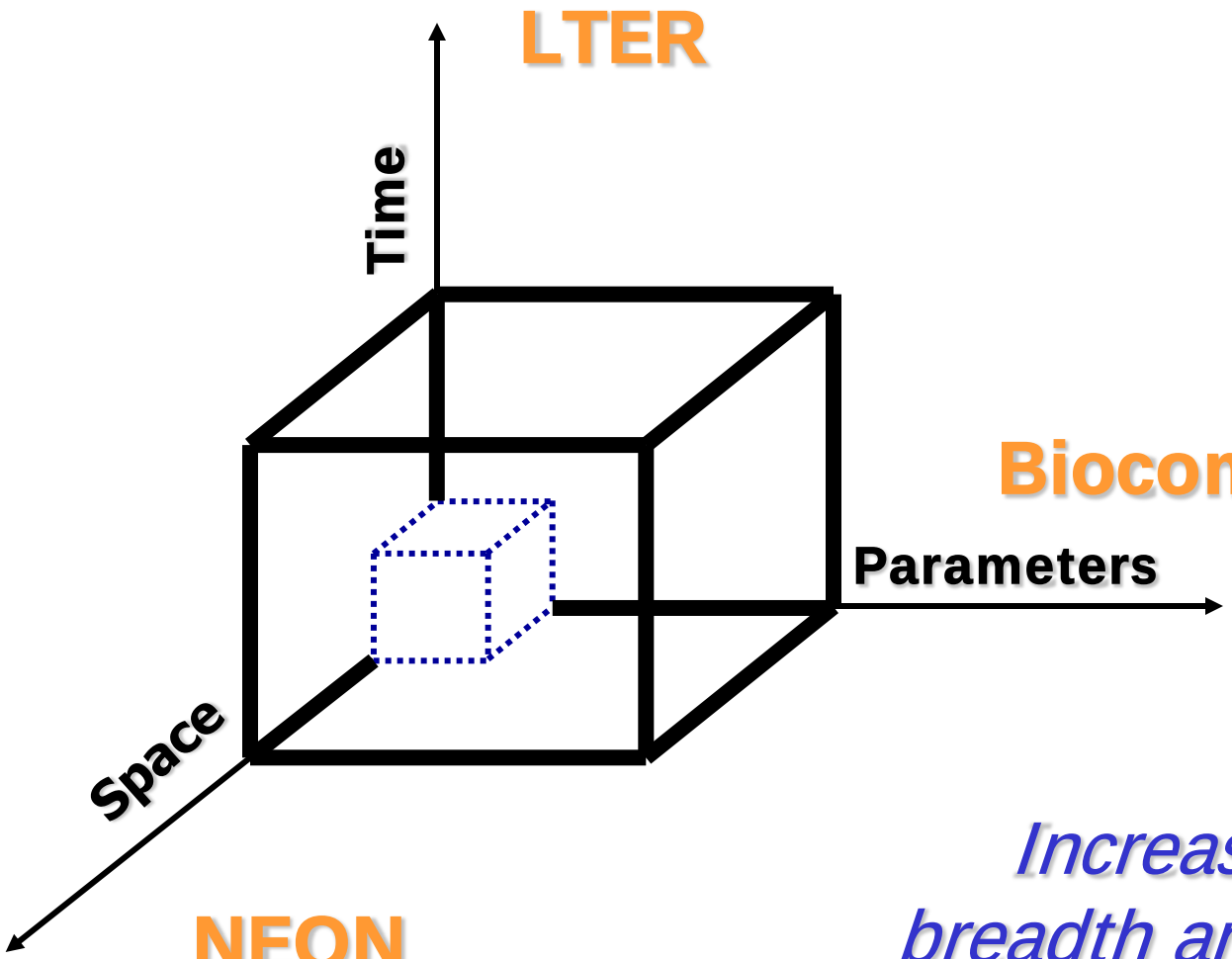
Thinking Outside the "Box"



Increase in breadth and depth of understanding.....

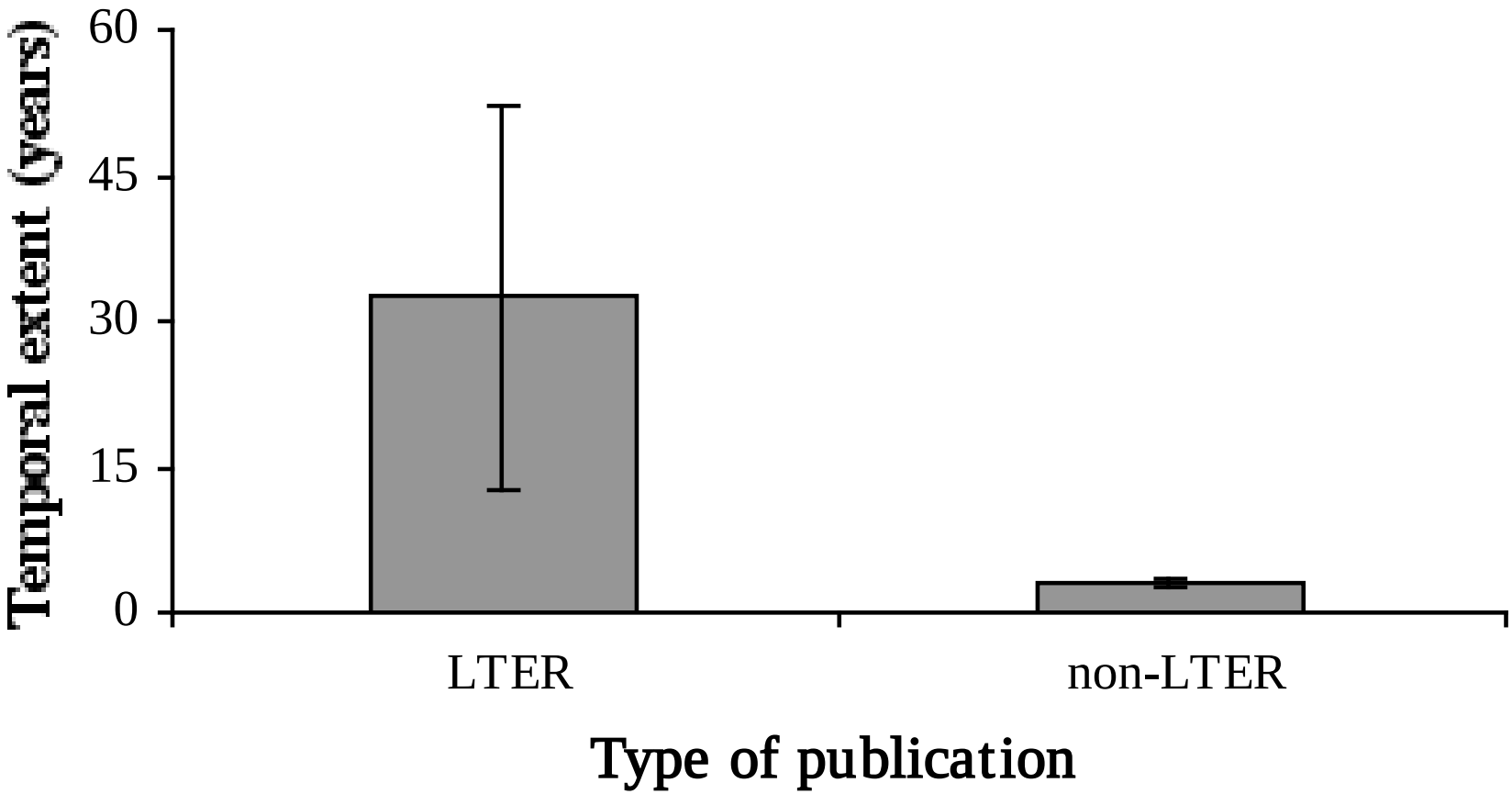


Figure 1. Mean temporal extent of datasets in LTER and non-LTER publications. LTER sites included in this analysis are Cedar Creek, Harvard Forest, and North Temperate Lakes. Vertical bars indicate standard error.

