

This assignment requires you to find an environmental story in the news and apply systems thinking to it. You will write a short summary of the news item, and then look at the story from a systems perspective. We'll start with an overview of systems thinking (covered in Chapter 2 and Lectures 7 & 8), and then get to the assignment instructions.

Background: *Systems thinking* in environmental science is a powerful tool for understanding and addressing the complexity and interconnectedness of the environmental problems and challenges that we currently face. Rather than focusing on individual parts in isolation, systems thinking seeks to understand the relationships, feedback loops, and emergent properties that arise from the interactions among different elements of the environment, and thus recognizes that changes in one part of the system can have (sometimes unexpected) effects on other parts. It provides the conceptual framework for understanding the scope and boundaries of the problem, identifying and assessing “knock-on” effects, predicting the future state of the system, and thus helps to develop integrated and comprehensive solutions that can lead to better environmental management strategies.

Systems thinking is used in all types of environmental problem solving. Researchers studying the Earth's climate system focus on feedback loops that can amplify or mitigate the impacts of climate change. Instead of managing individual species or habitats, systems thinking helps to assess the overall health and resilience of an ecosystem by considering the interactions among its components. Systems thinking in pollution management considers pollution sources and sinks, pathways and feedbacks, to develop effective, practical and sustainable solutions. Systems thinking promotes holistic approaches to sustainable development that consider long-term consequences for different entities. Good policy decision-making depends on systems thinking: solutions are effective only when they consider the broader implications of environmental actions and their potential effects on other parts of the system.

Systems thinking encourages collaboration among scientists from various disciplines, as well as experts from fields outside of science. Systems thinking can allow us to find the ways in which systems are resilient and adaptable – by identifying vulnerabilities and “tipping points” that may lead to system collapse, we can also learn how systems absorb disturbances while maintaining function, or how they can adjust and evolve to cope with changing conditions.

Some key principles of systems thinking in environmental science:

1. Interconnectedness: Systems thinking recognizes that environmental systems are networks of abiotic and biotic components that interact and influence each other in predictable and unpredictable ways. Understanding these relationships (and sources of unpredictability) is key to developing complex predictive models – such as forecasting changes in the climate system, modeling the effects of habitat loss or sea level rise, etc. etc. Taking a holistic approach reveals hidden connections and dependencies and can help identify unintended consequences of environmental actions.

2. Hierarchies and Boundaries: Systems are always embedded in other systems (all systems are ultimately embedded in the entire Earth system). However, we can isolate parts of systems for investigation by defining boundaries. Smaller systems embedding within larger systems tend to be “open” (exchanging energy, matter, and information with other systems); larger systems may tend towards “closed” systems, exchanging only small amounts of energy or matter or information

with other systems. Understanding and defining the boundaries of systems for the purpose of studying them allows us to better understand the internal and external influences on any system.

3. Feedbacks: Feedback loops are a way of thinking about “downstream” effects of changes in a system. Positive feedback loops amplify the effects of changes; negative feedback loops tend to stabilize the system. Both positive and negative feedbacks can operate in large systems. Environmental systems are often non-linear, meaning that small changes can lead to disproportionately large effects or unexpected outcomes. Identifying and understanding these mechanisms is key to predicting outcomes from a system.

4. Emergent Properties: Systems thinking recognizes that systems often exhibit emergent properties—qualities or behaviors that arise from the interactions of the system's components but cannot be predicted by examining individual components in isolation. New properties or patterns may emerge from interactions among individual components. These emergent properties may have profound effects on the overall behavior of the system.

Assignment Instructions:

You will be writing and submitting your assignment on Packback. If you are unfamiliar with how Packback works, please check the “Packback” information page on Quercus.

Step 1. *Find a recent (2023) news item about the environment.* It could be news about a new study or research finding, reporting on a specific event, a new initiative, etc. Anything related to the environment is fine! Although there are a lot of “bad news” stories about climate disasters, etc., you can also find a story about conservation efforts, restoration projects, community initiatives, etc. Try to find something that really engages you on a personal level -- climate, biodiversity, invasive species, food security, waste management, energy, environmental justice, etc. It's probably best to stay away from something too complex or too global (e.g., a news item about the whole global climate system is probably a lot to tackle for this assignment) – something with a specific location is probably easier to analyze. You don't need to seek out a long, investigative-type piece, but make sure there's enough substance for you to work from (e.g., if it's only a 1-paragraph description of a town being evacuated due to flooding, you won't have a lot of information to go on). There are MANY environmental stories in mainstream media being published daily – you shouldn't have difficulty finding something that interests you.

Step 2. *Write a post on Packback.* Once you have chosen your news item, you'll create a post (a “question”) on Packback. Packback posts start with an open-ended question, and the body of the post provides some background and development of the argument/idea.

Examples of open-ended questions relating to some recent environmental news:

- “Will opening up the Greenbelt to development have a negative effect on biodiversity?”
- “Will changes to Ontario's Blue Box program help solve some of our waste management problems?”
- “Are wind turbines likely to have a negative effect of whale populations?”
- “What effects will climate change have on food prices here in Canada?”

The possibilities are endless! In the “body” of your question, a) include *a link to your news article* (feel free to add any images that you think might help the reader), b) *summarize* the main points of

the article (a couple of paragraphs is fine), and b) *apply some systems thinking* to the issue. What are some of the main components of the system/ How do they interact/affect each other? Are there feedback loops operating? Are there any emergent properties arising from the system? For example, if your topic happens to be a new invasive species that has been recently found in a lake, what are some of the **main components** (e.g., the new species, existing species, components of the habitat, people who rely on the lake for their livelihoods, etc.)/ How do they **interact**? (e.g., what effect is the invasive species having (or may have in future) on the other species? What are the “knock-on” effects on other components in the system?) Is there a possible **feedback loop** operating (e.g., as the invasive species becomes established, it alters the habitat, making it harder for native species to survive, which in turn creates more areas for the invasive species to colonize, etc.)? Are there any **emergent properties** (e.g., if the invasive species reduces populations of sport fish, the local economy may shift from fishing tourism to other types of activities, etc.).

An important point to keep in mind is that there are many ways to describe a system that are equally valid – there isn’t “one right way”. *The point of this assignment is to encourage you to use systems thinking when approaching environmental problems* – what is being affected? How do parts of the system interact with each other? What “downstream” or “knock on” effects may be present (e.g., a change in X causes a change in Y, which then influences Z...)? Are there feedbacks (positive or negative) operating (e.g., a change in X causes a change in Y, which then causes a further change in X, which also influences Y....).

Evaluation: The assignment is worth 5% of your final grade. Three of those 5 marks are derived from your final Curiosity Score on Packback (i.e., if you edit your post, the final CS is the one we will use). The remaining 2 marks are assigned by your TA, who will assess the “systems thinking” in your post. If you identify a few components of the system, discuss the interactions among them, look for any feedbacks and/or emergent properties, you will get the full 2 marks.