National Center for Earth-surface Dynamics

THEN AND NOW: 2002 to 2012

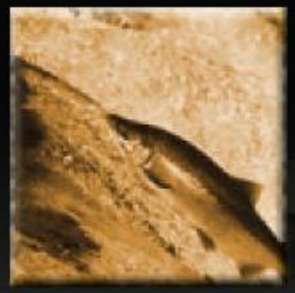
Efi Foufoula-Georgiou -- On behalf of the NCED family

Year 9 site visit

May 17-18, 2011

earth

water



life

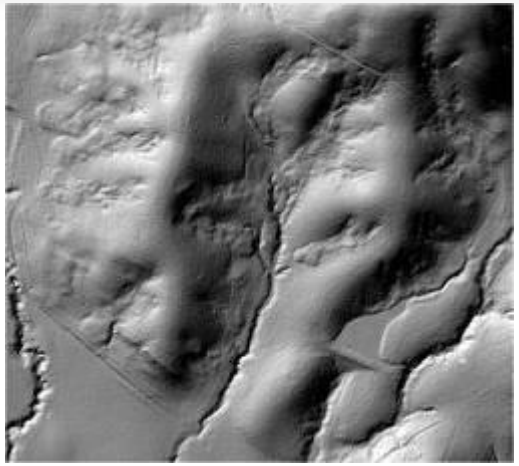
NCED Reflections: 2002-2011

- The vision, the premise [2000]
- Life is never the same after an STC [2002]
- The true meaning of transformative research
- The true meaning of synthesis research
- So what has NCED accomplished?
- What is to be lost beyond 2012?

NCED in one day:
- 35,000 ft overview – Efi
- 10,000 ft overview – 5 IP leaders
- 1 ft zoom in – students and post-docs

- Big ideas get refined but they remain true to their core …

The big idea



Theme:

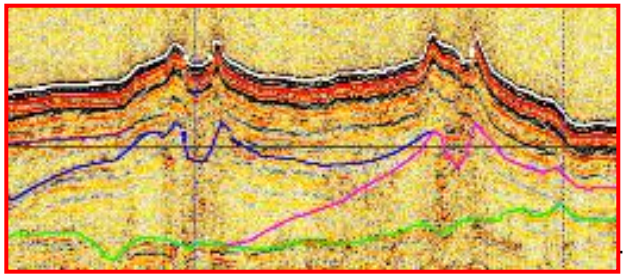
the Earth's surface ("critical zone") *is* the environment. But we cannot quantitatively answer even relatively simple questions about its response to climatic and other changes, or provide tools to manage it effectively. Why?

Problem:

Earth-surface science has been hindered by disciplinary fragmentation and a tradition of descriptive research and training

Solution:

a center focused on developing an **integrated, predictive, quantitative** understanding of Earth-surface dynamics



NCED's purpose:

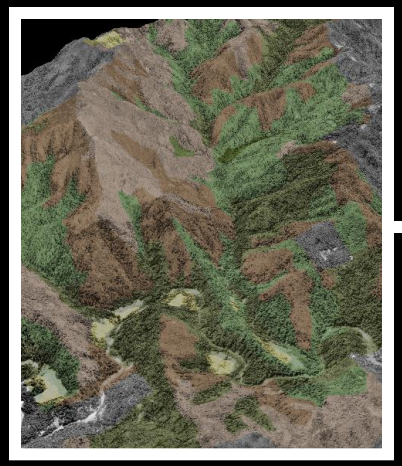
to catalyze development of an integrated, predictive science of the processes shaping the surface of the Earth, in order to transform management of ecosystems, resources, and land use

Year 2 site visit – Chris Paola

- NCED’s Vision and Mission statements have been refined and much talked about but the core work and approach to accomplishing that vision has remained the solid same ……

NCED Vision

To predict the coupled dynamics and co-evolution of landscapes and their ecosystems, in order to transform management and restoration of the Earth-surface environment.



Watersheds

Streams

Deltas

Focus on channels and channel systems as they link disparate environments, and structure landscapes and ecosystems at all scales

The journey of a center

- Center = a collection of people, approaches, disciplines, and research faciltities towards a common goal
- The “journey of a Center” is a set of individual journeys (personal and professional) interacting non-linearly and transforming each other

NCED’s journey: Then and Now

Then	Now	Then	Now
			
			
			

The NCED Immediate Family (PIs)






















The NCED Extended Family

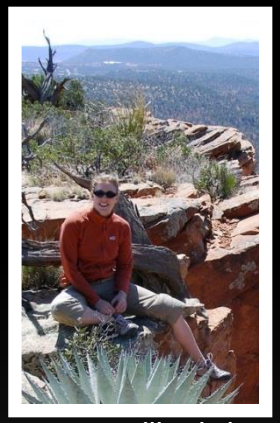
(Affiliate Scientists)


Kyle Straub


Paola Passalacqua

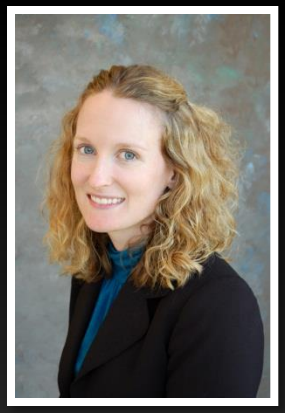

Patrick Belmont


Nicole Casparini


Jane Willenbring


Wonsuck Kim


Paul Venturelli


Leslie Hopkinson


Doug Jerolmack


Ann Lightbody


Laurel Larsent

and keeps growing ….

The NCED Administrative Backbone


Education and Diversity is not delegated or managed from an office; it becomes your life!










Thank you!

Center-added value

✓ **Whole > Sum (parts)?**

X1 = productivity of PI 1

X2 = productivity of PI 2

X = X1 + X2 X = productivity of center

Mean(X) = Mean(X1) +Mean(X2);

Var(X) = Var(X1) + Var(X2) + ***COV(X1,X2)***

Whole > sum of its parts Iff *COV* (+)

"CRUDE LOOK AT THE WHOLE" THE KEY TO UNDERSTANDING COMPLEXITY

"...if the parts of a complex system or various aspects of a complex situation, all defined in advance, are studied carefully by experts on those parts or aspects, and the results of their work are pooled, an adequate description of the whole system or situation does not usually emerge.

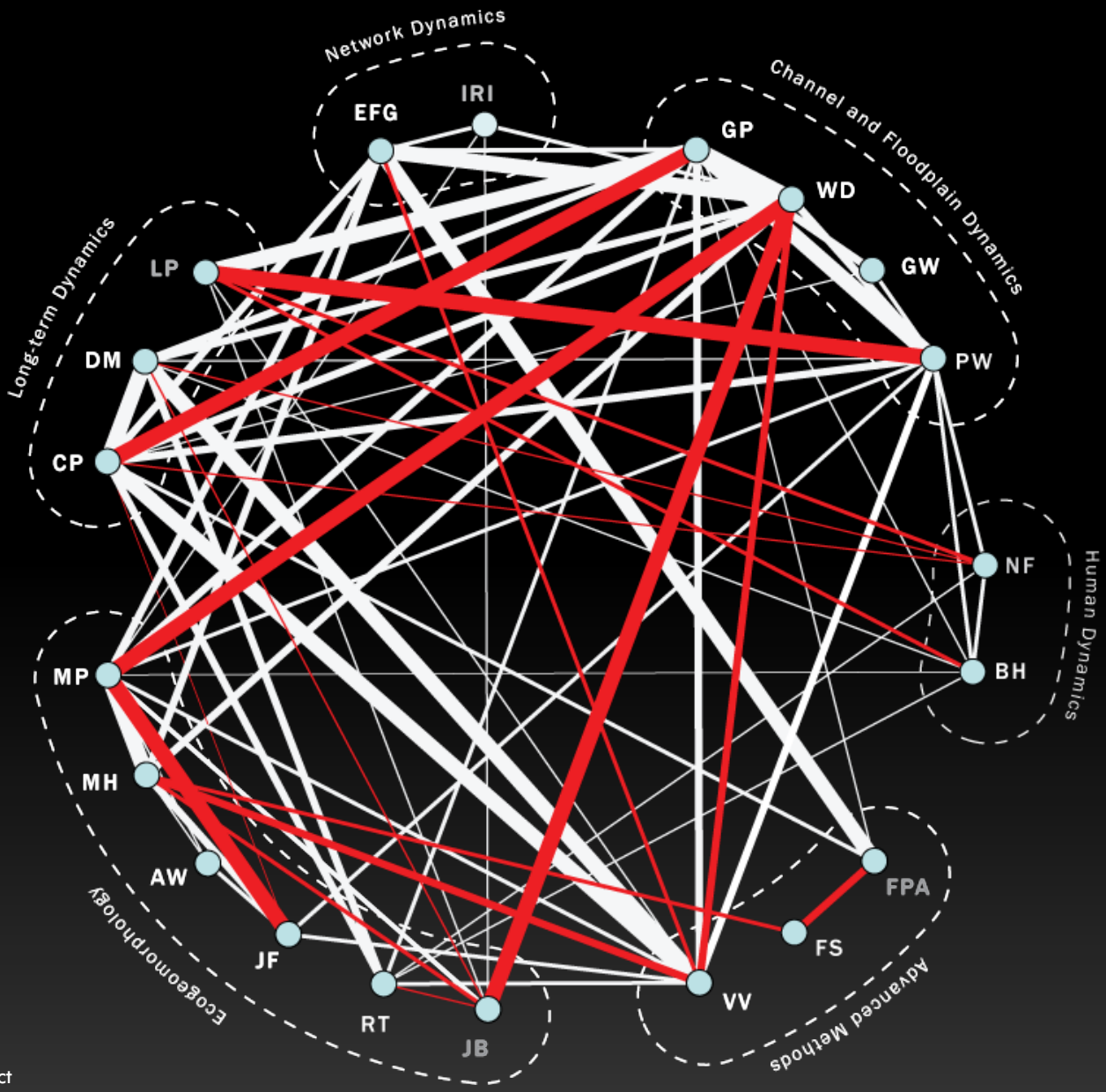
The reason, of course, is that these parts or aspects are typically entangled with one another.

We have to supplement the partial studies with a transdisciplinary "crude look at the whole."

Murray Gell-Mann, Let's call it plectics

(2003 – Year 2 site visit Foufoula's presentation)

A crude look at the whole: Then and Now



0.5px: initial development
2.0px: on-going defined project
4.0px: project produced synthesis paper
8.0px: well-established project with shared students or multiple papers

Year 8

NCED: Then and Now

Transformation metrics:

-- 158 MS/PhD students graduated, 50 post-docs
-- 49 placed in academic positions
-- 550 journal publications/ more than half co-authored
-- 378 underrepresented students in science camps
-- 11 underrepresented students now in graduate school
-- 8 NAISEF grant award winners (out of 32 nation wide)

-- 800+ participated in short courses and partner group meetings
-- 100+ scientists in 3 multi-disciplinary working groups
-- 22 PIs in 9 institutions
-- liaison with 9 other community efforts
-- a major conference for young scientists in ES (MYRES:80 delegates)
-- 16 (10 grad, 6 undergrad) students studied abroad
-- 280,000 visited the SMM BBY
-- 4,000,000 visited Water: H_2O=Life
-- 2 NAS, 20 disciplinary awards
-- 60 REU and summer interns
-- 1.5 TB served on NCED's web site

-- First degree in water resources in a Tribal college
-- Created the Partnership for River Restoration in the Upper Midwest
-- Created the Geoscience Alliance
-- Created post-baccalaureate program in SR
--

NCED's core values

- NCED core values:
  - -- working at the frontier
  - -- dedicated to excellence and community growth
  - -- an agile and adaptive organization
  - -- mentor a diverse workforce: the next generation
  - -- taking science to practice

Working at the frontier: imagining the future, embracing risk, promoting creativity and initiative at the interfaces of disciplines

Dedicated to excellence: nothing less than the best in intellect, performance and commitment of the center as a community resource

Agile and adaptive: strategic shifts, recruit new talent

Diverse workforce: create the next generation of leaders in ESD

Science to practice: create sustained partnerships, science-based approaches to pressing problems, educate the public

NCED Organization

3 Integrated Programs (IPs)

- Desktop Watersheds (DW) IP -- Watersheds
- Stream Restoration (SR) IP - Streams
- Subsurface Architecture (SA) IP – Deltas

3 Initiatives

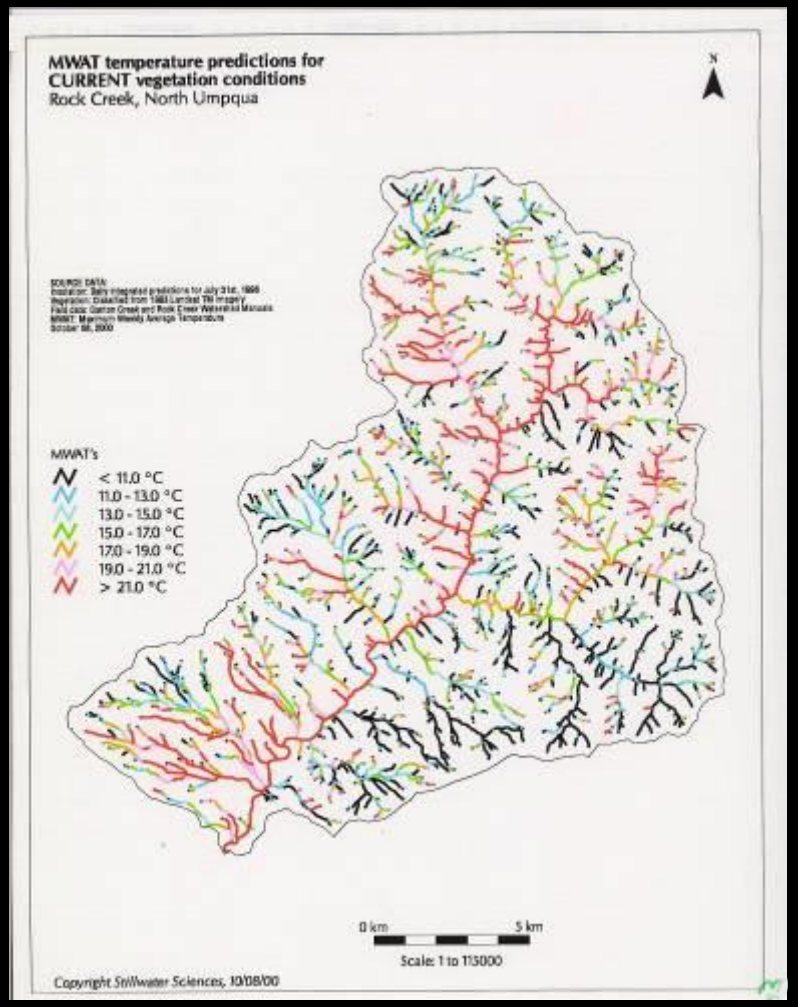
- Education Initiative
- Knowledge Transfer Initiative
- Diversity Initiative