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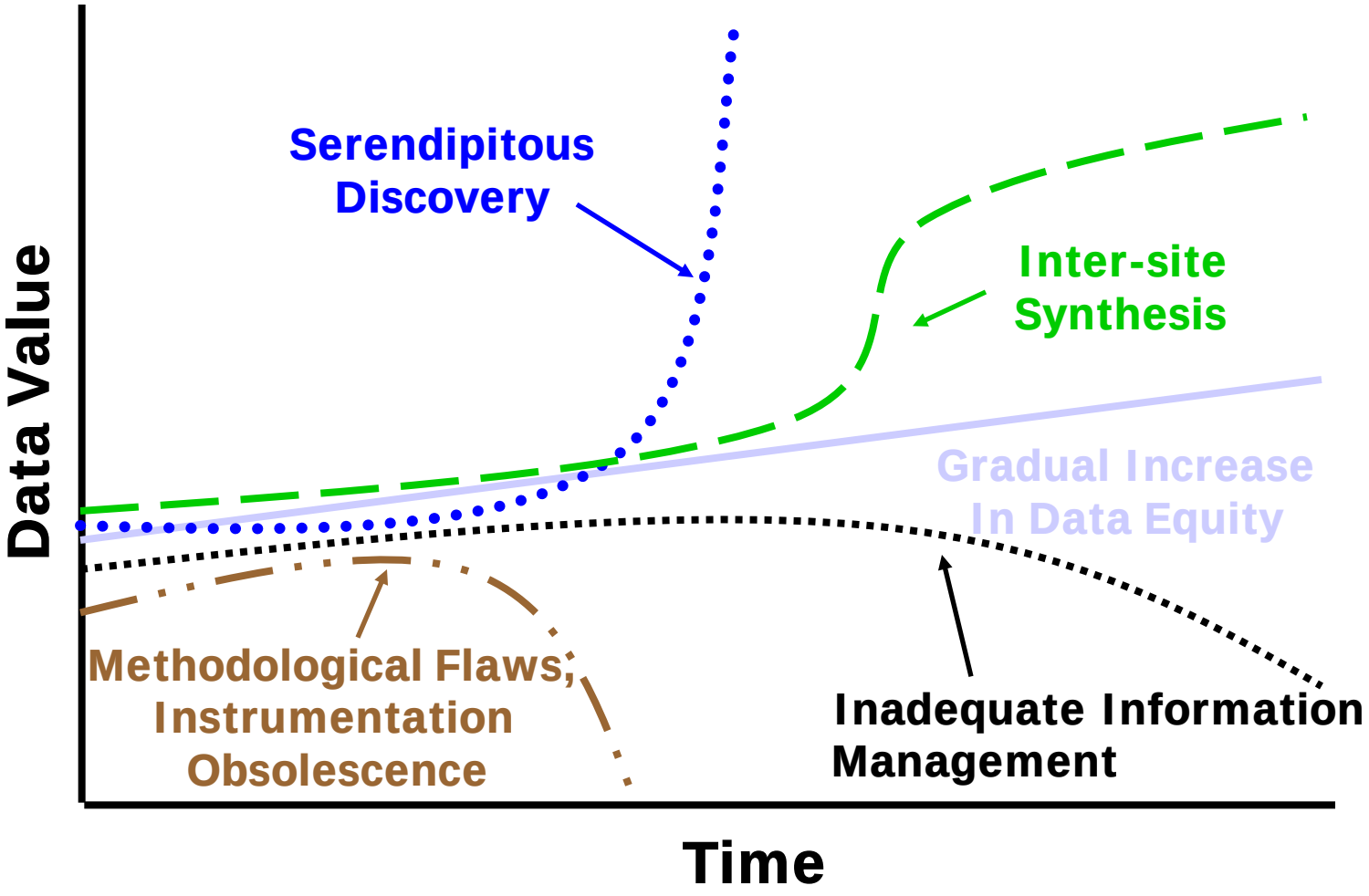
✓ Increasing value of data over time



Variety of Approaches and Foci Across LTERs

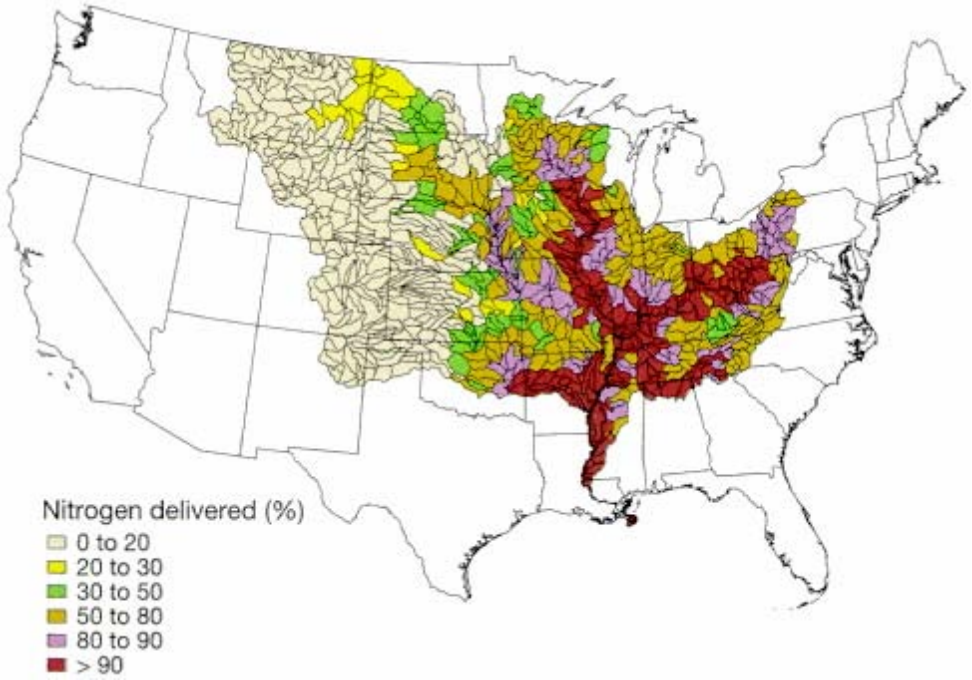
Approaches and Scales:

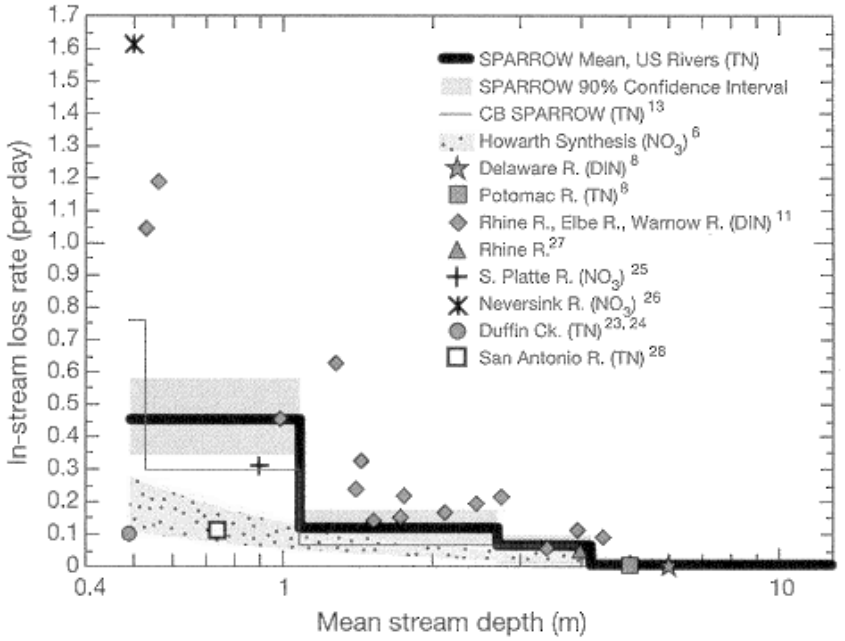
- Plot Level and Stream Reaches
- Catchments
- Whole Watershed
- Regional Scaling

Foci:

- Understanding Specific Processes
- Studying “Hot Spots”
- Assessing the Effects of Human Modifications and
- Incorporating Social Science (humans as system components)
- Predicting Future Scenarios

