

# Lesson Plan: Concentrated Animal Feed Operations in the Genesee River Watershed

## Description

In this lesson students will use the Genesee Riverwatch interactive map and other primary sources to study Concentrated Animal Feed Operations (CAFOs). They will consider the impacts of these farms on the Genesee River.



## Essential Question

How is the Genesee River affected by CAFOs?

## Learning Targets

1. I can understand what a Concentrated Animal Feed Operation (CAFO) is.
2. I can analyze a map of CAFOs in the Genesee River Watershed.
3. I can explain how CAFOs affect the quality of water in the Genesee River.
4. I can synthesize an understanding of the impact CAFOs have on the Genesee River.

| Class                    | Duration                     | Topics  |
|--------------------------|------------------------------|---|
| AP Environmental Science | 2 class periods (90 minutes) | Environmental Health<br>Human Impact<br>Genesee River |

## NGSS

|  |   |   |
|--|---|---|
| Science and Engineering Practices<br><br>Constructing Explanations and Designing Solutions | Disciplinary Core Ideas<br><br>ESS3.C: Human Impacts on Earth Systems | Crosscutting Concepts<br><br>Influence of Science, Engineering, and Technology on Society and the Natural World |
|--|---|---|

## NYS Standards:

- 4.7.1e The environment may contain dangerous levels of substances (pollutants) that are harmful to organisms. Therefore, the good health of environments and individuals requires the monitoring of soil, air, and water, and taking steps to keep them safe.



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## Plan for Lesson

Notes: This lesson requires access to the internet and a computer for each student or group of students. The lesson can be completed digitally or paper copies of the lesson and related readings can be provided.

**Do Now:** Students read about CAFO enforcement from page of one of the EPA document, “EPA Targets Clean Water Act Crimes - Illegal Pollution by Animal Confinement Operations Punished by Fines and Incarceration”.

<https://www.epa.gov/sites/production/files/documents/cr-cafo-06-13.pdf>

After reading students complete a chart that outlines what they learned, think, feel and questions they have about the document.

**Build Background Knowledge:** Students learn basic facts about Concentrated Animal Feed Operations. This information can be presented through direct instruction or class discussion.

1. What is a Concentrated Animal Feeding Operation?

A farm that has a certain number of animals confined in a barn or similar space.

(See this chart - [https://www3.epa.gov/npdes/pubs/sector\\_table.pdf](https://www3.epa.gov/npdes/pubs/sector_table.pdf))

2. Why should I care about CAFOs?

Concentrated Animal Feeding Operations have the potential to contribute significant amounts of pollution to the Genesee River if the waste from animals is not managed properly. The most significant form of pollution from CAFOs is phosphorus but excess nitrogen and pathogens can also be a problem.

3. What are the problems associated with pollution from CAFOs?

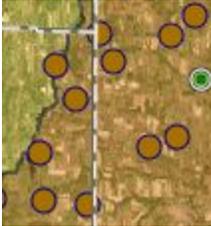
There are risks to human and ecosystem health. Pollution from CAFOs can cause algae blooms, fish kills, contaminate drinking water and transmit disease causing pathogens.

**Familiarize Yourself with the Genesee Riverwatch map of Concentrated Animal Feeding Operations Map:** Students study the map created by Genesee Riverwatch.

<http://ceinfo.maps.arcgis.com/apps/webappviewer/index.html?id=4e092f2c597f4f49a18a1e896531a8c0>

The areas shaded in different colors on the map are the watersheds within the Genesee River watershed. Everything that is shaded flows into the Genesee River and eventually Lake Ontario.



|   |  |
|---|--|
| <p>Layers represent all of the data that you can show, for this activity you will need the three layers shown on the right selected</p> | <ul style="list-style-type: none"> <li>▶ <input checked="" type="checkbox"/> CAFOs</li> <li>▶ <input checked="" type="checkbox"/> Genesee River Basin</li> <li>▶ <input checked="" type="checkbox"/> Genesee River Sub-Watersheds</li> </ul> |
| <p>The Brown dots on the map represent CAFOS. You can zoom in on these dots to see a satellite view of the farms.</p>                   |    |

**Analyzing CAFOS in the Genesee River Watershed:** Students use the map to zoom in on the satellite view of a CAFO. Have the student list the name of the farm and what they notice and wonder. This period of exploration can be followed by a discussion of what they notice and wonder about CAFOs. After studying an individual CAFO students count the number of CAFOs in each sub-watershed (different shaded areas) to determine how many CAFOs there are in the Genesee River watershed as a whole.

