluate potential pros and cons of possible solutions to environmental concerns. Students should also understand the role that humans play in maintaining biodiversity of ecosystems and that responsible management of natural resources is a necessity for sustainability.

**Resources**

* <https://www.labxchange.org/library/pathway/lx-pathway:69980a09-42bf-418d-9679-f8756f2bcc6a/items/lx-pb:69980a09-42bf-418d-9679-f8756f2bcc6a:html:7bcac1df>
* <https://www.dec.ny.gov/docs/water_pdf/researchguide.pdf>
* <https://www.morningagclips.com/wp-content/uploads/2019/04/28774453358_37389bee19_z.jpg>
* <https://www.youtube.com/embed/HSoHkG7bbJE?feature=oembed>
* <https://www.canada.ca/en/environment-climate-change/services/freshwater-quality-monitoring/publications/phosphorus-aquatic-ecosystems/chapter-1.html>
* <https://newyork.agclassroom.org/matrix/lesson/802/>
* <https://assets.savvas.com/asset_mgr/current/202131/LabSamp_MLBio.pdf>
* <https://lpelc.org/the-michigan-enviroimpact-tool-a-supporting-tool-to-help-farmers-in-forecasting-manure-nutrient-runoff-risk/>
* <https://www.usda.gov/media/blog/2017/12/13/farmers-keeping-nutrients-field-out-streams>
* <https://www.feedlotmagazine.com/news/feedlot_special/2022-msu-feedlot-educational-series/article_e3c4f044-6d71-11ec-ae65-7f78422b6ac5.html>
* <https://extension.wsu.edu/animalag/content/protecting-the-water-on-your-small-farm/>
* <https://extension.sdstate.edu/impacts-drought-soil-water-forage-and-livestock-grazing-systems>
* <https://www.sustainablefarms.org.au/news/benefit-cost-analysis-lends-support-for-improved-farm-dam-management/>
* <https://www.usda.gov/media/blog/2017/12/13/farmers-keeping-nutrients-field-out-streams>
* <https://extension.missouri.edu/publications/eq681>
* <https://extension.sdstate.edu/impacts-drought-soil-water-forage-and-livestock-grazing-systems>
* <https://www.sustainablefarms.org.au/news/fencing-farm-dams-halves-methane-emissions/>
* <https://extension.wsu.edu/animalag/content/protecting-the-water-on-your-small-farm/>

[0-how-clean-is-the-water-student.pdf (nourishthefuture.org)](https://nourishthefuture.org/media/pages/curriculum/water-quality/ms/phenomenon/ff01ec70fe-1647616853/0-how-clean-is-the-water-student.pdf)

### **Collaborations**

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