A Systems Approach to Population-Environment Studies

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Population-environment interactions are complex. Examples of complex characteristics include nonlinear relationships, feedbacks, time lags, legacy effects, thresholds, heterogeneity, and surprises. Achieving a better understanding and prediction of these and other complex characteristics requires a systems approach with a comprehensive framework that encompasses multiple dimensions across multiple scales.

The conceptual framework needs to be more comprehensive and broader than one considering population and environment only. The concept, coupled human and natural systems (CHANS), which are integrated systems where human and natural components interact, provides one such framework. Humans have multiple dimensions, including social, economic, policy, and political, besides population. Population-environment systems, social-ecological systems, and economic-ecological systems are examples of CHANS, with a special focus on population, social, and economic dimensions, respectively. Although some previous studies on population-environment systems have considered other dimensions, such as socioeconomic factors in addition to population, the CHANS framework helps to consider those other dimensions more systematically and explicitly.

The systems approach emphasizes organizational, spatial, and temporal couplings between human and natural systems. It would be ideal to conduct studies at multiple organizational, spatial, and temporal scales because there are not only differences among different scales, but also different interactions among scales. On one hand, many properties at the large scales emerge from interactions at the local scales. On the other hand, local interactions are often shaped by regional and global contexts.

While population-environment studies over a short period of time are more feasible and more affordable, it is necessary to conduct more long-term studies. Even though long-term studies are more costly, they can discover many patterns and processes that short-term studies cannot. As illustrated in our 14-year CHANS study in Wolong Nature Reserve for giant pandas in China, CHANS change over time, there are legacy effects (prior interactions affect current and future conditions), and time lags prevent many patterns and processes from being observed during a short period of time.

There is a great need for more comparative studies. Although research projects on population-environment interactions have spread across the globe, this type of research has mainly been conducted separately and independently, each usually focused on one site, one spatial scale, and short term. While individual projects have generated important insights, it is essential to capture the wide variations and produce more general principles. In response to this need, the U.S. National Science Foundation (NSF) has recently funded a project "International Network of Research on Coupled Human and Natural Systems" (CHANS-Net). The goal of CHANS-Net is to foster more comparative studies and promote more communication and collaboration among members of the CHANS community. This goal will be pursued through a series of activities, such as establishing a Virtual Resource Center, organizing symposia and workshops, publishing comparative and synthesis results, and creating a CHANS Fellows program to help students and junior researchers participate in CHANS-Net activities.

The CHANS-Net's first symposium, "Complexity of Human-Nature Interactions across Landscapes," and a companion workshop, "Challenges and Opportunities in Research on Coupled Human and Natural Systems," will be held at the annual meeting of US-IALE (U.S. Regional Association of the International Association for Landscape Ecology). The meeting will be held in Snowbird, Utah, USA, April 12–16, 2009, with the theme "Coupling Humans and Complex Ecological Landscapes." The director of NSF's program "Dynamics of Coupled Natural and Human Systems," approximately 20 leaders of projects funded by the program, and the first cohort of 14 CHANS Fellows will give presentations and participate in discussions at the meeting. Interested individuals are welcome and encouraged to attend this meeting and participate in the discussions (http://www.usiale.org/snowbird2009/). For those who would like to submit abstracts and give presentations at the meeting, please contact iale2009info@cnr.usu.edu.

In summary, the systems approach outlined above can help better understand complex population-environment interactions across spatial, temporal, and organizational scales. It will also, in turn, produce more useful information to help achieve environmental and socioeconomic sustainability.

Main References

- International Network of Research on Coupled Human and Natural Systems (www.chans-net.org).

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