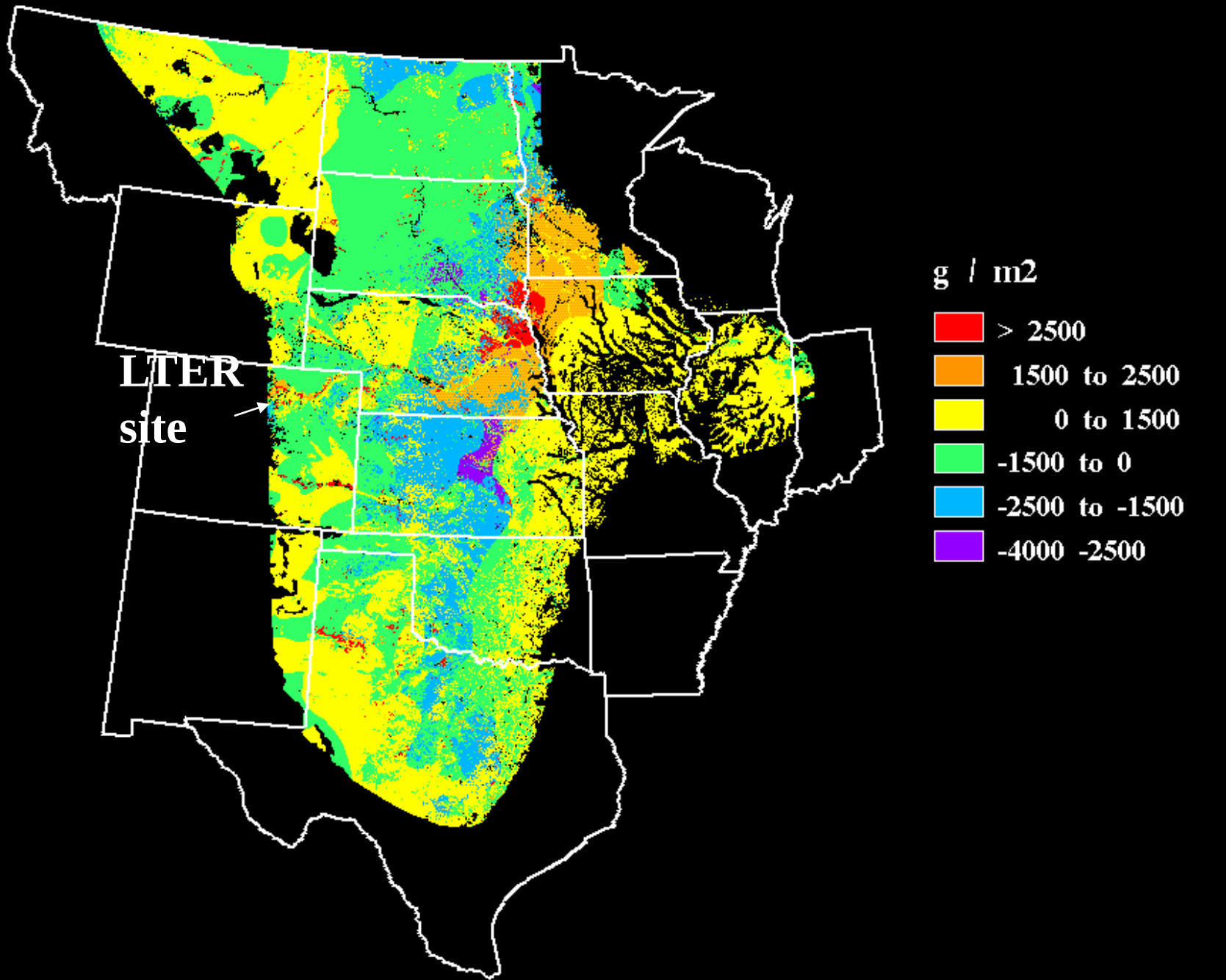
Scaling Up From Understandings Learned in Stream Reach Studies





Alexander et al. 2000
Nature 403:758-761

Soil Carbon Change (1995 - 1900)



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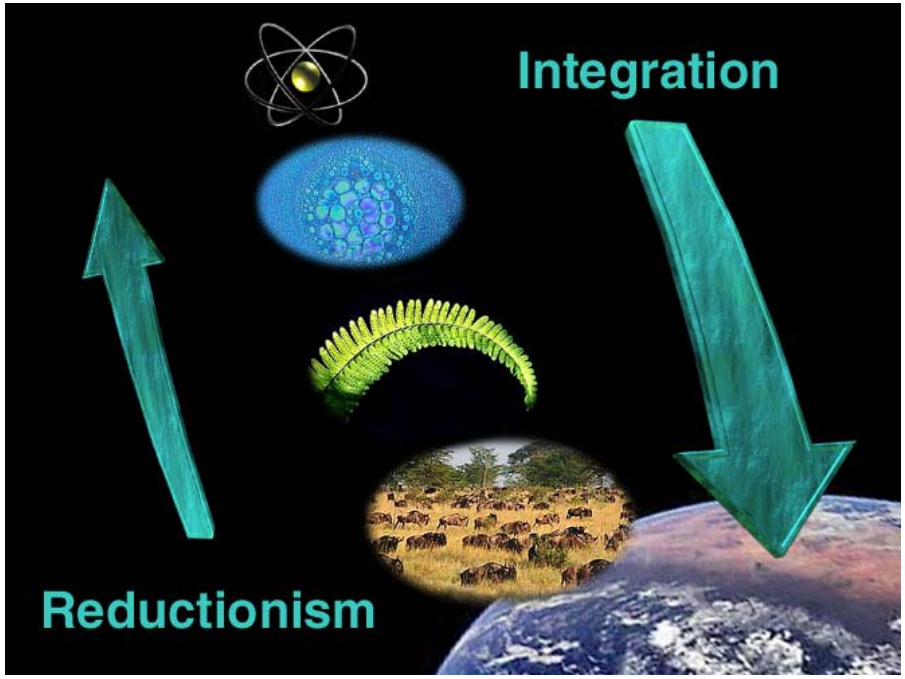
"It is not enough to explore and chronicle the enormous diversity of the world's ecosystems. We must do that—but also reach beyond, to discover the complex chemical, biological, and social interactions in our planet's systems. From these subtle but very sophisticated interactions and interrelationships, we can tease out the principles of sustainability."

Rita Colwell (Director, NSF), 1998



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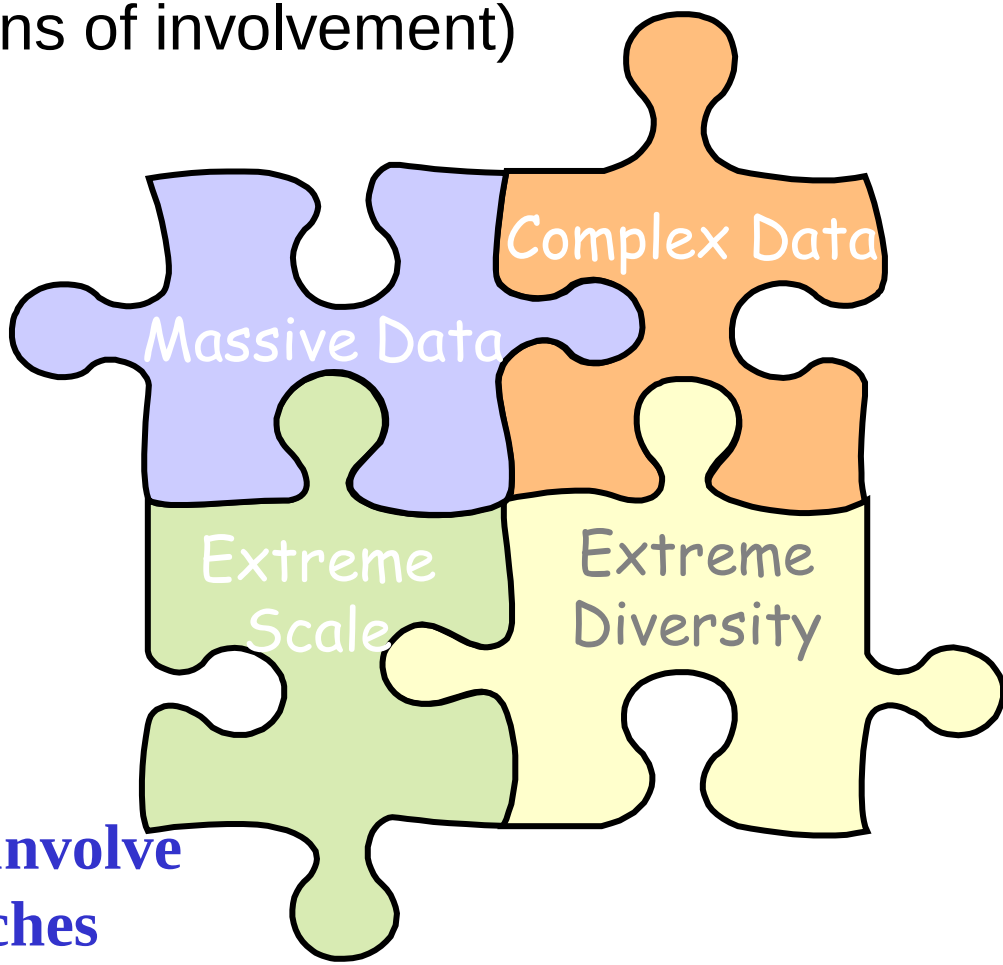
Understanding Biocomplexity
It's Really a "Human Problem"

