

Networking the Networks At USGS: Essential Measurements for a Changing World

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NADP Annual Meeting
Lake Tahoe, California
October 21, 2010



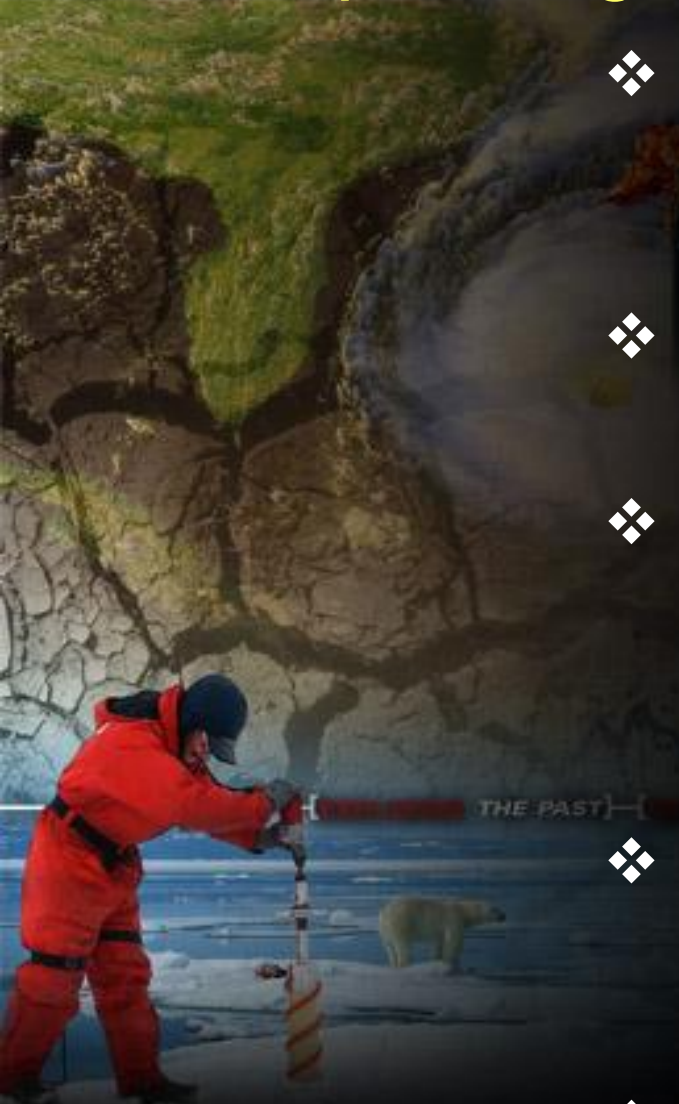
Networking the Networks: Essential Measurements for a Changing World

- ❖ What Networks are we talking about?
- ❖ What measurements do we need to link?
- ❖ What questions do you want to answer?
- ❖ At what spatial scale?
- ❖ When do we need answers?
- ❖ How much uncertainty is acceptable?

What does “Networking the Networks” really require of our programs?

- ❖ Conforming to common metadata and data delivery standards (e.g., common web services; releasing data)?
- ❖ Changing Site Selection Criteria or moving existing sites?
- ❖ Adding specific measurements to be collected by all programs?
- ❖ Altering data collection protocols or participating in data comparability studies?
- ❖ Making the time commitment to collaborate with other monitoring programs?

Explore an Example: Issues in Understanding and Responding to Climate Change



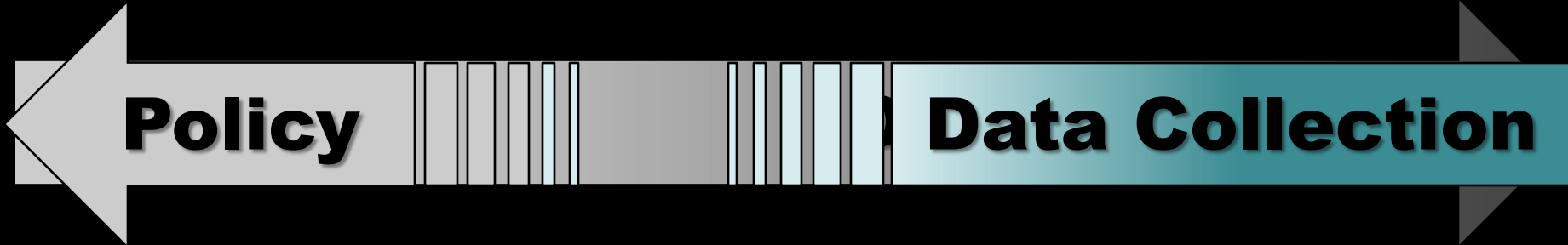
- ❖ To effectively respond to climate change, we must understand whole-systems and feedback responses
- ❖ Climate change will be a superimposed stress on already stressed systems
- ❖ To anticipate change, we must focus on system resilience and thresholds. By the time a problem is noticed in a specific location it will likely be chronic
- ❖ We therefore need long-term records and data at the full range of spatial and temporal scales
- ❖ We need the answers yesterday

The Climate Effects Science Dilemma

- ❖ Valuable historical records are available but scattered, so system-level observation is poor.
- ❖ Most science funding and thinking is short-term and also scattered.
- ❖ The chances of significant new money are weak.
- ❖ Without whole system datasets, adaptation strategies will be incomplete. Few whole-system datasets are available
- ❖ In 50 years, our representative site will be 50 miles north.

So, how do we provide the information our speakers have described in the shortest period of time? How do we effectively tap our multiple existing programs?

A Requirement: Linking Monitoring to Policy



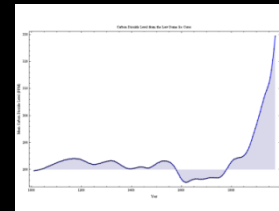
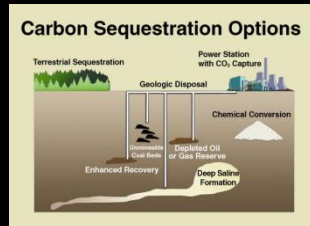
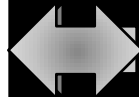
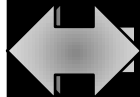
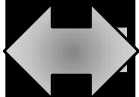
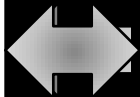
**Policy and
Science
Issues**

**Management
Decisions**

**Science
Questions**

**Data
Synthesis**

**Data
Collection**



DOI Observing Alliance Vision Statement

“To provide earth system information for understanding, tracking, and forecasting the effects of climate change on ecosystems, natural resources, and society; and to empower and assess adaptation or mitigation responses to those changes in the most cost effective, timely, and scientifically-rigorous manner possible.” (DOI Climate Impacts Task Force, 2009)



