Sustainability Science for Watershed Landscapes

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Sustainability Science for Watershed Landscapes

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MESSAGE

Cynicism surrounds the concept of "sustainable development" and its approaches, for at least two reasons. Firstly, the concept, as practiced, is nebulous – meaning different things to different people, even among serious researchers and policy analysts. Indeed, many vociferous advocates of sustainable development have one thing in common – they tend to speak a language other than what we know as science. Secondly, evident success or sustained impact of approaches to sustainable development in many parts of the world is quite sparse and wanting.

A useful point of departure is thus to define sustainability science at the outset. As William Clark succinctly puts it, sustainability science is a field defined by the problems it addresses rather than by the disciplines it employs, much like health science and agricultural science. In particular, it is a field that seeks to, and I quote, "facilitate a transition toward sustainability – that is, improving society's capacity to use the earth in ways that simultaneously meet the needs of a much larger but stabilizing human population, … sustain the life support systems of the planet, and … substantially reduce hunger and poverty*"* (*Our Common Journey: A Transition Toward Sustainability*, National Research Council Policy Division Board on Sustainable Development, 1999). Clark sees sustainability science "transcend(ing) the concerns of its foundational disciplines and focus(ing) instead on understanding the complex dynamics that arise from interactions between human and environmental systems."

Bringing together the various sciences along with other dimensions of human thought to address sustainability's concerns, including the social goals of sustainable development and humanity's well-being, is, to say the least, exciting. This is indeed synergy of a 21st century kind!

On the other hand, the challenges facing this new field are huge. For the most part, sustainability science requires detailed information synthesized into new knowledge, enriching and even revolutionizing present paradigms and methods of research and policy design. Interestingly, the transdisciplinary nature and requirements of this new science, which is a key to its promise of generating new knowledge, is in itself a challenge. Particularly for us scientists and researchers, it may mean having to change our paradigms and ways of looking at our world, modifying our way of viewing and doing science, stepping out of the neat little boxes we have fashioned for our respective disciplines, and developing new ways of talking and working with each other as well as nonscientists and other stakeholders who similarly aspire for society's well-being. Perhaps the ultimate promise, and at the same time challenge, of this new field is its systems perspective of problem-

solving – indeed, to be able to address human-and-environment concerns in ways that do not beget bigger problems nor bypass more significant issues. Just thinking of its possibility is overwhelming and exciting.

Key to making this transdisciplinary initiative work is placing the policy question or issue at the forefront of the research agenda. How do the different chapters in this volume contribute to an improved understanding of what works – and what does not – in the area of watershed management? The other element of this initiative is the recognition that one-size-fits-all approach to policy design aimed at addressing sustainability concerns across landscapes seldom works in practice. What may work well in a Hawai'i landscape will not necessarily work well in a Philippine landscape and vice versa. Indeed, because the bio-physical, socio-economic, and institutional conditions are quite diverse across landscapes, even within a country, the choice of appropriate policy and technology levers for addressing resource management issues is extremely challenging.

It is widely believed that the present development path of the world is not a sustainable one. As a development organization, SEARCA sees in sustainability science a way of carrying out its mandate of agricultural and rural development for Southeast Asia yet managing the natural base on which most of these agricultural and rural activities depend.

Arsenio M. Balisacan
Former SEARCA Director

FOREWORD

The goal of *Sustainability Science for Watershed Landscapes* was to synthesise the third wave of sustainability science and make science directly relevant to specific pressing policy questions. Current efforts are grounded in almost four decades of international concern commencing with the Stockholm Conference on the Environment (1972), and including, to mention only a few of the key initiatives, the Brundtland Commission (1983-1987) and the resulting report, *Our Common Future (*1987) and the four year Millennium Ecosystem Assessment (2005). The Assessment addressed environmental, social sustainability, and economic sustainability to meet fundamental human needs while preserving the earth's life support systems. The challenges facing us early in the 21st century are so complex that they demand trans-disciplinary approaches, coupled models, multi-scale assessment, and the involvement of stakeholders in defining our basic questions. These challenges are heightened by a changing climate. This volume presents important case studies highlighting these approaches.

It was logical for the East-West Center (EWC) to partner with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) and the University of Hawai'i in convening the 2007 "International Conference on Sustainability Science for Watershed Landscapes" that resulted in this volume. The EWC has had a sustained partnership with SEARCA and its parent organisation, the Southeast Asia Ministers of Education Organisation (SEAMEO). Furthermore, since at least the mid-1970's the EWC has been committed to the policy aspects of equitable access to resources in the Asia Pacific region. A milestone was the creation of what was then the Resource Systems Institute (1977) under the leadership of Harrison Brown. In the same year the Environment and Policy Institute (EAPI) was established under the leadership of William Mathews to study human interaction in tropical ecosystems. Both RSI and EAPI concentrated on international comparative studies with an Asian focus and hosted many Asian visiting researchers often leading to long-term research partnerships. Although there has been institutional change, the focus on the policy aspects of equitable access to resources is continued today by the Center's Environment, Vulnerability and Governance concentration, led by Jefferson Fox, a co-organiser of the meeting and a contributor to this volume.

Place-based understanding makes an important contribution to sustainability science. Hawai'i is a logical place in which to have hosted this dialogue. Indigenous Hawaiian land management practices are rooted in the *ahupua'a* – the watershed comprised of the mountaintop to the reef's edge. This volume includes valuable

examples from Oʻahu, Kauaʻi and the Island of Hawaiʻi as well as Micronesia, American Samoa, Thailand, the Philippines, and Timor Leste, Xishuangbanna, Yunnan, Japan and Guatemala and Brazil in Latin America. The East-West Center is committed to continued partnerships with colleagues and institutions in the Asia Pacific, the US and beyond in furthering the frontiers of sustainability science.