Watersheds

To discover and advance the fundamental relations needed to predict landscape evolution and to model the coupling of ecosystem, landscape, and land-use dynamics

IP leader: Bill Dietrich

IP manager: Collin Bode

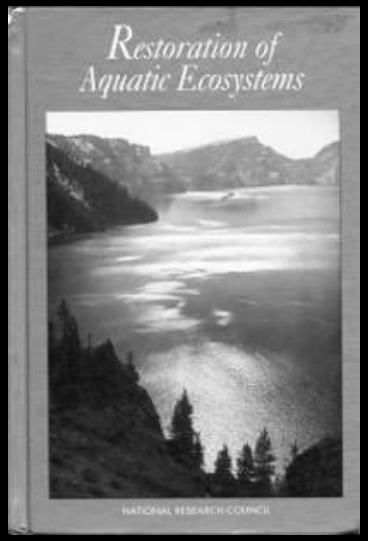


Streams

IP leader: Peter Wilcock

IP manager: Don Baker

*To **a**dvance the science and practice of stream restoration by conducting and coordinating research and by working with agency and industry partners to identify information needs, develop improved tools, and transfer this knowledge into practice*

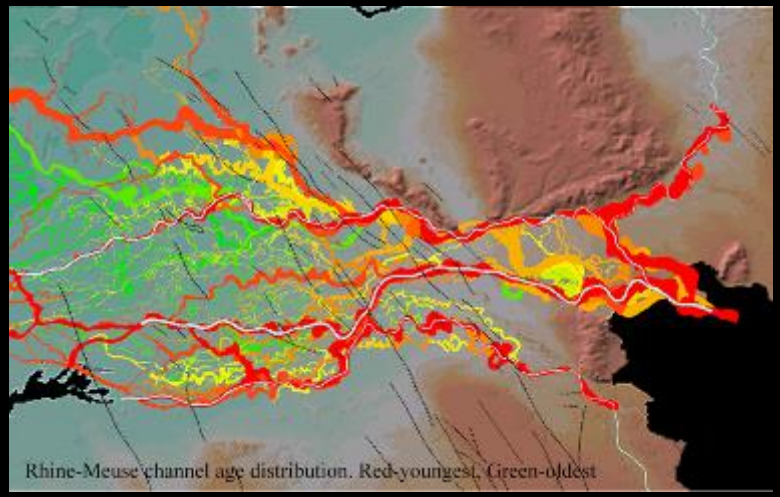


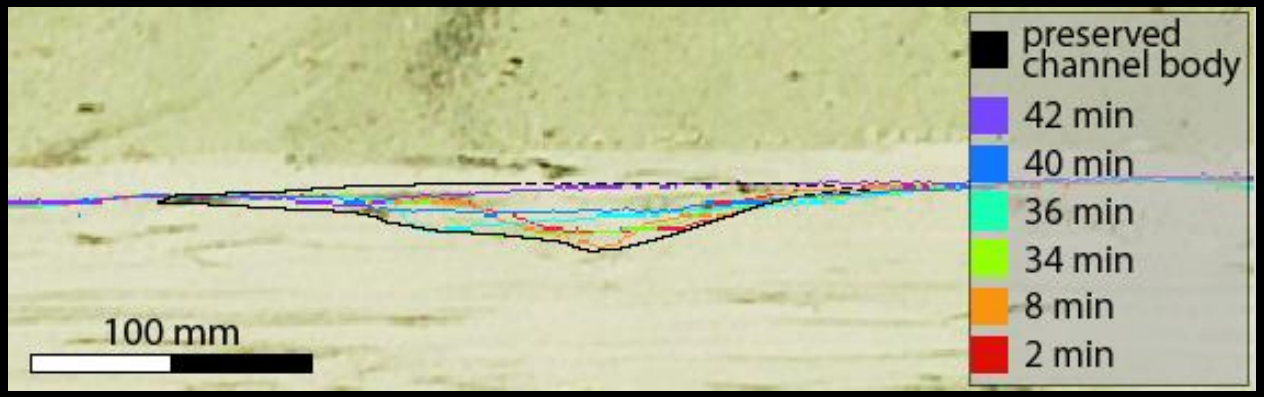
Deltas

IP leader: David Mohrig

IP manager: Jim Buttles

To use information from modern systems, experiments, and stratigraphic records to develop a predictive understanding of delta evolution, and apply this understanding to delta restoration

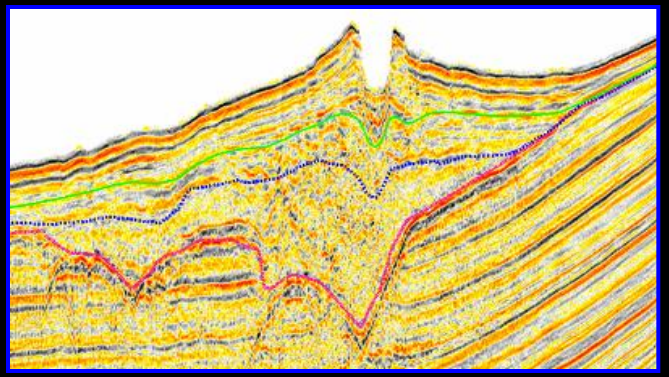




Knowledge Transfer Initiative

Distributed across all IPs
KT Manager: Deborah Hudleston
Visitor's Program: Sara Johnson

To create and maintain two-way communication with application stakeholders and the broader research community to inform NCED research and disseminate NCED results



Education Initiative

Education Director: Karen Campbell

To bring Earth-surface dynamics to life for a broad spectrum of learners, in order to educate future leaders in NCED's key mission areas of land, resource, and ecosystem management.

Diversity Initiative

Diversity Director: Diana Dalbotten

To increase participation by under-represented groups in NCED until minority representation is continuously reflective of the US national population

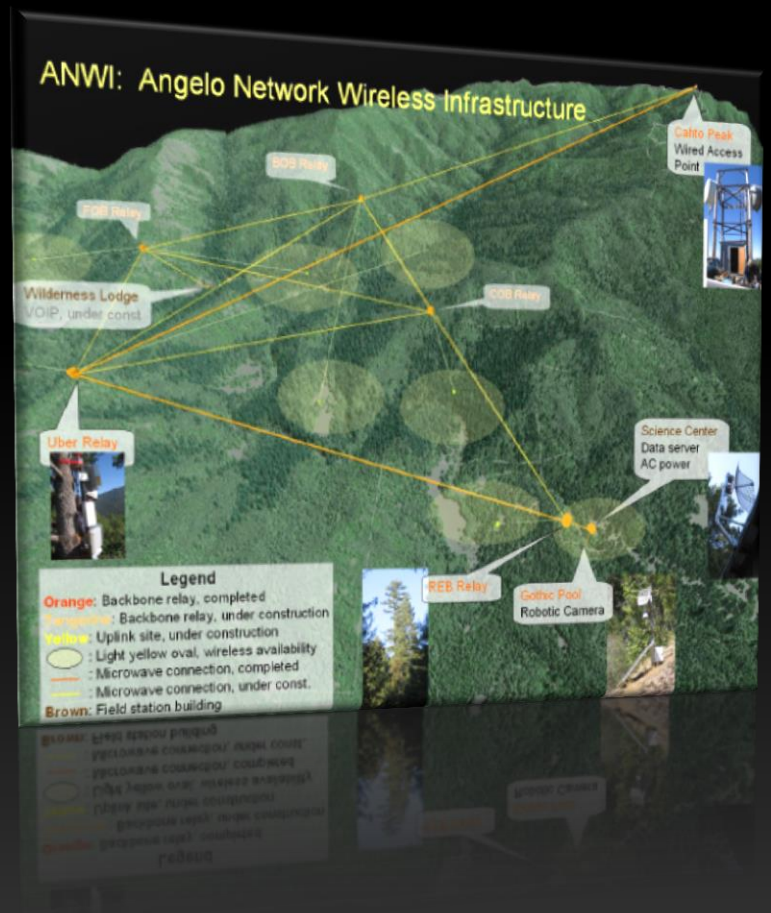
The NCED Nexus of Institutions

The NCED Nexus of Research Infrastructure

NCED Laboratories and Field Sites

A mountainous steep terrain (ACRR)

Angelo Coast Range Reserve



32 km^2 managed by UCB

Chosen by NCED in 2002 to field-test our predictive ecogeomorphic models of channels and channel system evolution.

Hotspot of activity

291 researchers last year; total of 1,952 researcher user days

Wireless infrastructure

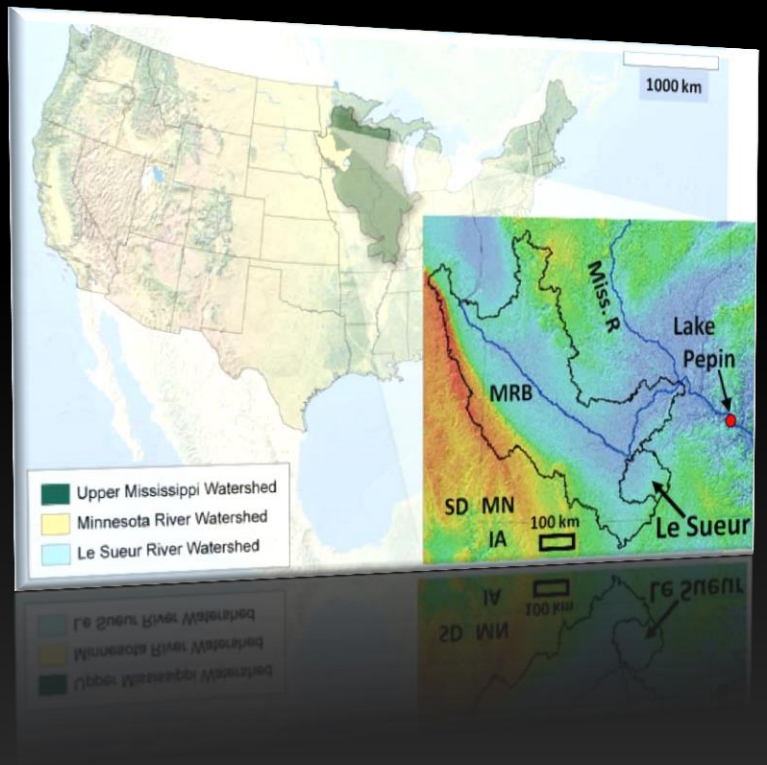
NCED has invested extensively in long-term environmental monitoring at the ACRR. At this time, ~1000 sensors fully functional and online.

Capacity building

NCED has continued investment at ACRR through renovation of aging facilities and equipment.

A human impacted landscape (MRB)

Le Sueur River Basin



2,880 km^2 in the Minnesota River Basin

chosen by NCED in 2008 to study sediment dynamics on a watershed scale

Excessive sediment loads

7% of the MRB by area, yet contributes 30-40% of the total suspended sediment load of the Minnesota River and Lake Pepin.

Testbed for HANC hypothesis

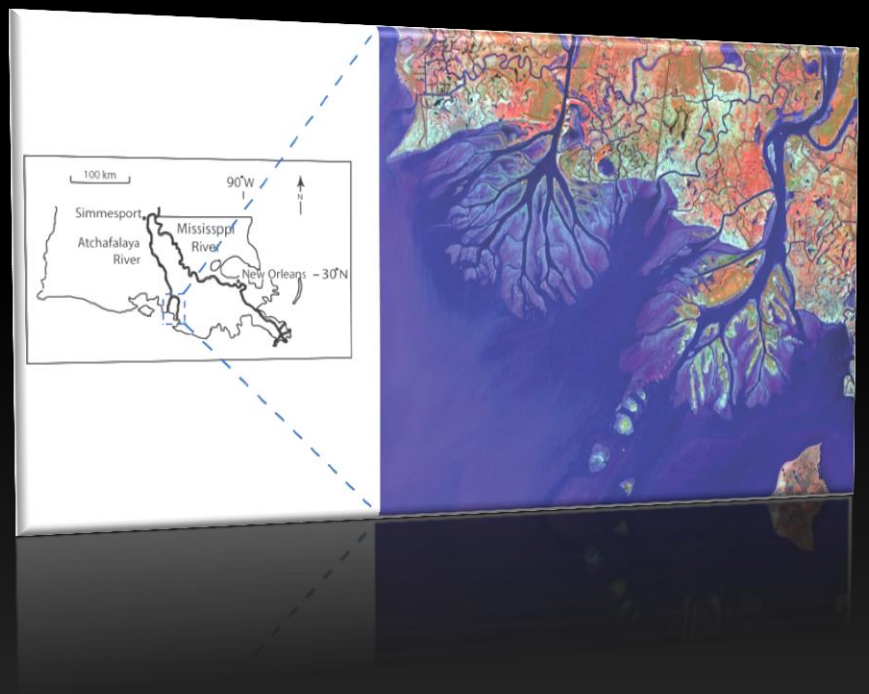
Large set of water, sediment, and biotic responses to well-defined and pervasive natural and anthropogenic changes

Socioeconomic significance

Direct implications for sustainable watershed management and policy

A vulnerable coastal environment (WLD)

Wax Lake Delta



250 km^2 located in coastal LA

WLD chosen by NCED in 2007 to develop methods to predict delta evolution in support of sustainable restoration of the Mississippi River Delta

Model for natural delta growth

WLD provides an excellent template for delta land-growth prediction because the delta has evolved naturally

A species-rich community

WLD provides an excellent opportunity to examine linkages between geomorphology and ecology in a coastal restoration context

Broader Impacts

Sustainable solutions to delta restoration

A State-of-the-art Experimental Facility

St. Anthony Falls Laboratory

A "Jewel on the River"

SAFL provides an ideal site for a variety of experimental flumes and channels.

