

Developing an Integrated History and future Of People on Earth (IHOPE): Proposal for a major international conference at NCAR, Summer 2006

Robert Costanza¹, Lisa Graumlich², Kathy Hibbard³, David Schimel³, and Will Steffen⁴

1. Gund Institute of Ecological Economics, Rubenstein School of Environment and Natural Resources,
University of Vermont

2. Big Sky Institute, Montana State University

3. NCAR, Boulder, Colorado

4. Bureau of Rural Sciences, Australian Government

Human history has traditionally been cast in terms of the rise and fall of great civilizations, wars, and specific human achievements. This history leaves out the important ecological and climate context which shaped and mediated these events. The capability to integrate human history with the natural history of the earth now exists. The goal of IHOPE is to produce an integrated history of the climate, atmospheric chemistry and composition, material and water cycles, ecosystem distribution, species extinctions, land use systems, human settlement patterns, technological changes, patterns of disease, patterns of language and institutions, wars and alliances, and other variables on earth from several new and existing data sources that would provide a much richer picture of how (and why) the planet has changed in historical times. This integrated history will serve as an improved basis for studies from various perspectives of the earth's history and possible futures. It will also be used as a core data set to test integrated models of humans in natural systems at multiple time and space scales, from regional to global.

Human-environment systems are intimately linked in ways that we are only beginning to appreciate (Steffen et al. 2004, Diamond 2005, Kirch 2005). To achieve the ambitious goals of IHOPE there are multiple scientific challenges that must be met. In order to understand the integrated history of the Earth it is necessary to integrate the different perspectives, theories, tools, and knowledge of multiple disciplines across the full spectrum of social and natural sciences and the humanities.

A first step towards the development of such an integrated database took place at an IHOPE-Dahlem conference in Berlin, Germany; June, 2005. IHOPE-Dahlem assembled an interdisciplinary group of 40 top scientists from a range of natural and social science disciplines with the goal of identifying mechanisms and generalizations of how humans have responded to and impacted their environment over millennial, centennial and decadal scales as well as a glimpse of the future of the human-environment system. The overall conclusion from the IHOPE Dahlem is that humans societies respond to environmental (e.g., climate) signals through multiple pathways including collapse or failure, migration and creative invention through discovery. Extreme drought, for instance, has likely triggered both social collapse and ingenious management of water through irrigation. Future response and feedbacks between the human-environment system will depend on our understanding of the past and adaptation to future surprises. Results from the IHOPE Dahlem Conference will be published in a book from MIT press in 2006. In addition, the Dahlem authors have been invited to contribute to an Invited Feature for *Ecological Applications*, to be published in 2006.

Following the IHOPE Dahlem Conference, an international symposium was sponsored by the Japanese Ministry of Environment and Technology in October 2005 through the Environment, Economies, Civilization and Global Change Program (EECGP) on the theme of Sustainability of Islands and Resource-Recycling Societies in Japan. This symposium discussed sustainability and failure of past and present Mayan, Monsoon Asia, Pacific Island and Atlantic Island civilizations as well as future models for sustainability and technologies for future resource recycling. Several participants from the Dahlem conference as well as experts in island-nation archeology from Europe, India, the US and Asia contributed to this symposium. The EECGP symposium was a precursor to a larger, Asian IHOPE conference to be held at the International Center for Japanese Studies, University of Kyoto, Japan in November, 2006.

A third IHOPE meeting with about 20 participants will be held at the Swedish Academy of Sciences in Stockholm on Jan. 12-13, 2006. The purpose of this meeting is to review final draft chapters from the Dahlem workshop, integrate IHOPE activities with the Global Change community, and plan the proposed meeting at NCAR for summer 2006.

Coupling the human-environment system with Earth System models is a primary objective of the Analysis, Integration and Modeling of the Earth System (AIMES) project of the International Geosphere/Biosphere Programme (IGBP). AIMES (<http://www.aimes.ucar.edu>) is challenged with not only contributing to improving process understanding of biogeochemistry and biophysical processes in the global climate system models, but to begin to integrate human processes into a new generation of coupled Earth System models. AIMES is thus the logical host for the IHOPE activity.

The IHOPE activity will provide a clear mechanism to test a broad range of hypotheses about human-environment interactions. For example, Ruddiman (2005) suggested that departures of methane concentrations in the Vostok Ice Core (Petit et al. 1999) since the most recent interglacial period were anomalous from previous interglacial periods and were primarily the consequence of the rapid increase in global rice cultivation. The insight, data and models generated from the IHOPE activity from environmental historians, archeologists, ecologists and modelers will allow the testing of such hypotheses. It will also allow the calibration and testing of integrated global earth system models that contain a range of embedded hypotheses about human-environment interactions.

NCAR IHOPE conference.

We propose to hold an international conference in the summer of 2006 that builds on the Dahlem, Asian, and Stockholm conferences. The conference would be held at the National Center for Atmospheric Research (NCAR) in Boulder, CO. The AIMES project will host and lead this workshop, in association with the Institute for the Study of Society and the Environment (ISSE) at NCAR and the Global Land Project. The conference would assemble the necessary communities from database development, statistics, environmental history, integrated modeling, archeology, and others to begin the considerable task of developing spatially and temporally explicit integrated databases for the past 10,000 years. The IHOPE activity is structured around four different time frames: millennial (up to 10,000 years ago), centennial (up to 1000 years ago), decadal (up to 100 years ago), and the future.

A major goal of this conference is to assemble key initial datasets to start the activity. We have identified two specific product goals:

1. Integrated timelines for the three historical IHOPE time frames. These timelines would show both key human and environmental events of each timeframe (i.e. start and collapse of civilizations, new technologies, climate events, etc.) and also the change in key continuous variables over the time frame (i.e. population, land use, energy use, temperature, precipitation, etc.). These timelines will provide a compelling graphic representation of our integrated history.
2. Integrated land use/cover histories for the three historical IHOPE time frames. These series will show the geographic spread of both human land use change and climate induced land cover change. Over the past ten years, our ability to model climate systems has dramatically improved, with the very recent (c.a. 5YA) implementation of the terrestrial carbon cycle into many of the climate system models (e.g., see Cox et al. 2004 and Friedlingstein et al, 2003, 2005). While current models are improving parameterizations and mechanisms of the carbon cycle, there is a lack of human-driven global historic land use and land cover datasets necessary to adequately simulate the terrestrial carbon cycle.

The intent is to marshal the people and resources necessary to produce initial drafts of these products at the NCAR workshop, and publish the results (both on the web and in journals) within the next 6-12 months.

Budget

We request \$125K to invite 60 participants from the international community for this 5 day workshop. Funds will be used for participant support, and deployment of prototype datasets utilizing the TimeMap software (<http://www.timemap.net>).

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