

AGRICULTURE & FERTILIZER RUNOFF GRADE 8 AND UP READING

Science Applicability

Sub Plan

Improve students'
literacy skills



Reading Comment

“

Extremely satisfied - Great resource to work on student reading comprehension and it tied into the topic I was teaching. My students have been struggling with reading and I've been incorporating more reading into my lessons. Thank you for the resource.

”

SCROLL
to take a look inside!

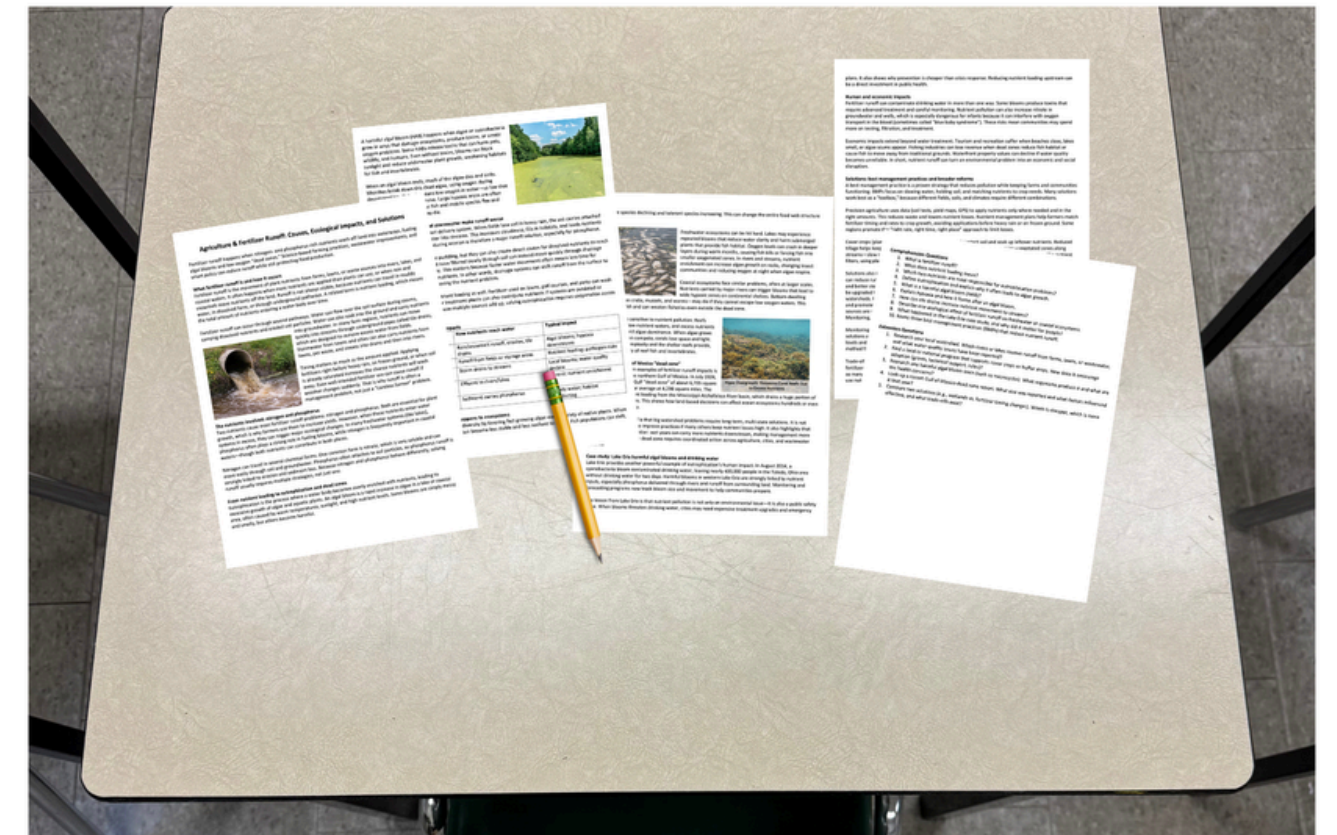


THE PROBLEMS YOU FACE

- Limited time to teach scientific literacy and strengthen students' reading and analysis skills.
- Need meaningful extension activities to engage fast-moving learners.
- Difficulty creating effective last-minute sub plans that still support student learning.

CLASSROOM READY

- Questions and Answer Key
- **No Prep, Ready-to-Use:** Print or assign digitally with Google Docs, Microsoft Word, and PDF formats for flexible classroom use
- **Includes Varied Question Types:** Knowledge, thinking, connecting, application, and open-ended questions.