StreamLabs

a suite of research laboratories (physical and virtual) designed to help researchers from a broad spectrum of disciplines better understand stream processes + OSL

Experimental Earthscapes Basin

utilizes a dynamically subsiding bed and an electronic measurement system to document deposit evolution.

EcoFluids Laboratory

allows researchers to study the interactions among fluid mechanics, microbiological processes, and chemical reactions that are mediated by biological organisms.

A nexus of linked Laboratories

St. Anthony Falls Lab

Richmond Field Station

Ven Te Chow Lab

UTA Jackson School Lab

NCED: Educating a broad audience

A prototype partnership between academia and a Science Museum

Science Museum of Minnesota

Big Back Yard

a 1.75-acre outdoor park that uses miniature golf to teach visitors about how river systems sculpt the Earth's surface.

Water: H_20 = Life

two traveling exhibits that demonstrate the role water plays in shaping the land and human communities.

Science on a Sphere

a 6-foot video projection system that displays dynamic images of the Earth's surface using an animated globe

Future Earth Initiative

NCED is working with the SMM and five other STCs to demonstrate what it means for humans to live in the Anthropocene Epoch.

NCED: Increasing diversity in Geosciences

Native American STEM Programs

gidakiimanaaniwigamig

camps include a mix of lab science and field science programming, focusing on introducing the students to the scientific method and Native American culture.

giiwed'anang

part of the AISES Alliance, *giiwed'anang* works to promote minority participation in STEM fields by providing education opportunities and academic guidance.

manoomin

engages Native American students, teachers, and community members in a research project aimed at understanding the ecological conditions beneficial to the growth of wild rice

Geoscience Alliance

a national alliance whose mission is to broaden participation of Native Americans in the geosciences.

NCED: The Next Generation

REUs … to MS/PhDs… to synthesis post-docs … to faculty

Intensive Research Experience

a 10-week summer program providing exposure to real-world laboratory and field settings. In addition, students complete a report and poster at the end of the field campaign.

Team Oriented, Team Mentored

Students organized around two teams: Team Delta (Adv: Twilley) and Team Stream (Adv: Sotiropoulos).

Diversity

70% minority participation to-date

REU: 9/22/2009

Results Overview: Open Ended Responses
Filter: No filter applied (6 Response(s) Returned)

« Return to Results Overview

PRO Print | Excel Export

Display 25 Per Page

Displaying 1-6 of 6 Responses Select Page: First | Previous | Next | Last

16. Please use this space to add any comments, suggestions, etc.:	
#	**Response**
1	I would liked to have lived separately from my team members. By the end of the program (two months) it is hard to live and work with the same group of people. If it is possible I think living arrangements should have been mixed up so that we actually got to socialize with people in other REU's as well. I think that would have been really good for us as a group and as a program.
2	This research experience was great overall and a learning experience.
3	[redacted]
4	Thank You.
5	Thank You!!!!
6	Everyone did an incredible job, I will forever be indebted for all the work everyone put into this program to make it possible for me and my team mates. Thank You!! :)

Display 25 Per Page

Displaying 1-6 of 6 Responses Select Page: First | Previous | Next | Last

We want to see more of Efi. She is so cool. We should market Efi booblehead dolls.

Engaging the public: NCED's "SIP of Science"

Engaging the public to science-based solutions on pressing problems

"The Sip of Science series features discussions that bridge the gap between science and culture in a setting that bridges the gap between brain and belly. Food, beer, and learning are on the menu in a happy hour forum that offers the opportunity to talk with researchers about their current work, its implications, and its fascinations."

The series takes place the second Wednesday of every month.

Summer Institute on Earth-surface Dynamics

Mentoring the Next Generation of Earth-surface Scientists

SI 2011 esd

2009: Complexity and predictability in earth systems

2010: Rivers and Vegetation

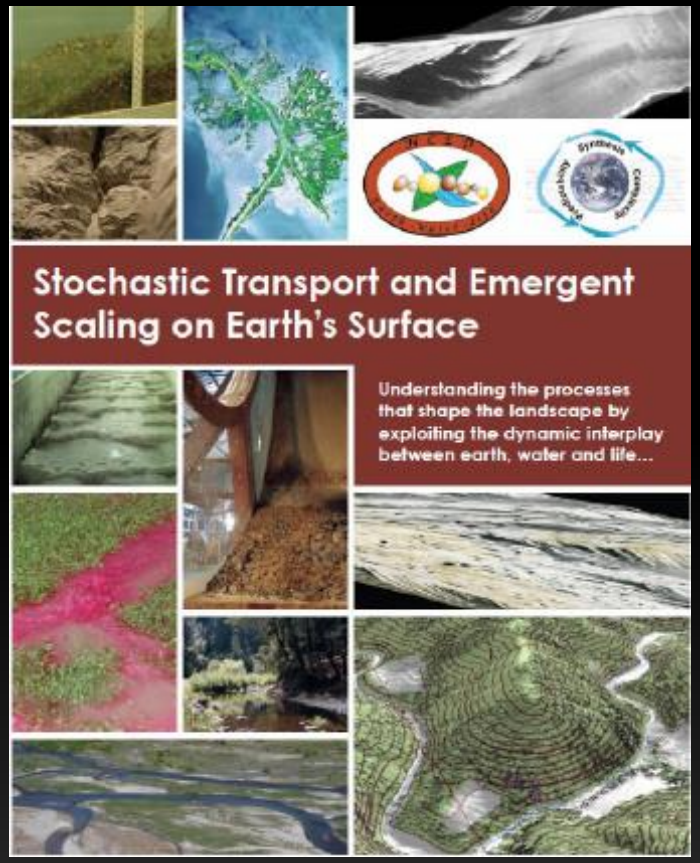
2011: Coastal processes and dynamics of deltaic systems

