Unit 1.3 Resources for sustainable development I: How do natural resources shape the prospects for sustainable development?

The ultimate determinants of humanity's ability to achieve sustainability goals are the *stocks of resources* afforded us by the global nature-society system. The central argument is that the current stock of resources constitutes the "fuel in the tank" or "capital assets" on which each generation can draw to generate a flow of goods and services it can consume in pursuit of its own goals of well-being. The amount of resource or asset stocks we have on hand, like the fuel we might have in our gas tank, thus partially determines our future options. The sustainability question then becomes one of whether each generation is managing the depletions of, and additions to, its stock of resources in such a way that it can hand on an aggregate stock to its successors that is of at least equal value for supporting inclusive well-being as was the stock that generation inherited from its parents.

The particular resource stocks most relevant to sustainability can conveniently be divided into two groups, those provided by nature (natural resources) and those provided by people (anthropogenic resources). The pursuit of sustainability can involve both depletion of and investment in these resources, as well as tradeoffs that enhance one group of resources by depleting others. (Terminology note: Much of the literature follows the economists in referring to "capital" and "assets" rather than to "resources." The more general term we have come to prefer is "resources." But in the context of sustainability analysis, all of these terms can be taken to mean the same thing).

This Unit begins our discussion of the determinants of sustainable development by focusing on the natural resources of:

- Foundations: Land and water
- Materials: Hydrocarbons (including fossil fuels), metals, and other minerals.
- Life: Biomass and biodiversity

Natural resources constitute the primordial determinants of human well-being. A general overview of natural resources, the flow of goods and services they contribute to well-being, and their patterns across space and time is provided in the readings. One note of caution: It turns out to be important to distinguish between the *stocks* of natural resources (e.g., hectares of forest, numbers of fish, reserves of lithium, amount of fresh water) and the *flows* of goods and services that people extract from those stocks to achieve well-being and other goals (e.g., harvest rates from the forest or fishery, consumption of water, rates of mining, etc.). We will discuss why this distinction is important in unit 2.1 on system dynamics.

Preparation for class:

a) **Read**: Matson, P., Clark, W. C., & Andersson, K. (2016). *Pursuing Sustainability: A Guide to the Science and Practice*. Princeton University Press. Review pp. 14-20, Read "The determinants of well-being… Natural capital (pp. 32-37); and "Farmer-managed Irrigation Systems in Nepal" (pp. 163-172).

An introduction to resources (here called "assets") as the determinants of well-being, and an overview of some of the natural resources most relevant to the pursuit of sustainability. And a fuller version of the Nepal case introduced in Unit 0.1.

b) **Read**: United Nations Environment Programme. (2024). *Global Resources Outlook 2024: Bend the Trend – Pathways to a liveable planet as resource use spikes*. International Resource Panel. https://www.resourcepanel.org/reports/global-resources-outlook-2024. The "Summary for Policy Makers" of this massive report can be accessed from the main page listed here. In that Summary, read for this unit pp. 9-18. (We draw on the Summary's prescriptions for action, pp. 19-29, later in the course).

This work summarizes the role of natural resources (land, water and materials) in sustainable development: how they contribute to "provisioning" the food, built environment, mobility and energy that shape social well-being, trends in how their stocks are changing as a result of human use, and

what the prospects are for bending those trends in the pursuit of sustainability. (The unfortunate title – which implies that all resources relevant to sustainability are from nature – is symptomatic of the disciplinary silos that still plague sustainability studies. The next unit addresses the complementary anthropogenic resources missing here).

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

I. Efforts to provision the constituents of well-being draw on many natural resources. For example, meeting needs for consumption of food involves agricultural production processes that draw on multiple natural resources including (at least) land, water, energy, and biodiversity. Consider another constituent of well-being identified in your work with the OECD "Better Life" effort (Unit 1.2): "housing." Which natural resources are most needed to provide the housing you have recently used? Think back to the housing of your grandparents generation: How did the resource demands needed for provisioning their housing differ from those of today?

II. What are the stocks of natural resources that played central roles in the Fishbanks game? In the Nepal and case from the Matson et al. book? What are the flows from those stocks that affect the servicing or provisioning of key constituents of well-being for people in the Nepal case?

III. In the London case from the Matson et al. book, lots of natural resources were required to rebuild the city in the wake of the multiple calamities it faced through the ages. What were the most important of those natural resources? Were they "materials" or "foundational land and water" or "living resources"? Where did they come from? Was the sourcing of those resources by London consistent with the "equity" dimensions of sustainable development goals?

IV. The claim is often made that increasing scarcity of natural resources will result in higher prices for them, which will automatically decrease demand and increase the search for alternatives. For which resources, and which conditions, is this a reasonable claim? For which not? Why?

V. **Your case**: Consider the sustainability challenge you're following throughout this course. First, identify three important natural resources for your case (they could be foundational, materials, or life resources). Second, for one of these resources, describe both what exists (the stock) and what's being used or extracted (the flow). Third, write about what concerns you (if anything) about this resource's future availability?

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

c) Read: Dasgupta, P. (2021). *The economics of biodiversity: The Dasgupta Review*. https://royalsociety.org/news-resources/projects/biodiversity/economics-biodiversity/.

Ecosystems are the natural resource addressed in this introduction to an independent, global review commissioned by the UK Treasury in 2019. The author is Partha Dasgupta, one the world's leading scholars of sustainability. The Review's focus, despite its name, is on the "life" dimensions of natural resources, i.e. on ecosystems and biodiversity and how these can contribute to sustainable development.

d) Read: Chaplin-Kramer, R., Neugarten, R. A., Sharp, R. P., Collins, P. M., Polasky, S., Hole, D., Schuster, R., Strimas-Mackey, M., Mulligan, M., Brandon, C., Diaz, S., Fluet-Chouinard, E., Gorenflo, L. J., Johnson, J. A., Kennedy, C. M., Keys, P. W., Longley-Wood, K., McIntyre, P. B., Noon, M., … Watson, R. A. (2023). Mapping the planet's critical natural assets. *Nature Ecology & Evolution*, *7*(1), 51–61. https://doi.org/10.1038/s41559-022-01934-5.

Ecosystems are the focus of this research that uses the framework introduced by Matson et al. (reading 'a') and by Dasgupta (reading 'c') to map the locations of ecosystems that contribute most and most directly to human well-being. The authors use the maps to propose action priorities for ecosystem conservation. Their terminology, however, does not quite match ours so here is a guide: For the "Goals" of sustainable development, these authors take (as we do) human well-being; the

authors address “critical natural assets (resources)”, but cover only ecosystems, not materials; for the “Goods and Services” of the Matson et al. framework, these authors focus on a dozen of “nature’s contributions to people (NCPs)” that have been identified in the recent assessments as being produced from ecosystems.