What Will Your Students Learn?

READING COMPREHENSION ARTICLE & QUESTION BUNDLE

Article with
Comprehension
Questions

Grade 8 and Up

Print & Digital

- Fertilizer Runoff and Nutrient Loading
- Nitrogen and Phosphorus Cycles
- Eutrophication and Algal Blooms
- Harmful Algal Blooms (HABs)
- Hypoxia and Dead Zones
- Surface Runoff, Groundwater, and Tile Drain Systems
- Soil Erosion and Sediment Transport
- Urban Stormwater and Wastewater Impacts
- Ecological Effects
- Case Studies (Gulf of Mexico Dead Zone, Lake Erie Water Crisis)
- Human Health and Economic Impacts
- Best Management Practices
- Precision Agriculture and Sustainable Solutions

Comprehension Questions

1. What is fertilizer runoff?
2. What does nutrient loading mean?
3. Which two nutrients are most responsible for eutrophication problems?
4. Define eutrophication and explain why it often leads to algae growth.
5. What is a harmful algal bloom (HAB)?
6. Explain hypoxia and how it forms after an algal bloom.
7. How does hypoxia affect the movement to streams?
8. Describe the effects of dead zones.
9. What are the causes of dead zones?
10. Name three ways to prevent dead zones.

Extension

1. Research the effects of fertilizer runoff on the environment.
2. Write a persuasive essay on the importance of preventing fertilizer runoff.
3. Create a poster or presentation about the dangers of fertilizer runoff.
4. Interview a farmer or scientist about the challenges of managing fertilizer use.
5. Investigate the role of government in regulating fertilizer use.

Agriculture & Fertilizer Runoff: Causes, Ecological Impacts, and Solutions

Fertilizer runoff happens when nitrogen- and phosphorus-rich nutrients wash off land into waterways, fueling algal blooms and low-oxygen "dead zones." Science-based farming practices, wastewater improvements, and smart policy can reduce runoff while still protecting food production.

What fertilizer runoff is and how it occurs

Fertilizer runoff is the movement of plant nutrients from farms, lawns, or waste sources into rivers, lakes, and coastal waters. It often happens when more nutrients are applied than plants can use, or when rain and snowmelt move nutrients off the land. Runoff is not always visible, because nutrients can travel in muddy water, in dissolved form, or through underground pathways. A related term is nutrient loading, which means the total amount of nutrients entering a water body over time.

Fertilizer runoff can occur through several pathways. Water can flow over the soil surface during storms, carrying dissolved nutrients and eroded soil particles. Water can also soak into the ground and carry nutrients quickly into streams through underground pipes called tile drains. In many farm regions, nutrients can move quickly into streams through underground pipes called tile drains, which are designed to remove excess water from fields. Stormwater from towns and cities can also carry nutrients from lawns, pet waste, and streets into drains and then into rivers.

Timing matters as much as the amount applied. Applying fertilizers right before heavy rain, on frozen ground, or when soil is already saturated increases the chance nutrients will wash away. Even well-intended fertilizer use can cause runoff if weather changes suddenly. That is why runoff is often a management problem, not just a "careless farmer" problem.

The nutrients involved: nitrogen and phosphorus

Two nutrients cause most fertilizer runoff problems: nitrogen and phosphorus. Both are essential for plant growth, which is why farmers use them to increase yields. However, when these nutrients enter water systems in excess, they can trigger major ecological changes. In many freshwater systems (like lakes), phosphorus often plays a strong role in fueling blooms, while nitrogen is frequently important in coastal waters—though both nutrients can contribute in both places.

Nitrogen can travel in several chemical forms. One common form is nitrate, which is very mobile and can move easily through soil and groundwater. Phosphorus, on the other hand, is less mobile and tends to be strongly linked to soil particles. It can be lost through erosion, but it is not as easily washed away as nitrate.

Nutrient loading is the process of adding too many nutrients to a water body. It can lead to eutrophication, a process where algae grow too fast, die, and are decomposed, leading to low oxygen levels. This can harm fish and other aquatic life. Algal blooms can also be harmful to humans if they are ingested or if they cause allergic reactions. In some cases, algal blooms can lead to the formation of dead zones, areas where the oxygen is so low that most life cannot survive.

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Your Reading

Agriculture & Fertilizer Runoff: Causes, Ecological Impacts, and Solutions

Fertilizer runoff happens when nitrogen- and phosphorus-rich nutrients from farms, lawns, and other areas wash into nearby water bodies. This can cause algal blooms and low-oxygen “dead zones.” Science-based farming and smart policy can reduce runoff while still protecting food production.