2012: Prediction under environmental change

…

Leading the community in new directions

Promoting Synthesis and Discovery

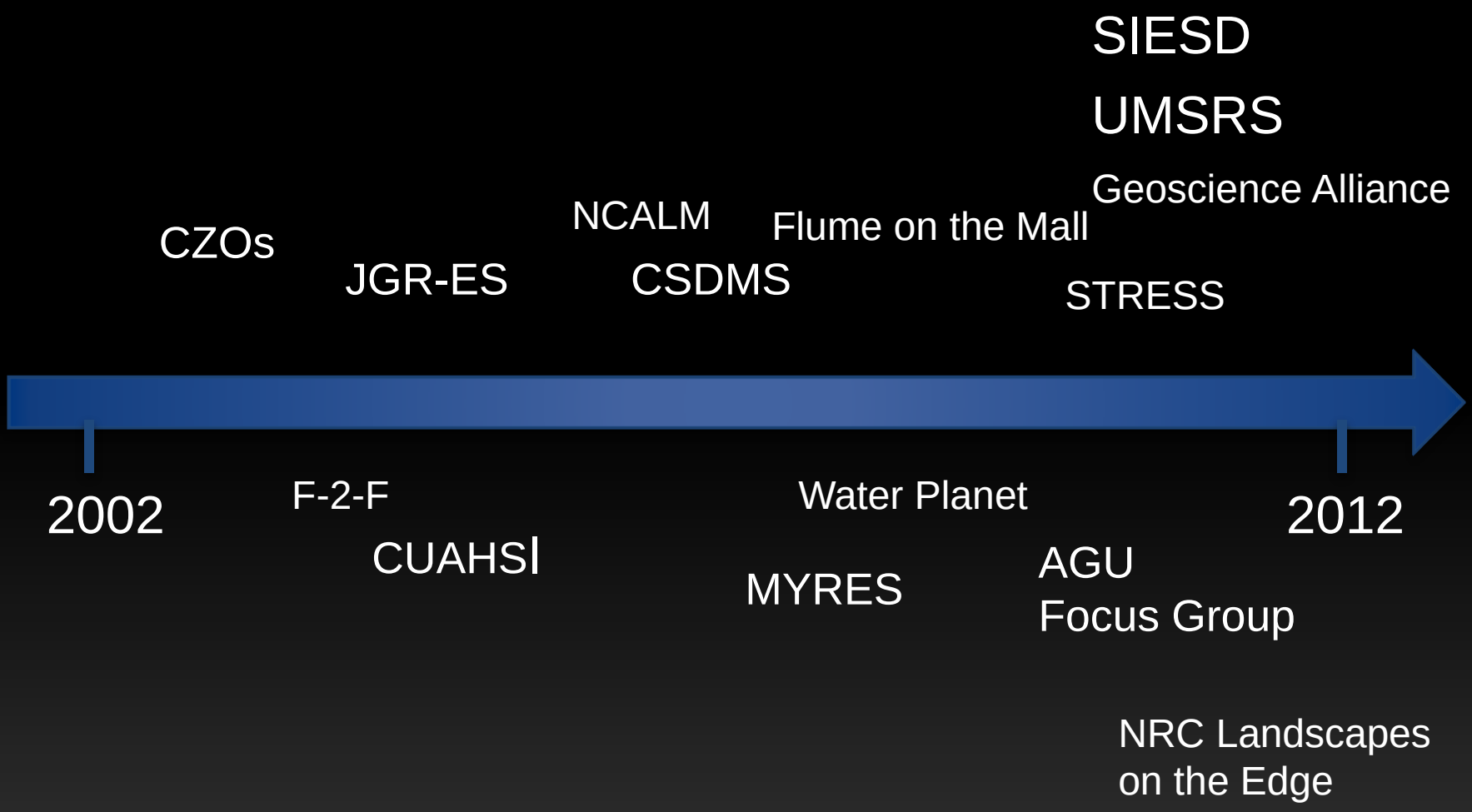


ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

Special Issue on River Flow Dynamics: Physical and Ecological Aspects

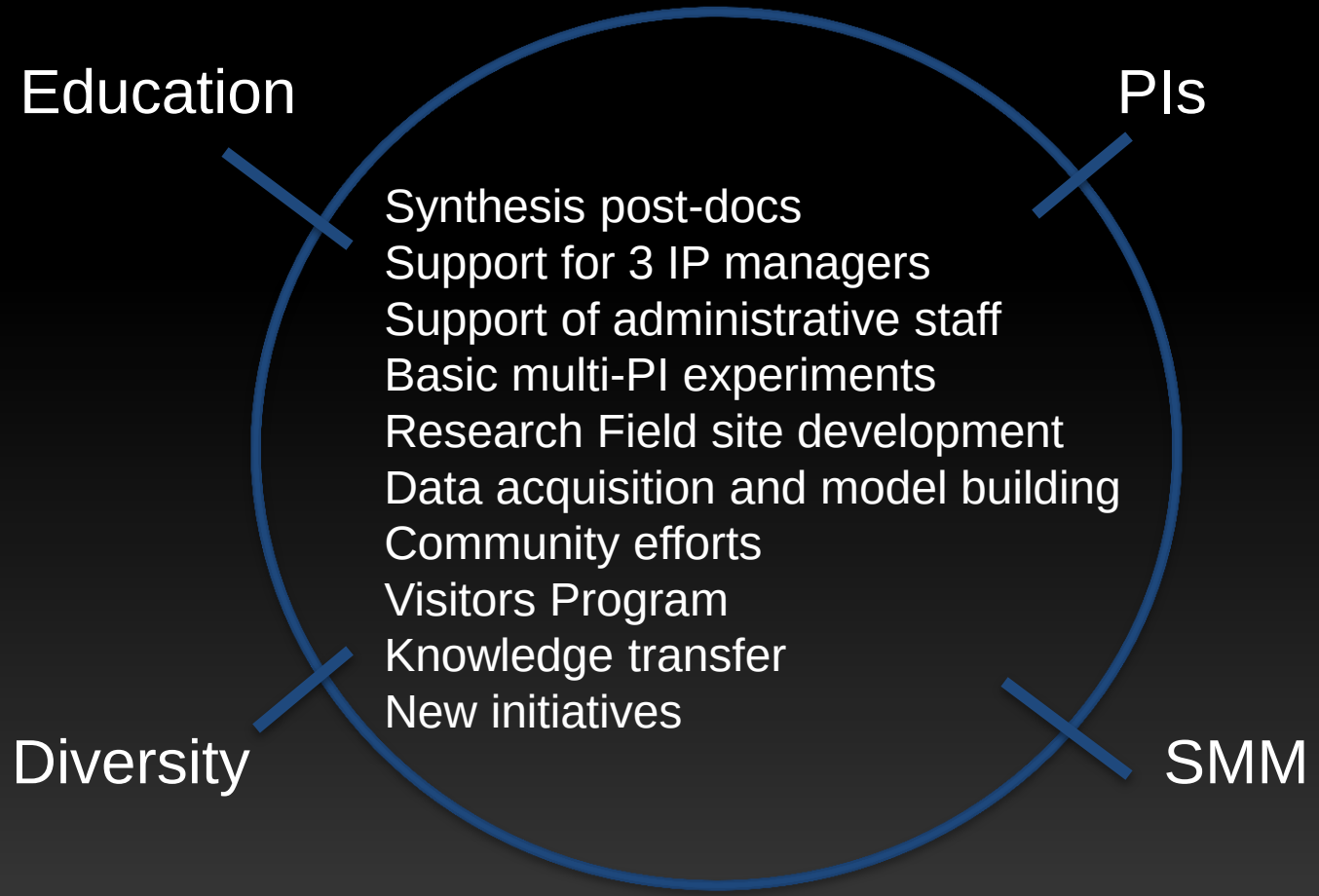
A overview paper on deltas

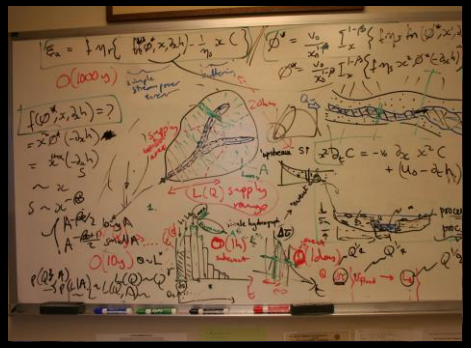
NCED as a player in Community Growth

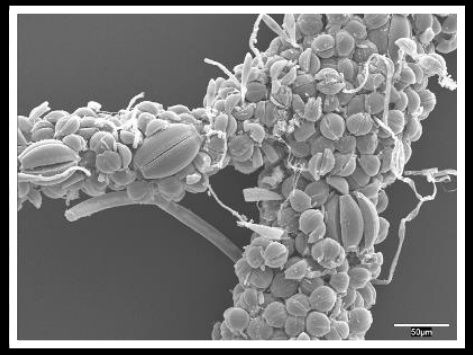


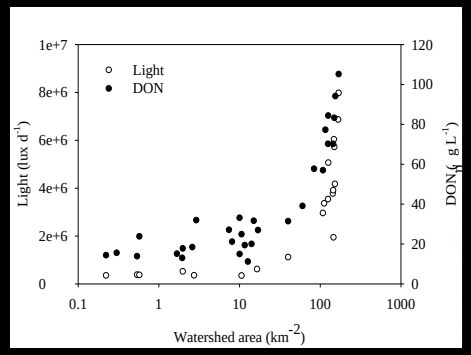
NCED Strategy for Resource Management

A minimalistic management approach geared towards synthesis and integration









NCED Synthesis and Discoveries

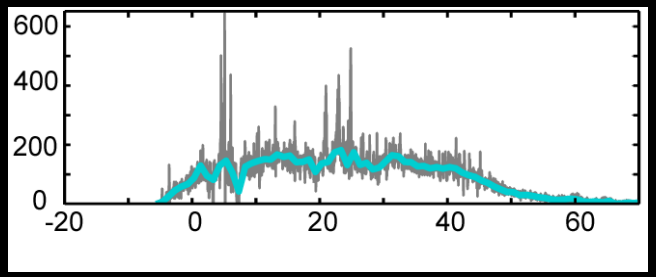
Breakthroughs in three Grand Challenges

1. Discovery of the linkages between physical, chemical, and biological processes over a range of scales and environments

2. Predictive understanding of ecosystem response to environmental change

3. Application of understanding to guide management decisions for resilient ecosystems

How does debris flow incise into bedrock?

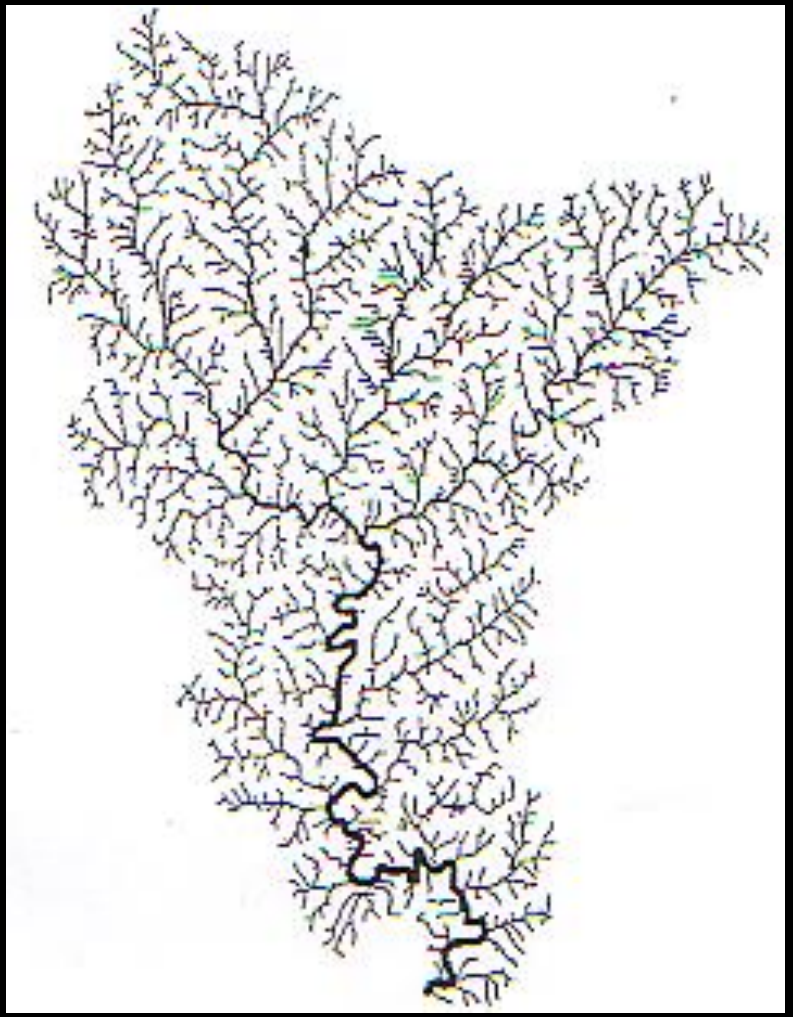


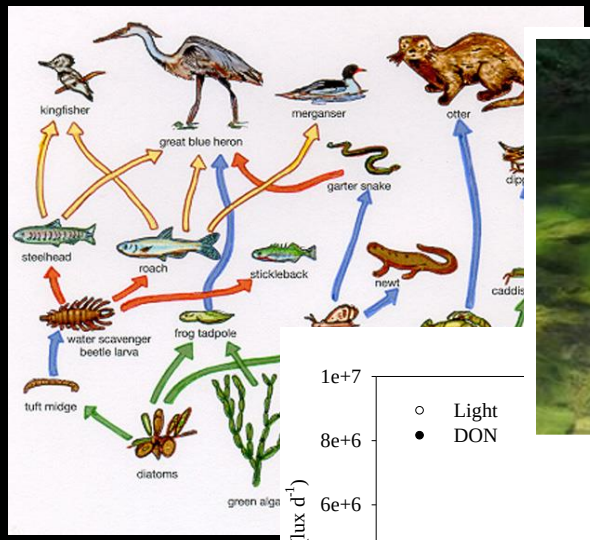
Excursion forces

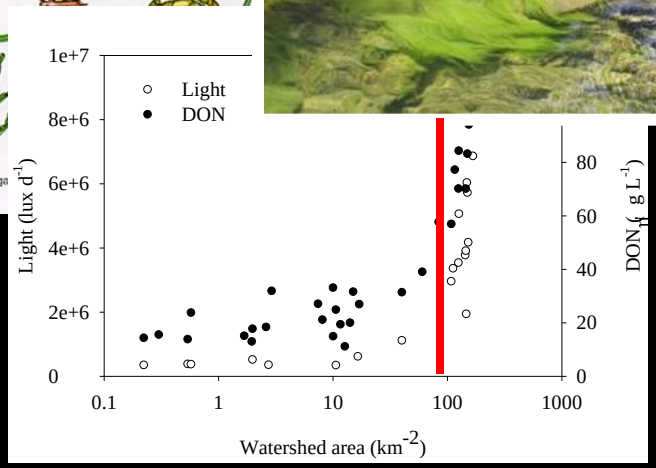
position in drum (degrees)

Local short-lived dynamic impacts are important in predicting erosion

How does the river network organize fluxes and whole ecosystems?

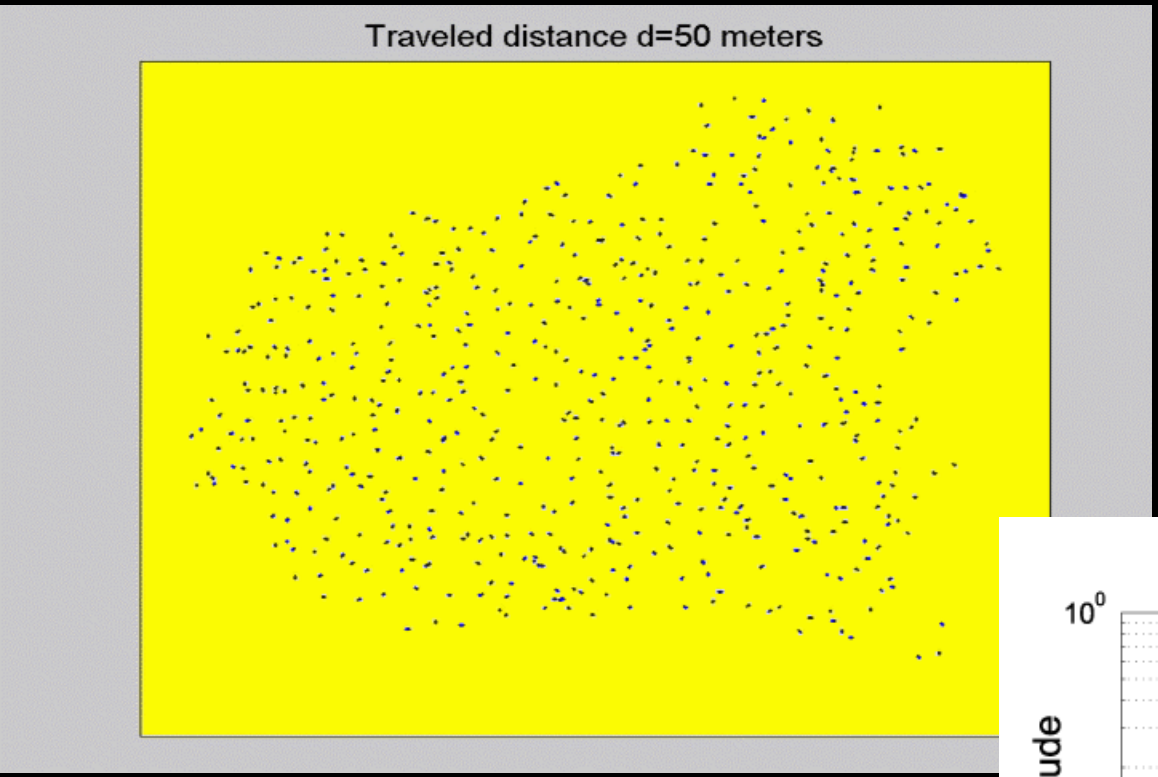




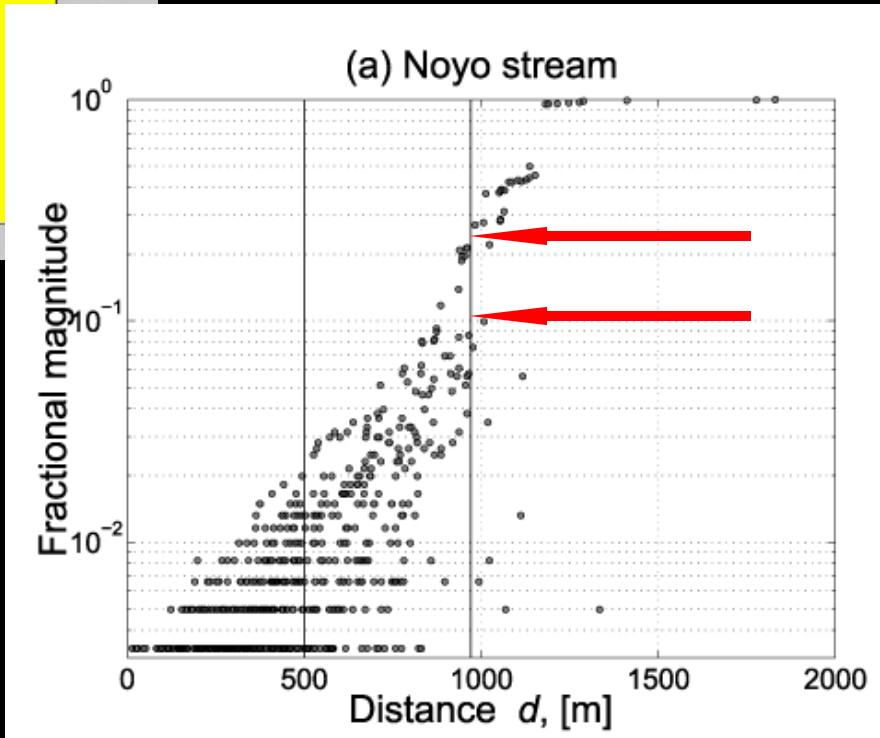


- Where in the landscape do functionally significant ‘ecological regime’ changes occur?
- Where would boundaries shift with environmental change?