Key Components of the CEN

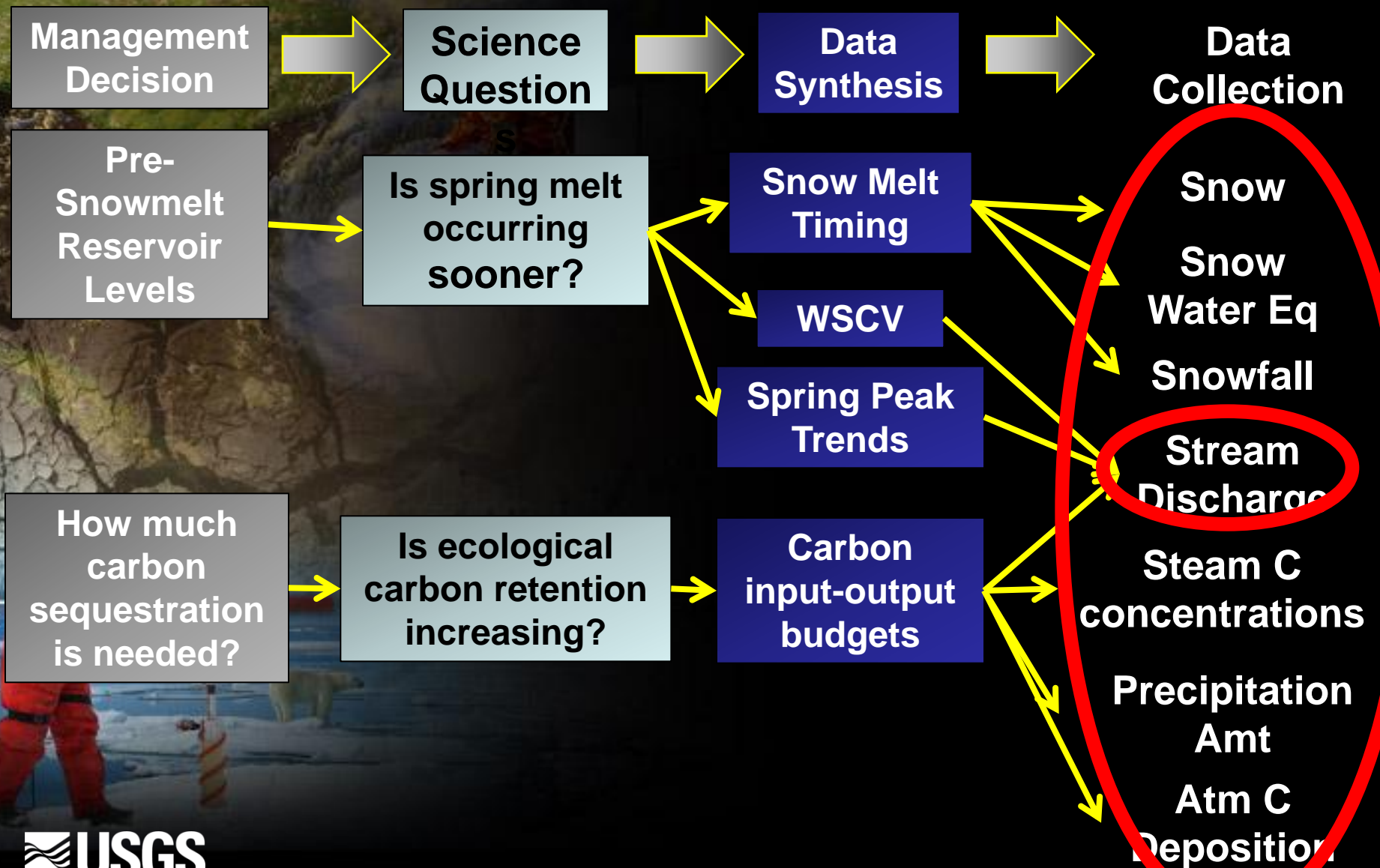


- ❖ Focus on manager and policy issues
- ❖ Enhancing (not controlling) existing monitoring to address climate change
- ❖ Enhanced access to science data and information
- ❖ Integrated information for understanding the response of whole ecosystems
- ❖ Core variables measured across the landscape
- ❖ New remote sensing tools linked to ground-truth observation sites
- ❖ Services that support data integration
- ❖ An early warning system for anticipating and responding to global change in the most cost-effective manner possible.

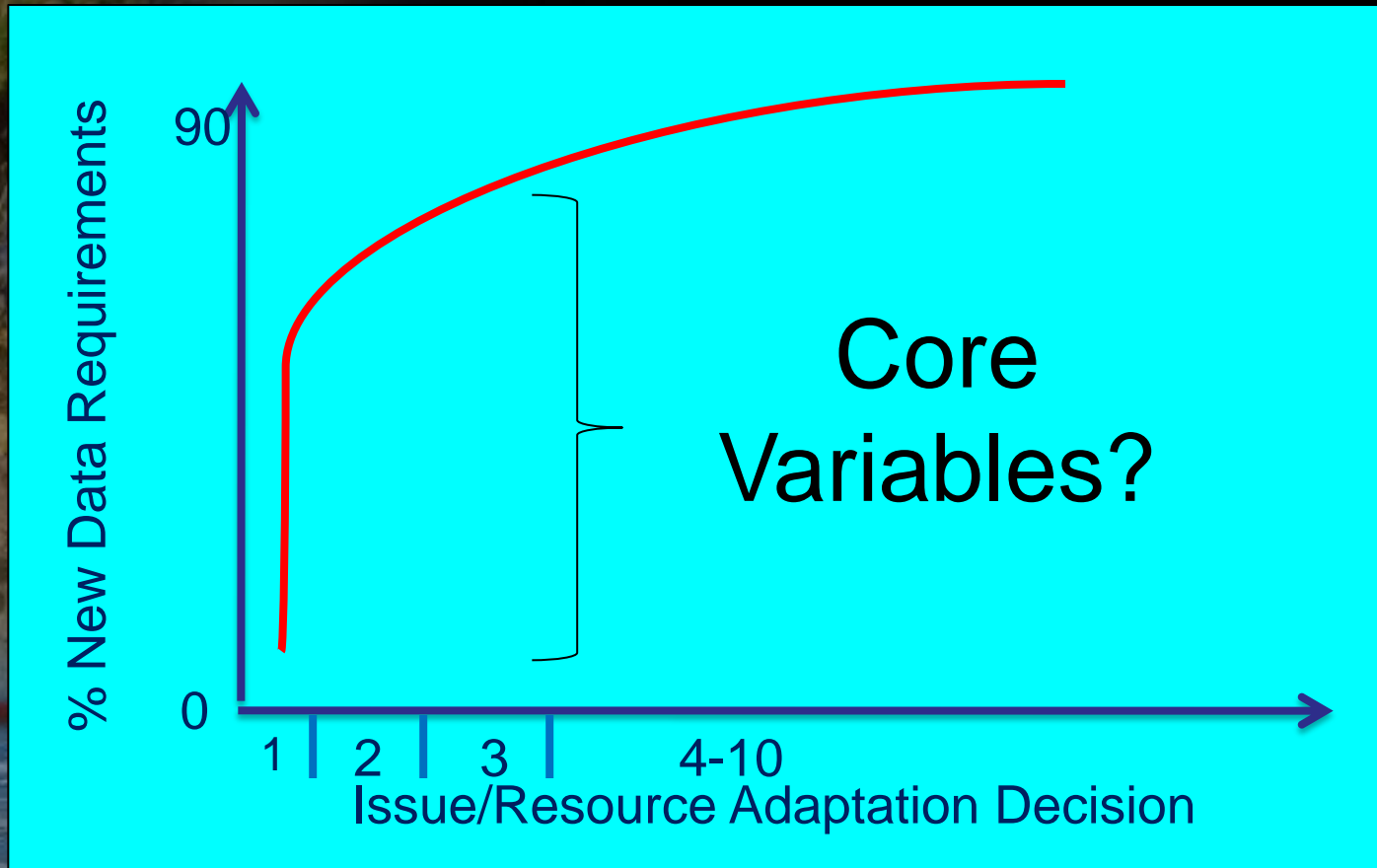
Steps Involved in Networking the Networks

1. Prioritize key management issues and decisions with stakeholders
2. Determine types of data needed
3. Determine what data is already being collected and by what networks
4. Complete an assessment and gap analysis relative to each issue
5. Provide the services necessary to support the collaboration
6. Ensure results are linked to applications for decision support

