



Integrated History and future Of People on Earth (IHOPE, an initiative sponsored by AIMES and PAGES core projects of IGBP)

24-28 March, Akita Prefecture, Japan

Venue: Hotel Sun Rural Ogata, <http://www.ogata.or.jp/sr/>

IHOPE Asia Workshop: ‘Human-Environmental pathways in Asia: IHOPE implementation priorities’

Sponsored by:

Akita Prefecture

International Research Center for Japanese Studies (IRCJS)

Science Council of Japan (SCJ)

Ministry of Environment in Japan

Institute for Global Environmental Strategies (IGES)

International Research Center for Japanese Studies (IRCJS)

International Geosphere-Biosphere Programme (IGBP)

Analysis, Integration and Modeling of the Earth (AIMES)

Integrated History and future Of People on Earth (IHOPE)

Past Global Changes (PAGES)

Organizing Committee

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Background of IHOPE

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 contexts that shaped and mediated these events. Human history and earth system history have traditionally been developed independently, with little interaction among the academic communities. Therefore, separate methods of describing these histories have been developed, and there have been few attempts to integrate these histories and information across these fields of study. Recent recognition that current earth system changes are strongly associated with the changes in the coupled human-environment system make the integration of human history and earth system history an important step in understanding the factors leading to global change and in developing coping and adaptation strategies for the future.

The capability to integrate human history with the natural history of the earth now exists. The goal of the *Integrated History and future Of People on Earth (IHOPE)* project is to understand the interactions of the environmental and human process over the past several ten to hundred millennia to determine how human and biophysical changes have contributed to Earth system dynamics. In order to reach this goal,

our objective 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 many new and existing data sources in a spatially and temporally consistent framework.

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 fully understand the 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 step towards the development of such an integrated history took place at an IHOPE-Dahlem conference in Berlin, Germany, 2005 (Costanza, Graumlich, Steffen 2007). The IHOPE-Dahlem workshop assembled an interdisciplinary group of 40 top researchers 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 providing a glimpse of the future of the human-environment system. The overall conclusion from IHOPE-Dahlem was that human societies respond to environmental (e.g., climate) signals through multiple pathways including coping, adaptation, 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 and environmental components of the Earth system will depend on our understanding of the past and adaptation to future surprises. Results from IHOPE-Dahlem will be published in a book from MIT press in 2006.

Following the IHOPE Dahlem Conference, an international symposium was sponsored by the Japanese Ministry of Economy, Trade and Industry in Kosaka, Akita Prefecture (24-30 October 2005) through the Environment, Economy and Civilization - 21th Global Program (EECGP) focusing on the theme 'Sustainability of Islands and Resource-Recycling Societies'. 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 (Yasuda, 2005). Several participants from IHOPE-Dahlem as well as experts in island-nation Archaeology 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 Akita Prefecture Japan with the support by the Akita Prefecture, International Research Center for Japanese Studies, Japanese Academy of Science, IGES and Japanese Ministry of Environment from 24 to 28 March, 2007.

IHOPE in the Global Change Community

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 charged with not only contributing to improving process understanding of biogeochemistry and biophysical processes in global climate system models, but also with integrating human processes into a new generation of coupled human-in-environment Earth System models. In addition to AIMES, the IGBP core project, Past Global Changes (PAGES) Focus 4 (Past Human-Climate-Ecosystem Interactions: PHAROS) addresses the long-term interactions between past climate, other ecological processes and human activities. An emphasis of this PHAROS focus lies in comparing regional-scale reconstructions of **ecological** and climatic processes, from natural archives, documentary and instrumental data, with evidence on past human activity derived from historical and archaeological records. AIMES has committed to host the administrated function for IHOPE, with co-sponsorship from PAGES (e.g. Dearing 2006). PHAROS intends to compile regional-global records of water availability and quality, soil erosion and sediment transport, and vegetation/land use changes through the Holocene. AIMES has committed to host the administrated function for IHOPE, with co-sponsorship from PAGES. The IHOPE activity also intersects with several other global change

projects and communities and the intention is that IHOPE be a shared activity of the entire global change community. In addition to the PAGES-PHAROS focus, particularly strong connections exist, for instance, with the Global Land Project (GLP) of IGBP and IHDP and IHOPE will work to maximize the synergies with these and other global change projects. In spirit, IHOPE is thus an activity of the entire Earth System Science Partnership (ESSP) community. In addition, IHOPE will connect to important activities being performed by communities not now part of the global change research community, including environmental historians, archeologists, sociologists, psychologists, and others. The broad range of IHOPE also implies that many different approaches to science, data, and knowledge will have to be integrated, and the inherent normative features of this problem will have to be acknowledged and dealt with (cf. Costanza 2001).

