

Introducing NHDPlus!

A Tool for Watershed Planning

May 8, 2006

National Monitoring Conference



The NHDPlus Team

**EPA Project Lead
Tommy Dewald**

Horizon Systems

Cindy McKay

Jen Hill

Bob Deffenbaugh

USGS WRD

Al Rea

Rich Moore

Craig Johnston

RTI International

Tim Bondelid



Presentation Outline

What is NHD and NHDPlus?
How can NHDPlus aid
watershed planning?

The background of the slide features several concentric, light blue circular ripples that resemble water droplets hitting a surface. These ripples are scattered across the lower half of the slide, with a larger one on the right and several smaller ones on the left and bottom.

What is the National Hydrography Dataset (NHD)?

A Framework dataset that includes:

- Hydrographic features for making maps
- A national stream addressing system
- A modeling network for navigating upstream/downstream



NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

1:100K NHD Improvements

Stream and waterbody names

Corrections to stream network geometry

Corrections to flow directions



NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. **A set of value added attributes to enhance stream network navigation, analysis and display**
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

Value Added Attributes (VAAs)

Analysis

- Stream Order
- Waterbody Identifier
- Waterbody Type
- Upstream Miles
- Distance to Terminus

Navigation

- Stream Level
- Link-Node Traversal
- Hydrologic Sequence
- Terminal Identifiers
- Level Path Identifiers
- QAQC'ed Connectivity

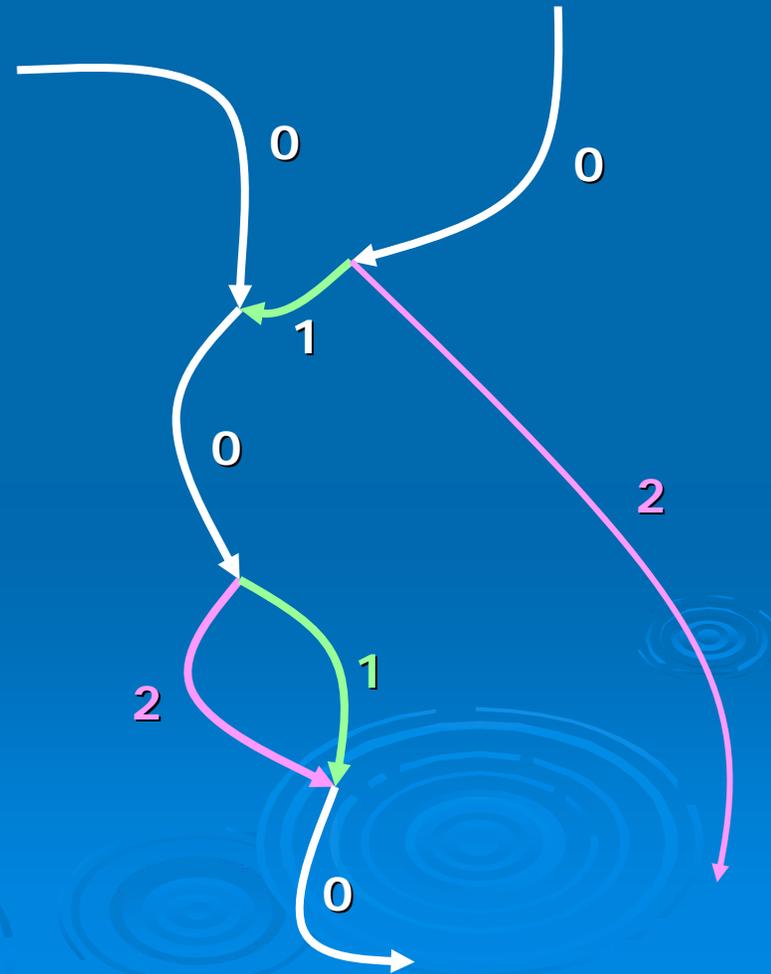
Table

Display

- Generalization Attribute

Divergence Flag

A flag which defines the major and minor branches of a flow split (divergence).

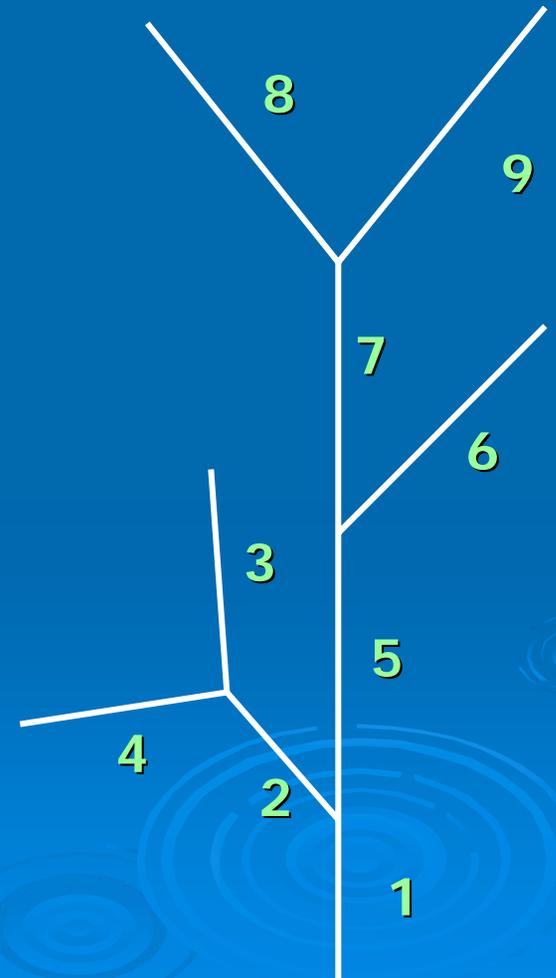


Hydrologic Sequence Identifier

A nationally unique sequence number that places the flowline in hydrologic sequence.

- Descending sequence = upstream to downstream

At any flowline, all upstream flowlines have higher hydrologic sequence numbers and all downstream flowlines have lower hydrologic sequence numbers.



NHDPlus – What is it?

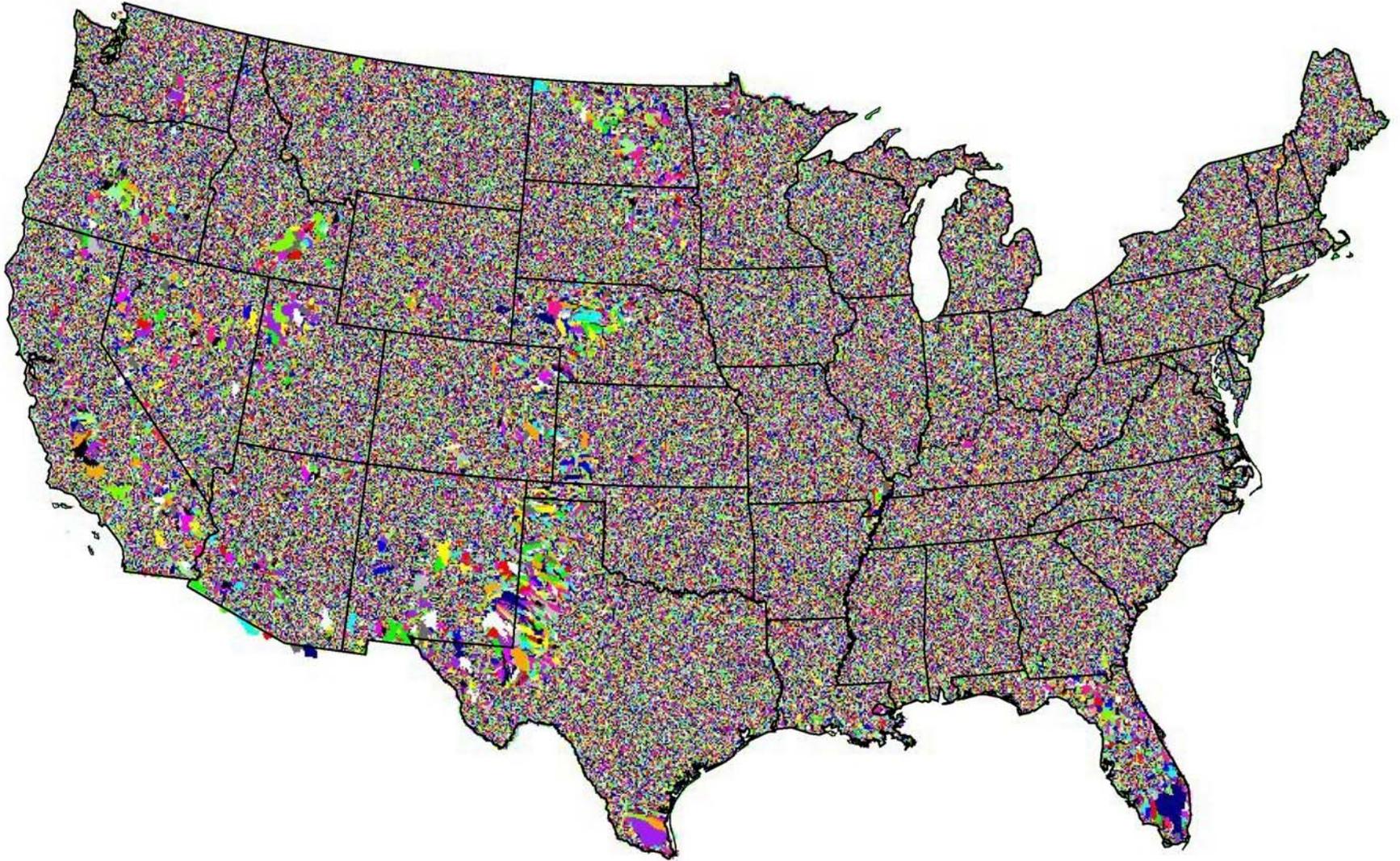
1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. **A National Seamless Database of topographically derived catchments for flowlines in the stream network**
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

