SCIENCE AND SUSTAINABILITY

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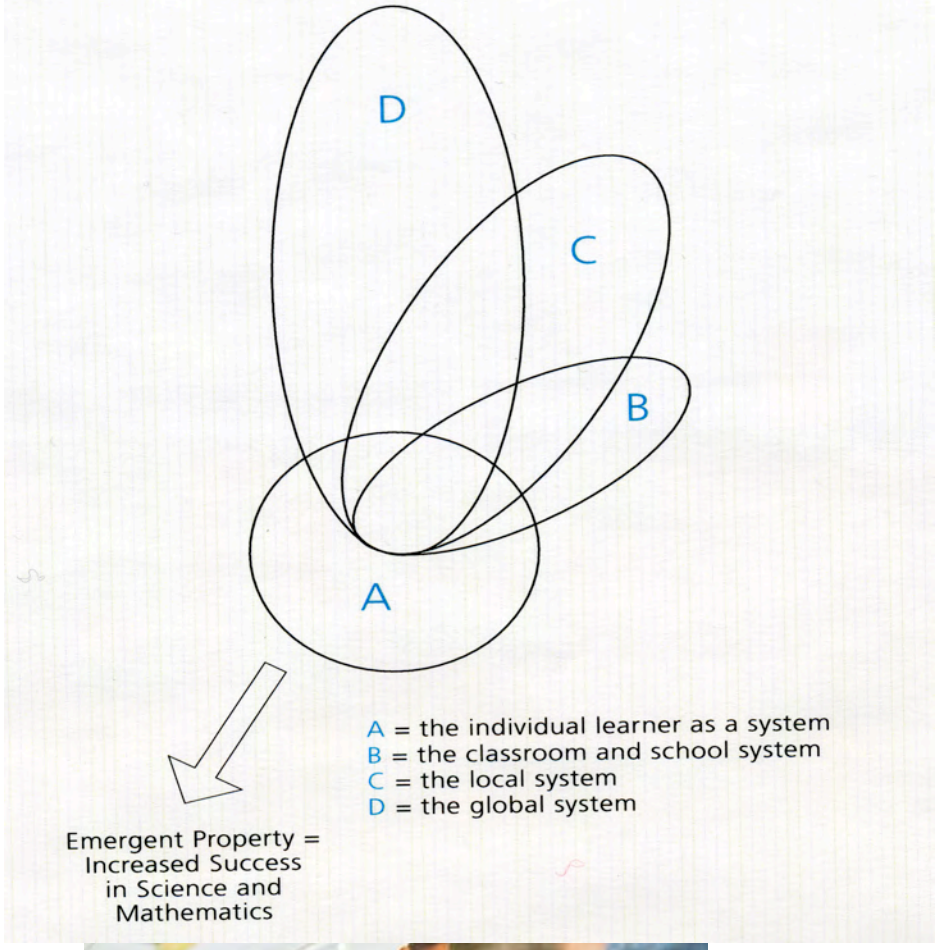
SYSTEM INTERACTIONS



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THE DESIRED OUTCOMES

- Increased understanding of, interest in and affinity for the utility of science.
- Increased awareness of the conditions necessary to attain sustainability.
- Associated with these altered behavioral patterns that favour sustainability would be highly desirable.

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THE WILL AND NECESSITY FOR BOTH SCIENCE LITERACY AND EDUCATING FOR SUSTAINABILITY

A. TEACHING AND LEARNING OF SCIENCE - OECD FORUM, ATLAS OF SCIENCE LITERACY (NATIONAL SCIENCE TEACHERS ASSOCIATION), BRIAN GOODWIN.

