

Abstract

The dynamics of ecological and social systems are inter-dependent. Understanding the feedbacks between these systems is a current challenge spanning many disciplines, including ecology, economics, geography, geology, sociology, engineering, and others. We are developing an interdisciplinary workshop to investigate one mechanism by which ecological and social processes are coupled. In addition to conducting interdisciplinary research, an important goal of this workshop is to develop a methodology for identifying the most interesting questions existing beyond a single academic domain and approaches to answering them. We have begun by identifying an inclusive research topic, the ecological footprint, which serves as a common set of ideas that can bring together a team of people from various backgrounds. We will achieve a breadth of expertise through the committed involvement of team members with a differing knowledge base. The core group will be complemented with short-term invited guests having specific expertise beyond the collective team background. Initially, we are scheduling weekly meetings throughout the spring semester. During these meetings we will review work completed, identify problems, and assign tasks. However, the workshop will have an adaptive structure to take advantage of our changing needs and experience. The success of this workshop will be assessed in relation to meeting our stated goal; we expect to have a manuscript submitted to an appropriate scientific journal by June 2001.

The Ecological Footprint Workshop: Creating an Ecological and Social Sciences Interface

G.D. Jenerette^{1,2}, K. Gade¹, N.B. Grimm¹, D. Hope³, M.A. Luck^{1,2}, W.A. Marussich¹, W.J. Roach¹

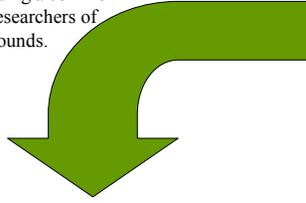
¹Department of Biology, Arizona State University

²Department of Life Sciences, Arizona State University West

³Center for Environmental Studies, Arizona State University



To study the socioecosystem, a conceptual model is needed to identify questions and approaches while also providing a common framework for researchers of differing backgrounds.



The Ecological Footprint

An ecological footprint is a representation of social dependence on ecosystem services. The footprint measures human impact on nature.

Ecological footprint calculations are based on keeping track of the resources humans consume and the wastes generated, and that the rate of these flows can be measured as the earth area needed to produce or assimilate these materials.

The ecological footprint shows the land area required to sustainably produce the resources consumed and assimilate the material released by an individual or society.

For example, the per capita ecological footprint of each U.S. citizen was estimated to be approximately 12 hectares (Wackernagel et al. 1997).

The ecological footprint was designed to be used as a public education and a policy making tool.

Example of Modified Ecological Footprints Computed Simultaneously for Multiple Cities of the United States

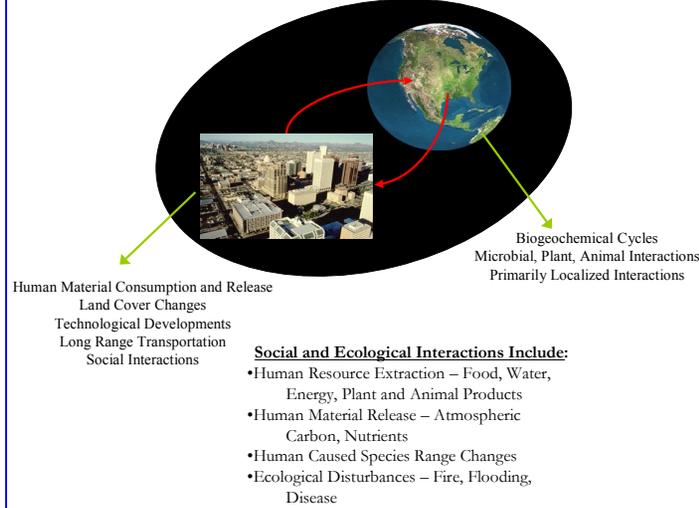


Researchers at Arizona State University have improved and extended the ecological footprint (EF). A new method was developed to incorporate information about the spatial distribution of ecosystem services into the EF calculation. A localized EF, the contiguous area of ecological services utilized by humans, was identified by taking into account the heterogeneity of ecosystem services. Comparisons between the traditional and spatially heterogeneous EF algorithms illustrated the importance of spatial heterogeneity in the patterns of resource limitation, regional ecosystem heterogeneity, and competition between cities for ecological resources. (for more information see Luck et al. submitted to *Ecosystems*)