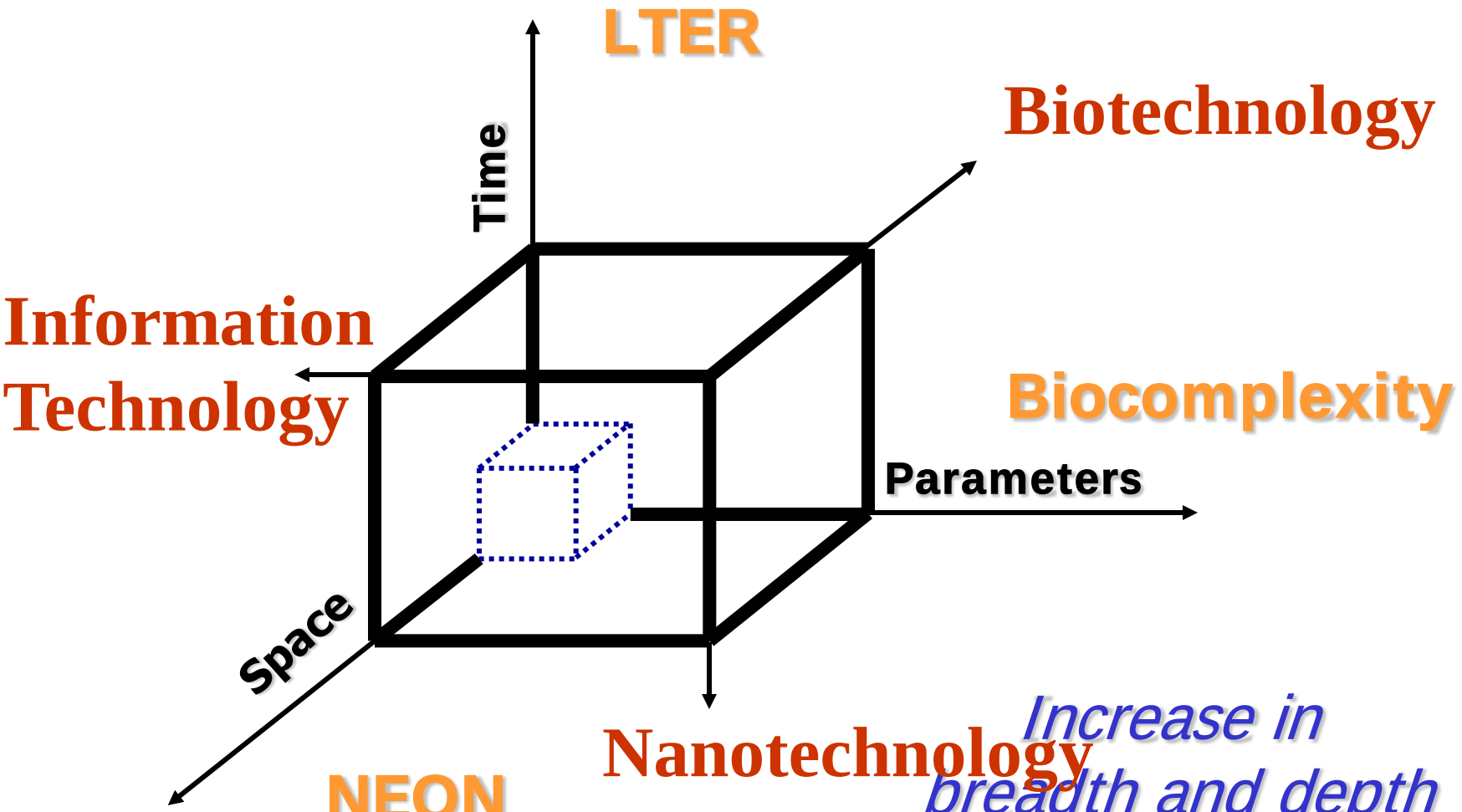
- "Cast of thousands" (varying disciplinary backgrounds, levels of expertise, durations of involvement)
- Many new to data sharing
- Most new to data standardization
- Virtually all new to metadata

… and that's just the data producers!



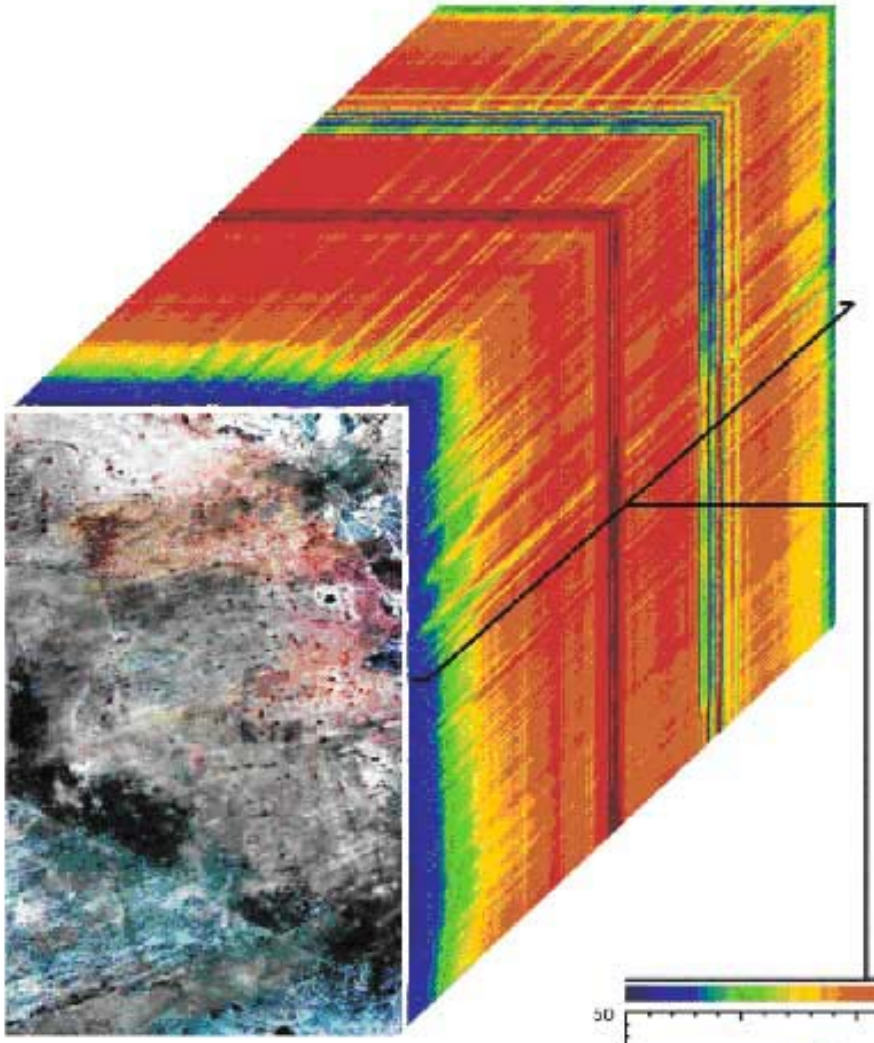
LTER, Biocomplexity, NEON involve interdisciplinary team approaches

Thinking Outside the "Box"



Increase in breadth and depth of understanding.....

