Office of Phosphorus

Overview

This collaborative research activity introduces students to the governance challenges associated with phosphorus management at the local, state and federal levels in the United States, through open-ended, exploratory research that allows them to practice identifying, using, and evaluating publicly available resources related to governance.

This activity can be a useful tool for helping students understand what is considered a reliable online source, determine strategies for open-ended research, navigate public resources (government websites), and distinguish the three branches of government as well as the levels of government. It can easily be adapted for an interdisciplinary assignment for social studies and science.

Objectives
Students will be able to:

- Classify the agencies that have some responsibility for phosphorus management
- Compare the state of current phosphorus governance with theoretical models of collaborative governance and/or collective action

Duration:
2-3 class periods

Background

Phosphorus sustainability is an important issue because phosphorus is an essential nutrient for all living organisms, playing a crucial role in plant growth and food production. However, phosphorus is a finite resource, and its availability is limited. Phosphorus is an essential nutrient and a key component of DNA and ATP. It is also a component of fertilizers used in agriculture to enhance plant growth and crop yields. Addressing the phosphorus sustainability issue requires collaborative efforts from policymakers, researchers, farmers, and consumers to ensure the long-term availability of phosphorus resources while minimizing environmental impacts and ensuring global food security. Students should have some understanding of the natural cycles. Using their understanding of the phosphorus cycle, students will be able to explore the structure and function of the government when they are tasked with conducting an inventory of how the U.S. federal government currently oversees and/or manages phosphorus and how the state government in North Carolina oversees and/or manages phosphorus. Note: Teachers who are not from North Carolina can adapt this activity for other locations.

Teacher Background Knowledge:

The three **branches** of government in the United States, as outlined in the U.S. Constitution, are the legislative branch, the executive branch, and the judicial branch. These branches were established to ensure a system of checks and balances, preventing any one branch from becoming too powerful.

Legislative Branch: This branch is responsible for making laws. The Congress consists of two houses: the Senate and the House of Representatives. The two Houses work together to propose, debate, and pass laws. The legislative branch also has the power to declare war, regulate commerce, and raise revenue through taxation.

Executive Branch: This branch is responsible for enforcing laws. It is headed by the President of the United States, who serves as the commander-in-chief of the military and the chief executive officer of the federal government. The executive branch also includes the Vice President and the President's cabinet members, who oversee various government departments and agencies.

Judicial Branch: This branch is responsible for interpreting laws. The federal court system has the Supreme Court serving as the highest court in the land. The judicial branch has the authority to review laws and determine their constitutionality, settle disputes between states, and interpret the meaning of the Constitution.

In the United States, the levels of government refer to the various tiers or **levels** of authority responsible for governing different geographical areas and populations. Each level of government has its own powers, responsibilities, and areas of authority, and they often work together to address complex issues and serve the needs of the American people. The three main levels of government in the U.S. are:

Federal Government: This is the highest level of government and is responsible for governing the entire country and is divided into the three branches.

State Government: Each of the 50 states in the U.S. has its own government, with its own constitution, governor, legislature, and judiciary. State governments have authority over matters not specifically delegated to the federal government by the U.S. Constitution.

Local Government: Local governments exist within states and are responsible for governing specific communities or regions, such as cities, counties, towns, and villages. Local governments provide essential services to residents, including police and fire protection, public schools, transportation, parks and recreation, waste management, and zoning regulations.

Student Background Knowledge:
(USDA, 2006)
Students should have some background knowledge of the natural cycles (carbon, nitrogen, and phosphorus) prior to completing this activity. More specifically about the challenges surrounding the phosphorus cycle and strategies to help with sustainability.

Challenges:

Limited Reserves: Phosphorus is primarily obtained from phosphate rock deposits, which are finite and unevenly distributed globally. Some estimates suggest that known reserves could be depleted within the next few decades.

Environmental Impact: Excessive use of phosphorus-based fertilizers can lead to nutrient runoff into water bodies, causing eutrophication, harmful algal blooms, and disruptions to aquatic ecosystems.

Political concerns: The concentration of phosphate rock reserves in a few countries raises concerns about tensions and trade dependencies.