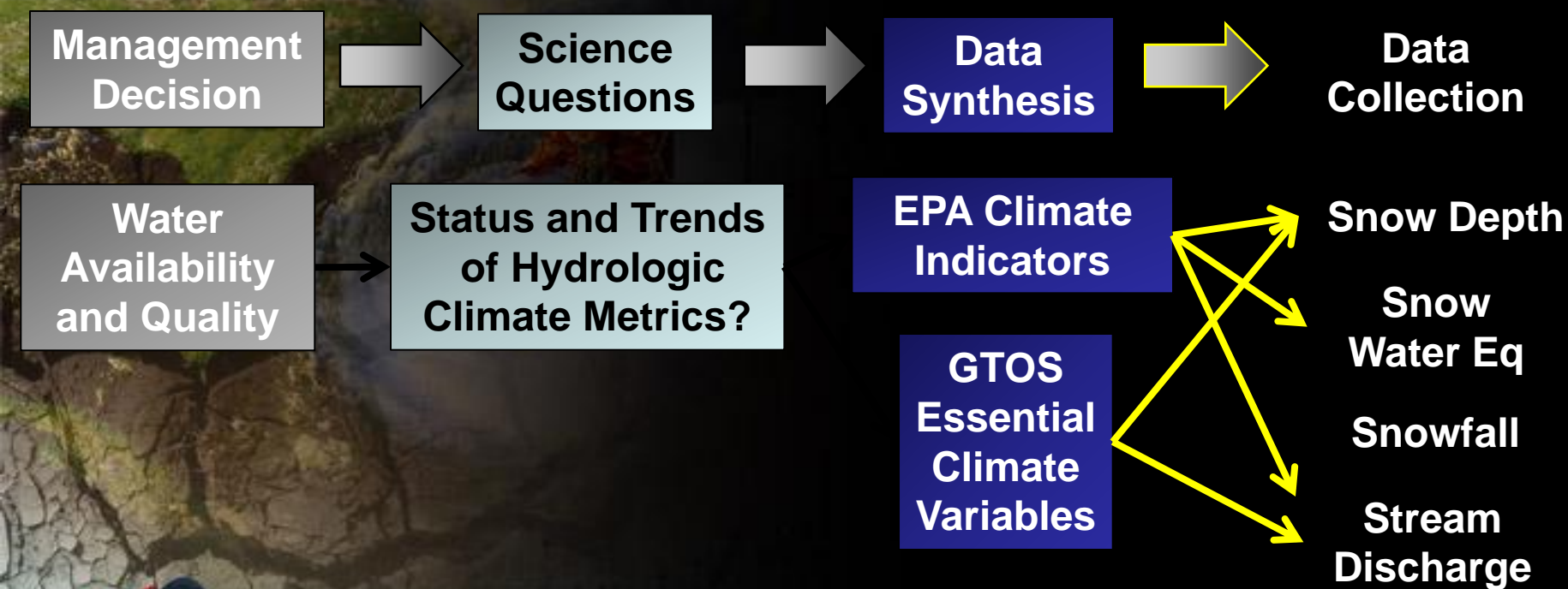
Linking networks through questions



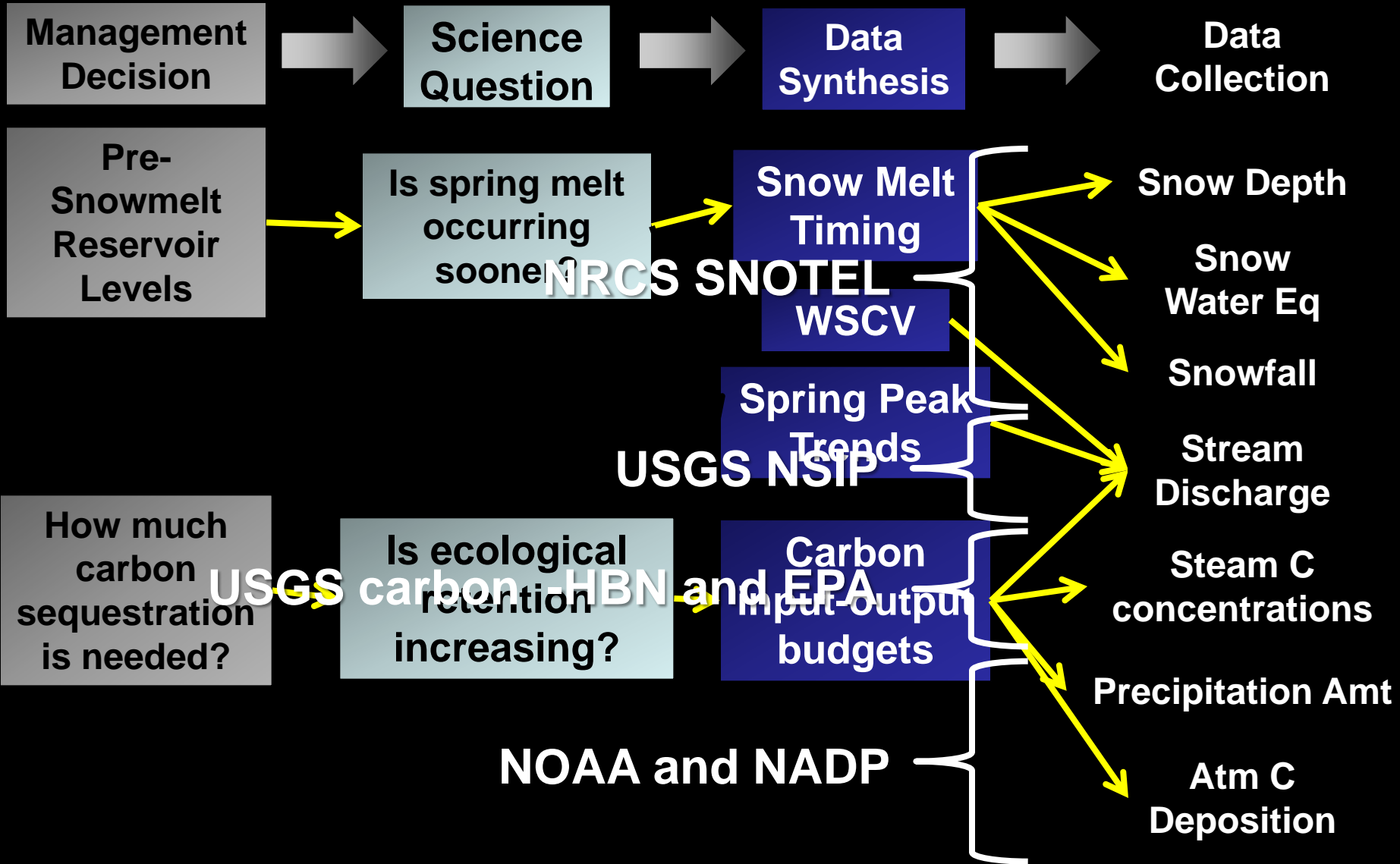
Adding issues does not double data needs



Serving Key Indicators



Identifying the Networks



How do we organize data across scales?

PROBLEM:

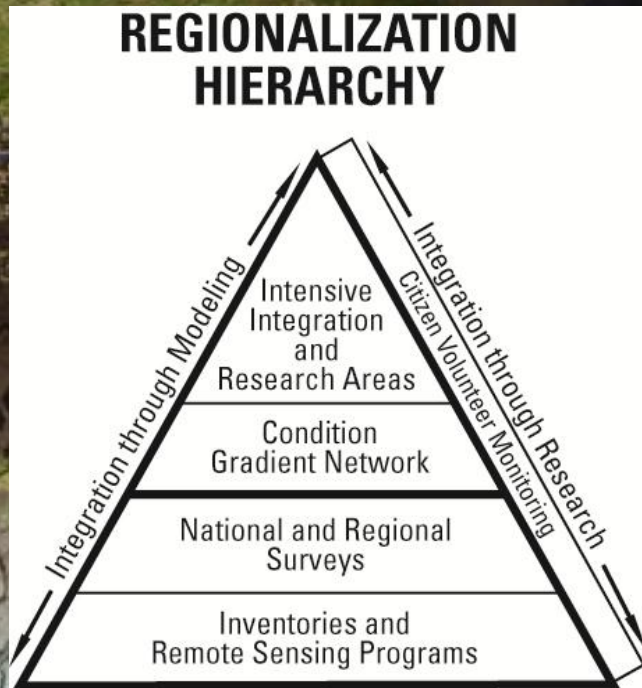
It is not possible to assess the complex changes, interactions, and feedbacks caused by climate change at every specific location where resource managers need us to -be, or by separate discipline/agency -specific initiatives.

THE NECESSARY ASSUMPTIONS:

The dominant processes controlling ecosystem function are similar; ecosystem condition is highly variable, but can be mapped.



Charge Given to CENR by Clinton Administration, July 1996:



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



The Watershed as a Landscape Frame of Reference

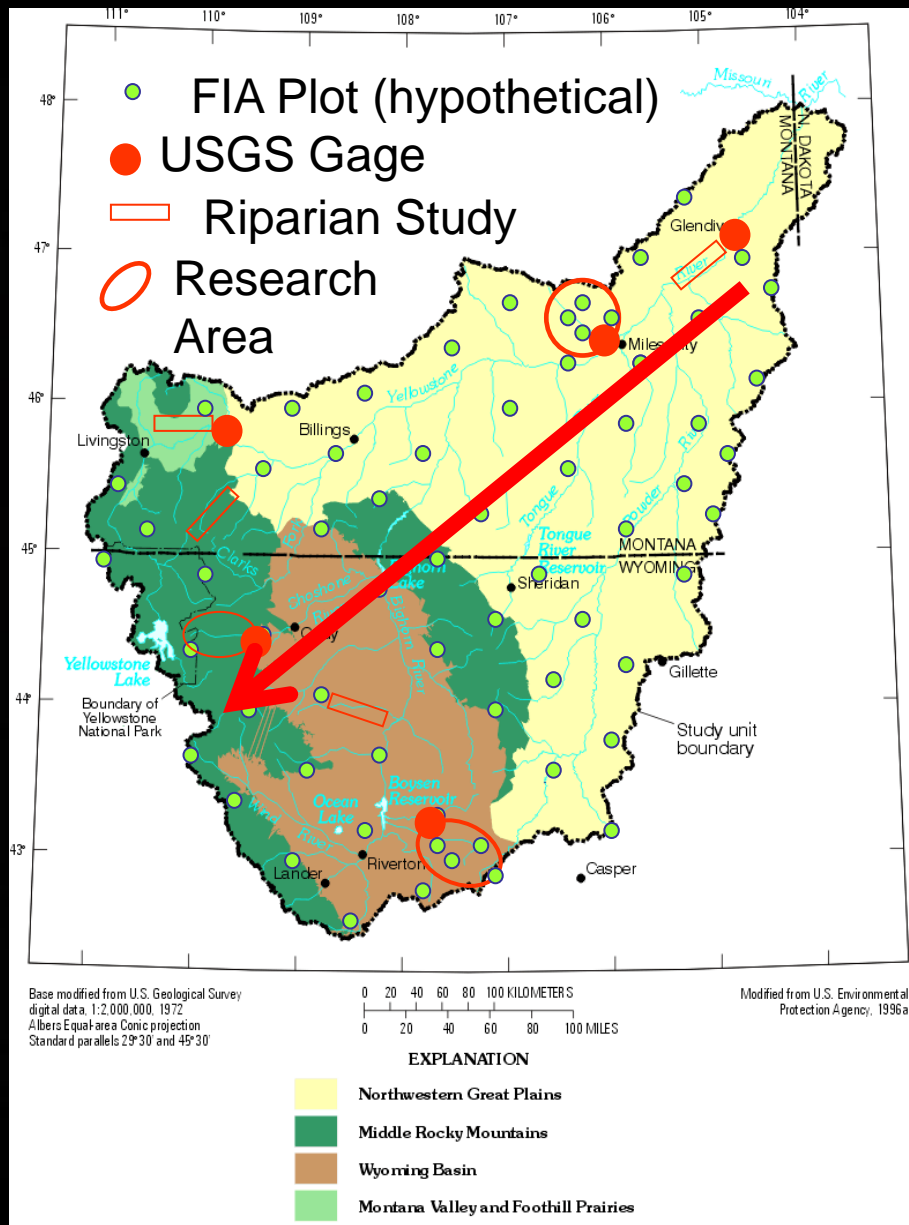
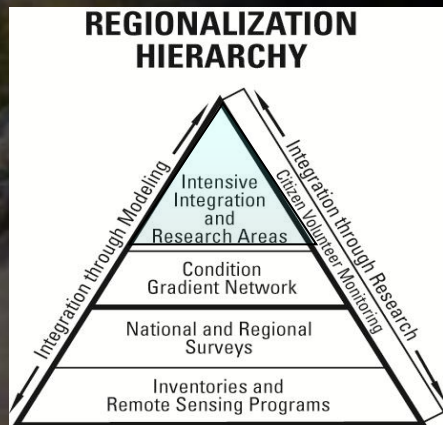
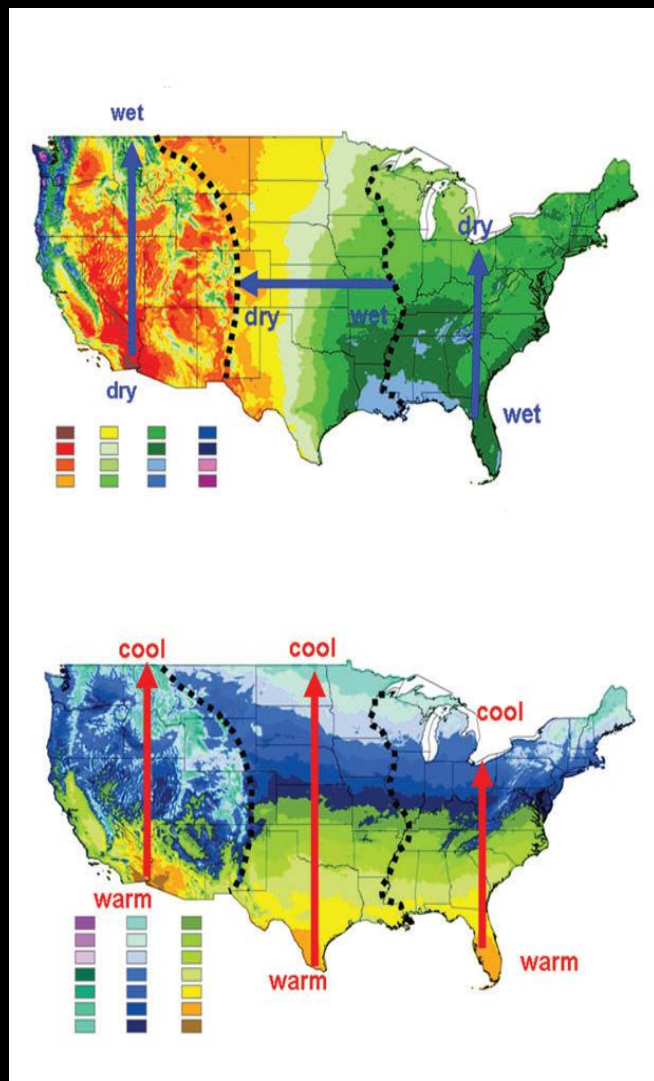
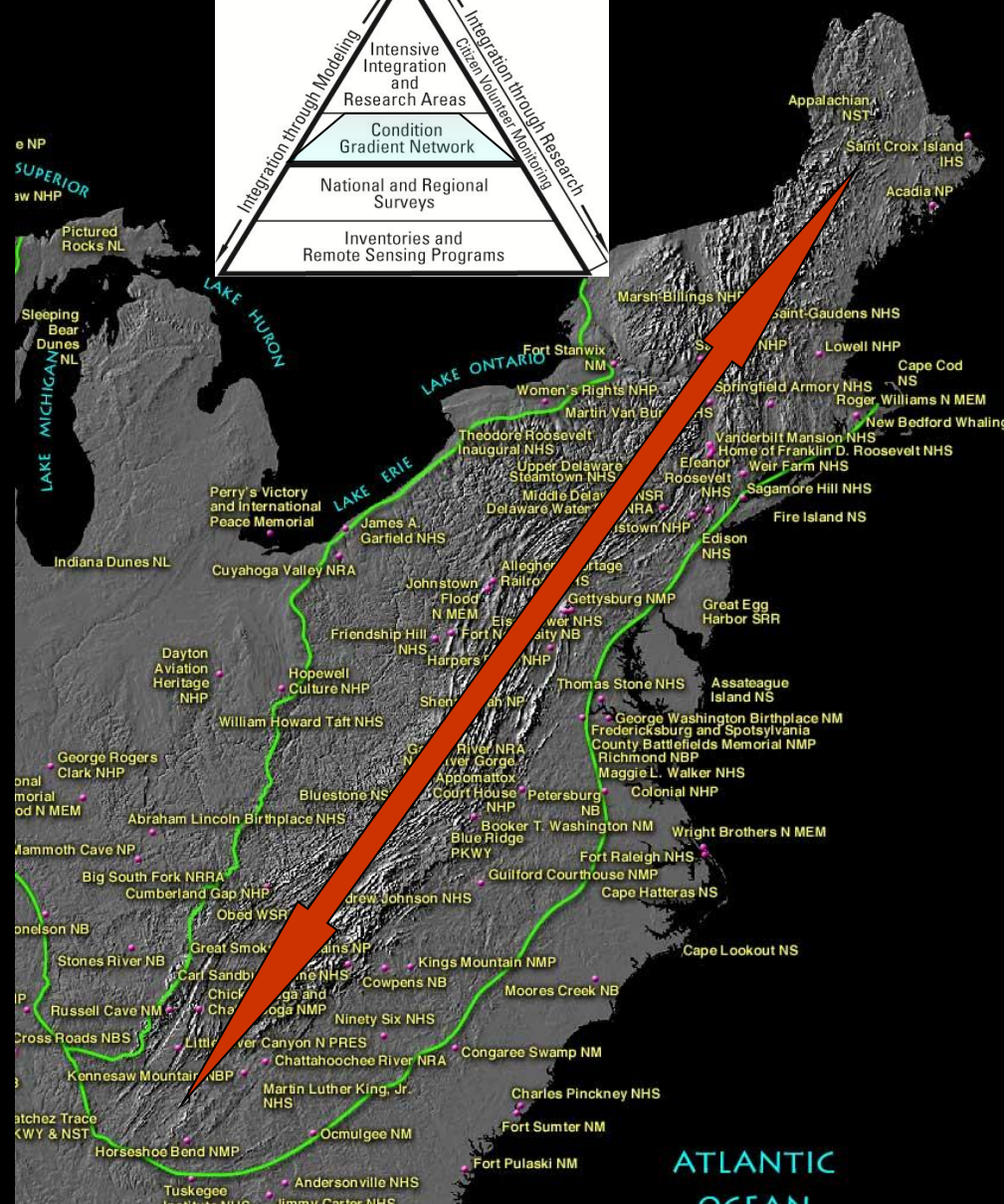
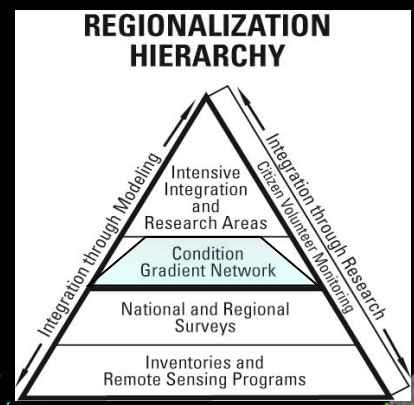


Figure 23. Ecoregions, Yellowstone River Basin, Montana, North Dakota, and Wyoming.

