

Understanding the planet: Earth System Science and Sustainability Science

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Earth system science and sustainability science are two related interdisciplinary endeavors that have developed over the last few decades. Both arose from the growing concern about the influence of the human species on the functioning of the planet. Earth system science encompasses the interactions among the atmosphere, oceans, and biota to understand the functioning of the Earth as an entity. Unlike individual disciplines that address a single component, earth system science emphasizes the interactions among the individual components. Earth system science grew out of atmospheric science with the recognition that understanding past climate and projecting future climate requires a more holistic approach. Sustainability science grew from the international recognition that development encompasses more than just economic advancement. Since the 1987 Brundtland report “Our Common Future,” academics and practitioners have sought to integrate environmental, economic, and social aspects of development. The emphasis in sustainability science is more centered on human development than earth system science, but the integrated, holistic approaches to understanding human influences on the planet are common.

Both earth system science and sustainability science lack educational and research institutions with the interdisciplinary, holistic approaches required to tackle the questions. University departments and research groups have developed over the last decade, but the numbers are limited. A few universities have departments for earth system science and traditional research groups have evolved into more interdisciplinary endeavors. The term “sustainable” is often a label, but in fact few departments, research institutions, or funding agencies are organized to address the full interdisciplinary breadth of the topic.

The most difficult challenge in both earth system science and sustainability science is incorporating social and natural science. The differing traditions, study methods, and scales of analysis are difficult to integrate. Some progress is being made through integrated assessment modeling and other efforts, but progress has been slow.

Readings:

Kates et al., 2001, Environment and Development: Sustainability Science. *Science* 292 (5517): 641-642.

Turner et al., 2003, A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences* 100 (14): 8074-8079.

Steffen, W., 2002, *Global Change and the Earth System: A Planet Under Pressure*. Springer.

Ernst, W.G., 2000, *Earth Systems: Processes and Issues*. Cambridge University Press.