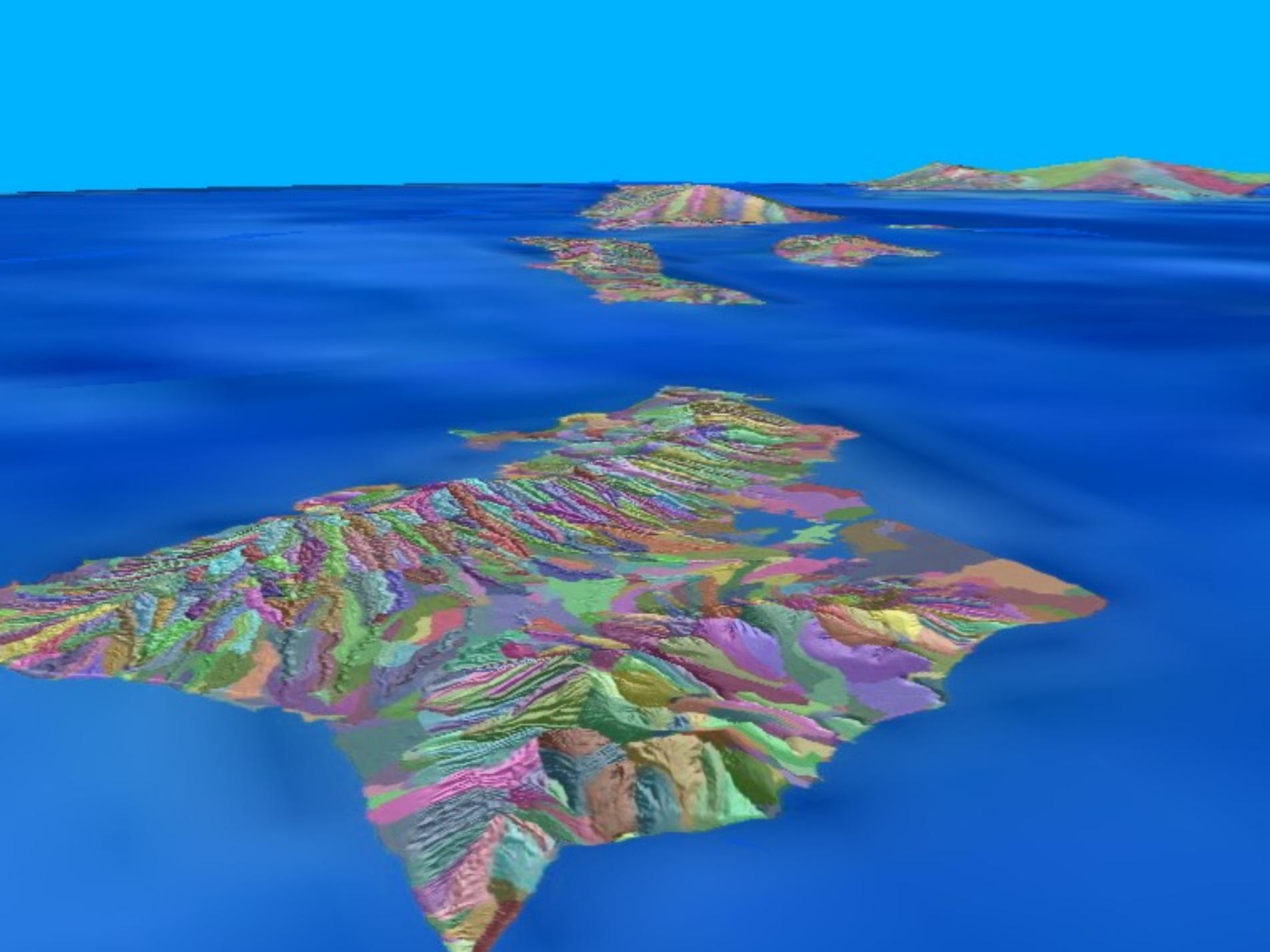
Catchments for Each Flowline

- Definition: The portion of the land surface that drains directly to a network flowline



A National Seamless Database of
Topographically Derived Catchments
part of the 1:100,000-scale NHDPlus
2,613,709 catchments

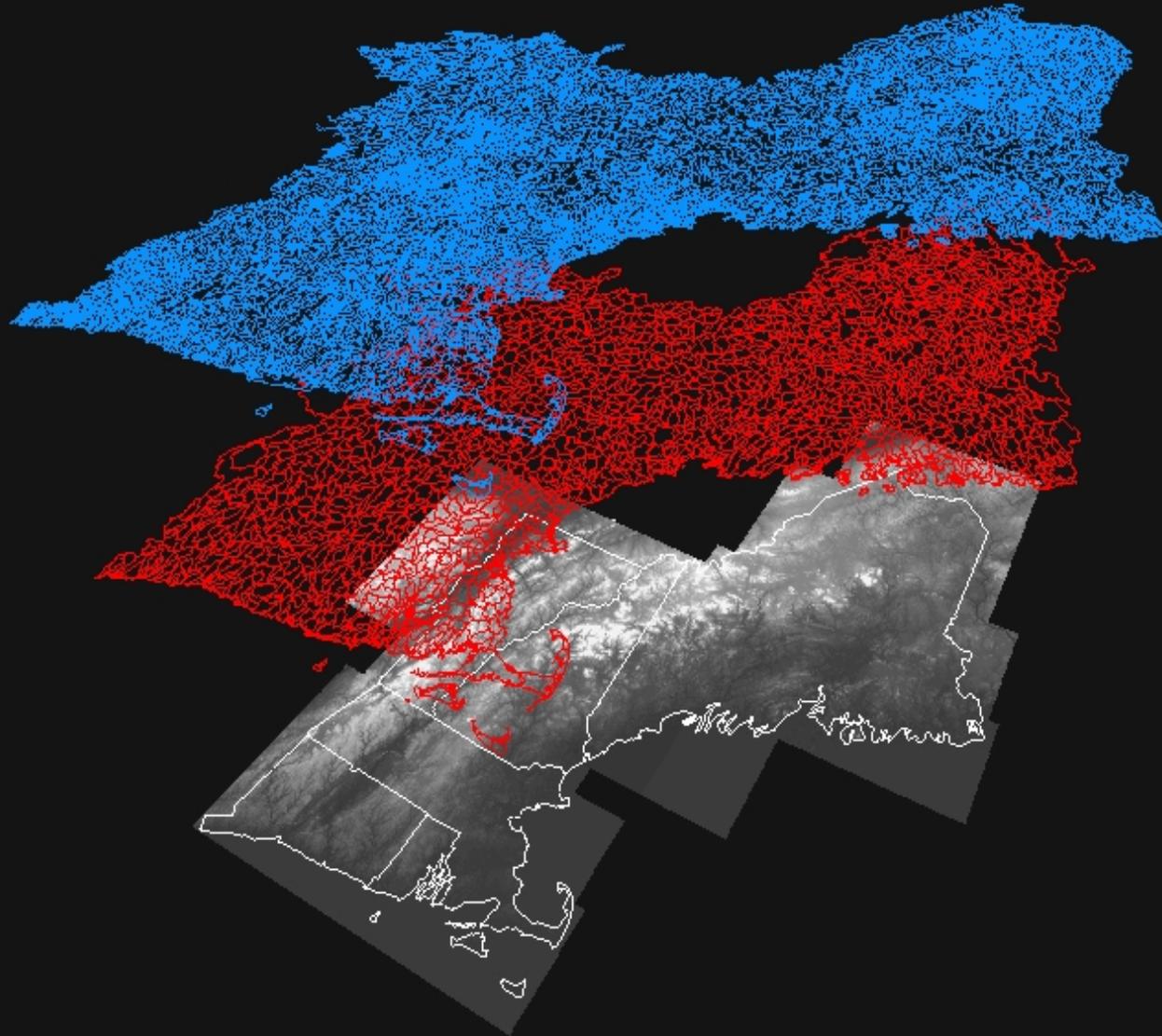




Catchments

- Catchment delineation process developed out of the New England SPARROW project (USGS) which builds upon the “Agree” aml (University of Texas)

