



I had planned a different talk than I will give today because Yasunari-san reminded me in a recent email that in this conference I must talk about the non-governmental organization I work for, especially our work on research-driven capacity building. I have therefore cobbled together a story about capacity building in the context of sustainability in the hope that a mix of my perspectives on sustainability and my work in START might be of interest to you.

Acknowledgements (incomplete!)

- Robert Kates/Harvard U.
- Leonard Berry/FAU
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- Many friends and colleagues in the START Family
- ...

I have been a bench scientist, but over the past several decades I have been involved in development, implementation and management of global program at the interface of research and development. Consequently, I can not really claim that the thoughts I share with you today are entirely original; rather, I must acknowledge many friends, colleagues and mentors, including those listed here. My task has also been made easier because over the past two days, many presenters at this symposium have made references to the things I may cover in my rambling chat with you today.

Inspiration for this presentation

- Challenge to science/scientists to support sustainability efforts
- Challenge of capacity building as an essential imperative to meet sustainability goals
- Faith in young people who are the custodians of the future



I draw my inspiration for today's presentation from these two challenges and an article of faith, specifically

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- , and
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I will draw upon the scientific and societal issues related presentations preceding this talk; note that issues of transformative change were touched on by Prof. Lee in his presentation on visioneering. I will very briefly visit the science for sustainability context with respect to the developing world, and consider the needs and framework for sustained capacity building, drawing upon on-ground experiences of START (global change SysTem

for Analysis, Research and Training). It is worth noting here that START is tagged as an essential component of the ICSU initiative on sustainability.

Take home messages

- Urgent **need for transformative change and leadership**
- **Capacity building** for sustainable development is an essential imperative



In case you need to tune out till lunch, then here are the two take home messages that I wish you to take from my presentation

















Adapted from Conditions for Survival

Major Impacts and Consequences

:

+ High variability at seasonal, interannual and decadal scales

INTERNATIONAL
S T A R T
SECRETARIAT

	"The Lungs of the Earth" destroyed by human activities	
	Loss of biodiversity accelerated	
	Water resources disappearing from the Earth	
	Well-fed countries and starving countries	
	Fossil fuels heading towards depletion	
	Rapid increase in energy consumption	
	Record-breaking droughts hitting grain-growing regions	
	Rapid increase in "climate refugees" in developing countries	

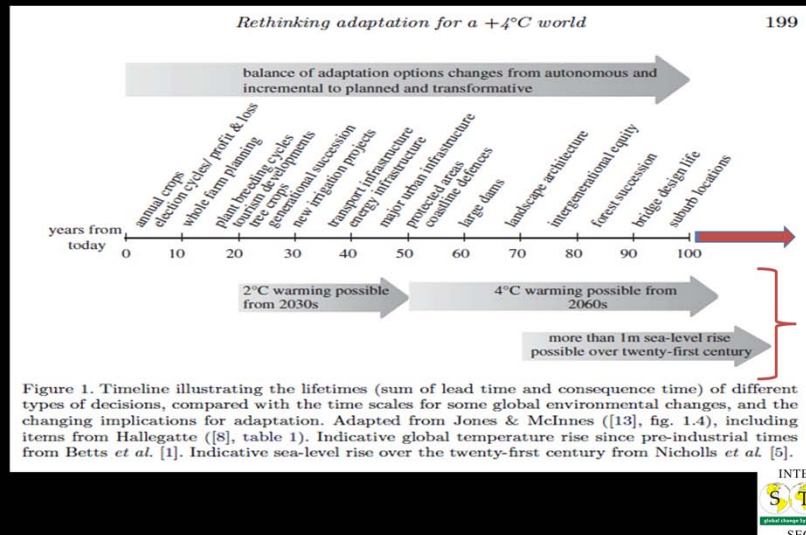
We have acknowledged that Global Change (GC) is occurring at a time of enormous and growing global inequities in income, wealth, services, energy access, and achievement of basic needs and rights

This slide, adapted from an synthesis on pathway to a green lifestyle, report titled Conditions of Survival (Ashai Glass Foundation, Japan) acknowledges that GC is intricately tied to questions of economic, social and human development, power and politics, resource use and management, and rights and responsibilities, i.e., about issues of relevance to the ICSU's Earth System Sustainability Initiative. Clearly, GC and sustainability nexus is a perfect candidate for academic scholarship

and applications at many scales from local to global.

The Game has Shifted!

We must address issues with decision lifetimes spanning seasons to centuries



We also note that over the recent two decades, **THE GAME HAS SHIFTED!** With anticipated future changes wrought by human actions accelerating climate change toward a much warmer world than has been experienced in human history, we now must address issues with decision lifetimes spanning seasons to several centuries. Our socio-economic and political structures and our mindsets are in general not yet robust enough to do reasonable justice to this urgent challenge. We need to learn more about the ramifications of GC and trade-offs that must be made to manage the risks and opportunities that will arise from anticipated trajectory of future state of the complex coupled human-natural system.

Sustainability Science

- **The ideas of sustainability science are two centuries old**
Focus on Unity of Nature
- **The practice is but a decade “young”!**
 - Fundamental research on use-directed problems
 - Nurture of the next generations of sustainability scientists
 - Moving knowledge into action



It is worth reminding ourselves that the ideas of sustainability science are at least two centuries old; the practice is but a decade. I want to begin with Alexander von Humboldt and the Unity of Nature, and go on to briefly discuss three major tasks of sustainability science: (i) Fundamental research on use-directed problems; (ii) Nurture of the next generations of sustainability scientists, and (iii) Moving knowledge into action.