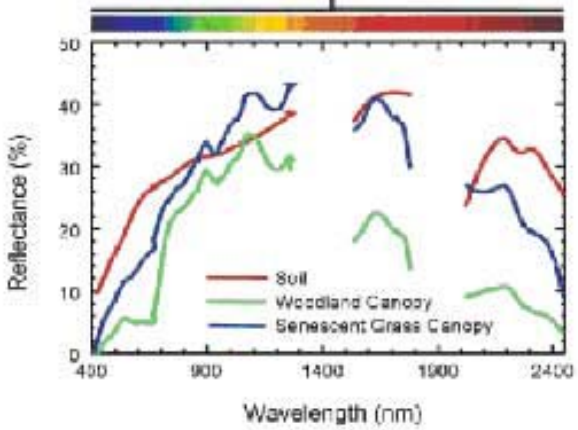
Hyperspectral Cube



Species-level signatures

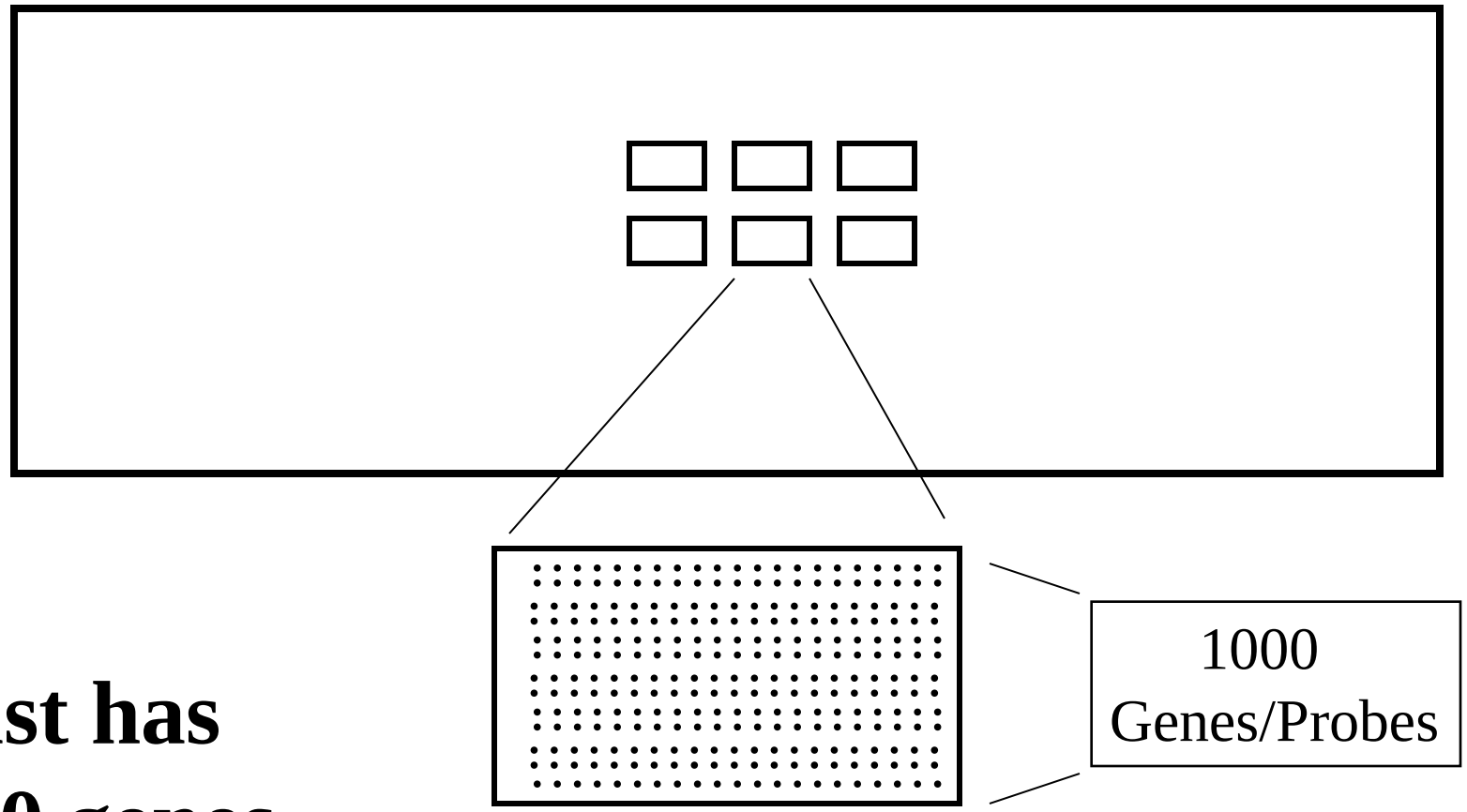
System biochemistry

System physiology

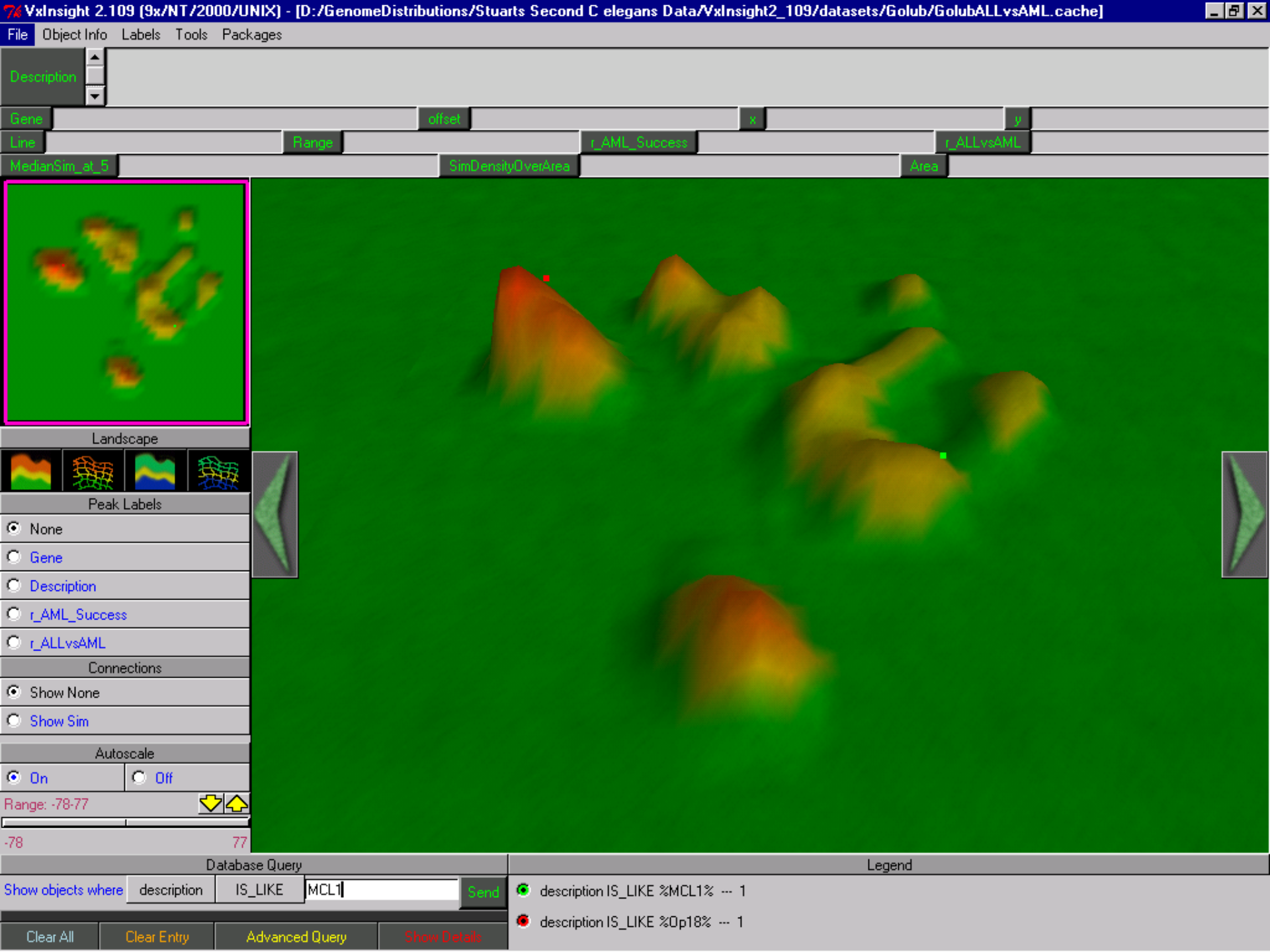


LTER

Slide (75 mm x 25 mm)

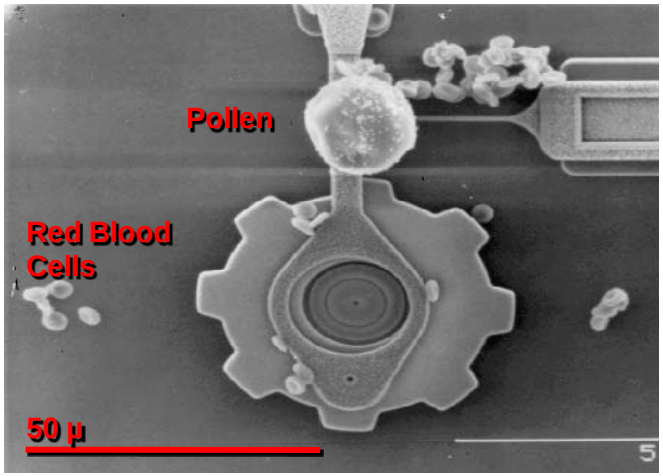


Yeast has 6000 genes

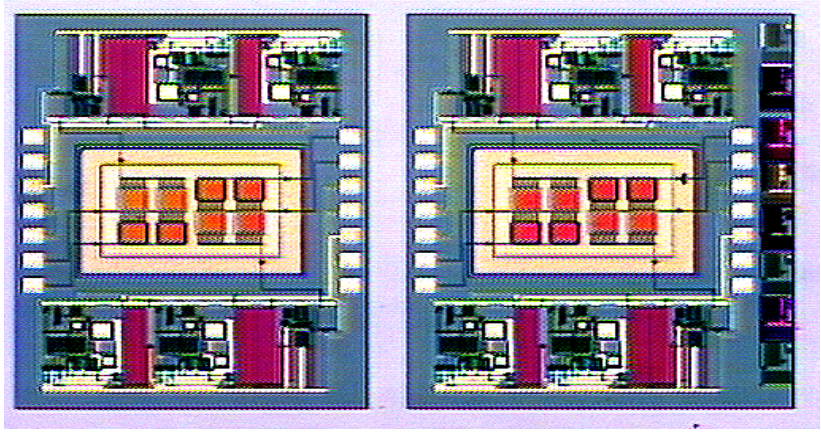

VxInsight 2.109 (9x/NT/2000/UNIX) - [D:/GenomeDistributions/Stuarts Second C elegans Data/VxInsight2_109/datasets/Golub/GolubALLvsAML.cache]
File
Object Info
Labels
Tools
Packages
Description
Gene
offset
x
y
Line
Range
r_AML_Success
r_ALLvsAML
MedianSim_at_5
SimDensityOverArea
Area
Landscape
Peak Labels
None
Gene
Description
r_AML_Success
r_ALLvsAML
Connections
Show None
Show Sim
Autoscale
On
Off
Range: -78-77
-78
77
Database Query
Show objects where
description
IS_LIKE
MCL1
Send
Legend
description IS_LIKE %MCL1% --- 1
description IS_LIKE %Op18% --- 1
Clear All
Clear Entry
Advanced Query
Show Details