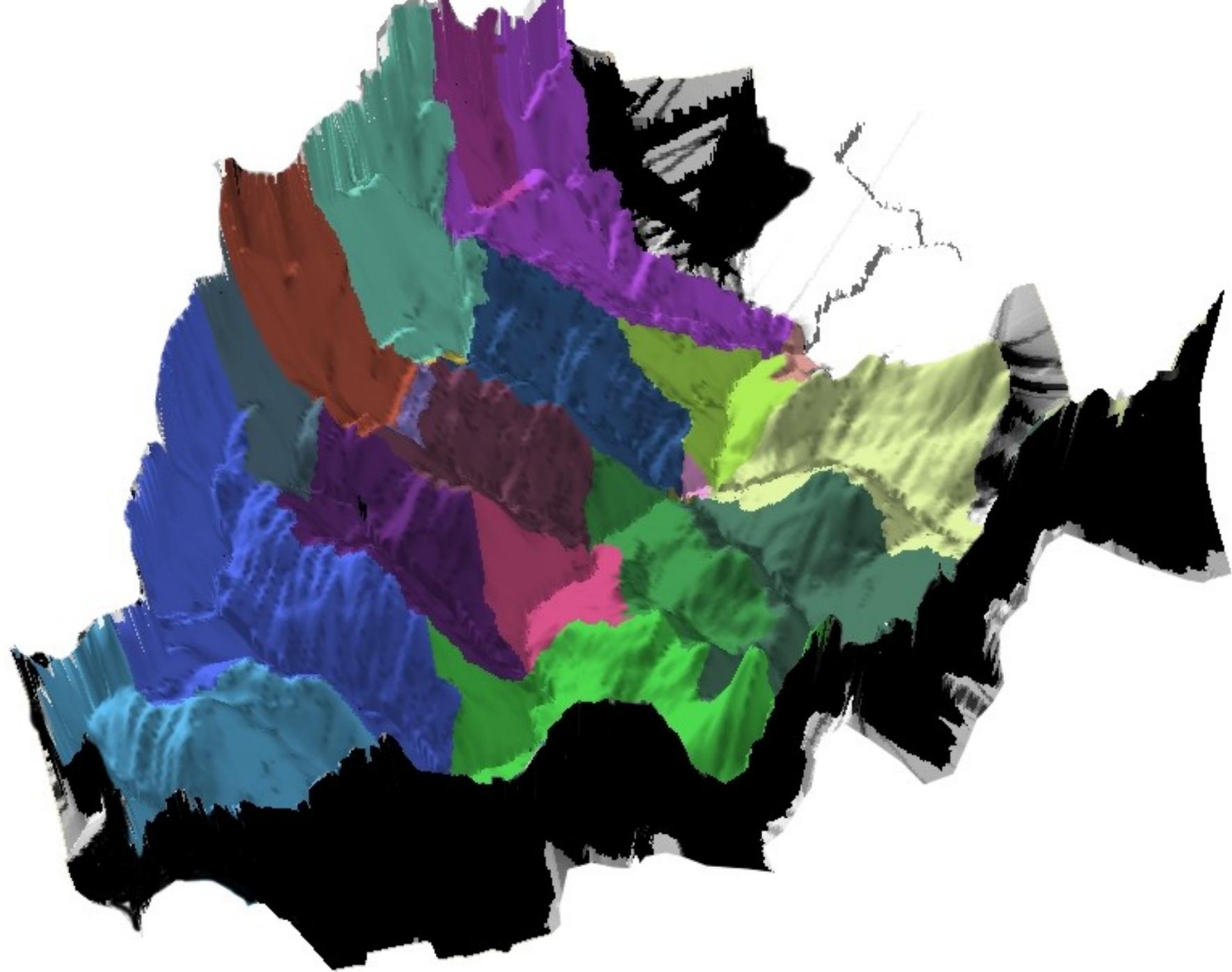
Hydrologically-Conditioned DEM Incorporating:



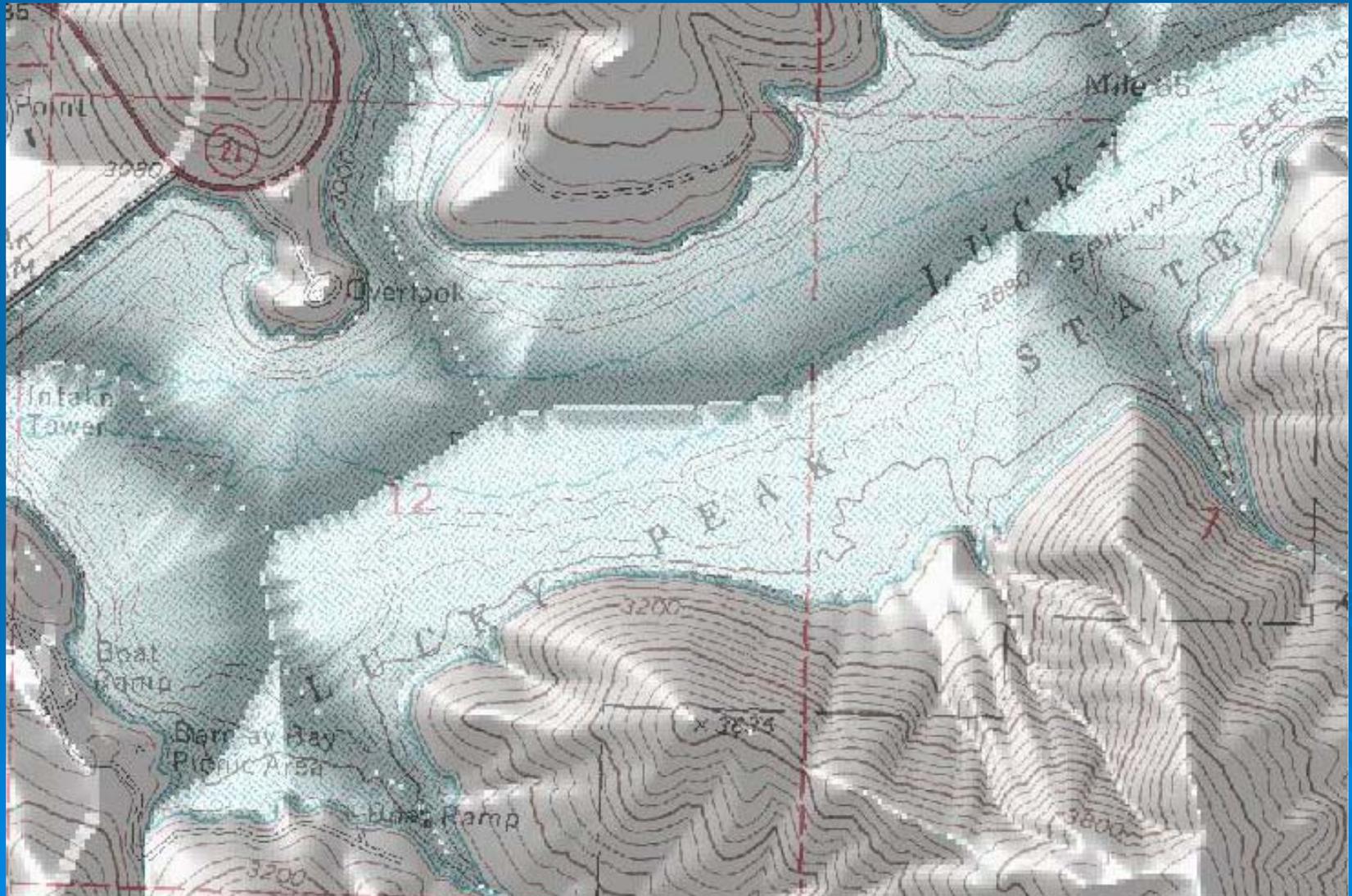
National
Hydrography
Dataset (NHD)

Watershed
Boundary
Dataset (WBD)

National
Elevation
Dataset (NED)