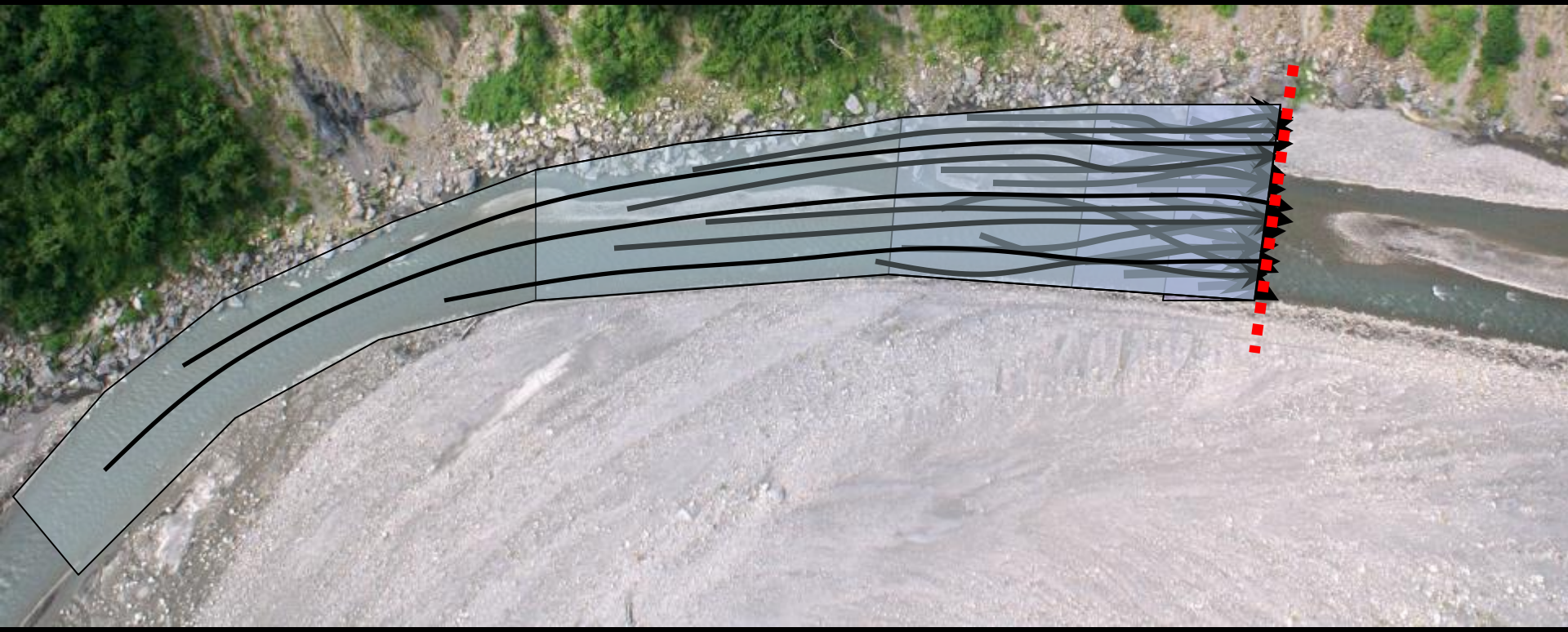
Do dynamics change system connectivity?



Emergent scales of system participation in transport dynamics



How can extreme variability and multiple scales of motion be incorporated into geomorphic transport laws?

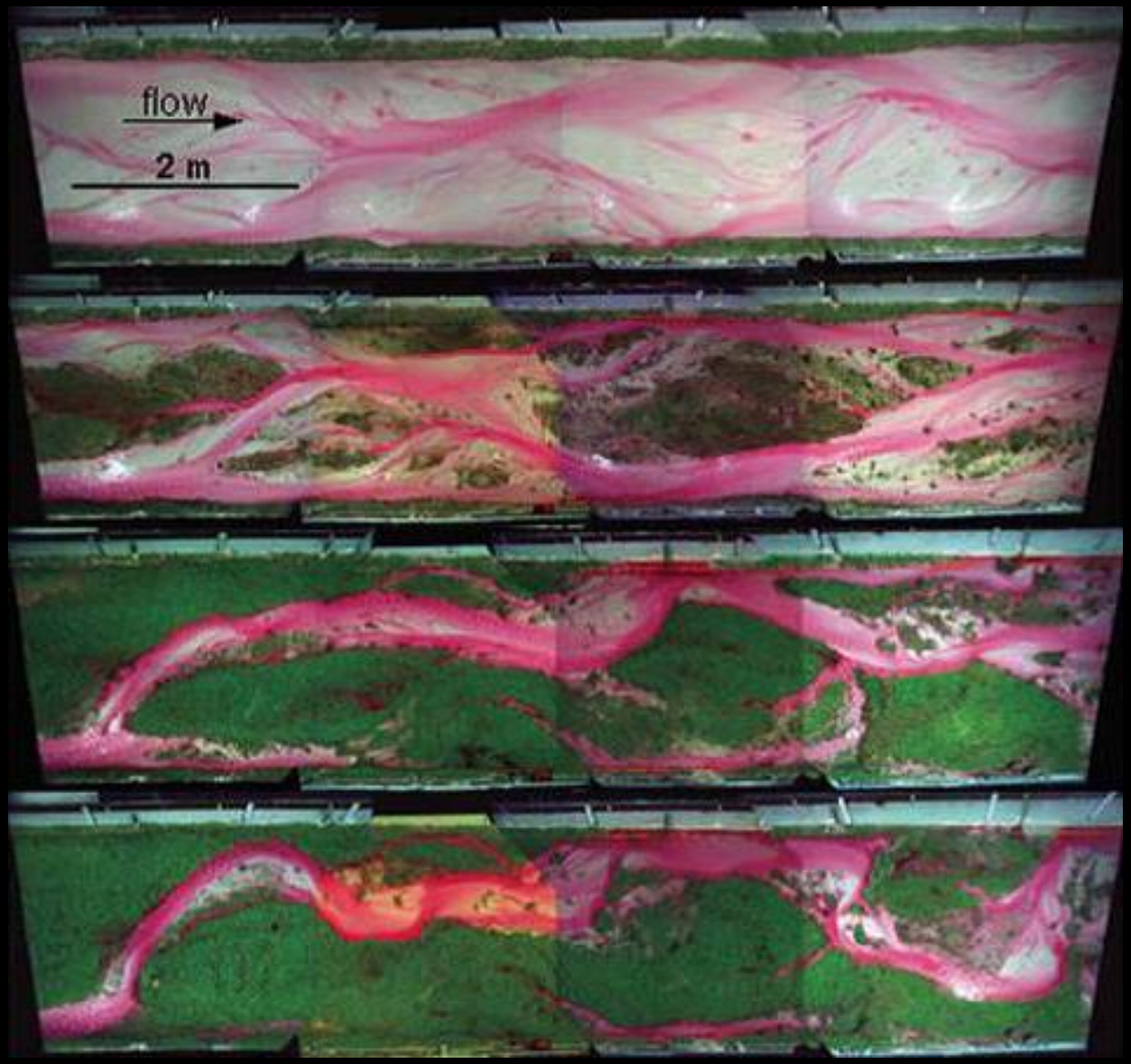


$$\mathbb{P}(V \geq v) \sim v^{-\alpha}$$

$$g(l) \sim l^{-\alpha}$$

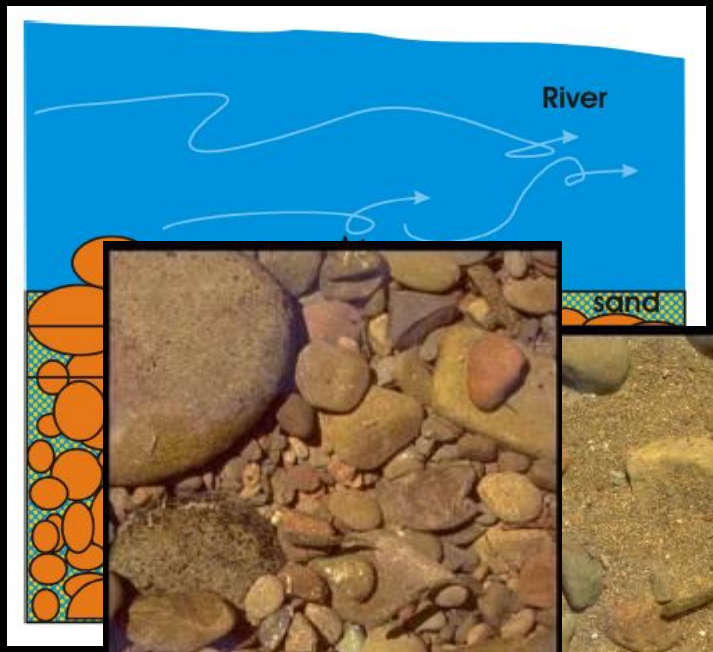
$$\phi^*(x,t) = \int_0^x g(l)\phi(x-l,t)\,\mathrm{d}l$$

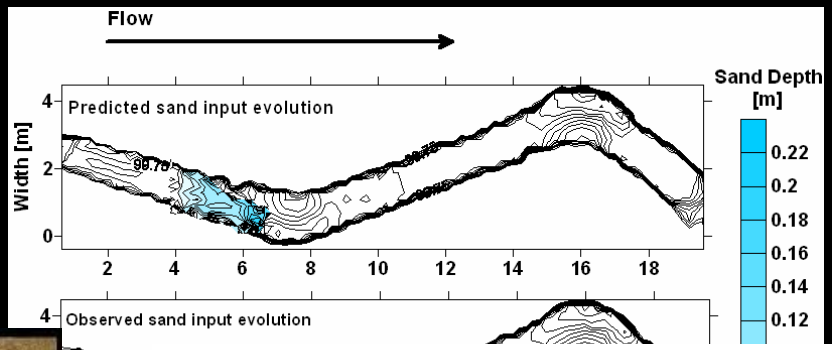
How does vegetation and landscape co-evolve?

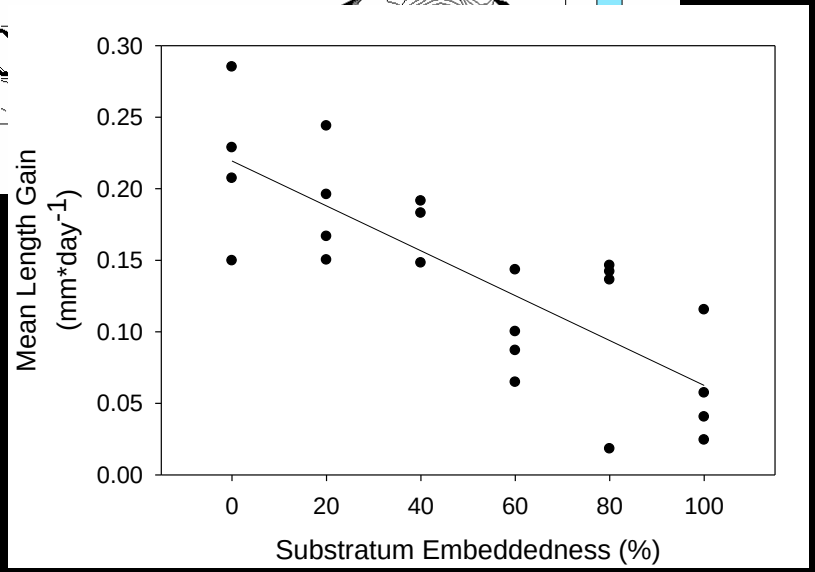


Wax Lake Delta

How does mixed sediment move downstream and how does it affect biotic life?

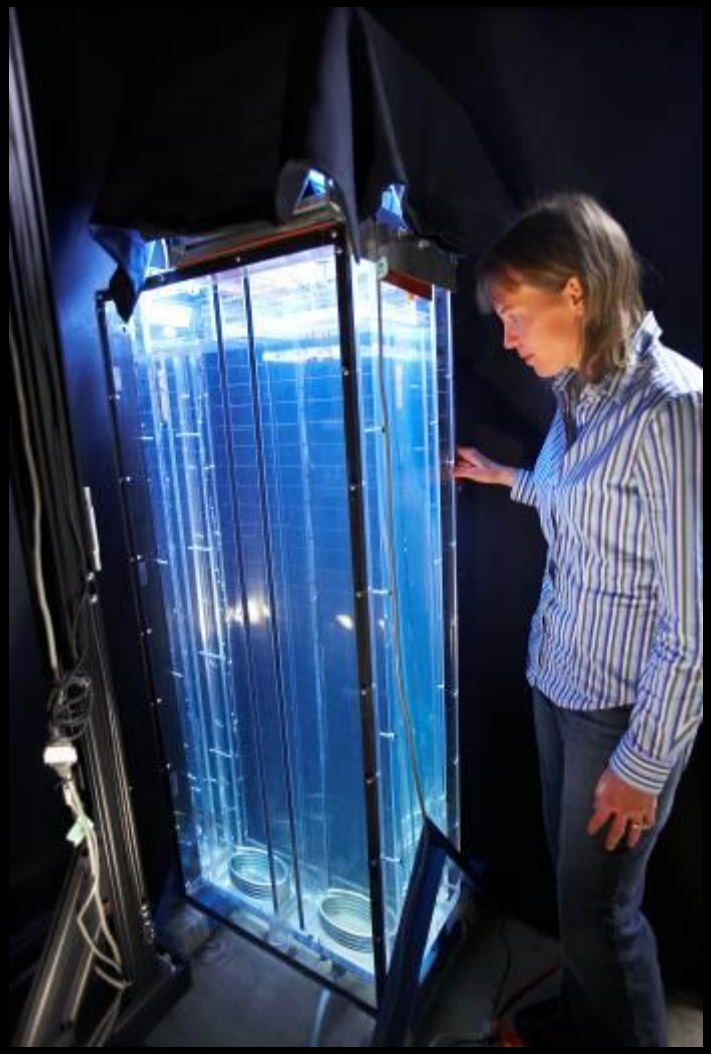






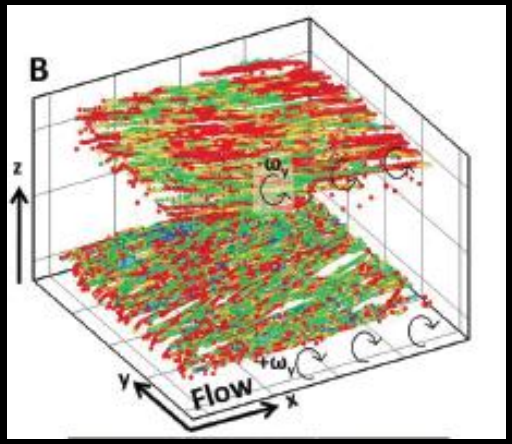
Fine sediments reduce growth and survival of juvenile steelhead

Do microorganisms feel turbulence and how does this affect nutrient cycling?