**Understanding the impact of CAFOs on Water Quality:** Students study an excerpt from the document published by the CDC to understand the impact of CAFOs on water quality using the protocol listed. This analysis can be followed by a class discussion.

1. Read the following section from the document, “Understanding Concentrated Animal Feeding Operations and Their Impact on Communities” ([https://www.cdc.gov/nceh/ehs/docs/understanding\\_cafos\\_nalboh.pdf](https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf))
2. As you read, underline phrases that identify how CAFOs impact water quality. This includes:
  - a. How pollutants get in the water
  - b. Types of pollutants
  - c. Effect of pollutants on plant and animal life
3. After each paragraph write key points from the paragraph

**Synthesizing the Impact of CAFOs in the Genesee River WaterShed:** Students use the information from the lesson to write their answers to the following questions:

Do you think CAFOs have an impact on the Genesee River? (write as a full sentence)  
 What do you think their impact might be?  
 What data or information lead you to this conclusion?  
 What additional information would be needed to confirm your conclusion?

# Mapping Concentrated Animal Feed Operations (CAFOs)

## Learning Targets

1. I can understand what a Concentrated Animal Feed Operation (CAFO) is.
2. I can analyze a map of CAFOs in the Genesee River Watershed.
3. I can explain how CAFOs affect the quality of water in the Genesee River.
4. I can synthesize an understanding of the impact CAFOs have on the Genesee River.



## Do Now

Read page 1 of the article, “EPA Targets Clean Water Act Crimes - Illegal Pollution by Animal Confinement Operations Punished by Fines and Incarceration”

Record your answers to the questions below:

| What did you learn?         | What do you think? | How do you feel about this? |
|-----------------------------|--------------------|-----------------------------|
|                             |                    |                             |
| What questions do you have? |                    |                             |
|                             |                    |                             |

## Build Background Knowledge

### 1. What is a Concentrated Animal Feeding Operation?

A farm that has a certain number of animals confined in a barn or similar space.

(See this chart - [https://www3.epa.gov/npdes/pubs/sector\\_table.pdf](https://www3.epa.gov/npdes/pubs/sector_table.pdf))

### 2. Why should I care about CAFOs?

Concentrated Animal Feeding Operations have the potential to contribute significant amounts of pollution to the Genesee River if the waste from animals is not managed properly. The most significant form of pollution from CAFOs is phosphorus, but excess nitrogen and pathogens can also be a problem.

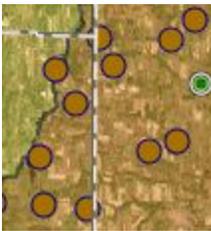
### 3. What are the problems associated with pollution from CAFOs?

There are risks to human and ecosystem health. Pollution from CAFOs can cause algae blooms, fish kills, contaminate drinking water and transmit disease causing pathogens.

## Familiarize Yourself with the Genesee RiverWatch map of Concentrated Animal Feeding Operations Map

Click the link to visit the map:

<http://ceinfo.maps.arcgis.com/apps/webappviewer/index.html?id=4e092f2c597f4f49a18a1e896531a8c0>