Bathymetric Gradient in Waterbodies

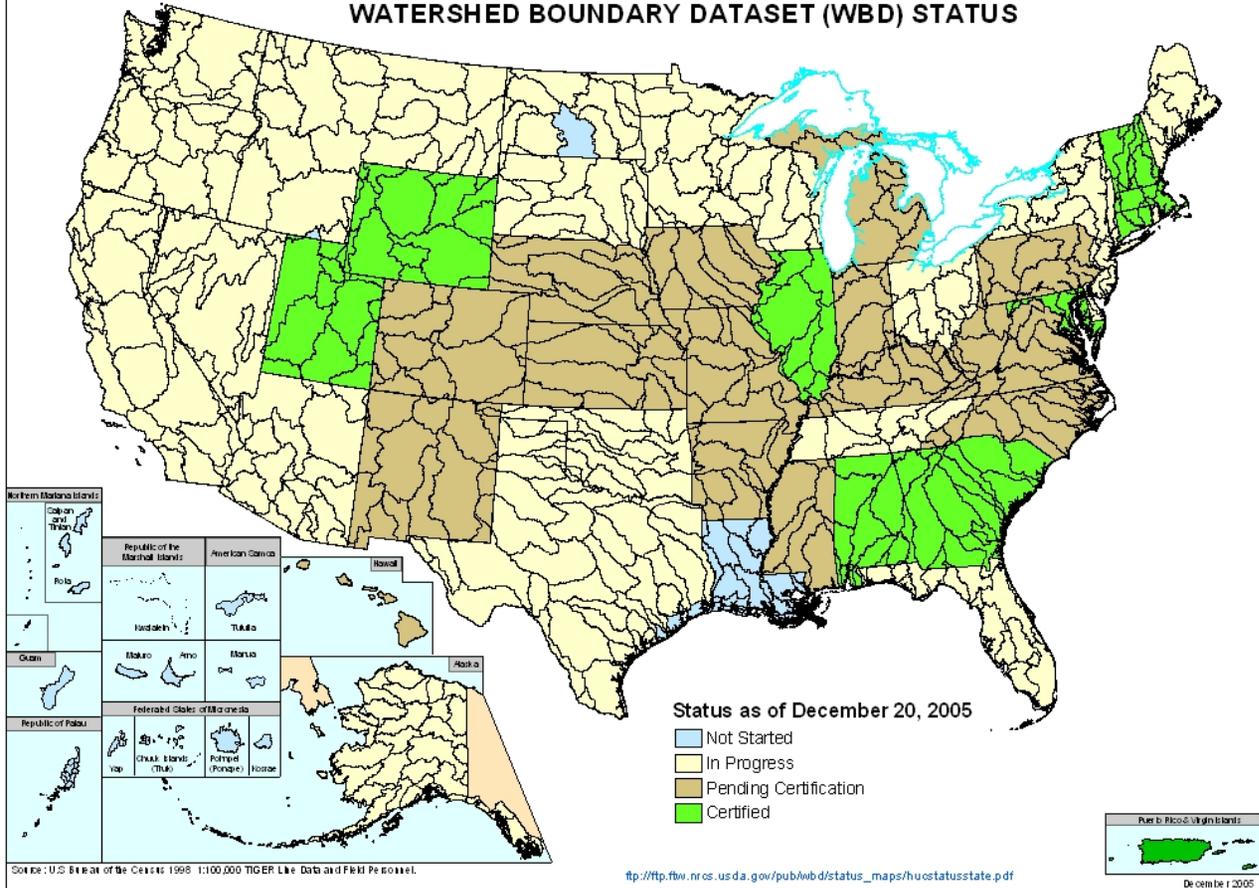


Only Certified WBD used in “walling” process

US DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

WATERSHED BOUNDARY DATASET (WBD) STATUS



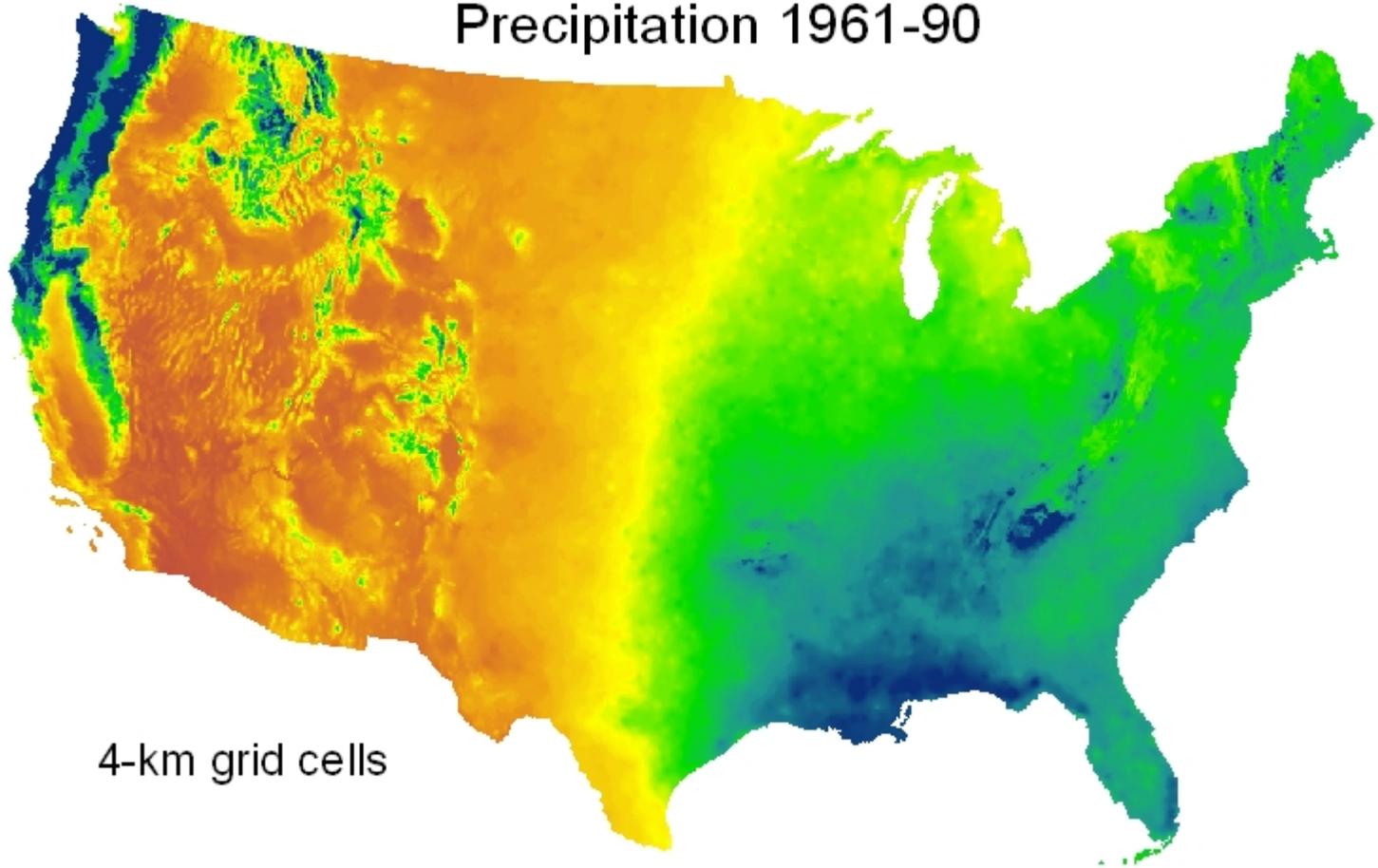
NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. **Catchment characteristics**
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

