



## What Is a Socio-Environmental System?

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A socio-environmental (S-E) system refers to a group of humans, social elements, and processes that interact with each other and nature (Figure 1). Sometimes called socio-ecological systems, they are more formally defined as [complex systems of tightly linked social and environmental subsystems](#) or component parts. Each subsystem has many components that [interact](#) not only with one another but also with other elements across parts of the system and across levels of organization socially, ecologically, temporally, and spatially.

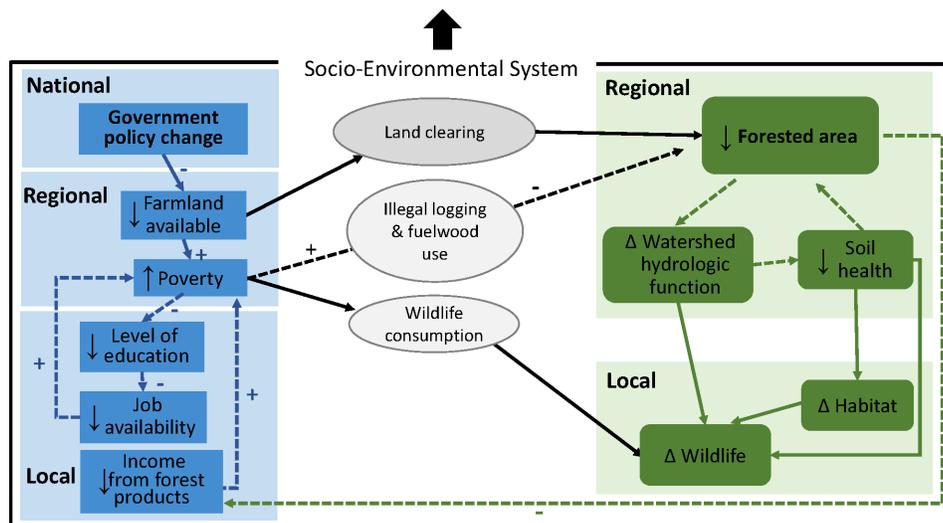


Figure 1. In this schematic, the socio-environmental system has many component parts (rectangles) that interact within and across levels of organization. The overall boundary of the whole S-E system is the solid black line, and the subsystems are in light blue or green. The large black arrow at the top indicates that the overall system state or behavior "emerges" as a result of the interactions. The interactions noted are not exhaustive (e.g., reduced forest-product income could spur changes to national policy).

The schematic on Page 1 is a common way to conceptualize and represent S-E systems, but many others exist. (For an overview and other examples, see Chapter 1 in Biggs et al., 2021.)<sup>1</sup> These schematics are broadly referred to as frameworks, and they vary depending on the purpose of the research or the management goal that motivates them. S-E frameworks may be in the form of network diagrams if the interest is in understanding relationships between individuals, groups, or institutions—collectively referred to as “agents” by S-E researchers (Figure 2).<sup>2</sup> Flowchart-type frameworks are often used when there is interest in developing different scenarios to explore how futures may play out based on different policies or assumptions (Figure 3).<sup>3</sup> And, of course, a framework’s organization may be designed around social processes. A well-known example is Elinor Ostrom’s Institutional Analysis and Development (IAD) framework, which is meant to help understand governance—specifically, how people interact and create communities, organizations, and rules to sustainably manage resources (Figure 4).<sup>4</sup>

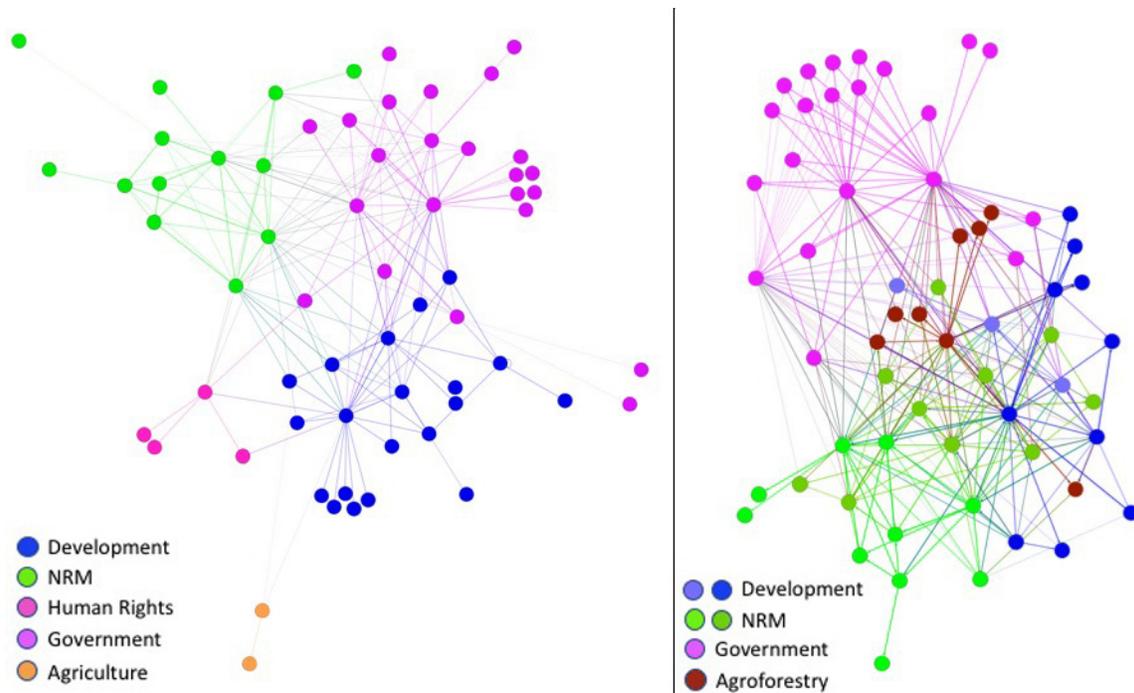
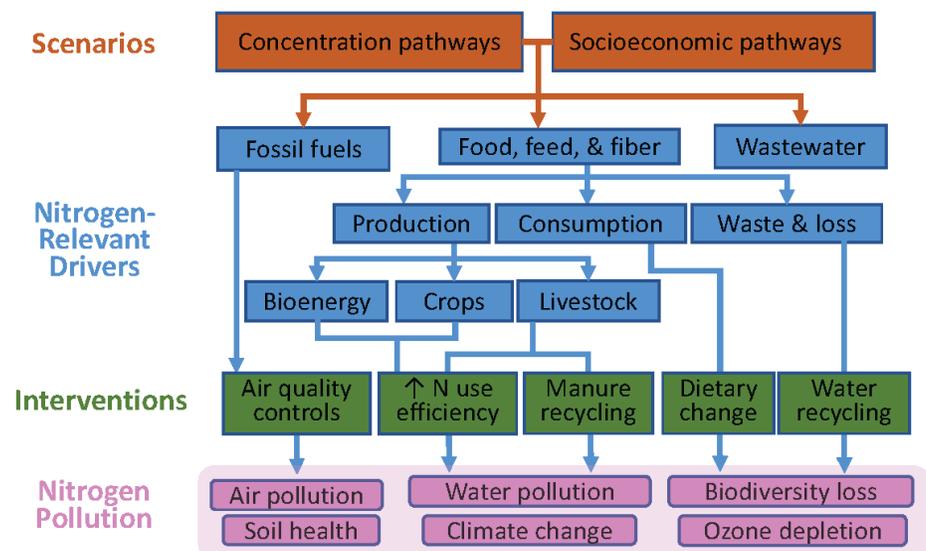