What fertilizer runoff is and how it occurs
Fertilizer runoff is the movement of plant nutrients from farms, lawns, and other areas into nearby water bodies. It often happens when more nutrients are applied than the soil can absorb, or when rain or irrigation water carries excess fertilizer away from the land. Runoff is not always visible, but it can be detected by testing water samples. A related issue is the total amount of nutrients entering a water body over time.

Fertilizer runoff can occur through several pathways. Water can carry dissolved nutrients and eroded soil particles. Water can also seep into groundwater. In some cases, runoff is quickly absorbed by plants, which are designed to take up nutrients from the soil.



Timing matters as much as the amount of fertilizer. Applying it right before a rainstorm is already saturated with water. Even well-intentioned weather changes sudden management problems.

The nutrients involved: nitrogen and phosphorus
Two nutrients cause most fertilizer runoff problems: nitrogen and phosphorus. Nitrogen is used for plant growth, which is why farmers use it to increase yields. However, in excess, it can trigger major ecological changes. In many cases, phosphorus often plays a strong role in fueling algal blooms, while nitrogen often plays a strong role in fueling blooms, while nitrogen often plays a strong role in fueling blooms, while nitrogen often plays a strong role in fueling blooms.

Nitrogen can travel in several chemical forms. One common form is nitrate, which can move easily through soil and groundwater. Phosphorus often attaches to soil particles, which are more likely to be eroded and carried away. Because nitrogen and phosphorus runoff usually requires multiple strategies, not just one.

From nutrient loading to eutrophication and dead zones
Eutrophication is the process where a water body becomes overly enriched with nutrients, leading to excessive growth of algae and aquatic plants. An algal bloom is a visible sign of eutrophication, often caused by warm temperatures, sunlight, and high nutrient levels. Algal blooms can be harmful to people and animals, but others become harmful.

A harmful algal bloom (HAB) happens when algae or cyanobacteria grow in ways that damage ecosystems, produce toxins, or create oxygen problems. Some HABs release toxins that can harm pets, wildlife, and humans. Even without toxins, blooms can block sunlight and reduce underwater plant growth, weakening habitats for fish and invertebrates.



When an algal bloom ends, much of the algae dies and sinks. Microbes break down this dead algae, using oxygen during decomposition. Hypoxia means low oxygen in water—so low that many organisms cannot survive. Large hypoxic areas are often called “dead zones” because fish and mobile species flee and bottom-dwelling species may die.

Why erosion, tile drains, and stormwater make runoff worse

Soil erosion acts like a nutrient delivery system. When fields lose soil in heavy rain, the soil carries attached phosphorus and organic matter into streams. This increases cloudiness, fills in habitats, and loads nutrients into downstream waters. Reducing erosion is therefore a major runoff solution, especially for phosphorus.

Tile drains can reduce surface puddling, but they can also create direct routes for dissolved nutrients to reach waterways. Water that would have filtered slowly through soil can instead move quickly through drainage pipes into ditches and streams. This matters because faster water movement often means less time for natural processes to remove nutrients. In other words, drainage systems can shift runoff from the surface to the subsurface—without removing the nutrient problem.

Urban stormwater adds to nutrient loading as well. Fertilizer used on lawns, golf courses, and parks can wash into storm drains. Wastewater treatment plants can also contribute nutrients if systems are outdated or overwhelmed by storms. Because multiple sources add up, solving eutrophication requires cooperation across farming, cities, and industry.

Nutrient sources and typical impacts

Nutrient source	How nutrients reach water	Typical impact
Farm fertilizer	Rain/snowmelt runoff, erosion, tile drains	Algal blooms; hypoxia downstream
Livestock manure	Runoff from fields or storage areas	Nutrient loading; pathogen risks
Urban lawns and stormwater	Storm drains to streams	Local blooms; water quality decline
Wastewater treatment discharge	Effluent to rivers/lakes	Chronic nutrient enrichment
Soil erosion	Sediment carries phosphorus	Cloudy water; habitat smothering

Ecological consequences: what happens to ecosystems

Nutrient pollution can reduce biodiversity by favoring fast-growing algae over a variety of native plants. When biodiversity drops, ecosystems often become less stable and less resilient to stress. Fish populations can shift, with sensitive species declining and tolerant species increasing. This can change the entire food web over time.



Freshwater ecosystems can be hit hard. Lakes may experience repeated blooms that reduce water clarity and harm plants that provide fish habitat. Oxygen levels can drop during warm months, causing fish kills or forcing fish into smaller oxygenated zones. In rivers and streams, nutrient enrichment can increase algae growth on rocks, change communities and reducing oxygen at night when algae die.