Catchment Attributes

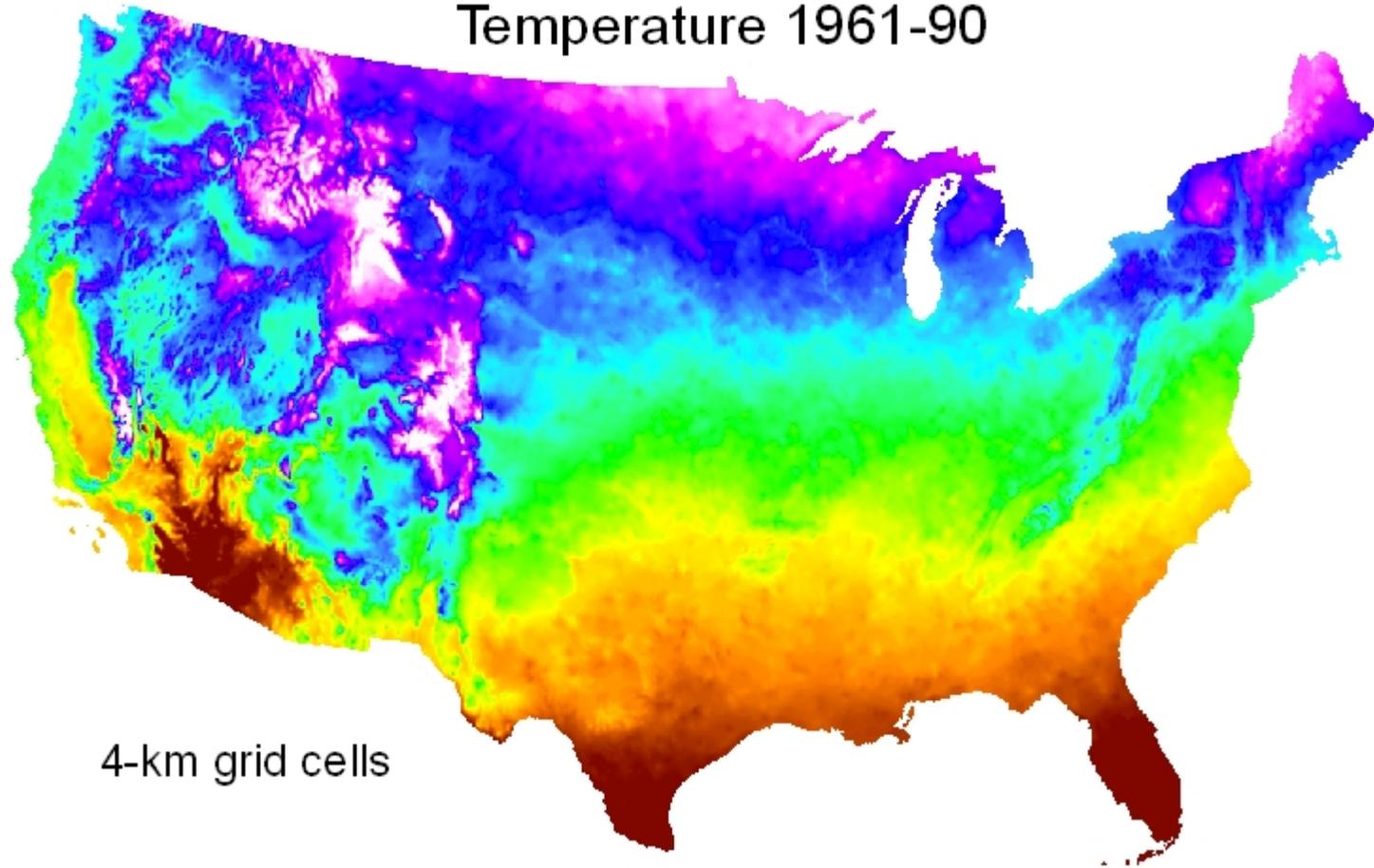
- Mean Annual Temperature (Prism - 4km)
- Mean Annual Precipitation (Prism - 4km)
- % of each of the 21 land use classifications from the 1992 National Land Cover Dataset (NLCD)

PRISM Mean Annual Precipitation 1961-90



4-km grid cells

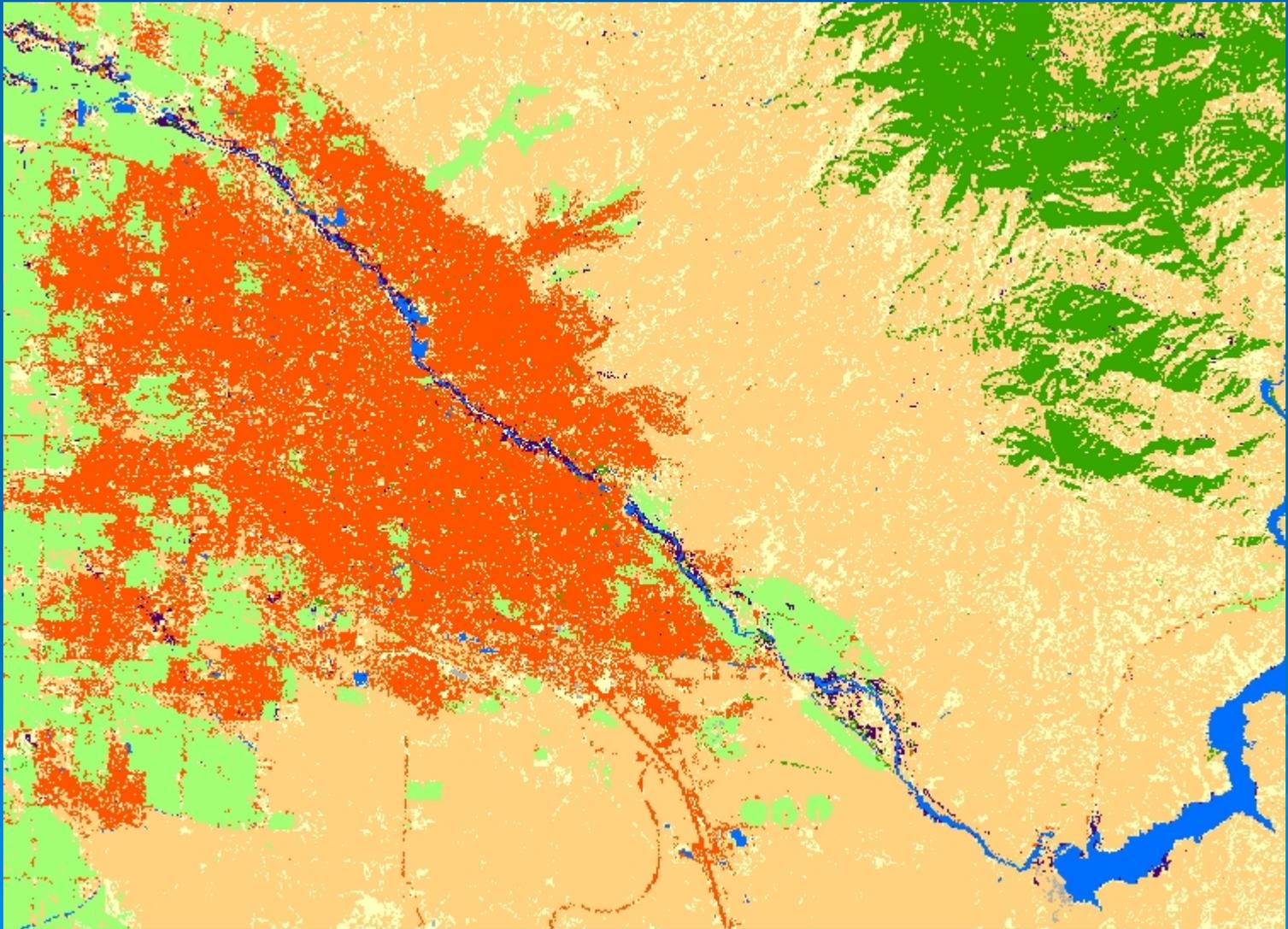
PRISM Mean Annual
Temperature 1961-90



4-km grid cells

NLCD—1992

Boise, ID



NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. **Cumulative drainage area characteristics**
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

Cumulative Characteristics

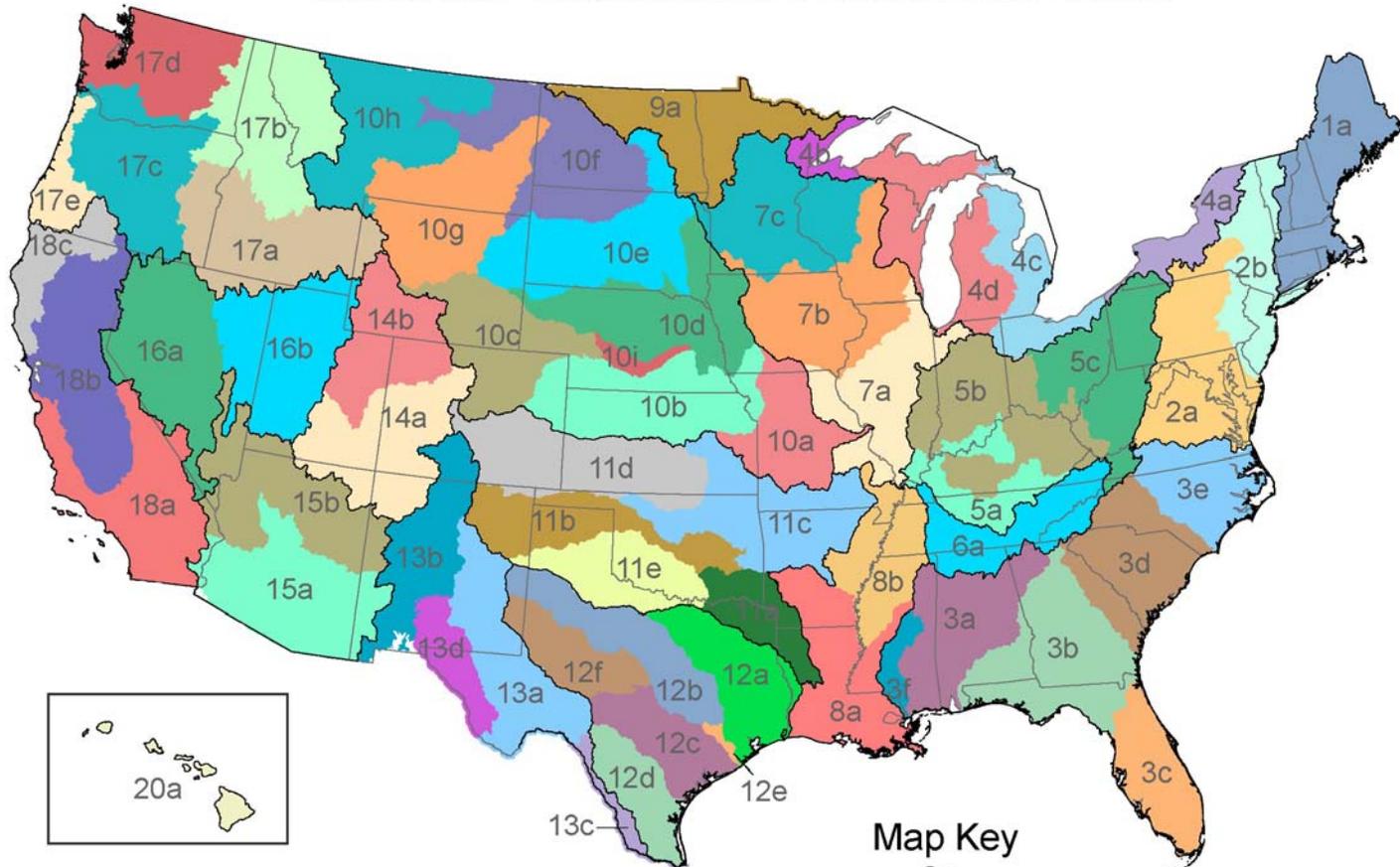
- Mean Annual Precip and Temp
 - Needed for stream flow & velocity estimates
- Drainage Area
 - Needed for stream flow & velocity estimates
- 21 NLCD Categories
 - For water-quality studies

NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. **Flow direction, flow accumulation and elevation grids**
8. Flowline min/max elevations and slopes
9. Flow volume & velocity estimates for flowlines in the stream network

Production Units for Catchments and Grids

NHDPlus Catchment Production Units



62 units total

Map Key
3a
Hydro-region # Production Unit

NHDPlus – What is it?

1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. **Flowline min/max elevations and slopes**
9. Flow volume & velocity estimates for flowlines in the stream network

NHDPlus – What is it?

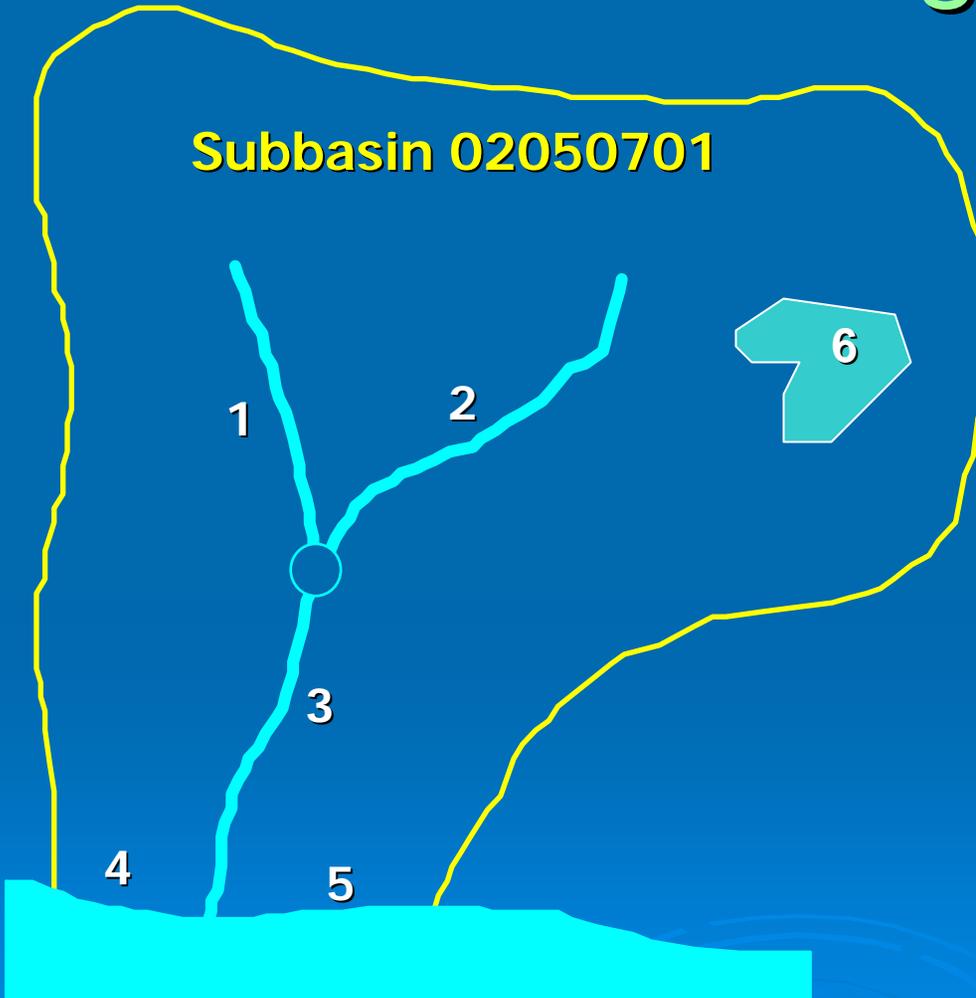
1. Improved 1:100K National Hydrography Dataset (NHD)
2. A set of value added attributes to enhance stream network navigation, analysis and display
3. A National Seamless Database of topographically derived catchments for flowlines in the stream network
4. Catchment characteristics
5. Headwater Node Areas
6. Cumulative drainage area characteristics
7. Flow direction, flow accumulation and elevation grids
8. Flowline min/max elevations and slopes
9. **Flow volume & velocity estimates for flowlines in the stream network**

How can NHDPlus aid watershed planning?

- A national stream addressing system
- A modeling network



NHDPlus is a national stream addressing system



Subbasin 02050701 contains

3 Stream reaches:

- 02050701000001
- 02050701000002
- 02050701000003

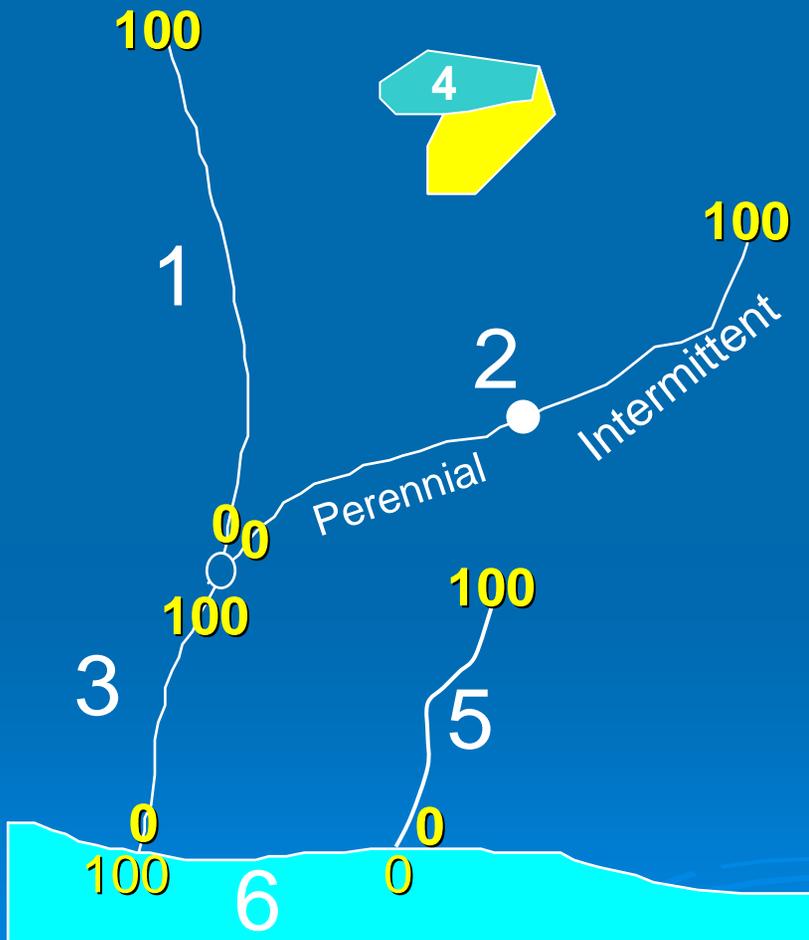
2 Coastline reaches:

- 02050701000004
- 02050701000005

1 Waterbody reach:

- 02050701000006

Addresses on Reaches



- Each reach is one “addressable” unit
- Addresses on linear reaches are proportional
0-100 from bottom to top
- Coastline reaches also have addresses
0-100 Clockwise
- Waterbody reaches are “addressed” by their reach code and, optionally, a shape



Watershed Assessment, Tracking & Environmental Results

[Recent Additions](#) | [Contact Us](#) | [Print Version](#)

Search:

GO

[EPA Home](#) > [Water](#) > WATERS

About WATERS

[Overview](#)

[Geography](#)

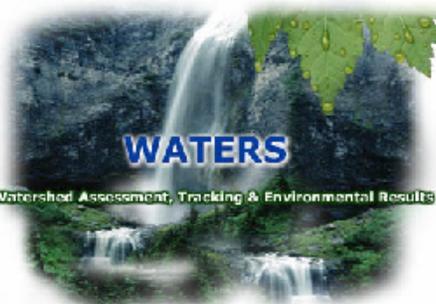
[Architecture](#)

[Tools](#)

[Data](#)

[Documents](#)

[Reporting](#)



Watershed Assessment, Tracking & Environmental Results

WATERS (Watershed Assessment, Tracking & Environmental Results) unites water quality information that was previously available only from several independent and unconnected databases.