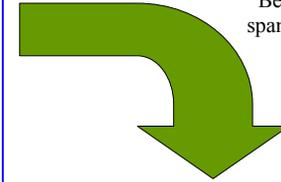
Some Limitation of the Footprint / Opportunities to Improve:

- Traditional footprints are not spatially explicit, thus they often assume all lands are equal (e.g. Arizona's Sonoran desert is equivalent to California's Napa Valley) and suggest that the distribution of people and/or resources does not matter (the cost of an apple grown in Washington is the same whether you live in Seattle, WA or Dallas, TX).
- Traditional footprints fail to distinguish between sustainable and unsustainable land uses and are therefore hypothetical. Also, all categories of land use are viewed equivalently (e.g. roads are equated with agriculture from a land consumption perspective).
- Traditional footprints use a linear summation of individual behaviors that may not yield an accurate accounting of societal impacts (and visa versa). There is no social discounting.
- Traditional footprints lack indices of temporal change.
- Traditional footprints inadequately account for trade and competition for resources between different regions.
- Traditional footprints do not allow for trade-offs among the three central dimensions of ecological economics evaluation (i.e. efficiency, equity and sustainability).
- Traditional footprints lump all ecosystem services together. As it is currently computed, the footprint is dominated by emitted carbon assimilation. (for more information see Jeroen et al. 1999)

THE SOCIOECOSYSTEM

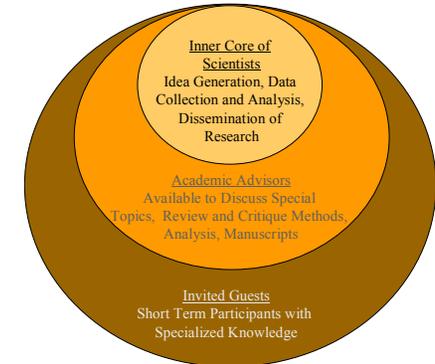


The Socioecosystem Is A Prominent Earth System.
To Study This System An Interdisciplinary Approach Must Be Undertaken.



Because the dynamics of the socioecosystem span multiple disciplines, a group of scientists with different backgrounds are needed to identify and conduct appropriate research.

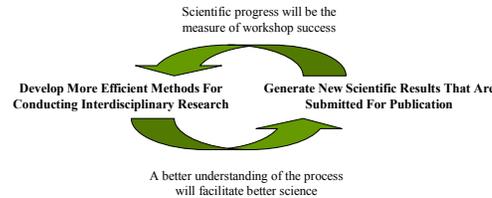
Interdisciplinary Team Creation



Three levels of involvement in the workshop are explicitly identified. This approach ensures that a small cohesive group can form and work together while also incorporating other interested individuals whose expertise are related to workshop. Invited guests, individuals with information and ideas that are critical for certain aspects of the project but are not able to make long-term commitments. Invited guests can include business, governmental, and non-profit organization members as well as scientists outside the university setting. Guests currently being identified could include Salt River Project management personnel and Carl Folke, a prominent scientist on human-ecological interactions.

Goals, Approach, and Possible Research Questions of the Ecological Footprint Workshop

GOALS



APPROACH

To study the socioecosystem we will use the multi-tiered interdisciplinary team approach to incorporate researchers with differing backgrounds. A single, comprehensive theoretical tool, the ecological footprint, will be a common framework for all members of the core group. Our first meeting will consist primarily of concept and question identification. Then, a single research question will be developed by the interdisciplinary team and research strategies will be identified. The following meetings will include discussion of research, reports from work completed, group problem solving, and meeting with outside members. Workshop progress will be frequently assessed by core participants and advisors. The approach will be adaptive to meet the changing needs of the group and take advantage of our experience in the workshop.

POSSIBLE RESEARCH QUESTIONS

- How can transportation of resources, both within a city and between cities, be realistically accounted for in the model?
- How can the ecological footprint be linked with other human-ecological models such as ecosystem service valuation?
- How can societal / cultural variables be incorporated into the ecological footprint? What is the effect of social scale, are households scalable to cities? How can choices affect the footprint?
- How does temporal heterogeneity affect the footprint? How can social changes, including technological developments, as well as ecosystem fluctuations be incorporated into the footprint?
- What is the footprint for the products of society, such as information or manufactured goods? How do these products affect the ecological footprint?

For more information or if you are interested in participating, please contact Darrel Jenerette (jenerette@asu.edu). The Ecological Footprint Workshop is supported by the Urban Ecology Integrative Graduate Research Training grant.