Small-scale turbulence significantly modulates algal and bacterial nutrient uptake and growth

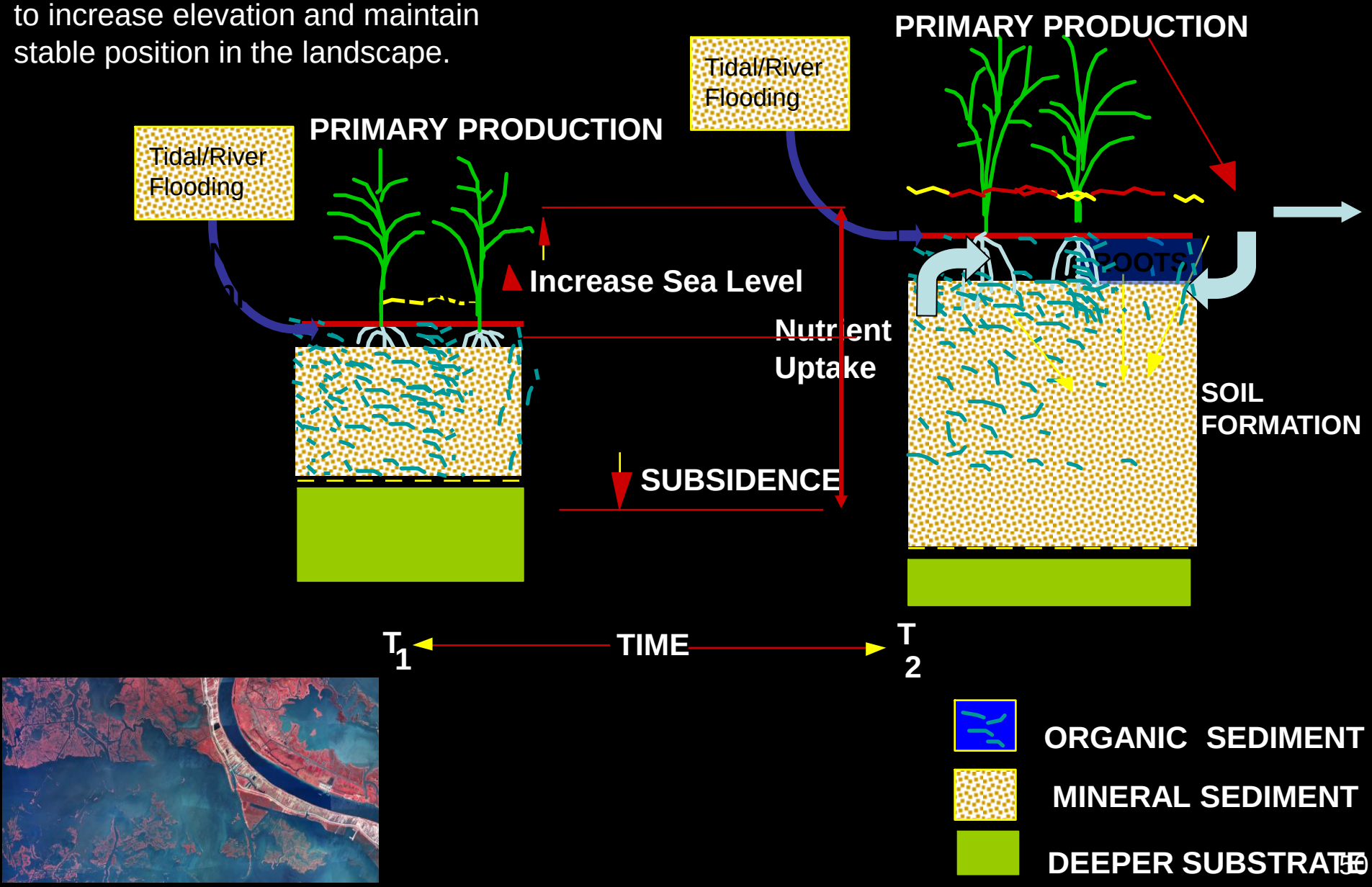
Ignoring the effect of turbulence in models of population dynamics can result in significant biases in nutrient cycling predictions at the reach scale



Shear guided swimming by green algae

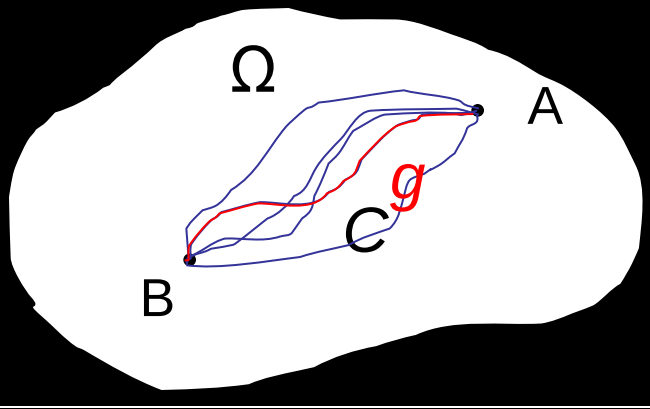
What is the role of plant–sediment interaction in wetland stability?

Critical Processes: Thresholds of sea level together with subsidence that limit ability of wetlands to increase elevation and maintain stable position in the landscape.



How to explore high resolution topography for improved modeling?

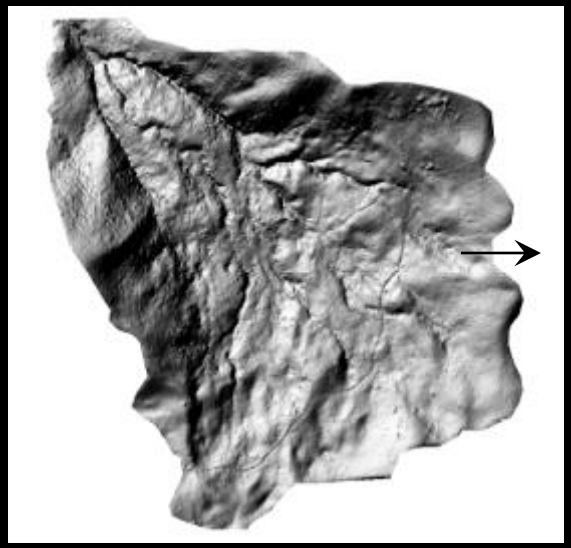
Ω: Surface described by the regularized LIDAR data through nonlinear filtering.



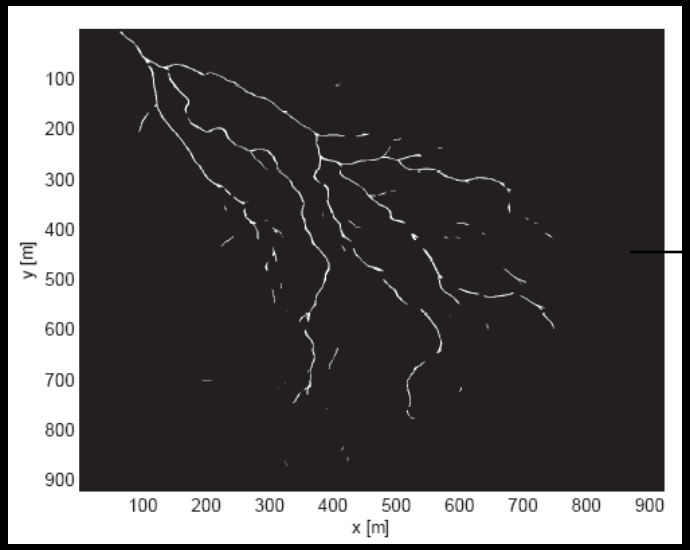
Cost function ψ: cost of traveling on the curve C.

Geodesic curve curve with minimal cost, among all possible curved connecting the two point *a* and *b*

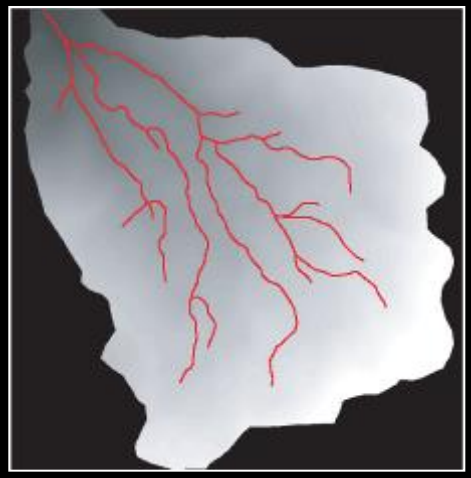
Example of river network extraction on Skunk Creek, South Fork Eel River basin, CA



Skunk Creek, CA (Original data)

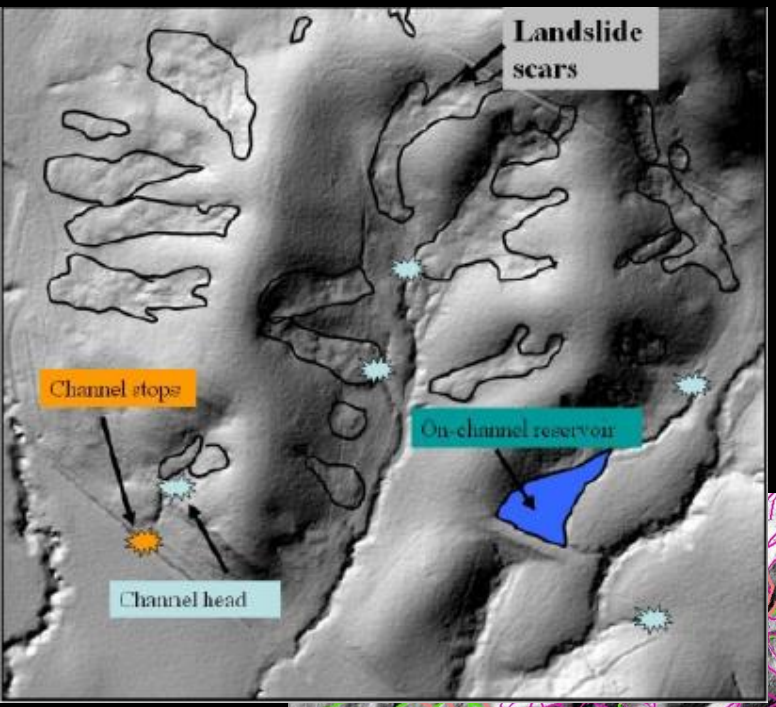


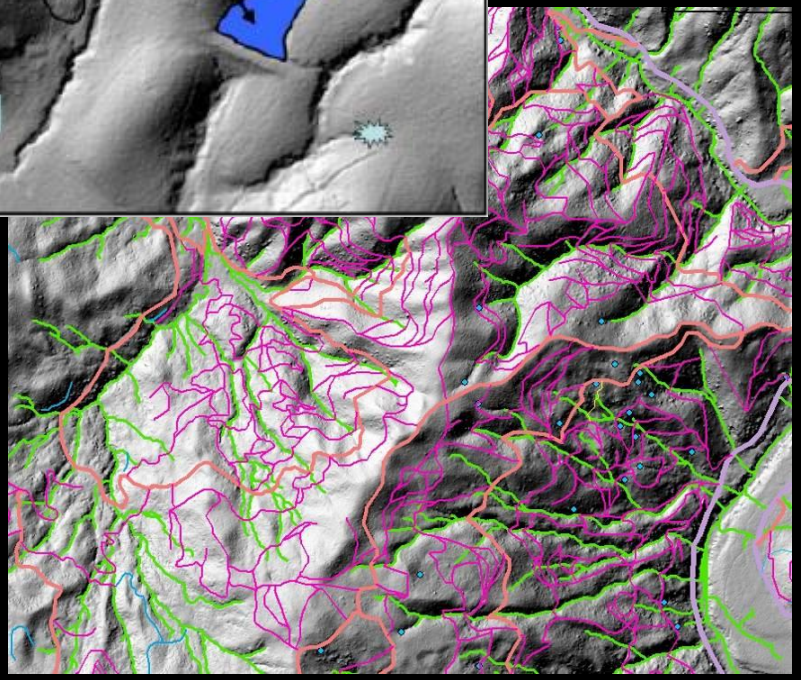
Likely channelized pixels



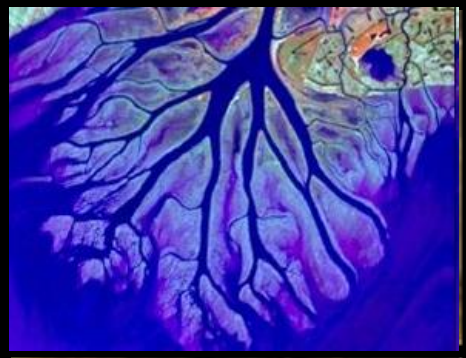
Extracted channels through geodesics

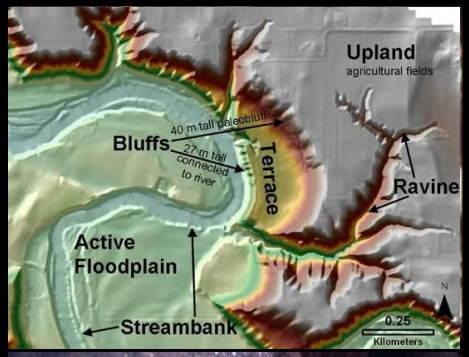
How to explore high resolution topography for hazard prediction and control?