Coastal ecosystems face similar problems, often at a larger scale. Nutrients carried by major rivers can trigger blooms of jellyfish and other organisms on continental shelves. Bottom-dwelling species like crabs, mussels, and worms may die if they cannot escape low-oxygen water and can weaken fisheries even outside the dead zone.



Algae Overgrowth Threatens Coral and Other Marine Life

Reefs are sensitive to nutrient pollution. Reefs in low-nutrient waters, and excess nutrients can lead to a shift in algae dominance. When algae grows out of control, it can smother corals and other organisms. Complexity and the shelter reefs provide, which is why they are so important for reef fish and invertebrates.

Gulf of Mexico “dead zone”

Recent examples of fertilizer runoff impacts in the northern Gulf of Mexico. In July 2024, a “dead zone” of about 6,705 square miles was reported, a 10-year average at 4,298 square miles. The nutrient loading from the Mississippi-Atchafalaya River basin, which drains a huge area of the United States. This shows how land-based decisions can affect ocean ecosystems hundreds of miles away.

The Gulf is that big watershed problems require long-term, multi-state solutions. Farmers to improve practices if many others keep nutrient losses high. It also helps to have a flow matter: wet years can carry more nutrients downstream, making managing the dead zone requires coordinated action across agriculture, cities, and industry.

Erie harmful algal blooms and drinking water

Another powerful example of eutrophication’s human impact. In August 2015, a harmful algal bloom contaminated drinking water, leaving nearly 400,000 people in the Toledo area without water for two days. Harmful blooms in western Lake Erie are strongly linked to phosphorus delivered through rivers and runoff from surrounding land. Monitoring and managing blooms now track bloom size and movement to help communities prepare.

Lake Erie is that nutrient pollution is not only an environmental issue—it is also a public health issue. In some cases, it threatens drinking water, cities may need expensive treatment upgrades and more monitoring.

plans. It also shows why prevention is cheaper than crisis response. Reducing nutrient loading upstream can be a direct investment in public health.

Human and economic impacts

Fertilizer runoff can contaminate drinking water in more than one way. Some blooms produce toxins that require advanced treatment and careful monitoring. Nutrient pollution can also increase nitrate in groundwater and wells, which is especially dangerous for infants because it can interfere with oxygen transport in the blood (sometimes called “blue baby syndrome”). These risks mean communities may need more on testing, filtration, and treatment.

Economic impacts extend beyond water treatment. Tourism and recreation suffer when bad smells, or algae scums appear. Fishing industries can lose revenue when dead zones reduce fish populations. Cause fish to move away from traditional grounds. Waterfront property values can decline if the water becomes unreliable. In short, nutrient runoff can turn an environmental problem into an economic disruption.

Solutions: best management practices and broader reforms

A best management practice is a proven strategy that reduces pollution while keeping farms and businesses functioning. BMPs focus on slowing water, holding soil, and matching nutrients to crop needs. They work best as a “toolbox,” because different fields, soils, and climates require different combinations of practices.

Precision agriculture uses data (soil tests, yield maps, GPS) to apply nutrients only where and when needed in right amounts. This reduces waste and lowers nutrient losses. Nutrient management plans that guide fertilizer timing and rates to crop growth, avoiding applications before heavy rain or on frozen ground. Regions promote the “right rate, right time, right place” approach to limit losses.

Cover crops (plants grown between main crop seasons) protect soil and soak up leftover nutrients. No-till or reduced tillage helps keep soil intact, reducing erosion and phosphorus loss. Buffer strips—vegetated areas along waterways—slow runoff and trap sediment before it reaches water. Constructed wetlands can filter nutrients, using plants and microbes to remove nitrogen and capture sediment.

Solutions also include urban and wastewater improvements. Cities can reduce runoff by using rain gardens, permeable pavement, and better stormwater storage. Wastewater treatment plants can be upgraded to remove more nutrients, especially in sensitive watersheds. Public education can reduce lawn fertilizer overuse and promote responsible disposal of pet waste. Because nutrient sources are mixed, solutions must be shared. Monitoring, adaptive management, and trade-offs are essential.



Monitoring is essential because it tells communities whether solutions are working. Scientists use water sampling, sensors, satellite images, and models to track nutrient levels and bloom risk. Adaptive management means adjusting strategies based on monitoring results. If a method fails, managers revise the plan rather than continuing blindly.

