

The Evolution of Sustainability Science: Ideas and Practice

Nancy Dickson

reporting on work led by William Clark and Robert Kates

Sustainability Science Program

Kennedy School of Government, Harvard University

<http://hks.harvard.edu/mrcbg/sustsci>

nancy_dickson@harvard.edu

Presented at

A Science based Approach to Realise the Future We Want for All

Sponsored by

United Nations Educational, Scientific and Cultural Organization

International Science, Technology and Innovation Centre for South-South Cooperation

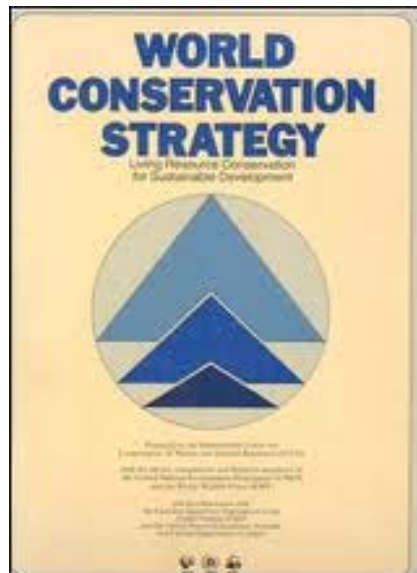
Ministry of Education, Culture, Sports, Science & Technology in Japan

Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia

April 4, 2013

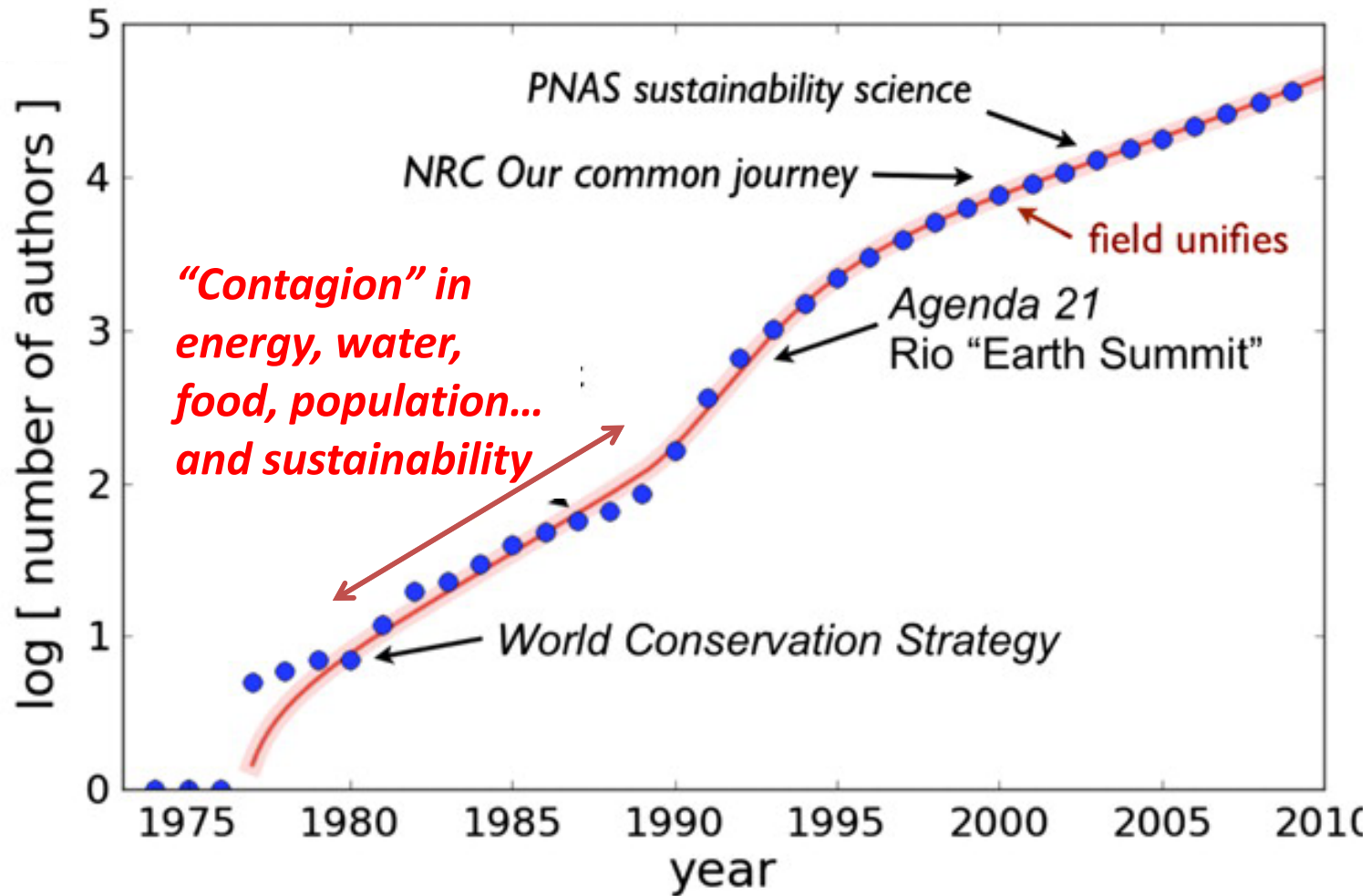


SUSTAINABLE DEVELOPMENT
SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS



Science & Technology for Sustainable Development

S&T for Sustainable Development



37,000 distinct authors of over 20,000 papers from 174 countries

Bettencourt & Kaur, 2011, PNAS

International Conference on Sustainability Science

ICSS 2012: Sustainability Science in Action



Tokyo, Japan: *Inaugural Conference*
1st International Conference on Sustainability Science - 2009

Rome, Italy: *It's Time to Change*
2nd International Conference on Sustainability Science - 2010

Tempe, Arizona, USA: *Sustainability Science in Action*
3rd International Conference on Sustainability Science - 2012



International Conference on Sustainability Science

In-depth engagement with three case studies:



Rebuilding from the Great Eastern Japan Earthquake: The Role of Sustainability Science

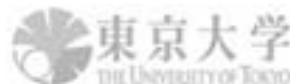


Bioenergy and Sustainability in Africa (COMPETE)



Precautionary Purchasing in San Francisco

Thanks to our institutional and academic partners:



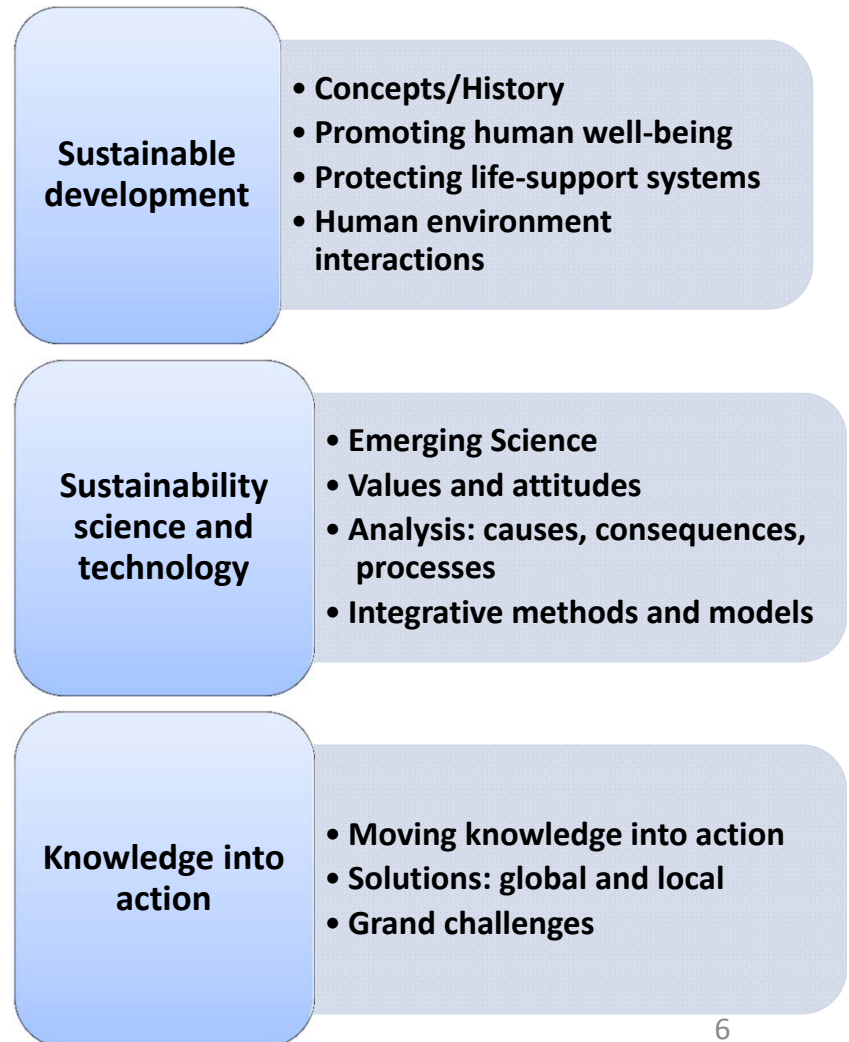
New Sources for Publication of Research

- ***Sustainability Science***
- ***Ecology & Society***
- ***Environment Science & Policy for Sustainable Development***
- ***Annual Review of Environment and Resources***
- ***GEC: Human and policy dimensions***
- ***PNAS: Proceedings of the National Academy of Sciences***
- ***Sustainability Science: Practice and Policy***



Readings in Sustainability Science and Technology

- **Electronic Reader**
- **Advanced undergraduates, graduate students**
- **Choose from 90 readings**
- **Extensive introductions**
- **Readily available in developing countries**
- **Easily updated**
- **Available from:**
- **<http://tinyurl.com/sustsci-reader>**



Sustainability Science today...

- *An emerging field* of ‘use-inspired’ research, like ‘agricultural’ and ‘health’ science before it;
- *Defined* by the practical problems it addresses, specifically the problems of sustainability;
- *Conducted* by drawing from and integrating research from natural, social, medical and engineering sciences;
- *Linking knowledge with action* through the design and implementation of improved practices, technologies and policies.

Findings and Challenges

1. What's the problem?
2. What kind of system are we investigating?
3. What kind of institutions are needed to manage such systems?
4. What is the role of science in supporting such management?

1) What's the problem?

- Formalizing Brundtland's "meet the needs...":

$$W = f(C_i, I, K)$$

- W is 'human well-being' (intra- and inter-generational)
- C_i are 'Capital assets' (from which services flow)
 - C_m is 'manufactured capital' (factories, homes, roads)
 - C_h is 'human capital' (population, health, education)
 - C_n is 'natural capital' (ecosystems and their services)
- I is 'Institutions' (laws, rules; norms, expectations)
- K is 'knowledge' (scientific and practical)
- **Challenge:**
 - Measure, evaluate sustainability of "alternative worlds"

2) What kind of system is $f(C_i, I, K)$?

- Complex
 - Components are interdependent, multi-scalar
- Adaptive
 - Local success selected for replication, scale-up
- Non-linear
 - Discontinuous, multi-equilibria, path dependent
- **Challenge:**
 - Design of interventions that advance “transitions toward sustainability” in such CAS

3) What kinds of institutions best manage such systems?

- No panaceas
 - Need *fit* to specific contexts
- Multi-level (polycentric) architecture
 - Local experiments + global facilitation
- Differentiated flexibility
 - Stable incentives + adaptive management
- **Challenges:**
 - Monitoring systems for useful feedback
 - Performance evaluation of alternative designs

4) What is the role for science?

- Not “from science to policy...”
 - Rather “linking knowledge with action”
- “Knowledge” (not just science)
 - Scientific, local experiential, practical (skills)
- “Linking” (not just transfer/ communication)
 - Collaborative production required for influence
- “Action” (not just policy)
 - Much change in policy, little in action... 40 yrs deeper
- **Challenge:**
 - Provide support for political decision / negotiation
 - The ability to forecast whether goals of SD are likely to be advanced by specific interventions

Summary Challenges for Sustainability Science

- Measure and evaluate the sustainability of “alternative worlds,” past and future
- Design interventions that advance “transitions toward sustainability” in complex adaptive systems
- Create monitoring systems for useful feedback
- Conduct performance evaluations of alternative institutional arrangements
- Provide forecasts for political decision/negotiation
- Ask how we would need to transform our work to “Realise the Future We Want for All”