Nancy D. Lewis
Director, Research Programme
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PREFACE

Globally, we must confront our inability to meet the demands of unchecked population growth, rapid depletion of natural resources, increasing energy needs, and the world-wide deterioration of aquatic and terrestrial ecosystems. In short, the current behaviour of humans on this planet is not sustainable.

In August of 2006, the University of Hawai'i at Mānoa (UHM) signed a Memorandum of Understanding with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA). The goal of the UHM-SEARCA initiative was to synthesise a third wave in sustainability science that goes beyond the nature of interactions in order to facilitate policy analysis. The resulting "International Conference on Sustainability Science for Watershed Landscapes," held on November 13-14, 2007, was a product of that collaboration and with the East-West Center. One of the major accomplishments of that conference is this reference volume on methods and applications in both Hawai'i and Asia.

In 2008, a Mānoa Ad Hoc Committee of Faculty and Administrators proposed the organisation of an Institute of Sustainability Science, Technology and Policy. The mission they articulated was to apply the knowledge and talents of the University to the practical problems that our society faces in supplying ourselves with the resources of energy, water, food that a growing population requires from a diminishing resource base. Specifically, they suggested that the Institute would build on the vision of sustainability science, a transdisciplinary method of organising research to deliver meaningful contributions to critical issues of resource management and rigorous policy analysis.

With this effort the University of Hawai'i joins many other universities in North America and Asia in leading the efforts to take us beyond sustainability. After all, it will not be enough to just sustain the current situation. Sustainability science offers a way of organising research to deliver practical solutions based on integrated and scientifically sound research.

In closing, I both congratulate and thank the authors of the ensuing chapters for their efforts to stimulate the sustainability science movement and facilitate further collaboration between East and West.

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United by a common goal to lay the foundations of policy analysis in the sustainability science arena, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), University of Hawai'i Mānoa (UHM), and East-West Center (EWC) agreed to support an international conference on "Sustainability Science for Watershed Landscapes" on November 13-14, 2007 in Honolulu, Hawai'i. SEARCA and UHM began planning the conference in August 2006; when the two institutions entered into a Memorandum of Understanding on sustainable resource management, risk management, and agricultural development. EWC partnered in the conference organisation and provided logistical support as well as the conference venue.

This volume emerged from the conference discussions and subsequent papers. The chapters herein help to synthesise a "third wave" of sustainability science by integrating traditional interdisciplinary environmental studies with policy science. The challenge lies in the integration of the analysis of natural and human systems with policy science. Abstraction is an essential part of science, and specific simplifications should be motivated by specific policy questions. By focusing on actual resource management and policy questions and interacting with stakeholders, research is organised to inform real-world decision-making. Sustainability science must go beyond the application of scientific knowledge to specific problems and develop new methods for dealing with dynamic, spatial, behavioral, and interactive complications of resource systems under pressure.

Watershed management is a natural challenge for sustainability science. Water is the unifying resource of a watershed. Watershed conservation generates on-site values such as timber and biodiversity and offsite values such as groundwater recharge and the reduction of downstream sedimentation. This volume suggests asking the policy questions up front before designing the research methodology and data protocols. Given the paucity of prototypes, the chapters provide case studies from Asia and the Pacific, including Hawai'i. Some of them serve as a starting point for asking particular policy questions. Others provide the full gambit of resource-systems analysis to specific policy recommendations.

We especially thank the chapter authors, including prominent economists, biologists, hydrologists, foresters, and ecologists who strove to advance sustainability science beyond the description of resource systems towards the posing and solution of particular policy questions. Without their support and enthusiasm, this venture would have failed. Our appreciation also goes to the other conference speakers and session chairs, Barry Usagawa, Bruce Wilcox, Daniel Murdiyarso, Jim Jacobi,

Kensuke Fukushi, Nguyen Hai Nam, Arnulfo Garcia and Nicomedes Briones, whose focus and stimulating discussion promoted the conference objectives.

Special thanks also go to the UHM Sustainability Council and its chair, Mary Tiles, for the funds granted to this project. Jefferson Fox, EWC Senior Fellow, was instrumental in arranging EWC support. Rodel Lasco, Philippines Coordinator for the World Agroforestry Centre (ICRAF), facilitated the ICRAF and Center for International Forestry Research (CIFOR) funding of two of the conference speakers.

This volume could not have been possible but for the concerted effort of the people at UHM, EWC, and SEARCA. Majah-Leah Ravago, UHM Economics Ph.D. student, EWC Degree Fellow, and chapter co-author, was coordinator extraordinaire, assisting the editors and facilitating communications between all parties involved. UHM Water Resources Research Center Director James Moncur and his stellar staff, Susan Yokouchi and Barbara Guieb, provided hassle-free handling of the direct costs for the conference. June Kuramoto, assisted by Arlene Hamasaki, ably accomplished administration and other logistics handled by EWC. Kevin Nishimura, from the UHM Economics Department, facilitated the travel logistics for some of the invited speakers. Arnulfo Garcia, former SEARCA Research and Development Department Manager, and his competent staff, Nyhria Rogel and Ruby Johnson, handled project management. Lily Tallafer also helped in various stages of the project. The Knowledge Management Department, headed by Maria Celeste Cadiz, together with her staff Lorna Calumpang and Bernadette Joven, helped polish the manuscript. Jane Kirton and Chris Wada also helped with the final copyediting of several chapters.

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