B. EDUCATING FOR SUSTAINABILITY - INTERNATIONAL SUPPORT, NATIONAL SUPPORT, PROVINCIAL SUPPORT (MECY) & (MESDWG)

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SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT

- LESTER BROWN - WORLDWATCH INSTITUTE
- WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT
- WHAT IS MISSING?
- ECOLITERACY?
- CAPRA (2002): *"THE HIDDEN CONNECTIONS: INTEGRATING THE BIOLOGICAL, COGNITIVE AND SOCIAL DIMENSIONS OF LIFE INTO A SCIENCE OF SUSTAINABILITY"*

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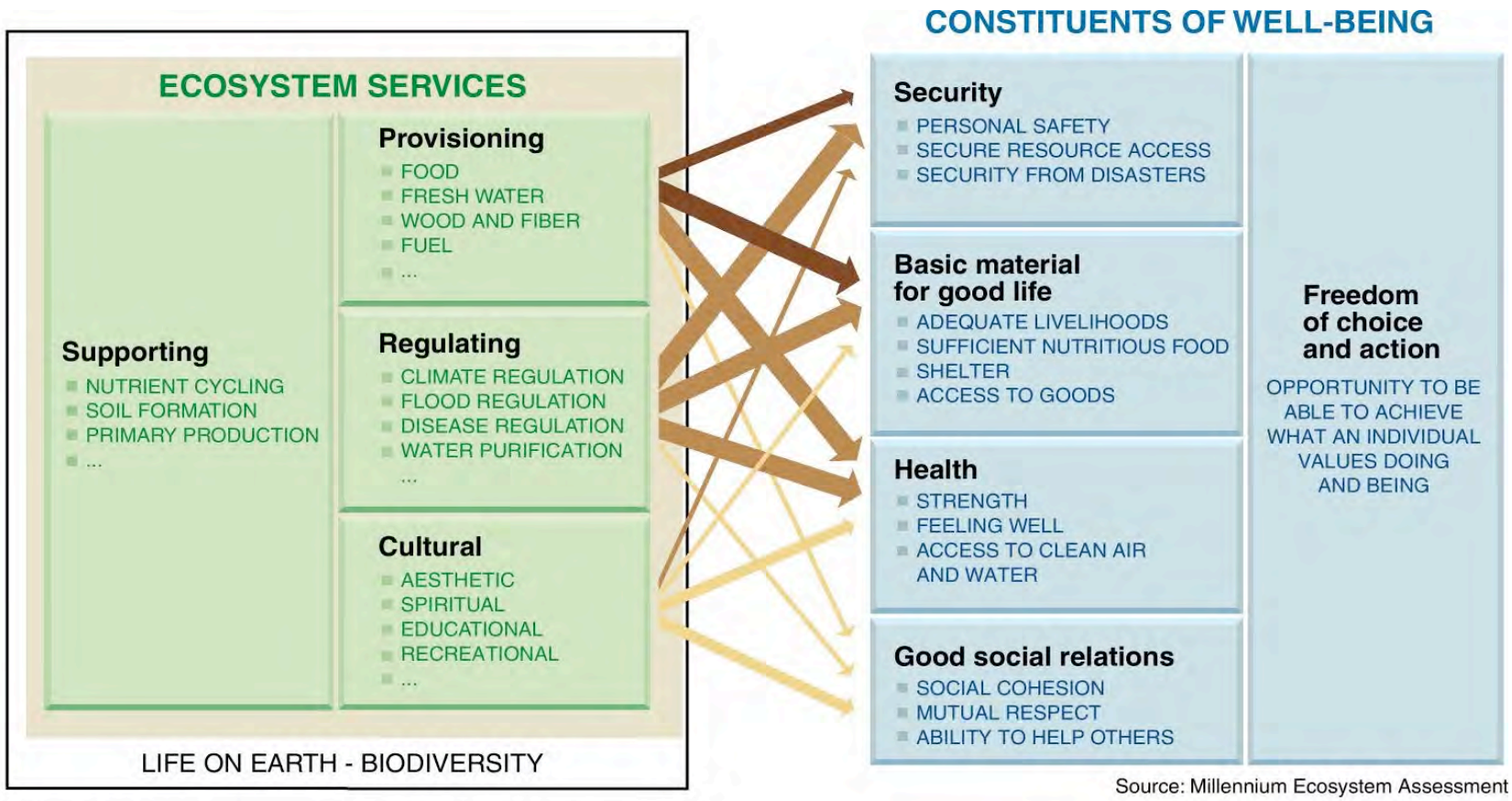

Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

ARROW'S WIDTH
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong

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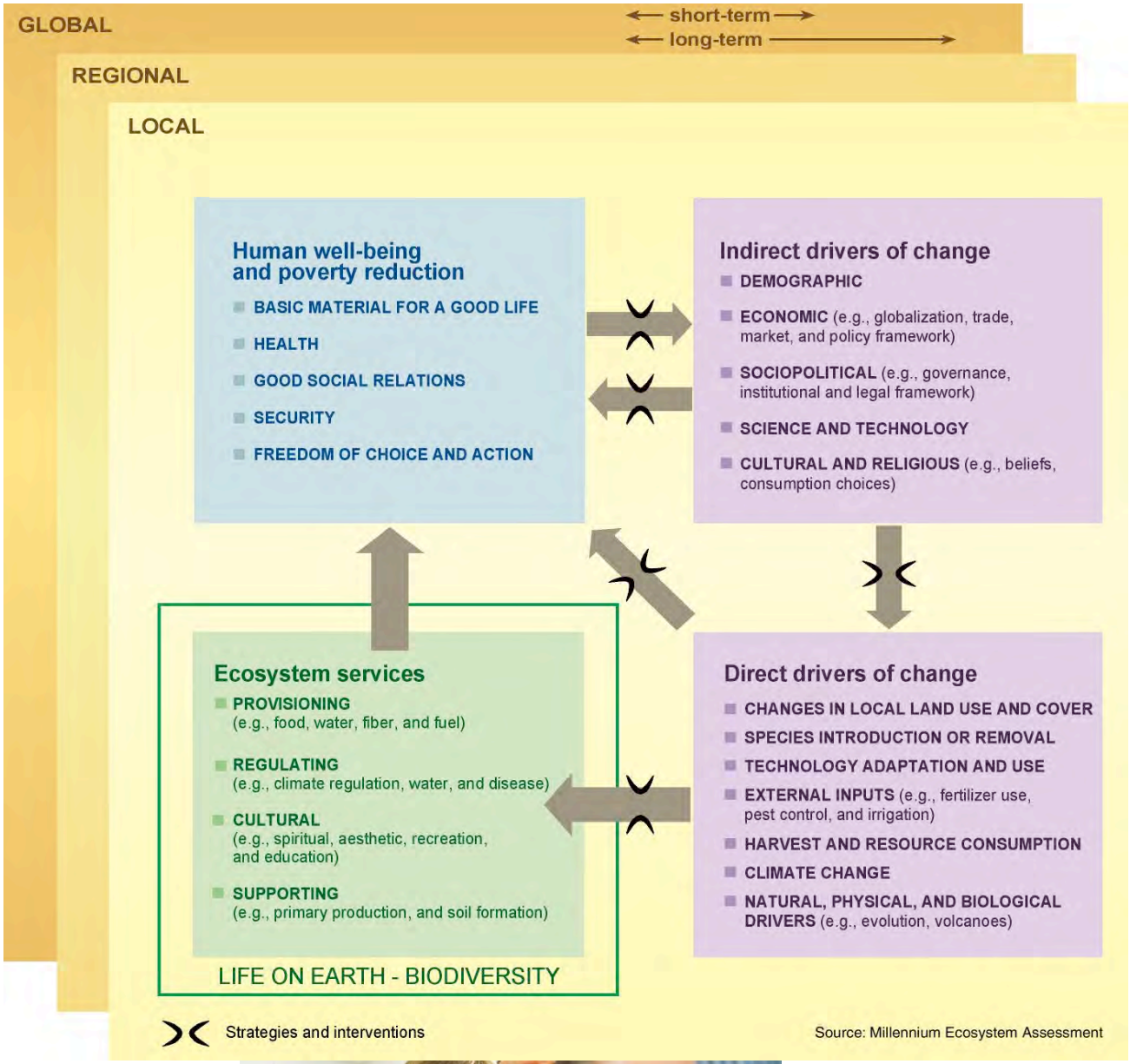

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KOFI ANAN (2001)

“Only by understanding the environment and how it works, can we make the necessary decisions to protect it. Only by valuing all our precious natural and human resources, can we hope to build a sustainable future. The Millennium Ecosystem Assessment is an unprecedented contribution to our global mission for development, sustainability, and peace.”