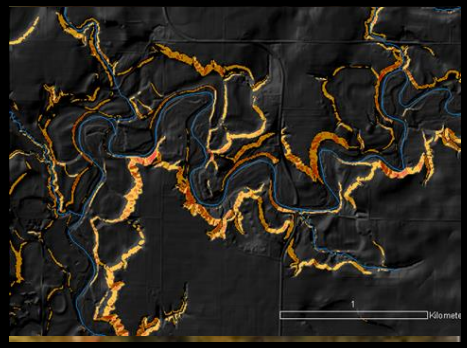




- GeoNet: A tool for river network extraction from LiDAR
- Mapping of river banks and floodplains
- Mapping of shallow landslides
- Mapping of deep-seated landslides
- Mapping roads



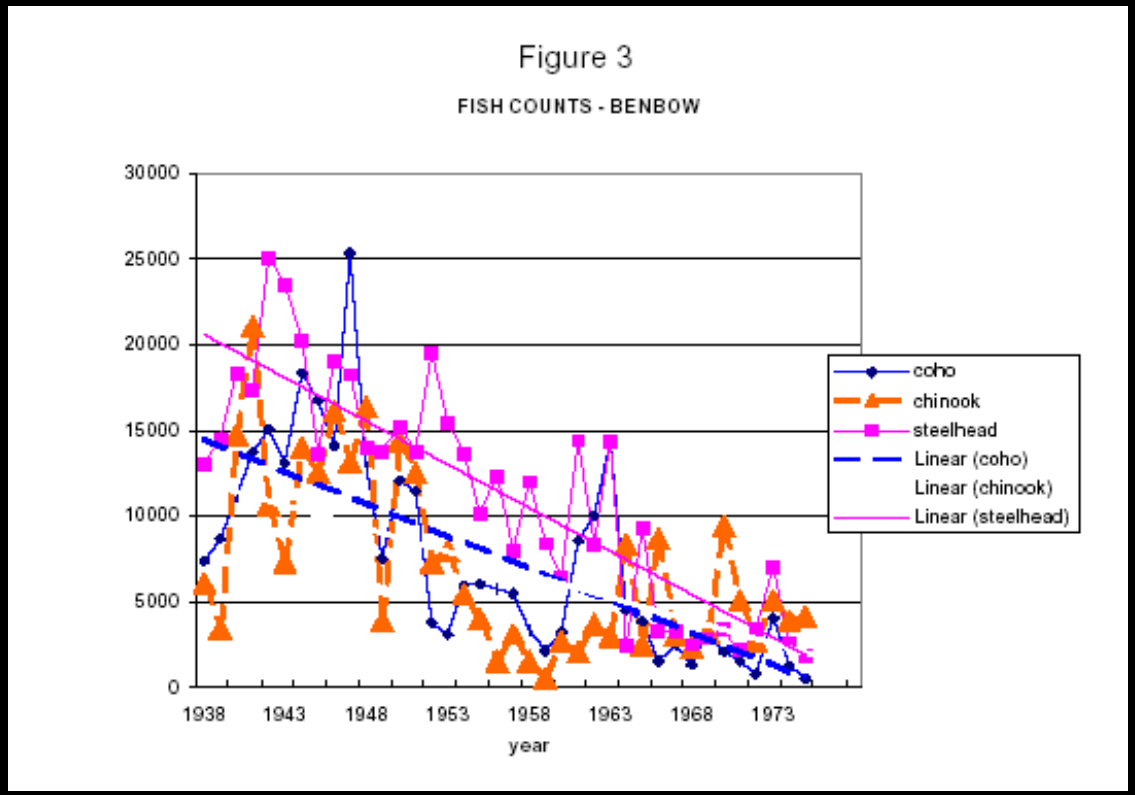




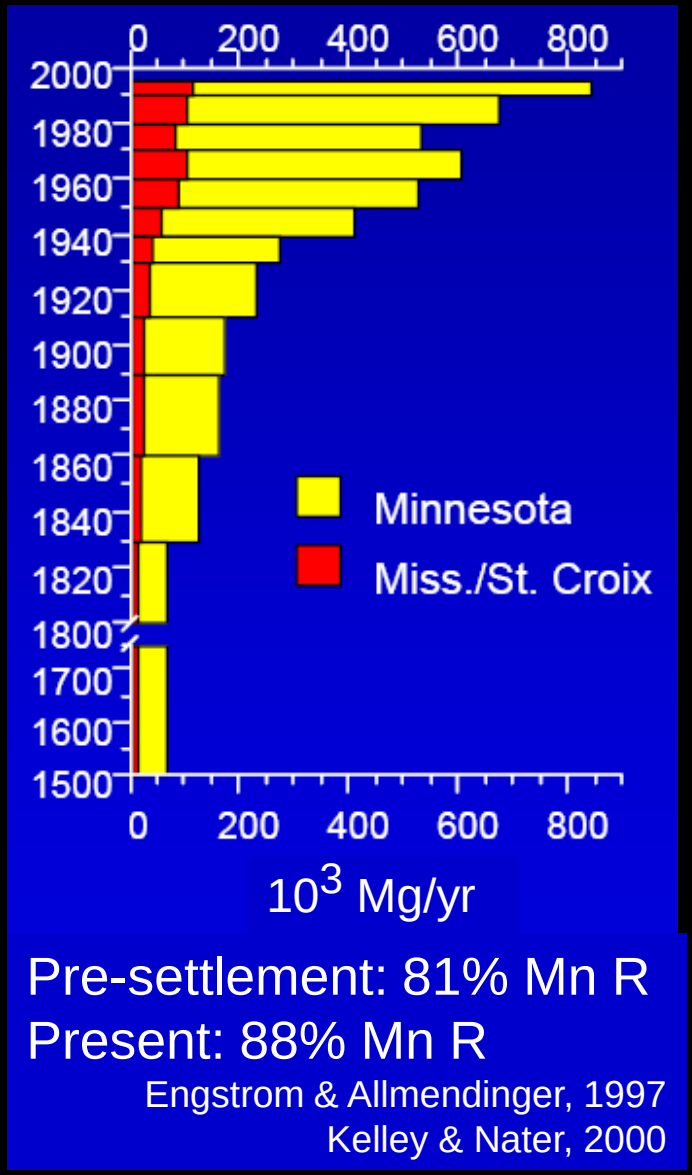
NCED Solutions

(Science-based solutions to real-world problems)

What causes the decline of Coho in the Eel River?



How to reduce sedimentation to Lake Pepin?



Pre-settlement: 81% Mn R

Present: 88% Mn R

Engstrom & Allmendinger, 1997

Kelley & Nater, 2000

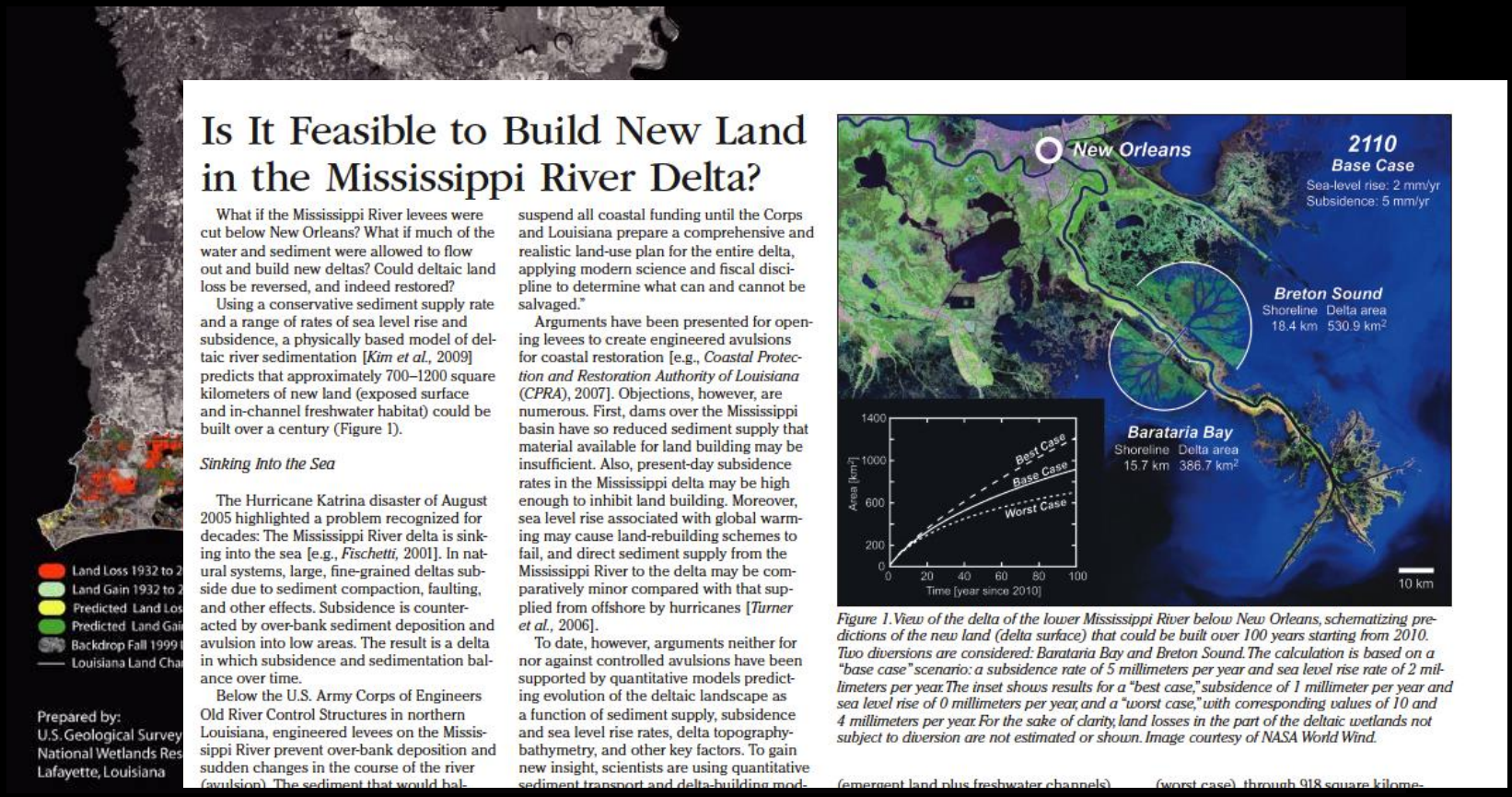
Minnesota River

- 38% of water supplied to Lake Pepin
- 81-88% of sediment supplied to Lake Pepin

Le Sueur River

- ~ 1/3 of sediment supplied to Minnesota River

How to build a sustainable Mississippi Delta?



Is It Feasible to Build New Land in the Mississippi River Delta?

What if the Mississippi River levees were cut below New Orleans? What if much of the water and sediment were allowed to flow out and build new deltas? Could deltaic land loss be reversed, and indeed restored?

Using a conservative sediment supply rate and a range of rates of sea level rise and subsidence, a physically based model of deltaic river sedimentation [*Kim et al.*, 2009] predicts that approximately 700–1200 square kilometers of new land (exposed surface and in-channel freshwater habitat) could be built over a century (Figure 1).

Sinking Into the Sea

The Hurricane Katrina disaster of August 2005 highlighted a problem recognized for decades: The Mississippi River delta is sinking into the sea [e.g., *Fischetti*, 2001]. In natural systems, large, fine-grained deltas subside due to sediment compaction, faulting, and other effects. Subsidence is counteracted by over-bank sediment deposition and avulsion into low areas. The result is a delta in which subsidence and sedimentation balance over time.

Below the U.S. Army Corps of Engineers Old River Control Structures in northern Louisiana, engineered levees on the Mississippi River prevent over-bank deposition and sudden changes in the course of the river (avulsion). The sediment that would bal-

suspend all coastal funding until the Corps and Louisiana prepare a comprehensive and realistic land-use plan for the entire delta, applying modern science and fiscal discipline to determine what can and cannot be salvaged."

Arguments have been presented for opening levees to create engineered avulsions for coastal restoration [e.g., *Coastal Protection and Restoration Authority of Louisiana (CPRA)*, 2007]. Objections, however, are numerous. First, dams over the Mississippi basin have so reduced sediment supply that material available for land building may be insufficient. Also, present-day subsidence rates in the Mississippi delta may be high enough to inhibit land building. Moreover, sea level rise associated with global warming may cause land-rebuilding schemes to fail, and direct sediment supply from the Mississippi River to the delta may be comparatively minor compared with that supplied from offshore by hurricanes [*Turner et al.*, 2006].

To date, however, arguments neither for nor against controlled avulsions have been supported by quantitative models predicting evolution of the deltaic landscape as a function of sediment supply, subsidence and sea level rise rates, delta topography-bathymetry, and other key factors. To gain new insight, scientists are using quantitative sediment transport and delta-building mod-

Figure 1. View of the delta of the lower Mississippi River below New Orleans, schematizing predictions of the new land (delta surface) that could be built over 100 years starting from 2010. Two diversions are considered: Barataria Bay and Breton Sound. The calculation is based on a "base case" scenario: a subsidence rate of 5 millimeters per year and sea level rise rate of 2 millimeters per year. The inset shows results for a "best case," subsidence of 1 millimeter per year and sea level rise of 0 millimeters per year, and a "worst case," with corresponding values of 10 and 4 millimeters per year. For the sake of clarity, land losses in the part of the deltaic wetlands not subject to diversion are not estimated or shown. Image courtesy of NASA World Wind.

