

Echinocystis lobata *(Wild Cucumber), a native species of North America, invades a riparian forest in Lithuania. Invasive species often display a timescale mismatch between the species' rapid growth and the slower capacity of humans to identify and remediate invasions. Photo Credit: Wikimedia Commons, Public Domain.*

# Lesson – Behavioral Economics and Timescale Mismatches

By Heidi Scott, SESYNC | September 5, 2023

**Overview:**

*This lesson pairs with an explainer article on behavioral economics, which can be found here:* Explainer – Classical versus Behavioral Economics: Environmental Applications*. It will be helpful to read through the explainer first, before completing the lesson, as it builds foundational understanding of the topic.*

The timescales of ecological systems often exist in longer or shorter intervals than the time scales of human decision making. These discrepancies can cause problems within socio-environmental (S-E) systems for conservation and management. Timescale mismatches bedevil effective S-E system management due to discrepancies between decision makers in policy venues, individual actors in the S-E system, and the timescales of ecological processes. For example, invasive species often move faster than humans can assess the problem, design solutions, and impose policy. Development of solutions to resolve timescale mismatches come from behavioral economics (BE) and psychology; they involve modifying human behavior at the individual level, such as addressing the irrational human tendency to downplay future outcomes.

In this lesson, based on research from Wilson et al. (2016), learners will explore possible solutions

that involve BE: enhancing the relevance and exigency of long-term consequences; using structured decision processes that make timescales of actions and consequences more explicit; and developing structural guides that change the perception of short-sighted behavior to a negative consequential framing. Learners will have the opportunity to work in small groups to identify a S-E management concern, and use technological, cognitive, and structural tools to design solutions that resolve timescale incongruities. They will have the opportunity to develop solutions in synergy and communicate their findings with managers of the target ecosystem.

### Assumed Prior Knowledge:

Appropriate for undergraduate, graduate, and higher-level learners.

### Learning Objectives:

- Learn how timescale mismatches can cause environmental damage in specific ecosystems.
- Apply BE to help managers design solutions to timescale mismatches.
- Use technological, cognitive, and structural tools to create resolutions to these mismatches.
- Outline a management plan for the long-term sustainability of a specific ecosystem.

### Key Terms and Concepts:

behavioral economics; psychology; timescale mismatches; decision theory; management decision frameworks; short-term versus long-term perspective; cognitive bias

### The "Hook" (suggestions for quickly engaging students):

**Myopic Thinking:** For 2 min., have learners critically recall a time when they chose a short-term reward and missed out on a long-term benefit that might have occurred if they had chosen differently. Learners should write down examples for 2 min. Many will recall choosing fun over work (e.g., scrolling on social media rather than studying); eating or drinking in quantities that benefitted the short term but not the long term (e.g., partying and hangovers); or impulse purchases that they regretted later (e.g., retail therapy becomes buyer's remorse). Have the whole group share 4–5 examples of a human cognitive bias toward quick gratification.




*Photo Credit: Karin Beate Nøsterud via Wikimedia Commons, 2.5.*

Then, spend 2 min. brainstorming how they might impose technological, cognitive, or structural tools to shift the cognitive bias from short-term to long-term thinking—that is, to make their former self choose differently when myopic temptation arises again.

## Teaching Assignments:

**Behavioral Economics and Timescale Mismatches in S-E Systems** (One, 75-min. class, with optional extension)

1. **Prior to Class:** As preparation for the session, have learners read the SESYNC explainer on Behavioral Economics and the article by Wilson et al. (2016), paying special attention to the highlighted areas.

2. **(10 min.)** After The Hook, above, open the session by reviewing BE and timescale mismatches using these lesson PPT slides.

   Behavioral_Economics_Timescale_Mismatches_Lesson_Slides_Accessible

3. **(5 min.)** Divide the class into small groups of three to five people. Assign or allow each group to choose one of the following cases of S-E systems' timescale challenges:

   **Domain 1: Mismatch between the manager's objectives, actions, and learning:**

   - A timber company needs to manage timber extraction on annual scales (short-term economics) while supporting biodiversity and economic viability on decade-to-century scales (long-term sustainability).
   - An ocean fisheries-management team needs to set a harvest rate for fish species that balances short-term priorities (social, economic, and political) while maintaining long-term, ecosystem and fish-population resilience (sustainability).