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Human Health and Well-Being and Social Progress

- Quality Education
- Gender Equality
- Health Promotion
- HIV/AIDS
- Rural Development
- Human Rights
- Indigenous Knowledge
- Peace and Human Security
- Sustainable Urbanization

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Environmental Stewardship

- Water
- Rural Development
- Climate Change
- Biodiversity
- Disaster Reduction

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Economic Growth

- Overcoming Poverty
- Corporate Responsibility
- Sustainable Consumption
- Governance
- Market Economy

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PRINCIPLES OF ECOLOGY - ROOTS OF ECOLITERACY

- **NETWORKS - AT ALL SCALES OF NATURE LIVING SYSTEMS ARE NESTED WITHIN OTHER LIVING SYSTEMS - NETWORKS WITHIN NETWORKS.**
- **CYCLES - NO NET WASTE. CONTINUAL FLOW OF MATTER AND ENERGY NECESSARY. MATTER CYCLES CONTINUALLY THROUGH THE WEB OF LIFE,**
- **SOLAR ENERGY - SOLAR ENERGY, CONVERTED INTO CHEMICAL ENERGY, DRIVES ECOLOGICAL CYCLES.**
- **PARTNERHIP - LIFE DOES NOT SUSTAIN THE PLANET BY "COMBAT", BUT BE COOPERATION, PARTNERSHIP AND NETWORKING.**
- **DIVERSITY - STABILITY AND RESILIENCE DEPENDS ON RICHNESS AND DIVERSITY.**
- **DYNAMIC BALANCE - ESSENTIAL AND DETERMINED BY MULTIPLE FEED-BACK LOOPS SUCH THAT ALL VARIABLES FLUCTUATE AROUND OPTIMAL VALUES.**

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In a sustainable society, nature is not subject to systematically increasing concentrations of substances extracted from the earth's crust.

In a sustainable society, nature is not subject to systematically increasing concentrations of substances produced by society.

In a sustainable society, nature is not subject to systematically increasing degradation by physical means.

In a sustainable society, people are not subject to conditions that systematically undermine their capacity to meet their needs.

The Natural Step, Canada

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RISK FACTORS ASSOCIATED WITH TEACHING SCIENCE IN A SUSTAINABILITY CONTEXT

- Sustainability Issues not viewed as essentials for teaching and learning of Science. (Remember previous commentary of Goodwin)
- Constraints that occur when curriculum outcomes do not require integration with sustainability.
- Lack of "curricular" time when a sustainability context is added as an "extra".
- Availability of entirely suitable resources and time taken to develop resource material.
- Some struggle with the connectedness between science content and sustainability (particularly for inexperienced teachers)

- "Time" - curricular and real time and "Resource Availability" appeared as greatest risk factors.

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SUMMARY OF MEANS (WITH SD) FOR PRE- AND POST-TESTS IN CONTROL AND EXPERIMENTAL SECTIONS OF "WE ARE ALL DOWNSTREAM" (n=111)

AFFINITY FOR SCIENCE		AFFINITY FOR SUSTAINABILITY		KNOWLEDGE OF WATER SYSTEMS		ACTIONS RELATED TO SUSTAINABILITY	
PRE TEST	POST TEST	PRE TEST	POST TEST	PRE TEST	POST TEST	PRE TEST	POST TEST
CONTROL (MEAN VALUES ON SCALE OF 1 - 4)							
3.57	3.39*	3.69	3.46*	0.43	0.56	2.22	2.11*
SD							
0.62	0.83	0.43	0.81	0.26	0.24	0.71	0.83
EXPERIMENTAL (MEAN VALUES ON SCALE OF 1 - 4)							
3.55	3.65*	3.73	3.72*	0.33	0.59	2.23	2.74**
SD							
0.47	0.53	0.58	0.56	0.20	0.21	0.76	0.65

* $P < 0.05$ ** $P < 0.01$

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RESIDUAL QUESTIONS

- **BEGINNING OF THE PIPE? END OF THE PIPE? BOTH ENDS OF THE PIPE?**

- **INTEGRATED EDUCATING FOR SUSTAINABILITY? SEPARATE EDUCATING FOR SUSTAINABILITY?**

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THE URGENCY REMAINS

- "Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel

- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people

- The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals

- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices, that are not currently under way."

MILLENNIUM ECOSYSTEM ASSESSMENT

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