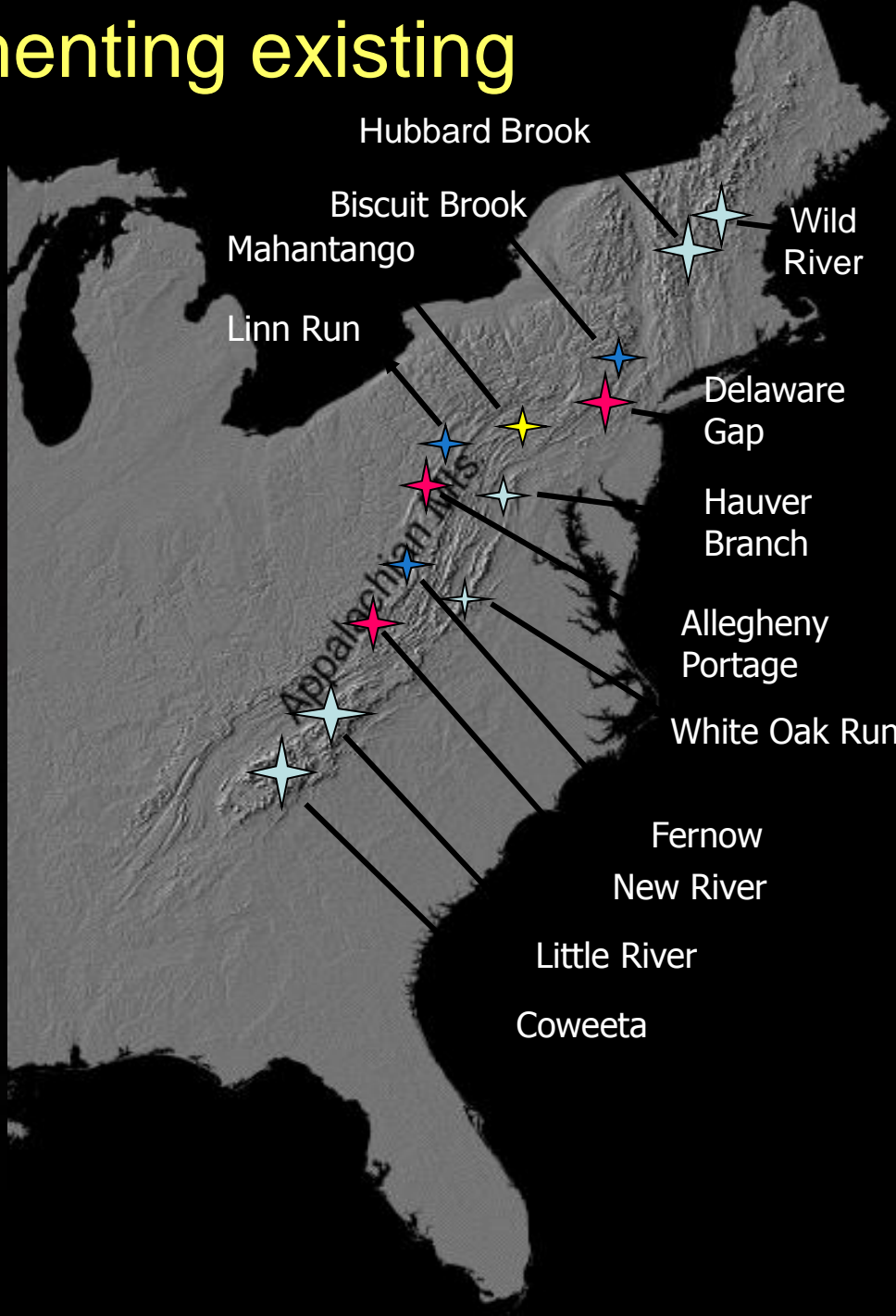
Appalachian Gradient Study



Organizing along stressor gradients



Leveraging and supplementing existing research watersheds



National and Regional Assessments Underway

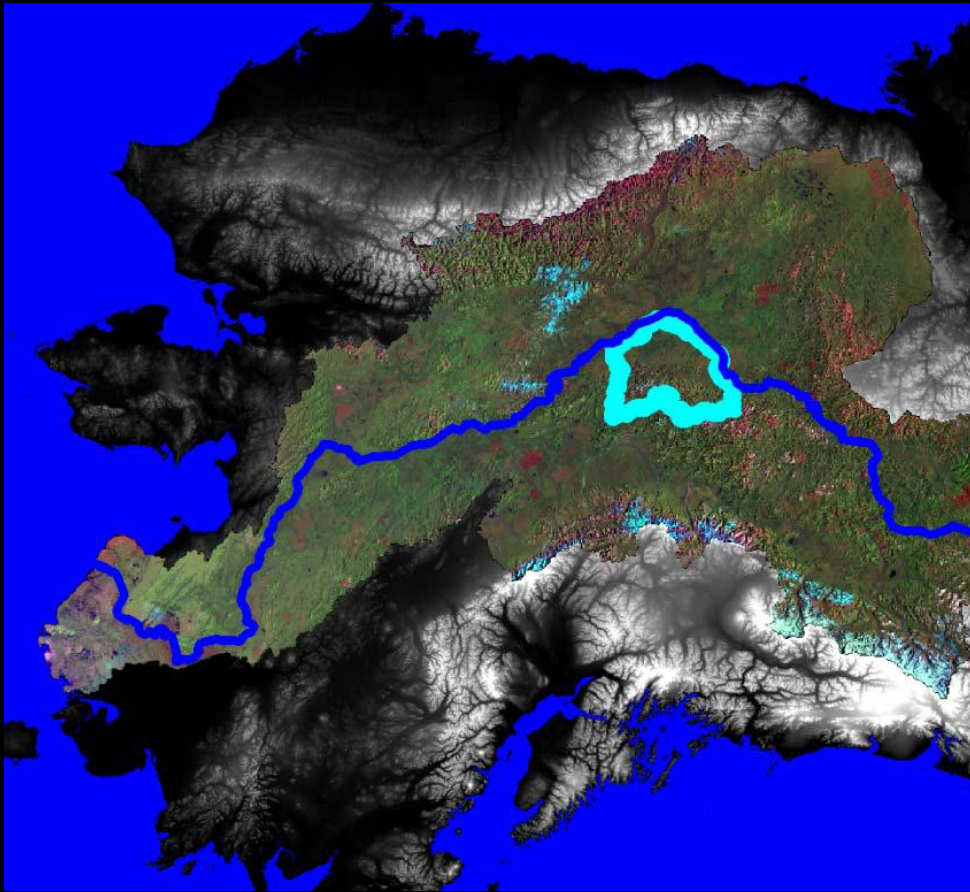


- ❖ Water in the Arid West (in Review)
- ❖ Water Availability and Quality- National
- ❖ Coastal Carbon and Sediment Export
- ❖ Coastal Impacts Associated with Sea-level Rise
- ❖ Landscape and carbon export changes from Thawing Permafrost
- ❖ Socio-economic feedbacks on water availability in the west
- ❖ Outbreaks of Pests, Invasive Species, and Diseases in the Platte River Basin
- ❖ Climate Impacts on Grassland productivity
- ❖ Climate and Wildland fires in Alaska

