Unit 0.2 Tragedies of the Commons: Why is sustainable development so hard?

Managing the dynamics of nature-society interactions for sustainable development is really hard! Nonetheless: 1) It must be done, and 2) We can learn to do it better. Trying out new approaches on simulated nature-society systems is safer and can be more informative than using the real world as a guinea pig. Simulations play a central role in modern research and policy design for sustainable development, and will appear frequently in the readings for this course where we will use them to address questions of public health, climate change, energy systems, biodiversity conservation, etc. We begin our pursuit of sustainability in this class with one such simulation: managing the commons of an open-access ocean fishery. Your goal at the most general level will be the same as for many sustainability efforts: to improve well-being of people now while limiting environmental degradation, and to do so in a way that passes on to the people of the "next generation" a world that gives them at least as good an opportunity to thrive as did the one they inherited from their parents. In the particular case of this fisheries simulation, your goal will be to improve the wealth of fisher* communities while limiting depletion of fish stocks, and to end the game with a combination of fish and fisher prosperity that has at least as much potential for future development as you had when the game began.

This Unit is devoted entirely to playing a simulation game called "Fishbanks" and reflecting on the results of that play. Fishbanks was developed by Prof. John Sterman and his colleagues at MIT, who have posted it online as a public good (see Readings below). The simulation can involve an indefinite number of participants and can be conducted either virtually or in the classroom. Students play the role of fishers, while the course instructor runs the game and serves as referee. The game has sufficiently many moving parts that careful study the readings listed below is essential for success.

We will come back to the Fishbanks case, and your explorations of it, frequently throughout the course.

Preparation for class To prepare for the class, please:

a) **Read**: Meadows, D., Sterman, J., & King, A. (2024). *Fishbanks: A Renewable Resource Management Simulation*. https://mitsloan.mit.edu/teaching-resources-library/fishbanks-a-renewable-resource-management-simulation.
This is the home page for the Fishbanks simulation from which you will play the game solo as homework and as a team in class. It is also where you can access reading 'b' below.

b) **Watch**: Sterman, J. (Director). (2011). *Fishbanks: A renewable resource management simulation: A video introduction* [Video recording]. MIT Management Sloan School. https://forio.com/simulate/mit/fishbanks/simulation/login.html.
This video runs about 36 minutes. It provides essential background to how you will play your role in the class simulation. It can be accessed through the main link provided above to the Fishbanks simulation. Scroll down and click on "Play Simulation" and then on the page that opens, look on the right-hand side for the Student menu click "View instructional video".

c) **Read**: Sterman, J., & King, A. (2011). *Introduction to Fishbanks* (Nos. 11–133; p. 2). MIT Sloan Management. https://forio.com/simulate/mit/fishbanks/simulation/downloads/english/Fishbanks%20Introduction.pdf
This is a two-page summary of essential preparation for the in-class gaming session including the decisions you will need to make in each round of the simulation.

d) **Play**: Please play the Fishbanks simulation solo before class to get the feel of the game. See additional details about how to do this here: *Fishbank preparation for Students* (in) Course Library. Then play the Fishbanks simulation as part of a class. (Note: Before you can play as a class, an

* We use the term "fisher" to include all people involved in fishing.

instructor (or other leader for your class) will have to do some set up, and then run the game. Instructions for the instructor(s) is here: *Fishbank preparation for Instructors* (in) Course Library.

Study Questions to help you get the most out of the readings:

I. **Some questions to consider after playing your solo game(s):**
- What was your worst mistake in your role as a solo fishing fleet?
- What indicator(s) available for reporting on the state of the fishery were most useful for managing it? Why?
- What additional indicator would you have most liked to have? Why?
- How would you describe to a novice fisher your strategy for sustainable development of the fishery from your perspective as the only fleet in the ocean?

II. **Some questions to consider in strategizing for the multi-player in-class game:**
- Relative to your "solo" experience with Fishbanks playing as the only fleet in the ocean, how do you expect the presence of other fishing fleets in the multi-player simulation to change the likely outcome of the game? To change the challenges of devising a good strategy?
- What should be your team's goal for this multi-fleet game? How will you measure progress toward that goal during the game? Why?
- What should be your team's strategy for managing its own fleet in this multi-team version of the game? How will this change from when you played it as an individual? What knowledge from the previous iteration might you incorporate into your approach this time, and why?
- Do you believe that pursuing collaborative strategies with other teams is a useful approach? Why or why not? What strategies might you pursue, and why? What is your plan for revising your strategy if it doesn't work?

III. **Some questions for class discussion after playing the multi-player game:**
- How did the classroom community of fishers do in managing the fishery?
- Why is it so hard to develop the Fishbanks fishery sustainably?
- How might the classroom community of fishers do better next time?
- What can this experience teach us about the challenges of managing fisheries for sustainability? Of managing for sustainability more generally?

Digging deeper (optional materials for further exploring frontiers in the pursuit of sustainability):

The next three readings provide insights into recent progress and remaining challenges in managing fisheries for sustainability:

h) **Read**: Worm, B., Hilborn, R., Baum, J. K., Branch, T. A., Collie, J. S., Costello, C., Fogarty, M. J., Fulton, E. A., Hutchings, J. A., Jennings, S., Jensen, O. P., Lotze, H. K., Mace, P. M., McClanahan, T. R., Palumbi, S. R., Parma, A. M., Rikard, D., Rosenberg, A. A., Zeller, D., & Minto, C. (2009). Rebuilding Global Fisheries. *Science*, *325*(5940), 578–585. https://doi.org/10.1016/j.marpol.2017.02.003

i) **Read**: Hilborn, R., & Costello, C. (2018). The potential for blue growth in marine fish yield, profit and abundance of fish in the ocean. *Marine Policy*, *87*, 350–355. https://doi.org/10.1016/j.marpol.2017.02.003.

j) **Read**: Roberts, C., Béné, C., Bennett, N., Boon, J. S., Cheung, W. W. L., Cury, P., Defeo, O., De Jong Cleyndert, G., Froese, R., Gascuel, D., Golden, C. D., Hawkins, J., Hobday, A. J., Jacquet, J., Kemp, P., Lam, M. E., Le Manach, F., Meeuwig, J. J., Micheli, F., … O'Leary, B. C. (2024). Rethinking sustainability of marine fisheries for a fast-changing planet. *Npj Ocean Sustainability*, *3*(1), 41. https://doi.org/10.1038/s44183-024-00078-2.