   **Domain 2: Mismatch between the manager's realm and individual actors in the social system:**

   - A state forest manager must choose how much and where to use fire as a proactive tool in the wildland-urban interface while maintaining the safety and support of local residents and businesses.
   - A city-planning team must choose how to implement a climate resilience plan by re-naturalizing a parcel of drained wetland that had been converted into a parking lot for the adjacent, high-income, waterfront residential neighborhood.

   **Domain 3: Mismatch between the manager's domain and ecosystem dynamics:**

   - A water resource team has a mandate to reduce cyanobacterial and algal blooms due to overloaded nutrients from farm and lawn runoff—despite the fact that these infestations can take decades to redress due to the extent of nutrient imbalance and their slow drawdown in aquatic ecosystems.
   - A state forest manager is tasked with removing an invasive species and restoring the ecosystem to its previous state within a 2-year budget allotment.

   **Instructor Note:** Wilson et al. identify six domains of behavioral/timescale mismatches, and this lesson guides learners through the first three. Instructors should feel free to research additional case studies in domains 4–6 or within their experience. This further work may be especially valuable for advanced graduate and postdoc learners. Also note that the domains are not mutually exclusive—several domains may affect an ecosystem simultaneously.

4. **(15 min.)** Allow each small group to share introductions, then conduct a quick internet search for a case study that fits into the domain and S-E topic they've chosen. Once they choose a case study, have the team type up the basics of the manager's dilemma: name the resource; managers; individual stakeholders; conflicts between economic gains and sustainability; and temporal lags in learning, social norms, policy implementation, or ecosystem dynamics.

5. **(15 min.)** As a whole class, discuss the **three levels of solutions** that learners may employ. The Wilson et al. paper details specifics of each of these levels on p. 46-48:

    - **Technological:** Technological tools adjust ecosystem timescales to human ones. They provide short-term solutions but may have unanticipated consequences. For example, the Green Revolution in Agriculture introduced artificial N-P-K fertilizer to solve human hunger, but it has caused global eutrophication problems. Or the technology of carbon sequestration could speed up decarbonizing the atmosphere but could also cause humans to continue to rely on fossil fuels.

    - **Cognitive:** Cognitive tools use messaging, framing, and social cues to change the way the public processes and uses information in decision-making. Examples include appealing to existing environmental values, emphasizing social cues of good behavior, and making the intended behavior easy to perform. Cognitive tools reduce judgment errors in how individuals perceive and value time.

    - **Structural:** Structural tools change the consequences of an action through regulatory carrots and sticks. They incentivize individuals to match the timescale of the ecological system. Incentives include tax breaks for conservation easements and reducing runoff through agricultural best practices (cover crops, buffers, reduced fertilizer use). Punishments include fines, higher taxes, harvest limits, and making voluntary actions default rather than opt-in.

6. **(25 min.)** Small groups should now formalize their strategies to resolve behavioral and timescale mismatches within their case study. Have each group brainstorm solutions within each of the categories above, with a description of at least one tool from each of the three categories. Once the group has sketched out one tool for each category, have them post to a shared class discussion board a short (~250-word) description of the reasoning, implementation, and desired outcomes for each tool.

7. **As Homework:** Have learners read and comment on the other groups' implementation strategies in the course's online discussion board. While learners should support one another's ideas, they should also feel free to critique specifics and offer additional guidance in the interest of resolving BE and timescale mismatches in specific contexts. Peers may be especially helpful in suggesting ways to make multi-level solutions work in synergy, rather than in isolation.

8. **Optional Extension: (15 min.)** In the next class, review the discussion board as a whole class to see what insights emerged from further discussion, including potential solution synergies.

9. **(15 min.)** Have each group use their new insight to revise their three-level strategy (technological,

cognitive, and structural) based on the best information and feedback they have. Then, have each group contact the managers of their target ecosystem and gently offer this guidance for the managers' benefit.

## Background Information for the Instructor:

1. **Behavioral Economics and Neuroeconomics of Environmental Values**

   - Focusing extensively on environmental valuation, this useful article provides a brief overview of BE and the research evidence to support it. The reference to neuroeconomics is related to the authors' section in the article on research on "the properties and interactions of brain activity during economic tasks" (p. 21.3). Finally, the article provides actionability guidance for policymakers, arguing BE is a good strategy for sustaining natural resources.