Implementation

Transdisciplinary Networks and Centers: As regional case studies are developed, it will be useful to draw from the regional case studies to

- a. Quantify *global population numbers and density* through time;
- b. Quantify and *map area affected by specific settlements and/or populations*;
- c. Develop and apply objective schemes *to assess 'human impact' on natural vegetation* (extension of the 'biomisation' method (Prentice and Webb 1998);
- d. Quantify and *map timings of expansion, migration events*;
- e. *Synthesis environmental data and reconstruction of regional changes* covering the relevant periods of interest (e.g., Holocene, last 20,000 years, Late Quaternary)
- f. Map the *land-geography through time* (NOTE Pat Barglejn has been working on this but there is still a ways to go).

The implementation of the challenging IHOPE research agenda will require contributions from scholars around the world. The IHOPE Science Plan (draft available at <http://www.ames.ucar.edu/>) outlines the way forward with regard to regional case studies and deliverables as described above. A networking approach will clearly be essential for IHOPE's success, and at least two types of networks can be envisaged. (i) *Regionally based networks of scholars from a wide range of disciplines* who undertake the *case studies* in an integrated fashion; (ii) *Complementing these: disciplinary networks, both regional and global*, who can further develop and test data and information gathering methodologies for particular aspects of the IHOPE agenda and who can develop specific simulation tools needed for the analysis and integration phases of the project. As integration across disciplines is central to IHOPE, the growing number of interdisciplinary research centers around the world will provide an infrastructural underpinning to the IHOPE effort. Examples of such centers include the Global Institute for Sustainability and the School for Human Evolution and Social Change at Arizona State University, the Gund Institute for Ecological Economics at the University of Vermont, the consortium of Stockholm-based society-environment research units (Centre for Transdisciplinary Environmental Research/Stockholm University/Stockholm Environment Institute/Beijer Institute for Ecological Economics), the National Center for Ecological Analysis and Synthesis (NCEAS) in Santa Barbara, CA, and the Centre for Resource and Environmental Studies, at the Australian National University.

Long-Term Goals of the IHOPE Project (see <http://www.ames.ucar.edu/>)

Three major long-term goals have been identified for the IHOPE project:

1. Map the integrated record of biophysical and human system change on the Earth over the last one hundred thousand years, with higher temporal and spatial resolution in the last 1000 and the last 100 years. The long-term timeframe of analysis will depend on the region. For example,

Australian history might cover up to the last 60,000 years, and in southern Europe, the last 20,000 years would capture initial colonization since the Last Glacial Maximum (LGM).

2. Understand the connections and dynamics of human and Earth history by testing humans-in-environment systems models against the integrated history. For example, how well do various models of the relationships between climate, agriculture, technology, disease, language, culture, war and other variables explain the historical patterns of human settlement, population, energy use, and earth system cycles such as global biogeochemistry?
3. Project with much more confidence and skill options for the future of humanity and earth system dynamics, based on models and understanding that has been tested against the integrated history and with participation from the full range of stakeholders.

General Questions

Consistent with the long-term goals mentioned above, three overarching questions have been identified for the IHOPE project.

- How do we best use an integrated history of socio-ecological interactions to inform us about options for the future
- How do we understand the complex reasons for the emergence, resilience, sustainability or collapse of coupled socio-ecological systems? Importantly, this includes understanding the relative contributions of humans as causal agents in the systems.
- How do we evaluate alternative explanatory frameworks and specific explanations and models (including complex systems models) against observations of highly variable quality and coverage?

Specific Questions of the IHOPE AKITA Workshop

According to the long-term goals and building on the three general questions above, organizing committee of this Akita workshop selected five more specific questions, intended as examples of the kinds of questions that might be addressed in the IHOPE AKITA workshop initiative.

1. What *causes* socio-ecological systems in the Asia-Pacific regions to be more or less successful in perceiving and adapting to decadal and longer changes (e.g. land use, climate, disease, governance)? Are some types of environmental stress in Asia-Pacific regions inherently more likely to cause collapse than others?
2. What are the *resilience* characteristics of socio-ecological systems of the Asia-Pacific societies and civilizations that lead to either sustainability or collapse? What makes socio-ecological systems resilient or brittle at various points in the evolution of the Asia-Pacific civilizations?
3. What might have been the long-term human contributions to changes in the *rates and composition of Earth System processes* in the Asia-Pacific regions? Historically, what are the effects of human impact on the natural environment and on the dispersal of other species (i.e. diseases, invasive species) and vice-versa?
4. How can we use our understanding of past socio-ecological interactions of the Asia-Pacific regions to help *map modern spatial variations in resilience, system trajectory and sustainability worldwide*, thus allowing classification and ranking of the state of world systems at different scales?

5. How do the societies and civilizations in the Asia-Pacific regions respond to the *closing of frontiers*? Can technology of the Asia-Pacific regions create new frontiers indefinitely?

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