Figure 2. These network frameworks depict individuals cooperating and exchanging information with one another from different sectors in Cambodia—development, natural resource management, human rights, government, and agriculture. (Riggs, Langston, & Phann, 2020).

Figure 3. This socio-environmental framework depicts scenario modeling of potential nitrogen (N) futures under new interventions across the food system and across all N-polluting sectors (agriculture, industry, transport, and wastewater). (Modified from Kanter et al., 2020).



## Ostrom IAD Framework

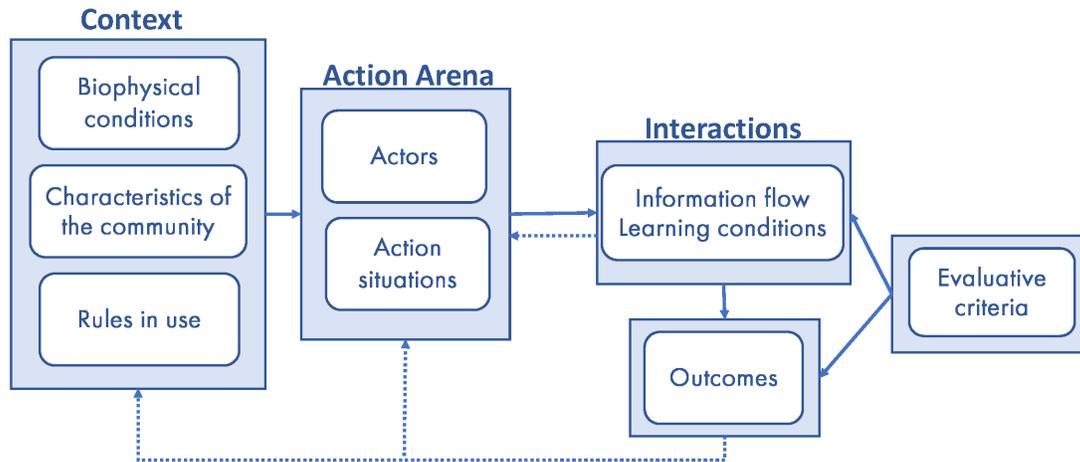


Figure 4. The Ostrom IAD framework particularly focuses on the “action arena” where policies or institutions are designed by people who interact in the context of the biophysical world they experience, as well within the current norms (e.g., rules/policies in use) and characteristics of their community (e.g., socioeconomics). Their decisions influence outcomes which in turn have feedback effects on decisions. (McGinnis & Ostrom, 2014)

### References

- <sup>1</sup> Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (Ed.). (2021). *The Routledge Handbook of Research Methods for Social-Ecological Systems*. Routledge. <https://doi.org/10.4324/9781003021339>
- <sup>2</sup> Riggs, R. A., Langston, J. D., & Phann, S. (2020). Actor network analysis to leverage improvements in conservation and development outcomes in Cambodia. *Ecology & Society* 25(4), 28. <https://doi.org/10.5751/ES-11854-250428>
- <sup>3</sup> Kanter, D. R., Winiwarter, W., Bodirsky, B. L., Bouwman, L., Boyer, E., Buckle, S., Compton, J. E., Dalgaard, T., de Vries, W., Leclère, D., Leip, A., Müller, C., Popp, A., Raghuram, N., Rao, S., Sutton, M. A., Tiano, H., Westhoek, H., Zhang, X., & Zurek, M. (2020). A framework for nitrogen futures in the shared socioeconomic pathways. *Global Environmental Change* 61, 102029. <https://doi.org/10.1016/j.gloenvcha.2019.102029>
- <sup>4</sup> McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology & Society* 19(2), 30. <http://dx.doi.org/10.5751/ES-06387-190230>