Strategies:

Efficient Use: Improving the efficiency of phosphorus use in agriculture through better fertilizer management practices, precision agriculture techniques, and soil conservation methods can reduce waste and minimize environmental impacts.

Recycling and Recovery: Developing technologies to recover phosphorus from wastewater, agricultural residues, and food waste can help recycle phosphorus and reduce reliance on finite reserves.

Alternative Sources: Exploring alternative sources of phosphorus, such as phosphorus recycling from animal manure, organic waste, or urban sewage, as well as developing sustainable farming practices like crop rotation and cover cropping to reduce reliance on external inputs.

Research and Innovation: Investing in research and innovation to develop phosphorus-efficient crops, soil amendments, and sustainable phosphorus management practices can help address the challenges of phosphorus sustainability.

Materials

The activity materials include a fictional “Executive Order” establishing the Office of Phosphorus, and step-by-step instructions and questions to investigate public information on governance of phosphorus at the federal level and in North Carolina. This activity can be readily modified to investigate state and local governance structures in other states or locations.

Engage

Begin by reviewing and/or discussing the type of government that exists in the U.S. It is considered a Federalist government with three branches.

Video review:
https://pbsnc.pbslearningmedia.org/resource/branches-of-the-government-video/wviz-politics-on-point/
There are different tiers or levels of government as well all working towards passing laws and bills to govern various aspects and/or issues that citizens face.

Explore

Divide the class into groups and provide them with the task at hand:

RESEARCH SCAVENGER HUNT: OFFICE OF PHOSPHORUS

Congratulations! You have been appointed as the Regional Director for Region IV of the newly created Office of Phosphorus. Region IV includes Virginia, North Carolina, and South Carolina, with a local headquarters in Raleigh.

The incoming Director of Phosphorus, Dr. Philomena Tucker, needs your help in preparing their first report to the President. The Director has asked you to conduct an inventory of (a) how the U.S. federal government currently oversees and/or manages phosphorus, and (b) how the state government in North Carolina oversees and/or manages phosphorus.

The Director of Phosphorus is also seeking input on how best to organize the new agency and how it will coordinate with other federal agencies as well as state and local governments.

To prepare your report, please complete the following steps:

- Carefully read the provided handout with information for resources to conduct the research.
- You should work together in small groups and compare answers with your team members, but avoid the impulse to "divide and conquer." Everyone must gain some experience with every task.
- Record the information on a collaborative document (i.e. google docs) and include hyperlinks and/or citations for all information referenced. Screenshots can also be helpful for capturing information quickly.
- Focus on breadth, not depth – think of this as an initial information-gathering exercise rather than a final product. It is more important to address all the tasks in the allotted time for the activity, rather than aim for something comprehensive and/or polished.
- Do not be afraid to ask for help or clarification on any task.

Day 1

Review the websites and **create a list of all the Federal agencies (within reason) that oversee or manage some aspect of phosphorus.**

To identify possible agencies, we suggest the following sources:

- U.S. Code: Text of the general and permanent laws of the United States.
- Code of Federal Regulations: Official source of all Federal agency regulations (i.e. final rules that have become law).
- Federal Register: The "daily journal of the U.S. Government," the Federal Register includes official published information about rulemaking, including notices, proposed rules, and final rules, as well as Executive actions.
- Regulations.gov: Online portal for commenting on rulemaking that has been active since 2003. Some older rules are also in the portal with incomplete information. Regs.gov includes published information about rules, notices, and proposed rules, which are also available on the Federal Register, as well as public comments to agencies.
- Government Accountability Office: Independent, nonpartisan agency that works for Congress to produce investigative reports on government spending.
- Congressional Research Service: Independent research service that provides timely, objective, and authoritative research and analysis to Congress.
- Index of all U.S. government departments and agencies

Create a list of all the N.C. state-level agencies, boards, bureaus, commissions, etc. (within reason) that oversee or manage some aspect of phosphorus.