   - Koundouri, P., Hammer, B., Kuhl, U. et al. (2023). Behavioral Economics and Neuroeconomics of Environmental Values. *Annual Review of Resource Economics, 15*, 21.1-21.27. https://doi.org/10.1146/annurev-resource-101722-082743

2. **Behavioral Economics**

   - This book, which may be accessed through a university library, provides an overview of BE and introduces key insights to a student reader. The book details BE theories—including mental accounting, prospect theory, present bias, and inequality aversion—that can be applied to environmental cases, though the book does not focus specifically on ecology. The author also discusses what makes humans happy and how to focus on happiness as an outcome by using nudges that influence behavior.

   - Cartwright, E. (2011). *Behavioral Economics* (3rd ed.). Routledge. https://www.google.com/books/edition/Behavioral_Economics/sFcPEAAAQBAJ?hl=en&gbpv=0

3. **Green nudges: Do they work? Are they ethical?**

   - Environmental "nudges"—subtle changes to the decision context—are central to behavioral economics approaches. This article is quite useful given that learners may question how ethical such nudges are in comparison to the offering of incentives or information to influence behavior as with traditional (neoclassical) economics. After providing an overview of the major categories of nudges, the author introduces a framework to assess the ethical quality of green nudges.

   - Schubert. C. (2017). Green nudges: Do they work? Are they ethical? *Ecological Economics, 132*, 329–342. https://doi.org/10.1016/j.ecolecon.2016.11.009

4. **Social Theory and the Global Environment**

   - This collection of essays, which may be accessed through a university library, takes a critical sociological perspective to interrogate the norm of technocratic managerialism in environmental management. The collection of essays includes entries on environmental economics, gender analysis, and social movements that reframe the pressing exigency of achieving sustainability as a cultural norm.

   - Benton, T., Redclift, M. (2013). *Social Theory and the Global Environment*. United Kingdom: Taylor & Francis.

5. **Challenges of mismatching timescales in longitudinal studies of collective behaviour**

    - This research article outlines challenges related to the temporal mismatches between individual and collective behavior, overviews existing approaches to resolving mismatches, and provides a case study based on animal behavior. The authors discuss the impacts of a given social environment on the direction and momentum of collective actions.

    - Ogino M., Strauss, E.D., & Farine, D.R. (2023). Challenges of mismatching timescales in longitudinal studies of collective behaviour. *Philosophical Transactions of the Royal Society B, 378*(1874). https://doi.org/10.1098/rstb.2022.0064

## References:


- Scott, H. (2023, August 15). *Explainer – Classical versus Behavioral Economics: Environmental Applications*. SESYNC. https://www.sesync.org/resources/classical-versus-behavioral-economics-environmental-applications

- Wilson, R.S., Hardisty, D.J., Epanchin-Niell, R.S. et al. (2016). A typology of timescale mismatched and behavioral interventions to diagnose and solve conservation problems. *Conservation Biology, 30*(1), 42-49. https://www.doi.org/10.1111/cobi.12632


## Related SESYNC Content:


- Boyd, J. (2022, March 2). *Explainer – Valuation of Natural Resources and Ecosystem Services: Economic Methods*. SESYNC. https://www.sesync.org/resources/explainer-valuation-natural-resources-and-ecosystem-services-economic-methods

- Boyd, J. (2022, March 1). *Lesson – Economic Valuation of Natural Resources and Ecosystem Services*. SESYNC. https://www.sesync.org/resources/economic-valuation-natural-resources-and-ecosystem-services

- Palmer, M.A. (2023, July 26). *Lesson – Climate Change and Choices: Change Behavior, Mitigate, or Adapt?* SESYNC. https://www.sesync.org/resources/climate-change-and-choices-change-behavior-mitigate-or-adapt

- Palmer, M.A. (2023, July 25). *Lesson – What Influences Pro-Environmental Behavior? Learning from Psychological Research*. SESYNC. https://www.sesync.org/resources/what-influences-pro-environmental-behavior-learning-psychological-research

- Scott, H. (2023, August 15). *Explainer – Classical versus Behavioral Economics: Environmental Applications*. SESYNC. https://www.sesync.org/resources/classical-versus-behavioral-economics-environmental-applications

- SESYNC. (2023, September 29). *Environmental Economics Resources*. https://www.sesync.org/resources/environmental-economics-resources


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