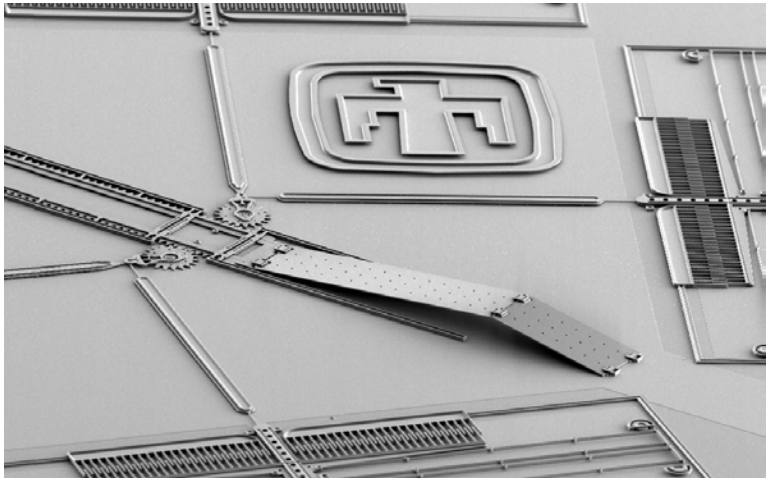
Intelligent Integrated Micromachines:

Keys to "The Next Silicon Revolution"

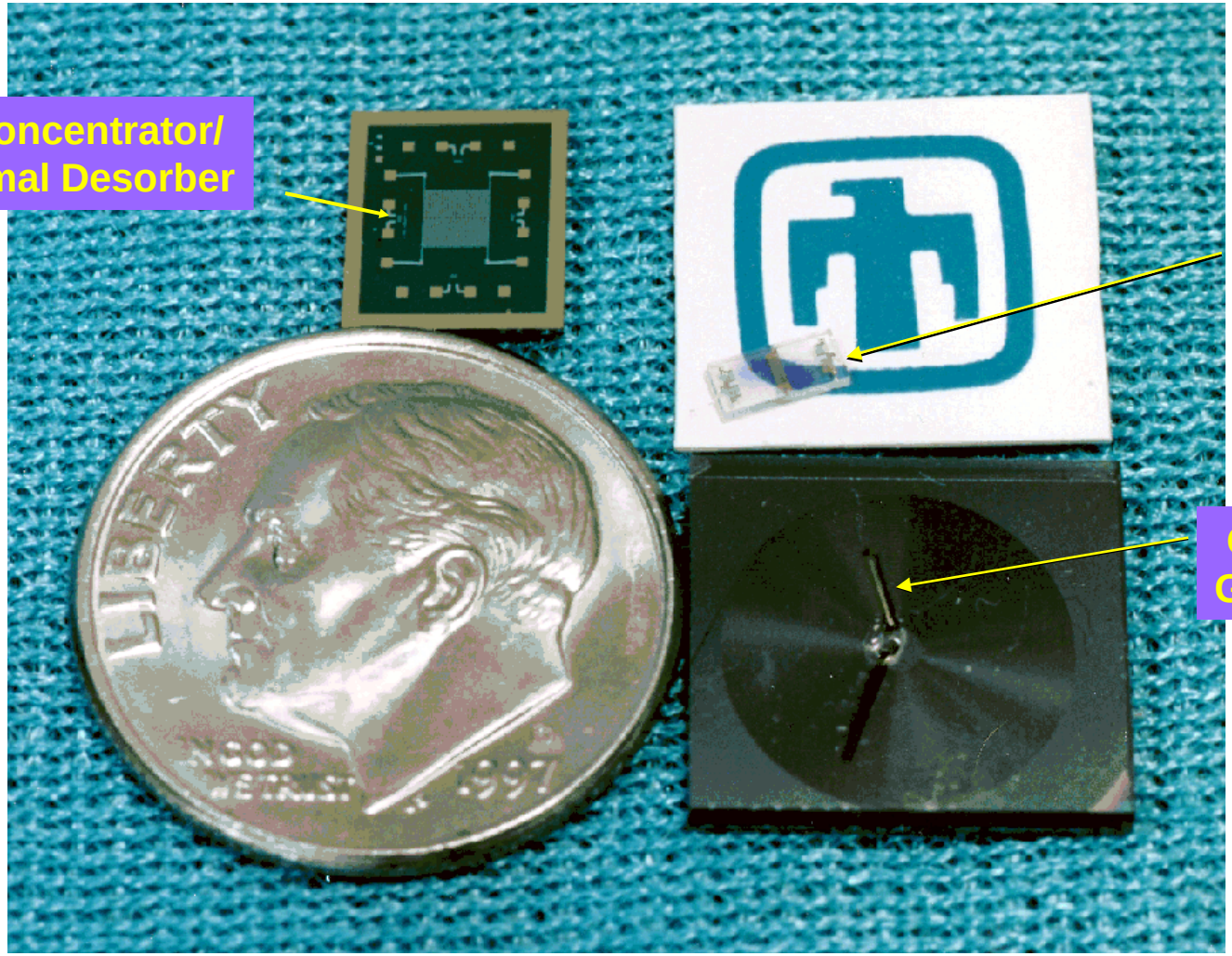


- **Miniature Mechanical Systems With Micron Feature Sizes**
- **Batch Fabricated With No Assembly Required**
- **Exploits Microelectronics Infrastructure**
- **Common Technology Base for Sensors, Actuators, and Electronics**





Sandia's State-of-the-Art Microfabrication Facilities Are Enabling Us to Develop and Fabricate Miniature Components Critical to μChemLab



Instrumenting the Environment

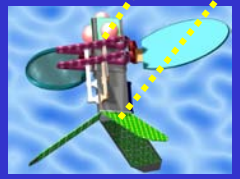
Smart Sensor Web

RF Telemetry
Macro-organisms

Micro-weather
Stations

Sap Flow Sensor
Array

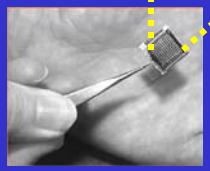
Sensor Clustered
MEMS Insects



Minirhizotron
Array

Multiparameter
Soil Probes

Automated E-tongue



E-nose

'Smart Dust' tagged Insects

The Framework for Environmental Monitoring and Related Research (FEMR): A status report

"Improved ecosystem monitoring through systematic, long-term collaboration among existing programs"

Is our monitoring adequate to track trends in ecosystem sustainability?