All have some common data needs

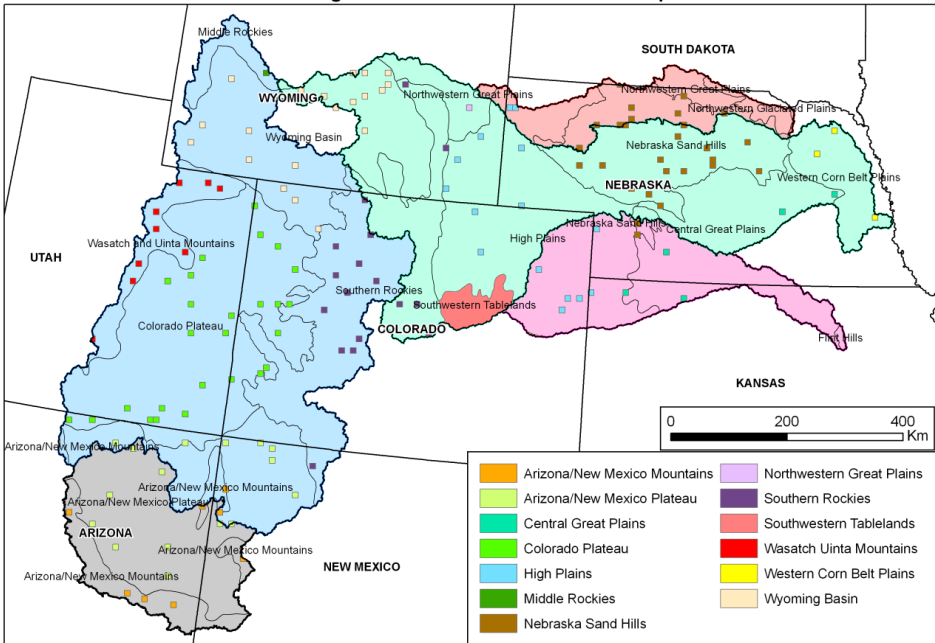
Yukon River Basin CEN Pilot

Started small (within budget) Planned Inter-disciplinary Design



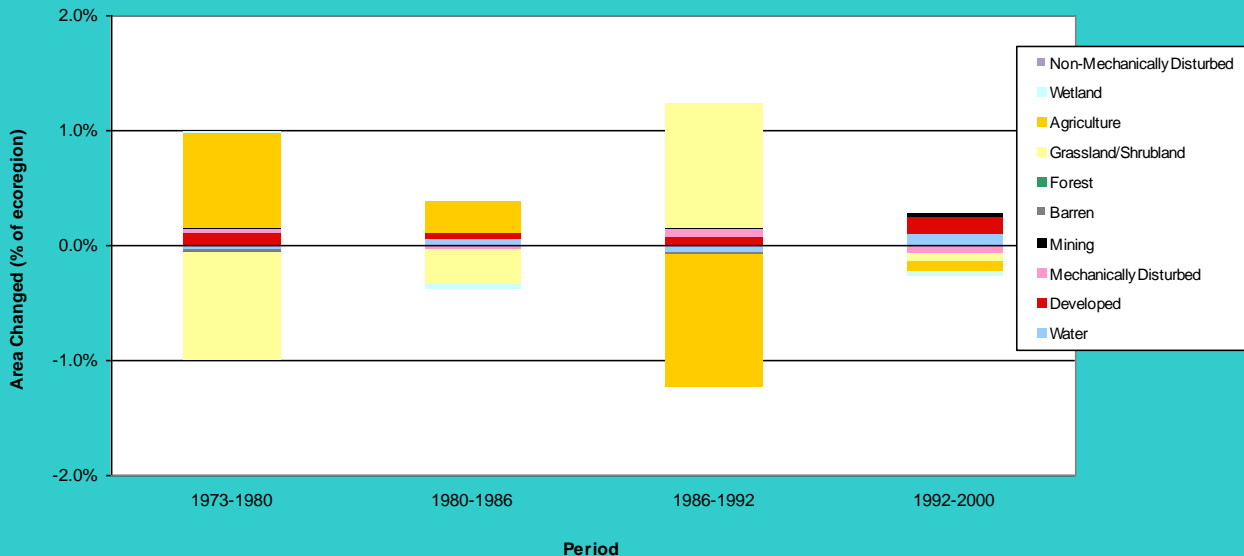
(“Small” in this case is the size of the Delaware River Basin)

USGS Climate Effects Network
Upper Colorado and Greater Platte River Basin
Level III Ecoregions with Land Cover Trends Sample Sites





Desert to Alpine to Grasslands Gradient Assessment: Changes in Land Cover

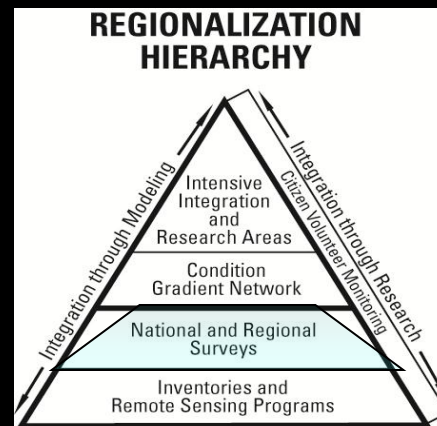
Estimated Net Change in Land Cover Classes by Interval



National Climate Effects Network Surveys



-  CORE study areas (proposed)
-  Survey points (hypothetical)



Proposed Regional Survey Datasets

- Vegetation Type (FIA)
- Vegetation Health (FHM)
- SOIL CARBON**
- Wildlife census
- Surficial Geology
- Water quality
- Forest Fragmentation
- Precipitation and air temperature networks
- Active layer thickness (north)

Improvements in National Observing Underway

Methods
development
on the
ground.....



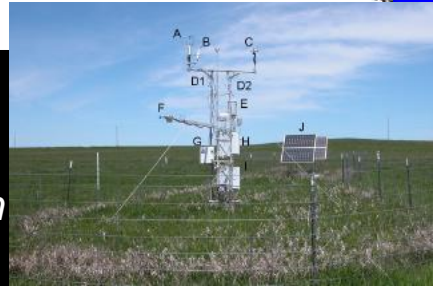
In-situ DOC probes and sediment
monitoring for Carbon flux to the
coastal ocean

Goal: Linking process understanding to the local, regional, national, and global scales

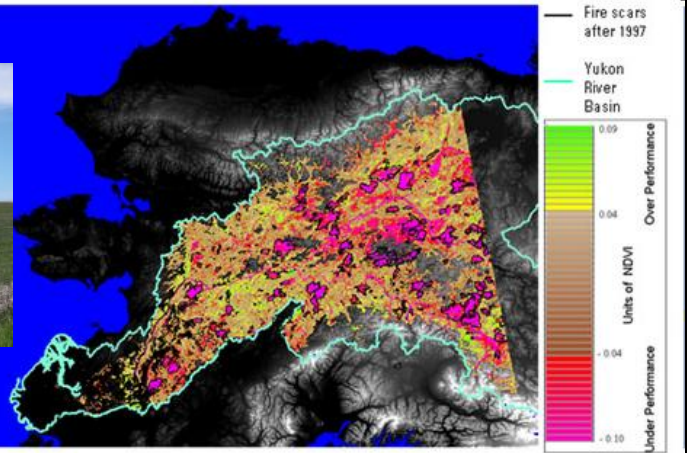


*Land Cover Trends:
30-Year Record of
Ecoregion Change
in the Conterminous
US (all 84
ecoregions)*

Global Change R&D:
*Science in Support of Climate
Change Monitoring & Adaptation*