To identify possible agencies, we suggest beginning with the following sources:

- NC DEQ's website (identify specific parts of DEQ that relate to phosphorus)
- NC Agriculture & Consumer Services' website (identify specific areas in Ag that relate to phosphorus)
- NC General Statutes
- List of governor-appointed Boards and Commissions

For each item in your list, include information on:

- What aspect of phosphorus management the agency oversees
- Why / how the agency has that responsibility

Day 2

Spend more time reviewing the websites of the organizations you identified on Day 1 (if they have a website - state agencies/boards/commissions may not), as well as any other publicly available information you encounter. Through these documents, try to learn more about how staff at these agencies communicate their understanding of the challenges associated with regulating phosphorus.

- Do the agencies' websites include specific information about phosphorus? If so, include links and describe that information here.

- In what ways does regulating phosphorus seem to fit into the agencies' overall mission? If it does not clearly fit into the agencies' mission, why not?

- What, if any, relationship does the federal agency have to state agencies (e.g. is there a state agency counterpart? Do you have a sense of coordination or communication between the states and the federal government?

Identify any examples of coordination and/or collaboration across agencies that came up in your research.

- Did your search reveal any coordination activities between agencies, such as task forces, advisory committees, etc.? Provide links and short descriptions of those here.

- If you identified coordination and/or communication between the states and the federal government, describe the nature of that coordination in more depth here.

- Especially if you did not identify coordination activities, do you notice any potential missed opportunities for coordination you'd like to follow up on?

Day 3

Discuss findings and what organizations should be included in the organizational chart. Design the organizational chart with summaries rationalizing your choices for each component in the chart. The charts could be on poster paper or digital.

Based on what you have learned about existing federal and state oversight of phosphorus, how would you recommend that the incoming Director organize the new Office of Phosphorus?

- Work with your group members to create an organizational chart that shows how your version of the agency will define and understand the challenges of sustainable phosphorus management.
- Include a short paragraph or blurb explaining your chart and why you made the selections you did. (You may use "I" or "we" in your explanation)
- You can choose to also describe how you plan to organize your regional office, or just focus on the federal level.

Explain

Have the student groups present and explain their organizational charts. Lead a discussion about what similarities and differences in the types of organizational charts that were developed. As the groups present their charts, the rest of the class should be paying close attention to any ideas they found interesting and helpful.

Extend

After the presentation, have the groups reconvene to talk about any changes they would like to make to their own organizational chart based on all of the presentation. Submit a summary of any changes they would like to make and if there are not changes then have them explain why.

Evaluate

Complete an exit slip that assesses what they learned about the three branches of government and the relationship among them. What is the importance of all levels of government taking a part in the phosphorus sustainability issue?

Teaching Resources

Suggested Reading for Teachers

- Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of public administration research and theory*, *22*(1), 1-29. https://doi.org/10.1093/jopart/mur011.
- Rickabaugh, J. (2023). Regional public sector organizations: A broader taxonomic classification to cross‐pollinate empirical research. Public Administration, 101(1), 271-283. 10.1111/padm.12779
- Elser, J., & Haygarth, P. (2020). *Phosphorus: Past and future*. Oxford University Press, USA.
- Egan, D. (2023). *The Devil's Element: Phosphorus and a World out of Balance*. First edition. New York, NY: W.W. Norton & Company.

Suggested Reading for Students

- Levy, Max G. "The World's Farms Are Hooked on Phosphorus. It's a Problem." *Wired*. Accessed January 26, 2023. https://www.wired.com/story/the-worlds-farms-are-hooked-on-phosphorus-its-a-problem/

- Rosen, Julia. “Humanity Is Flushing Away One of Life’s Essential Elements.” *The Atlantic* (blog), February 8, 2021. https://www.theatlantic.com/science/archive/2021/02/phosphorus-pollution-fertilizer/617937/

References

United State Department of Agriculture (USDA) Best Management Practices to Minimize Agricultural Phosphorus Impacts on Water Quality, 2006.

Branches of the U. S. Government: Politics on Point from PBS Learning Media for Teachers https://pbsnc.pbslearningmedia.org/resource/branches-of-the-government-video/wviz-politics-on-point/

*Note: This investigation was adapted from an investigation developed by Ashton Merck