"Available data, collected independently by various agencies for different purposes, are often incomparable and insufficient" GAO report on ecosystem management of Federal lands, 1994

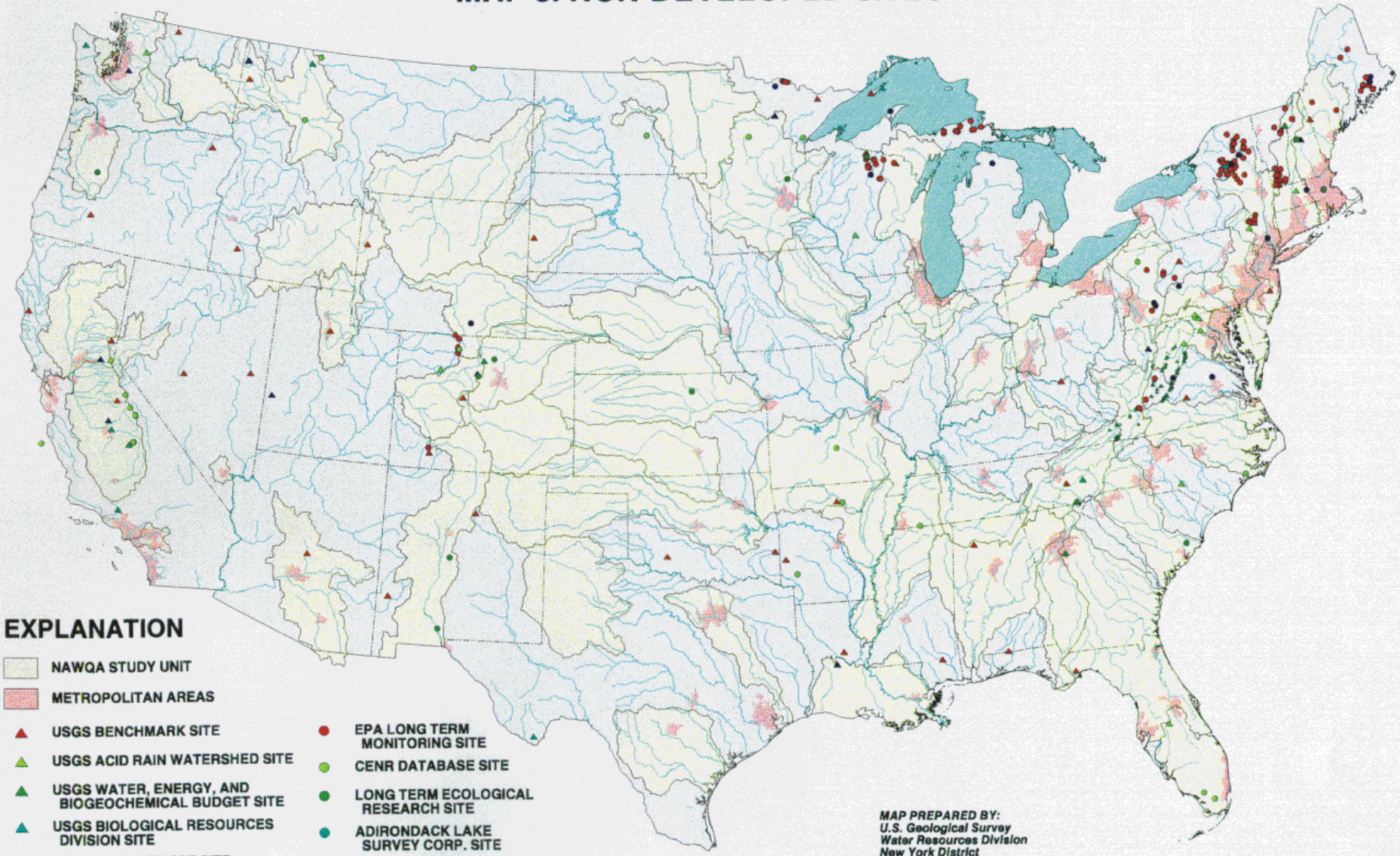
"Piecemeal, intermittent, and short-term monitoring does not provide the information required to distinguish natural from anthropogenically-induced effects" CRTAP, 1992

Possible solution:

To develop a national framework for integration and coordination of environmental monitoring and related research through collaboration and building upon existing networks and programs.

Charge given to the CENR environmental monitoring team, July 1996

ENVIRONMENTAL MONITORING FRAMEWORK
POTENTIAL INDEX AREAS
MAP 3: NON-DEVELOPED SITES



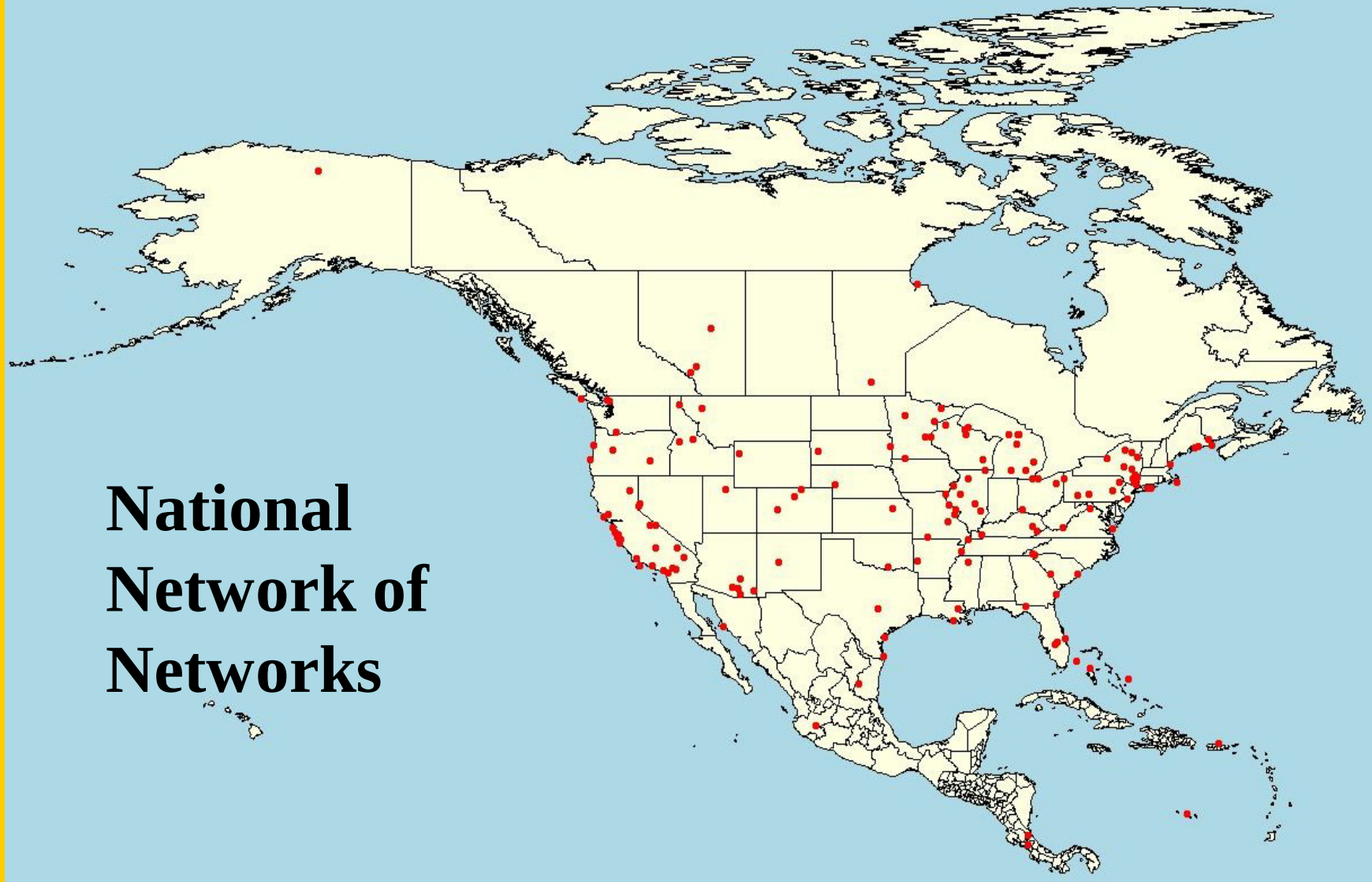
EXPLANATION

- NAWQA STUDY UNIT
- METROPOLITAN AREAS
- USGS BENCHMARK SITE
- USGS ACID RAIN WATERSHED SITE
- USGS WATER, ENERGY, AND BIOGEOCHEMICAL BUDGET SITE
- USGS BIOLOGICAL RESOURCES DIVISION SITE
- US FOREST SERVICE SITE
- NATIONAL PARK ECOSYSTEM MONITORING PROGRAM SITE
- EPA LONG TERM MONITORING SITE
- CENR DATABASE SITE
- LONG TERM ECOLOGICAL RESEARCH SITE
- ADIRONDACK LAKE SURVEY CORP. SITE
- UNIVERSITY SITE
- WESTERN LAKES SITE

MAP PREPARED BY:
U.S. Geological Survey
Water Resources Division
New York District
425 Jordan Road
Troy, NY 12180

PARTNERSHIP for BIODIVERSITY INFORMATICS

The OBFS "Network"