EPA gathers water quality information to address public concerns such as:

- How healthy is my watershed?
- Can I drink the water?
- Can I eat the fish?
- Is it safe to swim in the water?

To answer these questions EPA must examine data from several different databases. WATERS has the power to connect these databases and display the information by generating maps and reports.

[About WATERS](#) | [Tools](#) | [Data](#) | [Documents](#) | [Reporting](#)

QUICK LINKS

[EnviroMapper for Water](#)

[Web Services](#)

[TMDL Reports](#)

[National Assessment Database](#)

[Water Quality Standards Database](#)

[EPA Home](#) | [Privacy and Security Notice](#) | [Contact Us](#)

Last updated on Thursday, March 9th, 2006

URL: <http://www.epa.gov/waters/>

Office of Water Program	Program Database	Description
Water Quality Standards	WQSDB	The Water Quality Standards Database (WQSDB) contains information on the uses that have been designated for waterbodies. Examples of such uses are: drinking water supply, recreation, and fish protection. As part of a State's water quality standards, these designated uses provide a regulatory goal for the waterbody and define the level of protection assigned to it. WQS also includes the scientific criteria to support that use.
Water Quality Inventory 305(b) Report	NAD	The National Assessment Database (NAD) contains information on the attainment of water quality standards. Assessed waters are classified as either Fully Supporting, Threatened, or Not Supporting their designated uses. This information is reported in the National Water Quality Inventory Report to Congress under Section 305(b) of the Clean Water Act.
Total Maximum Daily Load (TMDL) 303(d) List	TMDL Tracking System	The Total Maximum Daily Load (TMDL) Tracking System contains information on waters that are Not Supporting their designated uses. These waters are listed by the state as impaired under Section 303(d) of the Clean Water Act. The status of TMDLs are also tracked. TMDLs are pollution control measures that reduce the discharge of pollutants into impaired waters.
Water Quality Monitoring	STORET	STORET (short for STORage and RETrieval) is a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. The Legacy Data Center, or LDC, contains historical water quality data dating back to the early part of the 20th century and collected up to the end of 1998.
NPDES Permits	PCS	Discharge of pollutants into waters of the United States is regulated under the National Pollutant Discharge Elimination System (NPDES) , a mandated provision of the Clean Water Act. To assist with the regulation process, state and federal regulators use an information management system called the Permit Compliance System (PCS) . PCS stores data about NPDES facilities, permits, compliance status, and enforcement activities for up to six years.
Safe Drinking Water	SDWIS	The Safe Drinking Water Act (SDWA) requires that states report to EPA information about public water systems and their violations of EPA's drinking water regulations. These regulations, and their enabling statutes, establish maximum contaminant levels, treatment techniques, and monitoring and reporting requirements to ensure that water provided to customers is safe for human consumption. This information is stored in SDWIS - Safe Drinking Water Information System .
Fish Consumption Advisories	NLFWA	The National Listing of Fish and Wildlife Advisories (NLFWA) database includes all available information describing state-, tribal-, and federally-issued fish consumption advisories in the United States and Canada.
Nonpoint Source Pollution	GRTS	The Section 319 Grants Reporting and Tracking System (GRTS) is the main reporting vehicle for the Section 319 program . GRTS enables EPA and States to describe the progress they have made in implementing the national Nonpoint Source (NPS) Pollution program. GRTS electronically tracks projects and activities funded with CWA Section 319(h) funds.
Nutrient Criteria	Nutrient Criteria Database	The Nutrient Criteria Database stores and analyzes nutrient water quality data, which will aid in the development of scientifically defensible numeric nutrient criteria. The ultimate use of the data is to derive ecoregional waterbody-specific numeric nutrient criteria.
BEACH program	BEACH Watch	The Beaches Environmental Assessment, Closure & Health BEACH Watch database provides information on whether a specific beach is being monitored for water quality, who is responsible for the monitoring, the pollutants that are being monitored, and if advisories or closures have been issued.
Vessel Sewage Discharge	NDZ	Vessel sewage discharge is regulated under Clean Water Act Section 312, which mandates the use of marine sanitation devices (on-board equipment for treating and discharging or storing sewage) on all commercial and



How can NHDPlus aid in watershed planning?

A MODELING NETWORK

New England SPARROW report is published and available as a pdf file at web site <http://nh.water.usgs.gov>

By

Richard Moore, Craig Johnston,

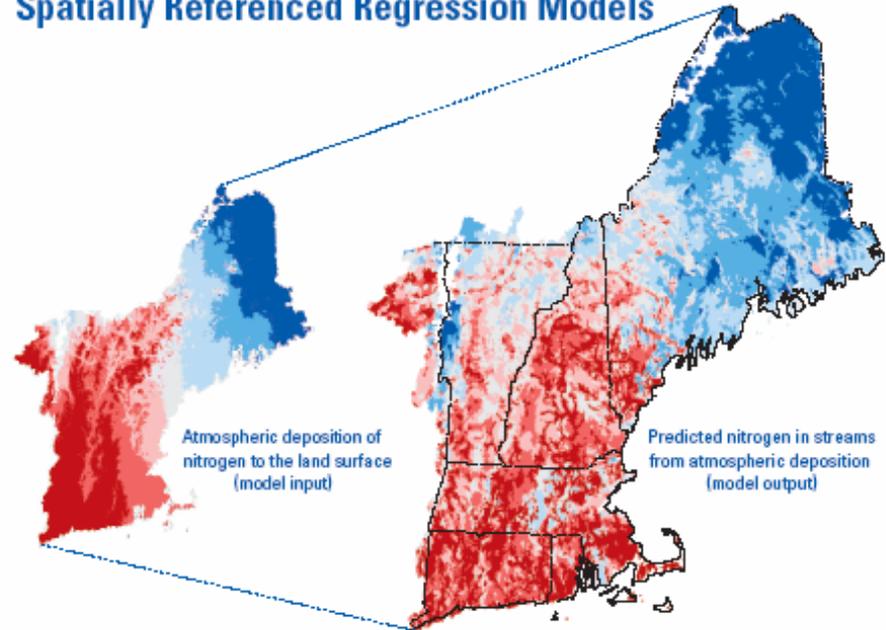
Keith Robinson, and Jeffrey Deacon

U.S. Geological Survey

New Hampshire / Vermont District

In cooperation with the
New England Interstate Water Pollution Control Commission and
U.S. Environmental Protection Agency

Estimation of Total Nitrogen and Phosphorus in New England Streams Using Spatially Referenced Regression Models