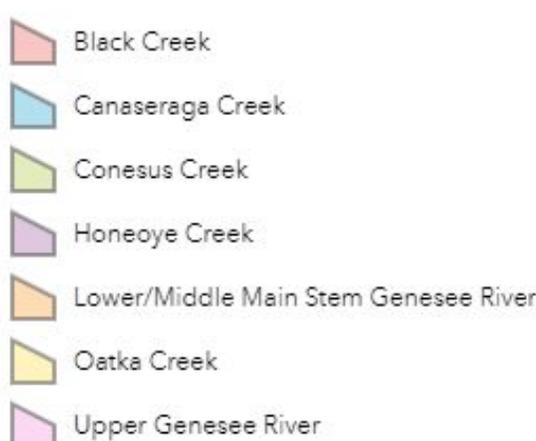
|   |  |
|---|--|
| <p>The areas shaded in different colors on the map are the watersheds within the Genesee River watershed. Everything that is shaded flows into the Genesee River and eventually Lake Ontario.</p> |    |
| <p>Layers represent all of the data that you can show, for this activity you will need the three layers shown on the right selected</p>   | <ul style="list-style-type: none"> <li>▶ <input checked="" type="checkbox"/> CAFOs</li> <li>▶ <input checked="" type="checkbox"/> Genesee River Basin</li> <li>▶ <input checked="" type="checkbox"/> Genesee River Sub-Watersheds</li> </ul> |
| <p>The Brown dots on the map represent CAFOS. You can zoom in on these dots to see a satellite view of the farms.</p>   |    |

## Analyzing CAFOS in the Genesee River Watershed

Use the map to zoom in on the satellite view of a CAFO.

| Name of farm | What do you notice? | What do you wonder? |
|--------------|---------------------|---------------------|
|              |                     |                     |

Use the map to count the number of CAFOs in each Sub-watershed

| Sub-Watersheds                         | Number of CAFOs |  |
|--|-----------------|--|
| Black Creek                            |                 | <b>Genesee River Sub-Watersheds</b><br> |
| Canaseraga Creek                       |                 |  |
| Conesus Creek                          |                 |  |
| Honeoye Creek                          |                 |  |
| Lower / Middle Main Stem Genesee River |                 |  |
| Oatka Creek                            |                 |  |
| Upper Genesee River                    |                 |  |
| Total                                  |                 |  |



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indigenous aquatic life (Sierra Club Michigan Chapter, n.d.). Nutrient over-enrichment causes algal blooms, or a rapid increase of algae growth in an aquatic environment (Science Daily, n.d.). Algal blooms can cause a spiral of environmental problems to an aquatic system. Large groups of algae can block sunlight from underwater plant life, which are environmental health habitats for much aquatic life. When algae growth increases in surface water, it can also dominate other resources and cause plants to die. The dead plants provide fuel for bacteria to grow and increased bacteria use more of the water's oxygen supply. Oxygen depletion once again causes indigenous aquatic life to die. Some algal blooms can contain toxic algae and other microorganisms, including Pfiesteria, which has caused large fish kills in North Carolina, Maryland, and the Chesapeake Bay area (Spellman & Whiting, 2007). Eutrophication can cause serious problems in surface waters and disrupt the ecological balance.

|  |
|--|
| Summary of paragraph                     |
| <br><br><br><br><br><br><br><br><br><br> |

Water tests have also uncovered hormones in surface waters around CAFOs (Burkholder et al., 2007). Studies show that these hormones alter the reproductive habits of aquatic species living in these waters, including a significant decrease in the fertility of female fish. CAFO runoff can also lead to the presence of fecal bacteria or pathogens in surface water. One study showed that protozoa such as *Cryptosporidium parvum* and *Giardia* were found in over 80% of surface water sites tested (Spellman & Whiting, 2007). Fecal bacteria pollution in water from manure land application is also responsible for many beach closures and shellfish restrictions.

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| Summary of paragraph                     |
| <br><br><br><br><br><br><br><br><br><br> |



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# Synthesizing the Impact of CAFOs in the Genesee River WaterShed

## Is the Genesee River affected by CAFOs?

Do you think CAFOs have an impact on the Genesee River? (write as a full sentence)

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What do you think their impact might be?

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What data or information lead you to this conclusion?

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What additional information would be needed to confirm your conclusion?

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