Ideas of Sustainability Science 1799-1999

- Humboldt *Kosmos* (1799-1859)
- Marsh *Man and Nature* (1865)
- Vernadsky “biosphere and noosphere” (1940s)
- Bariloche *World Systems Model* (1970s)
- IUCN *World Conservation Strategy* (1980)
- Schellnhuber & Wenzel *Earth System Analysis : Integrating Science for Sustainability* (1998)
- National Academy of Sciences *Our Common Journey: A Transition Toward Sustainability* (1999)



In this slide originally prepared by Bob Kates, I have selected some of the major ideas that contributed to the development of sustainability science from a much larger set, beginning with Alexander von Humboldt’s epic journey to South America, and publication of the *Kosmos*, followed by George Perkins Marsh identifying the impacts of people on nature, and Vladimir Vernadsky’s integrating the biosphere and human cognition. The Bariloche Argentinian group created its own world systems model as a Latin American answer to *Limits to Growth*. The International Union for the Conservation of Nature brought together environment and development that led to the World Commission on Environment and Development. And then more recently the earth system science community sought a science for sustainability and all these ideas cumulated in the U.S. National Academy of Sciences report of *Our Common Journey* and its specific call for a sustainability science.

Alexander von Humboldt's Dream

In a few hours we sail round Cape Finisterre. I shall collect plants and fossils and make astronomic observations. But that's not the main purpose of my expedition—I shall try to find out how the forces of nature interact upon one another and how the geographic environment influences plant and animal life, In other words, I must find out about the unity of nature.



Let me elaborate on the first of these ideas beginning with Humboldt's dream. Humboldt, a German geographer 29 years old, sets out his dream in 1799 in a letter to friends as he awaits his sailing from Spain to Venezuela and the beginning of his five year exploration of the Orinoco river and the Andes mountains. He describes his dream as follows: **In a few hours we sail round Cape Finisterre. I shall collect plants and fossils and make astronomic observations. But that's not the main purpose of my expedition—I shall try to find out how the forces of nature interact upon one another and how the geographic environment influences plant and animal life, In other words, I must find out about the unity of nature.** He would pursue the dream until the final posthumous publication of Volume 5 of the *Kosmos* in 1862. But his dream was not to be shared widely, for by then the growing community of academia had discovered another more powerful approach to understanding nature, but not to understanding its unity. To pursue this new approach of reductionism, specialization increased, disciplines were born, and graduate degrees were

invented.

Broad agreement that sustainability science should be: essentially integrative, bridging...

- the natural, social, and engineering sciences;
- the communities engaged in promoting environmental conservation, human health, and economic development;
- multiple sectors of human activity;
- geographic and temporal scales;
- the worlds of knowledge and action.



After two centuries of wool gathering as well as fundamental disciplinary research that fostered the industrial revolution, there now is broad consensus that science and technology for sustainability should be essentially integrative, working to integrate the natural, social and engineering sciences; to bridge the communities engaged in promoting environmental conservation, human health, and economic development across the multiple sectors of human activity, across relevant geographic and temporal scales; and bringing together the worlds of knowledge and action.

Sustainability Science Research needs to:

- Overcome the emphasis towards environmental science
- Increase studies to reflect developing country priorities and human well-being
- Move down scale to regional and place-based science
- Use what we already know to move knowledge into action

Nevertheless, indulge me to also be a bit of a critique, singling out four emphases still evident in current effort in regard to sustainability science. There is a clear emphasis in sustainability science towards environmental science. The varied fields of development sciences that include health and human development, economic and social development, governance, and the multitude of technologies that make development possible are still underrepresented.. Despite the encouragement of sustainability science toward regional and place-based studies, many studies seem to address global or continental scale. Finally, and perhaps most important, we need to overcome our normal penchant to do research rather than solve problems and create solutions, and to acknowledge how much we already know about the crucial needs for a sustainability transition.

Sustainability science is regional and place-based

Focused at intermediate scales, where...

- **multiple stresses intersect to degrade human-environment systems;**
- **complexity is comprehensible,**
- **integration is possible,**
- **innovation and solutions take place**
- **significant transitions toward sustainability have already begun.**



Our discussions here this week acknowledge that much of science and technology for sustainability will need to be regional and place-based, focused at intermediate scales where multiple stresses intersect to threaten or degrade human-environment systems. In a sense, sustainability differs in every place as human needs vary, life support systems differ, and hunger and poverty is smaller or larger. For sustainability science, it is at these scales that the complexity of coupled human-environmental systems is more readily comprehensible, where innovation and management happen, and where significant transitions toward sustainability have already begun.

Our focus should essentially be integrative, working to integrate the natural, social and engineering sciences; to bridge the communities engaged in promoting environmental conservation, human health, and economic development across the multiple sectors of human activity, across relevant geographic and temporal scales; and bringing together the worlds of knowledge and action. It is at these scales that the complexity of coupled human-environmental systems is more readily comprehensible, where innovation and management happen, and where significant transitions toward sustainability are possible.