INTERNATIONAL LONG TERM ECOLOGICAL RESEARCH

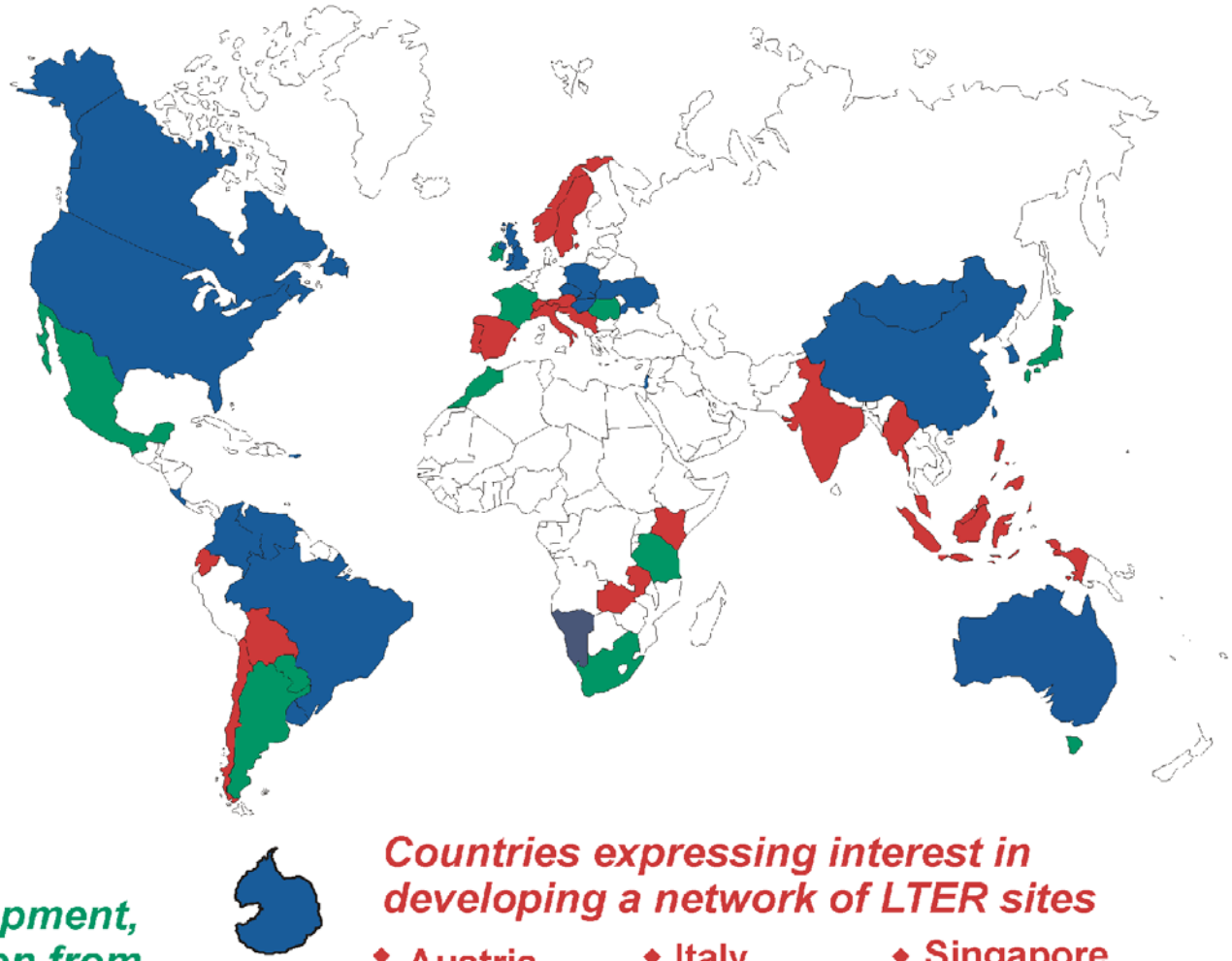
This is about Integrating Efforts to Achieve what we cannot do independently

And Developing and Networking Environmental Observatories for a comprehensive understanding of the environment

The International Long Term Ecological Research Network

Official ILTER Networks

- Australia
- Brazil
- Canada
- China
- China–Taipei
- Colombia
- Costa Rica
- Czech Republic
- Hungary
- Israel
- Mongolia
- Namibia
- Poland
- Slovakia
- South Korea
- Switzerland
- Ukraine
- United Kingdom
- United States
- Uruguay
- Venezuela



ILTER Networks in development, awaiting formal recognition from their governments

- Argentina
- France
- Ireland
- Japan
- Mexico
- Morocco
- Paraguay
- Romania
- South Africa
- Tanzania

Countries expressing interest in developing a network of LTER sites

- Austria
- Bolivia
- Chile
- Croatia
- Ecuador
- India
- Indonesia
- Italy
- Kenya
- Malaysia
- Norway
- Philippines
- Portugal
- Singapore
- Slovenia
- Spain
- Sweden
- Thailand
- Zambia

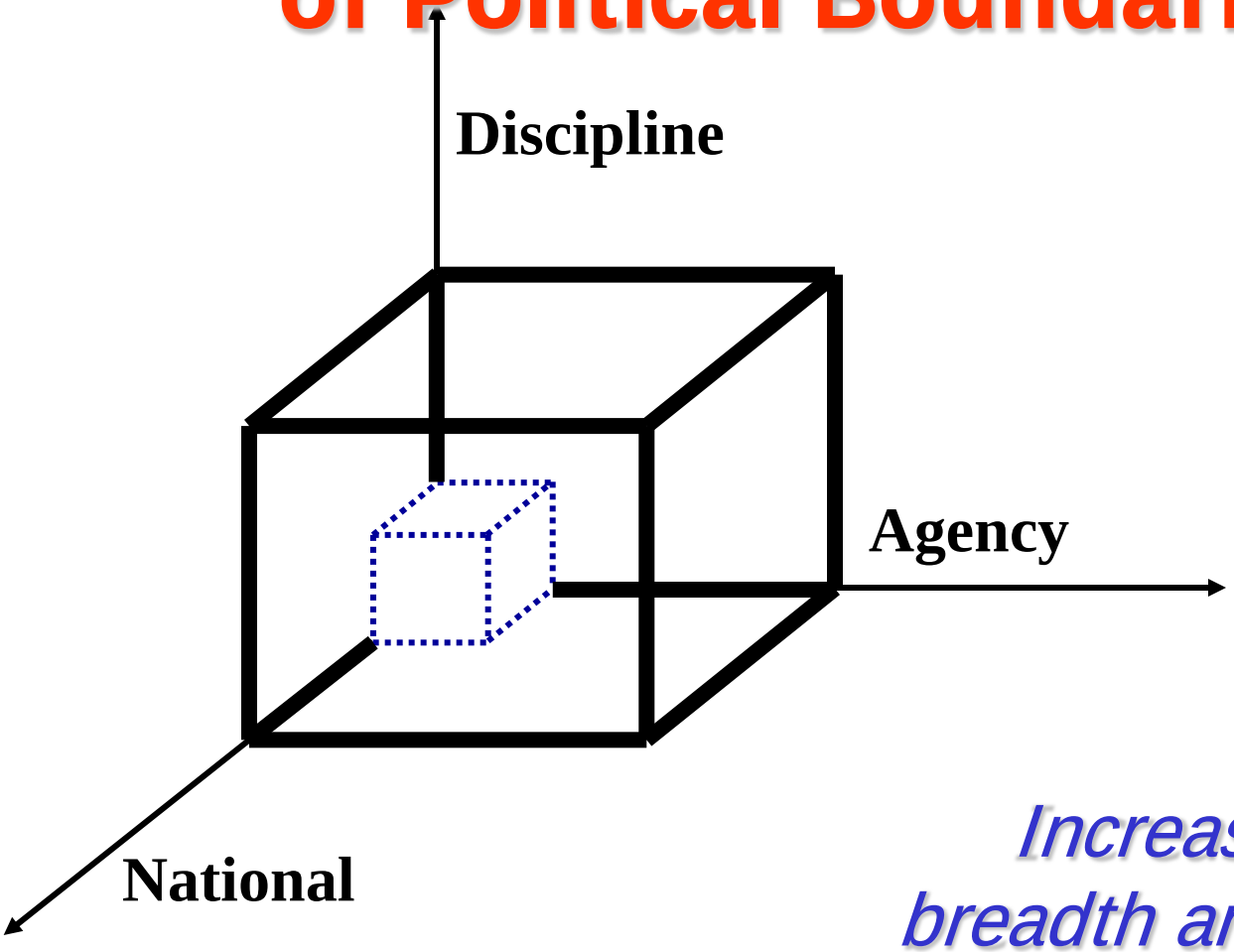
ILTER Mission Statements

- Promote and enhance the understanding of long-term ecological phenomena across national and regional boundaries
- Promote comparative analysis and synthesis across sites
- Facilitate interaction among participating scientists across disciplines and sites

Mission Statements cont.

- Promote comparability of observations and experiments, integration of research and monitoring, and encourage data exchange
- Enhance training and education in comparative long-term ecological research and its relevant technologies
- Contribute to the scientific basis for ecosystem management

Thinking Outside the "Box" of Political Boundaries



Increase in breadth and depth of understanding.....