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Pinpointing How Nature's Benefits Link to Human Well-Being

May 22, 2013 — What people take from nature -- water, food, timber, inspiration, relaxation -- are so abundant, it seems self-evident. Until you try to measure how and to what extent they contribute to humans.

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Scientists at Michigan State University's Center for Systems Integration and Sustainability, in two parallel papers published in this week's journal *PLOS ONE*, develop a new integrated approach to measure human dependence on ecosystem services and human well-being so as to promote the understanding of the linkages between them -- an important step toward improved understanding, monitoring and management of

coupled human and natural systems.

"Climate change, energy and food insecurity, biodiversity loss and water shortages all have raised the stakes," said Jianguo "Jack" Liu, Rachel Carson Chair in Sustainability and CSIS director. "If we can't quantify the complex relationships between ecosystem services and human well-being, both ecosystems and humans will suffer and will not be sustainable."

Wu Yang, a CSIS doctoral student, created two new index systems for measuring human dependence on ecosystem services and human well-being from ecosystem services. The trick, he said, was to come up with ways to represent the benefits people gained from these resources, as well as any socioeconomic benefits that are not gained specifically from nature. On the other hand, it was to design a reliable instrument to quantify different components of human well-being that could be linked and integrated with the index of dependence on ecosystem services in models.

"If you don't understand the linkages, you're not going to be able to sustain the flow of those benefits to human society," Yang said. "Thus, we've developed and validated our new methods. We made them as general as possible so they can be applied to many other coupled human and natural systems across the globe."

China's Wolong Nature Reserve served as an excellent laboratory to study coupled human and natural systems. The reserve was particularly suited for testing the new methods because it was close to the epicenter of a devastating earthquake in 2008, which dramatically changed local households' dependence on ecosystem services and human well-being in a short time. Because CSIS scientists had studied the area for almost two decades, they had rich long-term data and local knowledge to evaluate the relationships between people and ecosystem services.

Additional researchers contributing to the papers include Liu; Thomas Dietz, MSU professor of environmental science and policy, sociology, and animal studies; Wei Liu, former CSIS doctoral student now a postdoctoral fellow at IIASA in Laxenburg, Austria; Junyan Luo, CSIS research associate; Daniel Kramer, MSU associate professor in fisheries and wildlife and James Madison College; Xiaodong Chen, former CSIS doctoral student now on faculty at the University of North Carolina-Chapel Hill.

The research was funded by the National Science Foundation, NASA, MSU AgBioResearch, MSU Graduate Office, and the MSU Environmental Science and Policy Program.

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Lake Michigan beach. (Credit: Courtesy of Kurt Stepnitz)

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1. Wu Yang, Thomas Dietz, Wei Liu, Junyan Luo, Jianguo Liu. **Going Beyond the Millennium Ecosystem Assessment: An Index System of Human Dependence on Ecosystem Services.** *PLoS ONE*, 2013; 8 (5): e64581 DOI: [10.1371/journal.pone.0064581](https://doi.org/10.1371/journal.pone.0064581)

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