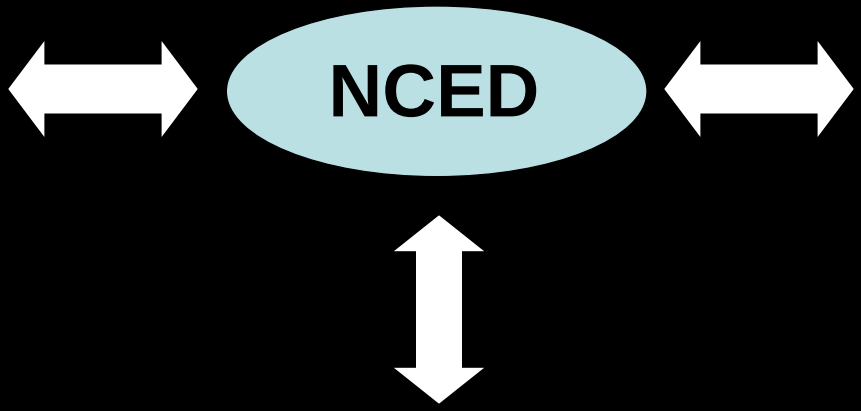
(emergent land plus freshwater channels) (worst case), through 918 square kilome-

EOS, Kim et al., 2010

Land loss since 1932 (2,000 Km2)

NCED Industrial and Agency Partnerships

Stillwater Science
Barr Engineering
URS
Schlumberger
Chevron
ConocoPhillips
ExxonMobil
InterFluve
Japan Oil Gas & Metals
Shell
Portland Gen. Electric



CalFED
US ACE
US BR
US EPA
US FS
US FWS
US GS
MnPCA
MnGS

PRRSUM = Partnership for River Restoration in the Upper Midwest

NCED Deliverables

- Ripple, ShalStab, ShaRun, GeoNet
- River morphodynamics modules → CSDMS
- Delta Land Building Manual
- Stream Restoration Decision Analysis and Design Guidance

NCED Legacies

1. Transformed the field of earth-surface dynamics: an integrative interdisciplinary predictive approach based on a seamless dialogue between experiments, theory, modeling and field observations to test hypotheses and models, guide field work, and bring science into restoration practice

2. Trained the next generation of interdisciplinary quantitative leaders

3. Developed state-of-the-art research infrastructure and tools as a community resource

4. Created a successful framework for engaging Native Americans into Geosciences

4. Established a paradigm for Museum-academia partnership to bring “earth surface science” to larger audiences

NCED as a world resource …

Terrain-based modeling within Google!

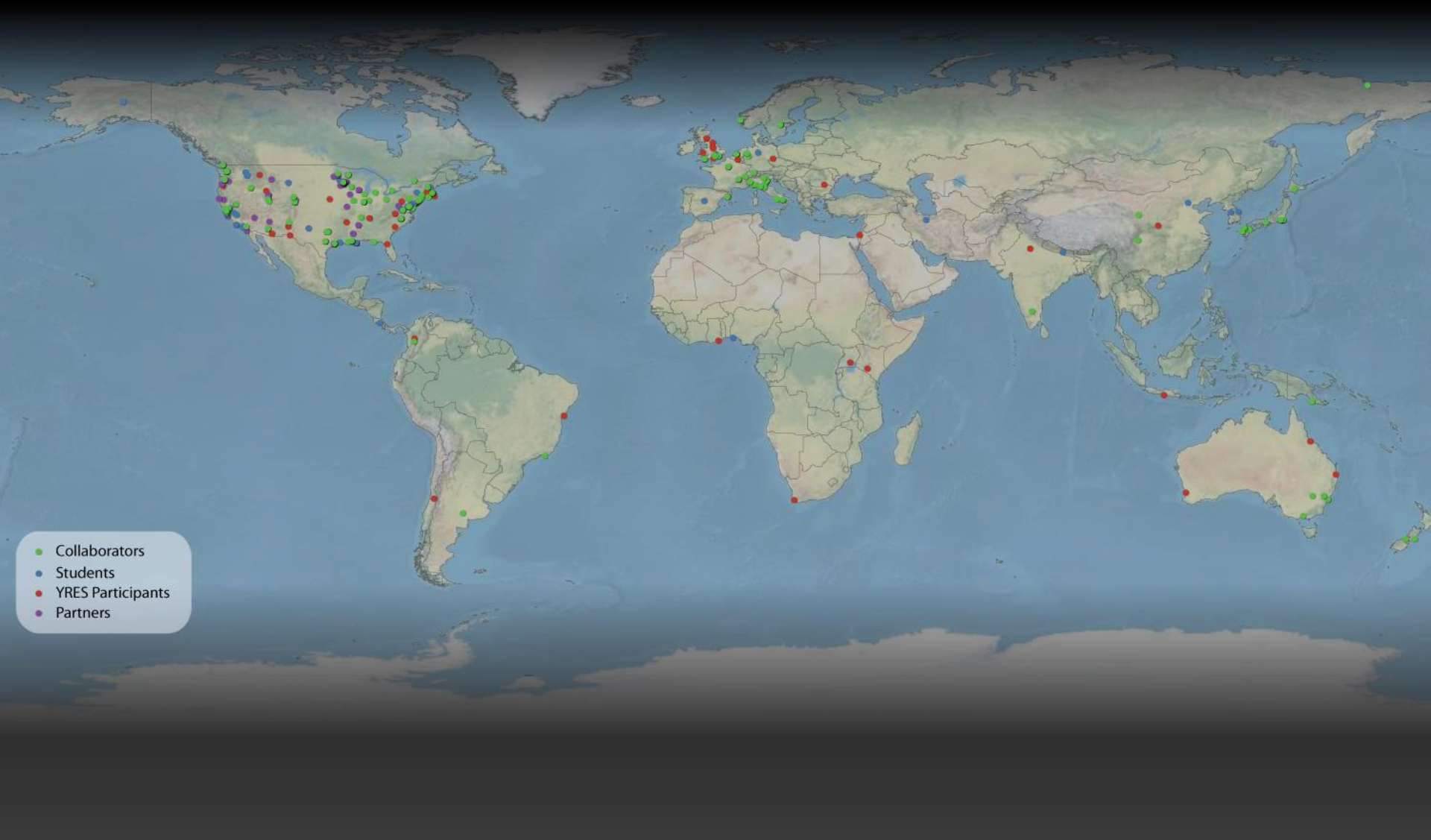
- NCED - Google.org collaboration to implement NCED tools ShalStab, ShaRun, and GeoNet within Googles' Earth Engine API

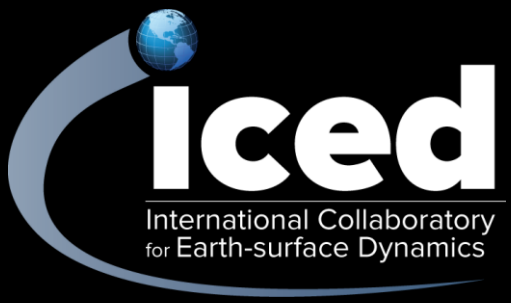
- An entry point for the earth sciences community

  to "democratize" data and terrain-based models for water, hazard, and ecosystem predictions …

Beyond Borders

NCED's Influence Around the World





ICED: a nexus of institutions committed to international collaboration in research, data exchange, and graduate education on Earth-surface Dynamics

Deltares partnership +
IPGP: Inst Phys Globe Paris
Univ of Padova
Univ Natural Res and Applied Life Science
Extensive international exchange in research and students

NCED as a catalyst of a Research Coordinating Network on Earth-surface Dynamics

RHNSS: Rivers for Humans and Nature -- Science for Sustainability

… to foster an integrative approach to river science, from source to sink, from science to implementing solutions, from social to cultural, and from research to education and policy.

… We propose to start with a prototype research coordination network that focuses on three large rivers of the world and their deltas: the Mississippi River in the United States, the Danube River in Europe, and the Parana River in South America.

IYD 2012

… to focus attention on the vulnerability of deltas worldwide and to promote and enhance successful international collaboration that will support more effective and efficient responses to the increasing pressures in river deltas worldwide …

Initiative is currently in progress, proposed at the World Delta Forum, Oct 2010, motivation paper in circulation, seeking support by ICSU …

EAB advice

Feb. 2011 report …. “NCED has a community identity and a momentum and it would be a great loss to lose a connection to NCED facilities and approach …”

Proposed 3 organizational models for continued growth of the community:

1. *Community Center for Earth-surface Dynamics (CCED)*

-- retain a critical mass of synergistic activities, maintain the ESD community access to experimental infrastructure, teach others the NCED experimental approach, and continue to bring different disciplinary groups together …

2. *International Research Coordination Network (ICED)*

-- An organization of institutions commited to international collaboration in research, data exchange and graduate education in ESD…

3. *National Community Earth-surface Dynamics Laboratories (CESDL)*

-- A collection of experimental facilities and labs for linked eco- and earth surface studies that provide continued training and tools to the community…

2010: ARI-R^2 grant to create a world-class laboratory for energy and environmental sustainability

NCED's Legacy and Future

NCED research naturally leads to future directions in Climate and the Energy-Environment Nexus

- Hydrokinetic energy in tidal systems: environmental impacts and mitigation
- Hydrocarbon and resource exploration in coastal regions: ecosystem and socio-economic impacts
- Resilient Coastal Landscapes
- Hydraulically mediated biomass for biodiesel

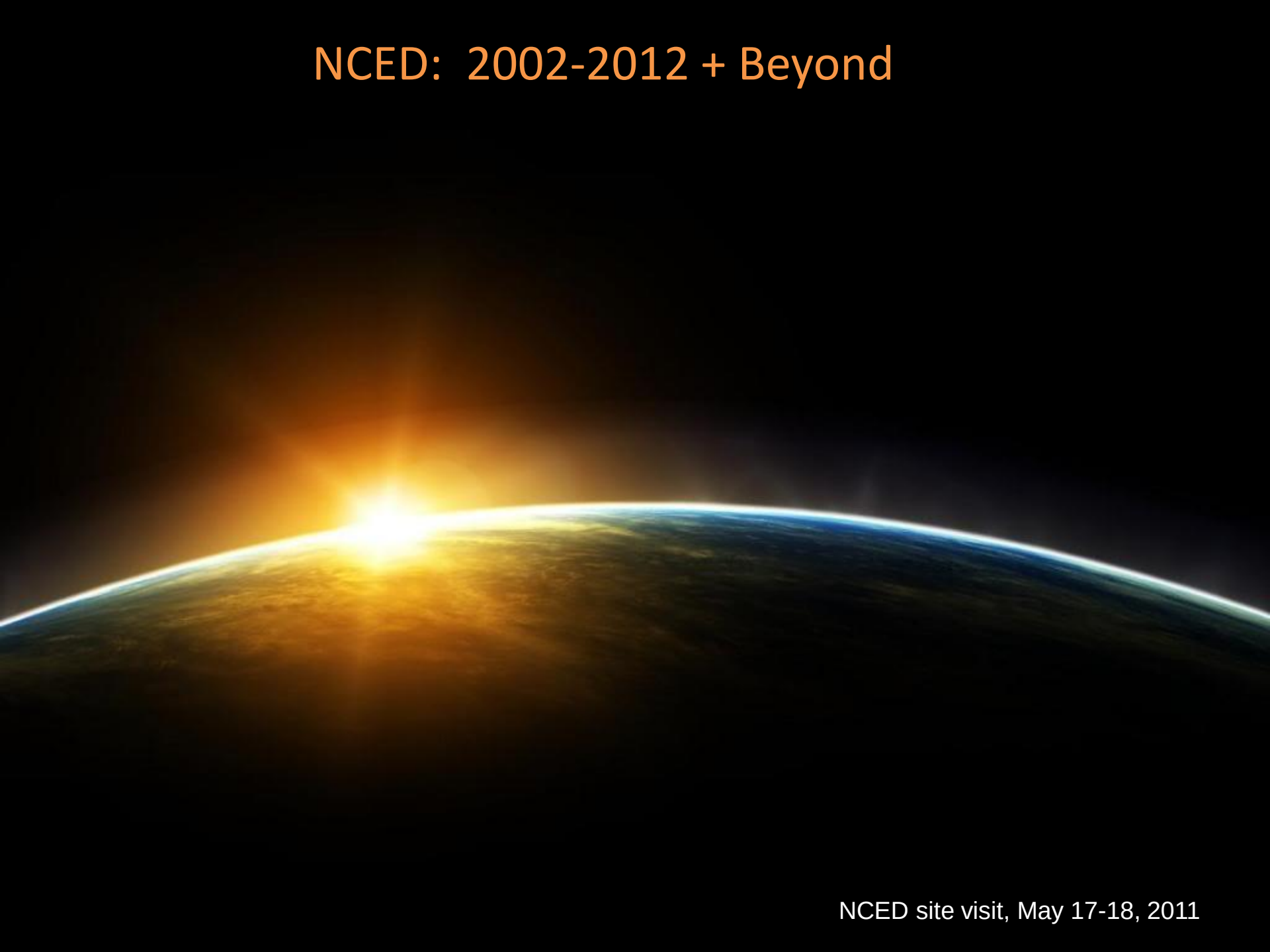
The NSF Science and Technology Centers Integrative Partnerships Program, 2000-2009
Report of the AAAS Blue Ribbon Panel

In all, the STC infrastructure is the glue that holds centers together. Without sustaining support, the partnerships that blossomed and were at the core of the center are at risk. As graduation of an NSF STC looms, the loss of partnerships nurtured over almost a decade jeopardizes continuing fulfillment of the STC's objectives

Thank you!

- Bill Dietrich, Jacques Finlay, Patrick Hamilton, Ben Hobbs, Miki Hondzo, Kimberly Hill, David Mohrig, Gary Parker, Chris Paola, Mary Power, Fotis Sotiropoulos, Robert Twilley, Peter Wilcock, Greg Wilkerson, Vaughan Voller, Andy Wold, Rina Schumer, Karen Gran, Anthony Berthelote, Gillina Roering
- Collin Bode, Jim Buttles, Karen Campbell, Diana Dalbotten, Lowanna Greeksky, Jeff Marr, Paul Morin, Holly Pellerin
- Patrick Belmont, Anne Lightbody, Enrica Viparelli, Melissa Kenney, Noah Finnegan, Taylor Perron, Paola Passalacqua, Doug Edmonds
- Dick Christopher, Chris Ellis, Craig Hill, Sara Johnson, Mike Plante, Jim Mullin
- Deborah Hudleston, Debra Pierzina, Lanie Lord-Van Slyke, Charles Nguyen, David Olsen, Andrew Zenk, Joel Drotos
- NCED graduate students
- NSF Directors and Program Managers
- 8 Site Visit Teams – Thank you!
- 8 EAB Advisory Committee Meetings – Thank you!

NCED: 2002-2012 + Beyond



NCED site visit, May 17-18, 2011

Year 8 PI retreat

January 13, 2010
Baton Rouge, LA