Trade-offs are real and should be discussed honestly. Farmers need productive land and stable income to use fertilizers to support food production. Policies that reduce runoff may have costs in time, equipment, or lost revenue. So many programs combine rules with incentives to help adoption. The goal is not to “ban” fertilizers but to use them more efficiently so farms remain productive while water stays safe.

Comprehension Questions

- What is fertilizer runoff?
- What does nutrient loading mean?
- Which two nutrients are most responsible for eutrophication problems?
- Define eutrophication and explain why it often leads to algae growth.
- What is a harmful algal bloom (HAB)?
- Explain hypoxia and how it forms after an algal bloom.
- How can tile drains increase nutrient movement to streams?
- Describe one ecological effect of fertilizer runoff on freshwater or coastal ecosystems.
- What happened in the Lake Erie case study, and why did it matter for people?
- Name three best management practices (BMPs) that reduce nutrient runoff.

Extension Questions

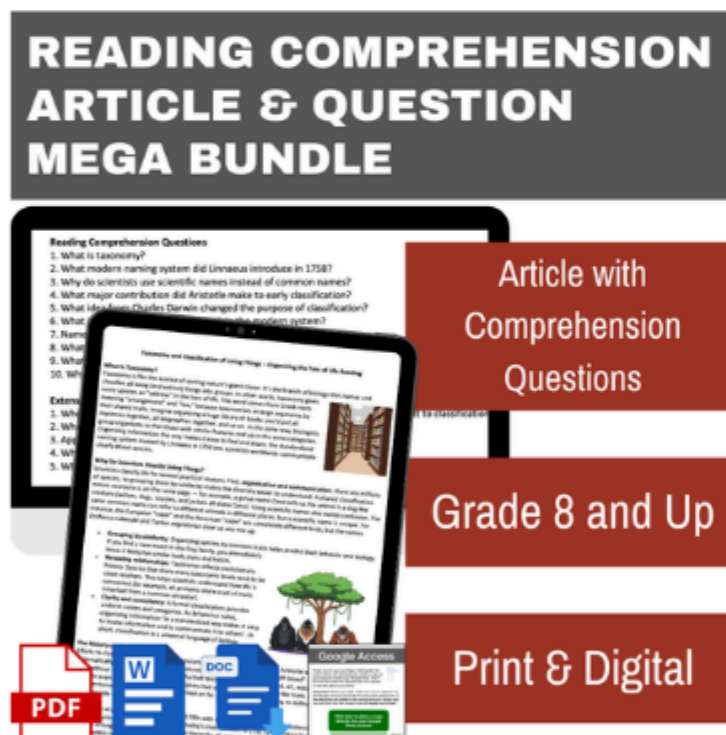
- Research your local watershed. Which rivers or lakes receive runoff from farms, lawns, or wastewater, and what water quality issues have been reported?
- Find a local or national program that supports cover crops or buffer strips. How does it encourage adoption (grants, technical support, rules)?
- Research one harmful algal bloom toxin (such as microcystin). What organisms produce it and what are the health concerns?
- Look up a recent Gulf of Mexico dead zone report. What size was reported and what factors influenced it that year?
- Compare two solutions (e.g., wetlands vs. fertilizer timing changes). Which is cheaper, which is more effective, and what trade-offs exist?

Comprehension and Extension Questions



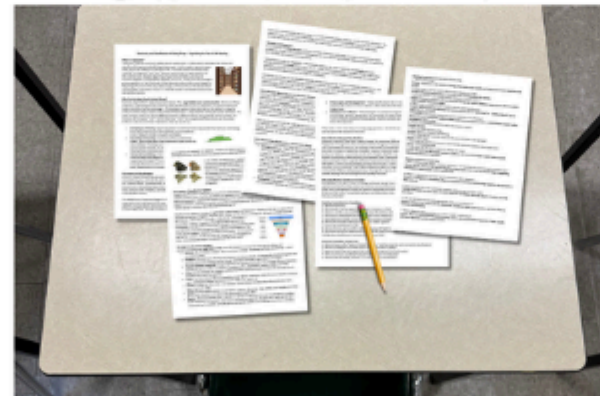
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Includes over 130 readings for students in grades 8 and up. The bundle covers all science topics and will save you over 75%.



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★★★★★ Extremely satisfied - It is a good supplemental activity either for review and at the same time introducing some concept. I also use this for sub plan. It is well presented, organized and interesting.

★★★★★ Extremely satisfied - This a great resource. I used this for a sub plan. It was fun and engaging for my students.

Grade 8 and Up Scientific Reading Comprehension Article Mega Bundle

ALL my current and future grade 8 and up readings, covering the following subject areas:

Biology
Chemistry
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Ecology and the Environment
Energy
Health
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