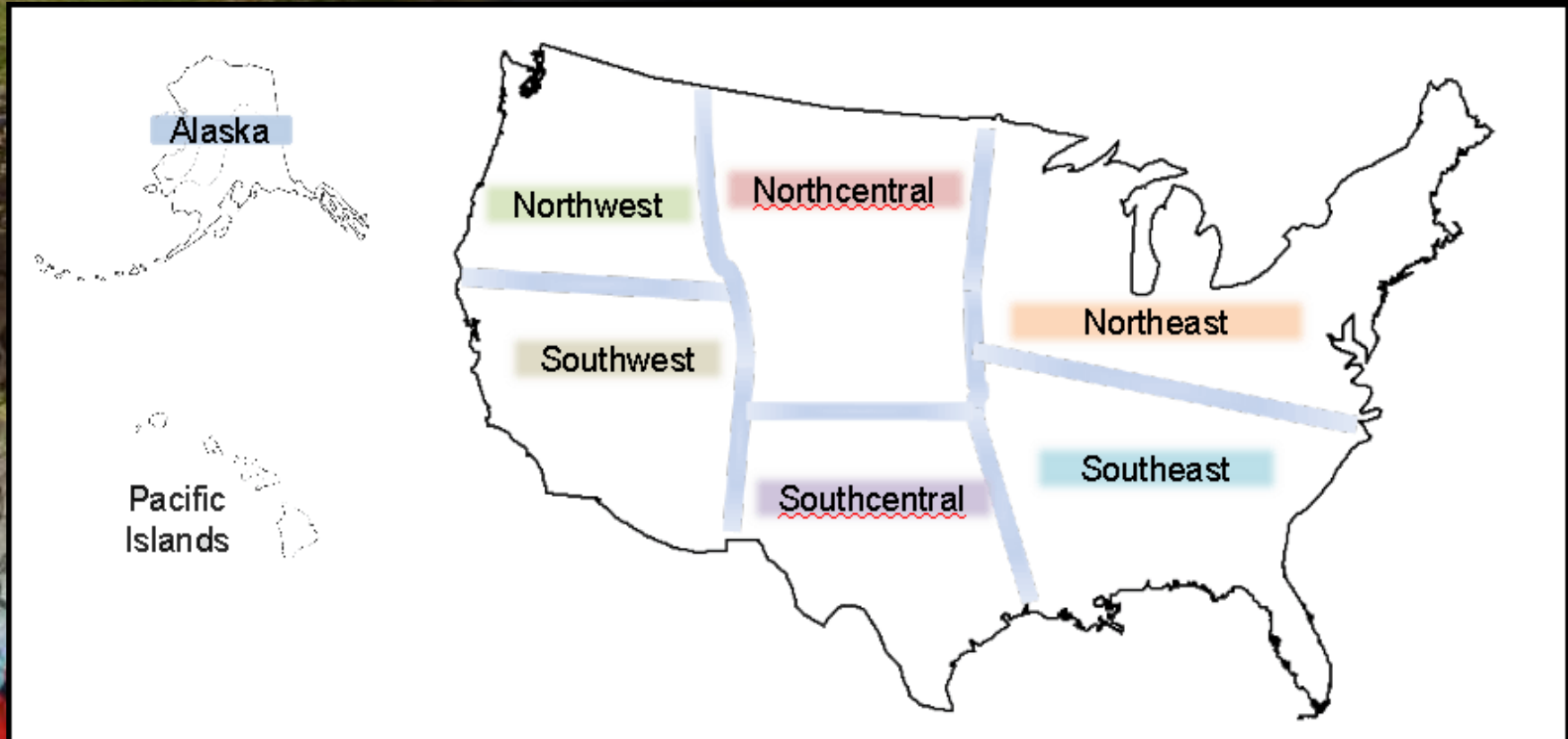


*FY 09 & FY 10 Major
Accomplishments*



....And OFF
the ground

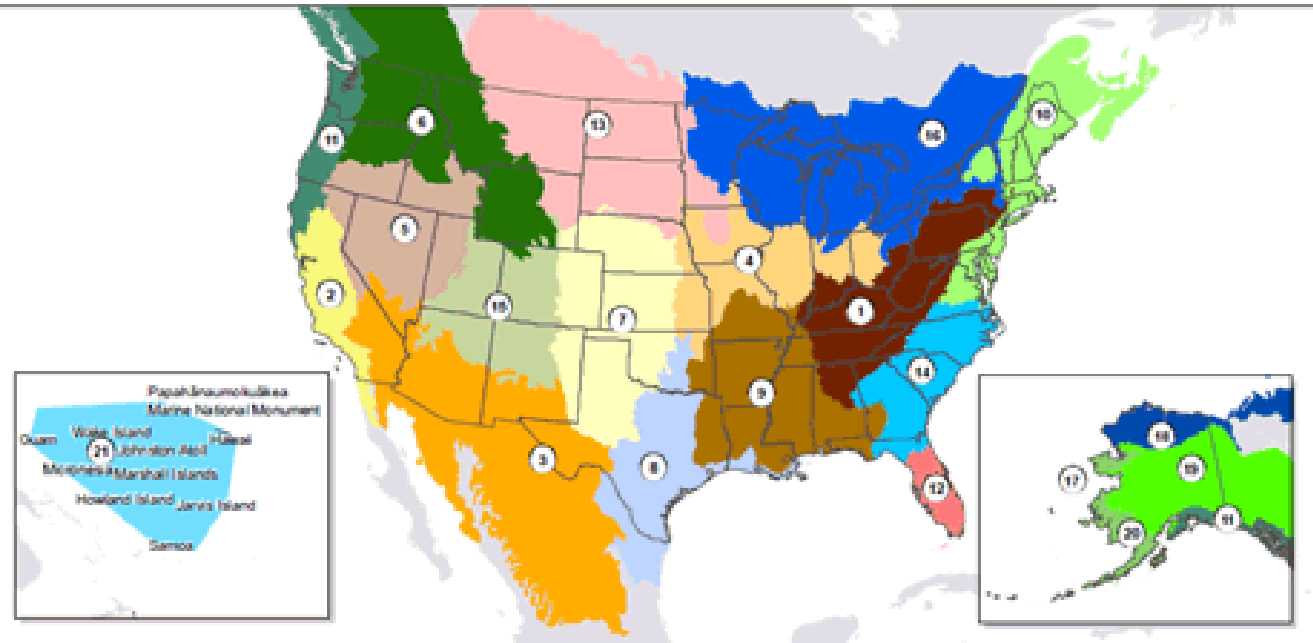
DOI Climate Science Centers



DOI Landscape Conservation Cooperatives



Landscape Conservation Cooperatives



Landscape Conservation Cooperatives

- | | | | |
|---|-----------------------------------|-------------------------------------|----------------------------------|
| 1. Appalachian | 6. Great Northern | 12. Peninsular Florida | 18. Arctic |
| 2. California | 7. Great Plains | 13. Plains and Prairie Potholes | 19. Northwestern Interior Forest |
| 3. Desert | 8. Gulf Coast Prairie | 14. South Atlantic | 20. Western Alaska |
| 4. Eastern Tallgrass Prairie and Big Rivers | 9. Gulf Coastal Plains and Ozarks | 15. Southern Rockies | 21. Pacific Islands |
| 5. Great Basin | 10. North Atlantic | 16. Upper Midwest and Great Lakes | Unclassified |
| | 11. North Pacific | 17. Aleutian and Bering Sea Islands | |

Albers Equal Area Conic NAD83
Produced by FWS, BRTM, Denver, CO
Map Date: 10/16/2010

Building the Database- A Pilot partnership of CEN and 9 Fed and State Partners in Alaska

We will need data sharing, management, assessment, and access at an unprecedented scale.



What does Networking the Networks Get Us?

- 💧 We can use each others data.
- 💧 The whole becomes greater than the sum of its parts.
- 💧 More exposure for your programs and your data.
- 💧 More data users equals more justification for your program.
- 💧 Potentially more long-term stability – safety in numbers.
- 💧 Collaboration without giving up our existing missions.

CEN's Potential Role in "Networking"

- ❖ Facilitate formation of an Observing Alliance- not dictate how it will be done
- ❖ Data management
- ❖ Data Comparability and Common Vocabularies
- ❖ Filling Data Gaps
- ❖ Sustaining Core Variables
- ❖ Communication
- ❖ Co-Host a workshop soon

CLIMATE SUMMIT

WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.



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Conclusions

- ❖ Networking the networks requires a careful analysis and a major commitment to the collaborative process.
- ❖ We can do this as a cooperative without giving up our individual sovereignty.
- ❖ We can come together to form a network of networks that is greater than the sum of its parts thereby helping each partner to justify their existence.
- ❖ The USGS-CEN's mission is simply to help make this happen.

Climate Effects Network

<http://gcp.usgs.gov>

pmurdoch@usgs.gov

518-285-5663 wk

571-230-3963 cell



THE PAST | THE FUTURE

Science and Management Questions

- How will increases in temperature affect the hydrology of the Yukon River Basin and how will these changes affect water distribution and river flow?
- Will carbon flux “feedbacks” to warming resulting from changes in the land cover, soil active layer, and basin hydrologic regime potentially enhance global climate warming?
- What are the effects of climate change on the abundance, quality, distribution and access to subsistence resources?
- How will these changes affect the distribution, species, and quality of forest resources ?
- What strategies are needed to adapt to the likely effects of climate change and associated permafrost thawing on natural resources, human infrastructure, and local culture?

Yukon Foundation Programs

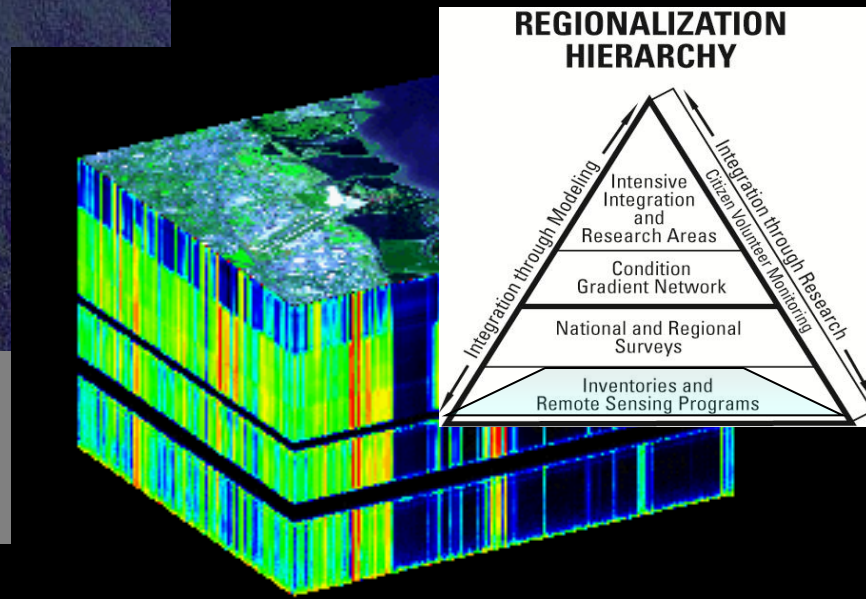
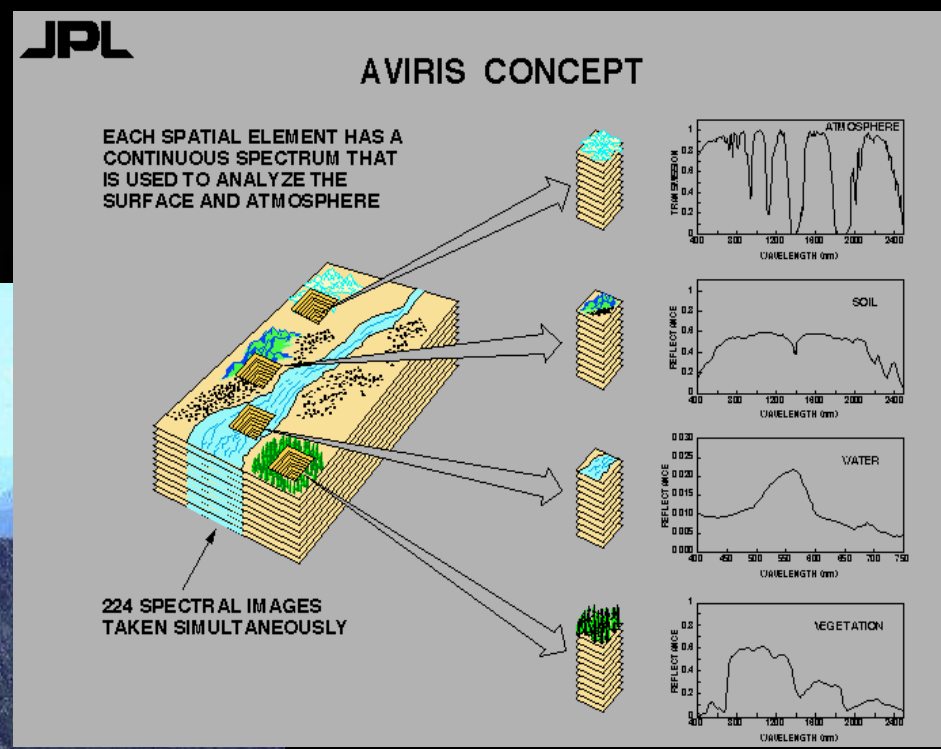
- Bonanza Creek/Caribou-Poker Flats LTER *Tier 1*
- UAF/UAA Research and Modeling (eg. Scott Rupp)
- FWS/NPS monitoring programs *Tier 1*
- Wolf Creek, Yukon Territories *Tier 1*
- New USGS Research Watersheds- *Hess Creek*
- Soil carbon studies, Gradient Karst sites *Tier 2*
- USGS- Yukon River monitoring program *Tier 2*
- USFS Forest Inventory & Analysis Prog (FIA)? *Tier 3*
- EROS coverage development- *Tier 4*
- NOAA RISA Program (*Tier 2,4*)

Remote Sensing: Building new tools through an integrated ground-truthing network



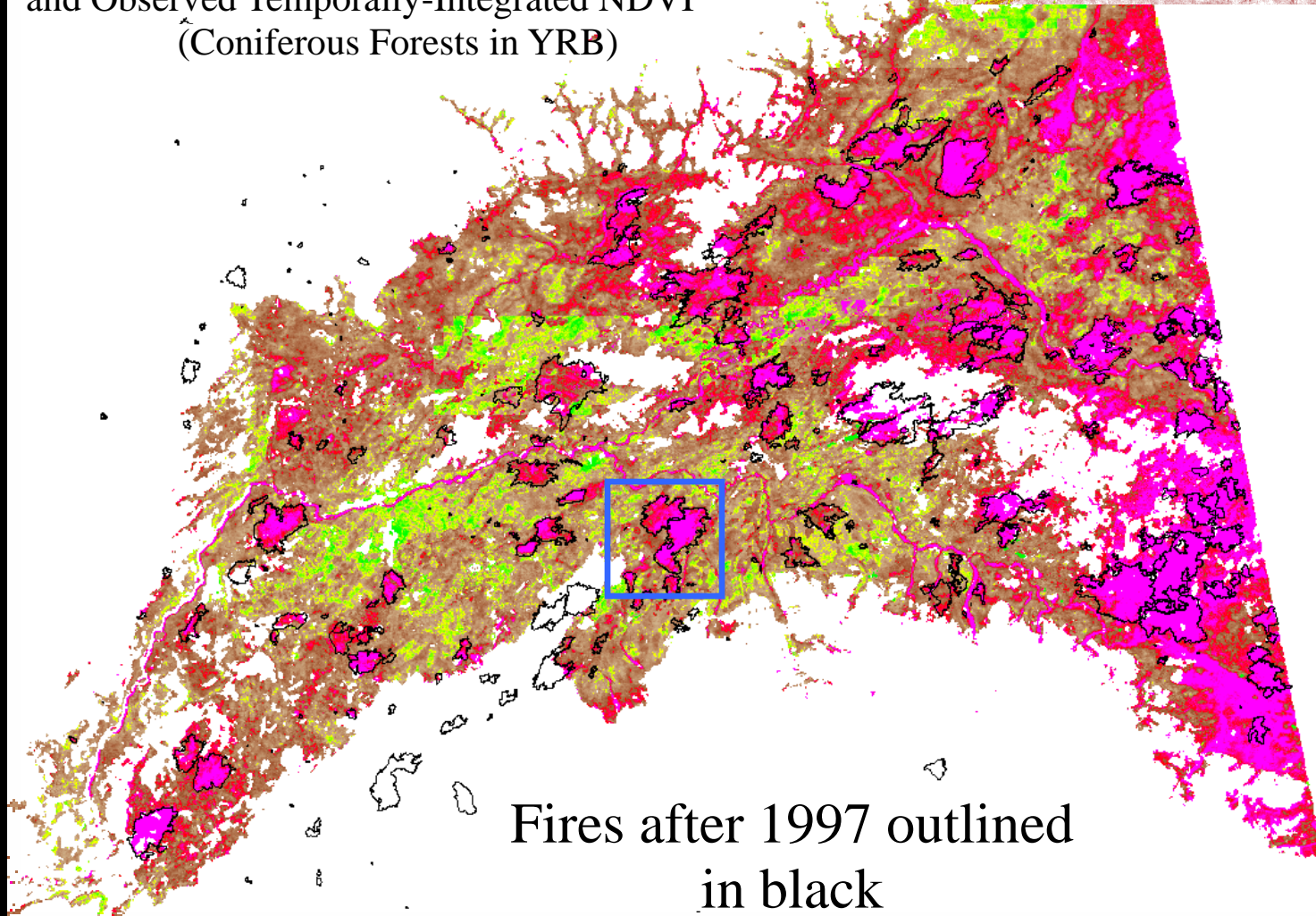
AVIRIS Airborne Visible InfraRed Imaging Spectrometer

The resulting 224 band layer image is known as an "image cube". When the data from each band is plotted on a graph, it yields a spectrum.



Develop new methods

2004 Difference Between Predicted
and Observed Temporally-Integrated NDVI
(Coniferous Forests in YRB)



positive
anomalies

negative
anomalies

The Data Challenge

We need:

- Interdisciplinary data
- From: Multiple data types
- Collected at: Multiple spatial and temporal scales
- Some of the data already have a home
- Some of the data have no home
- Some of the data are actually data products
- Dealing with Multiple Data Owners
- Must make all or most data linkable

Climate Effects Integrated Observing System

- ☹ Relevance to management and policy decisions
- ☹ Capacity to address local, regional, and national issues
- ☹ Provide a process for integrating and sharing data
- ☹ Collaboration: A Long-term Commitment of Partners
- ☹ Core Measurements and Indicators for specific science questions