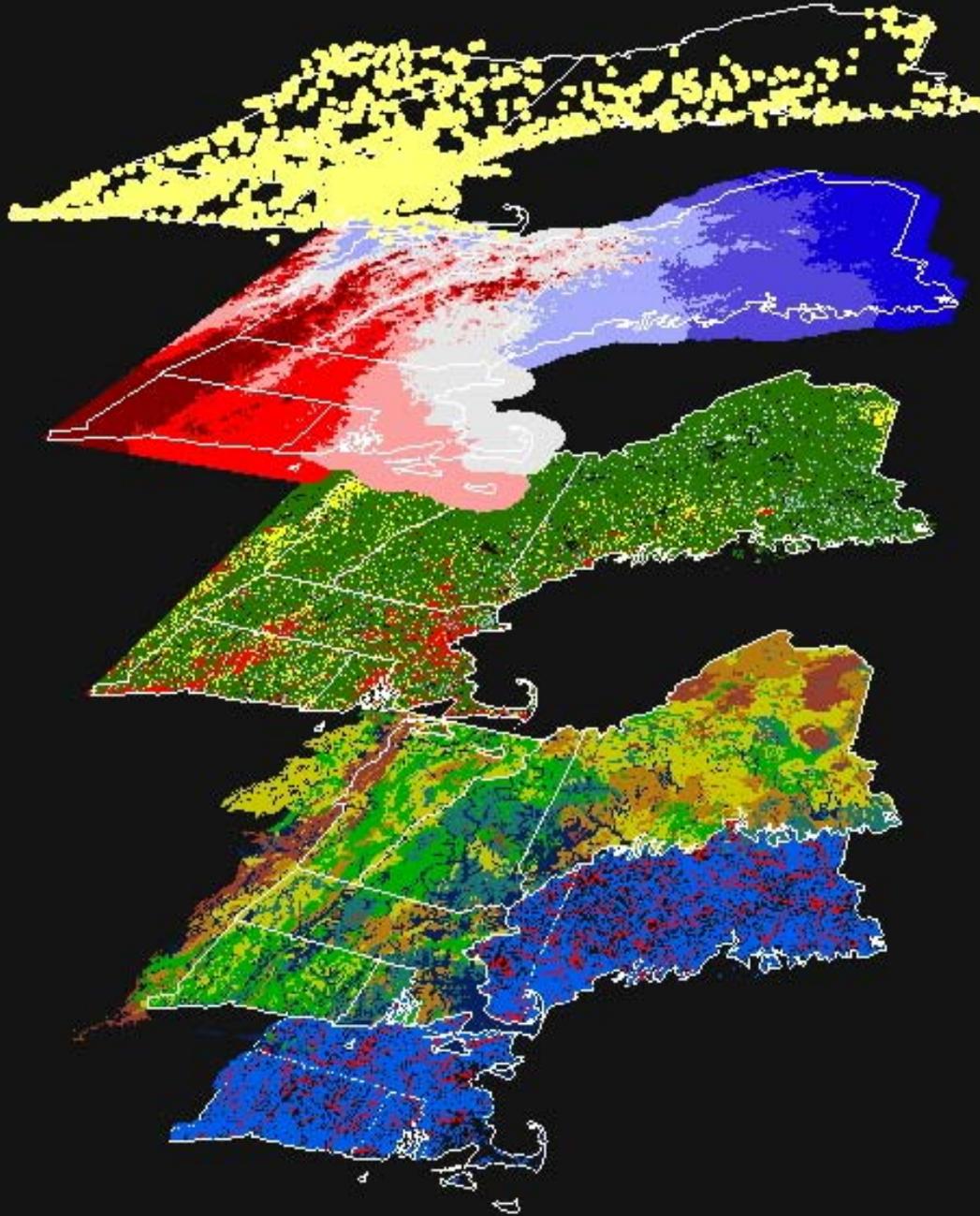
Scientific Investigations Report 2004-5012

U.S. Department of the Interior
U.S. Geological Survey

New England SPARROW

- Modeled Nitrogen and Phosphorus loads
(dependent variable)

NE SPARROW Model Input



Nutrient Sources

Point Source

Atmospheric deposition of nitrogen (Ollinger 1992)

National Land Cover Dataset 1992

- Agriculture
- Developed
- Forest

Processes

Land to water delivery

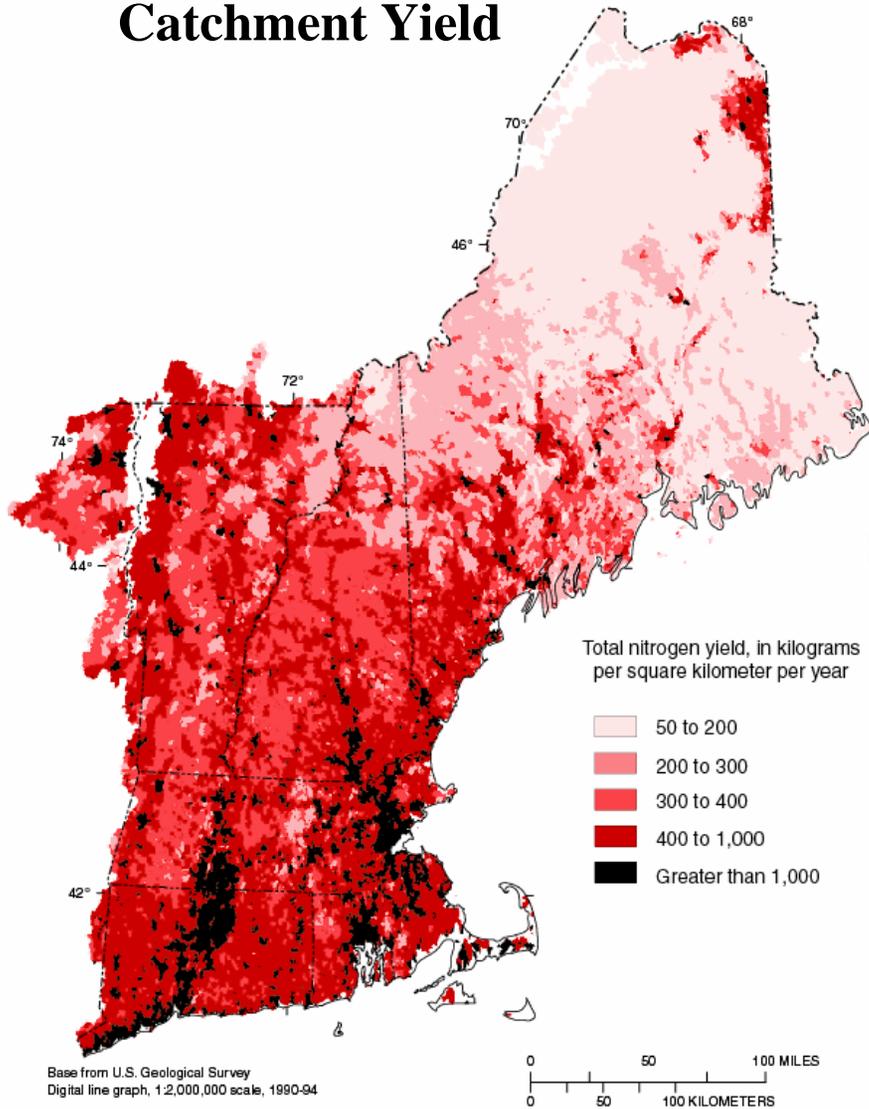
Soil permeability –
STATSGO

In-stream loss

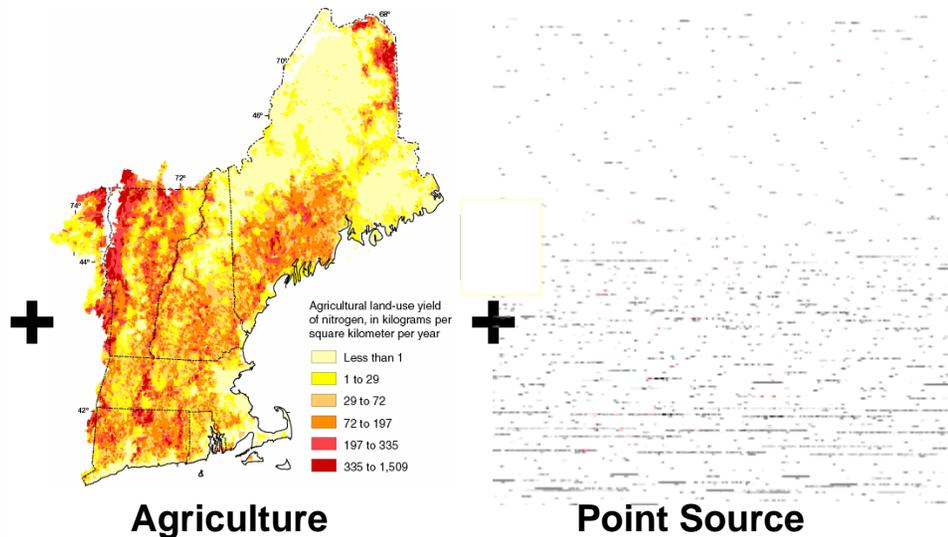
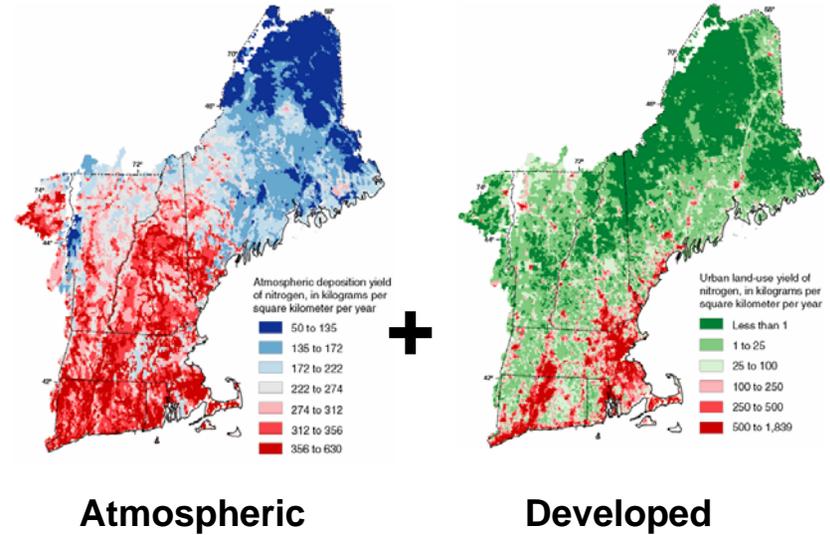
Stream travel time
Reservoir detention

SPARROW Model Results:

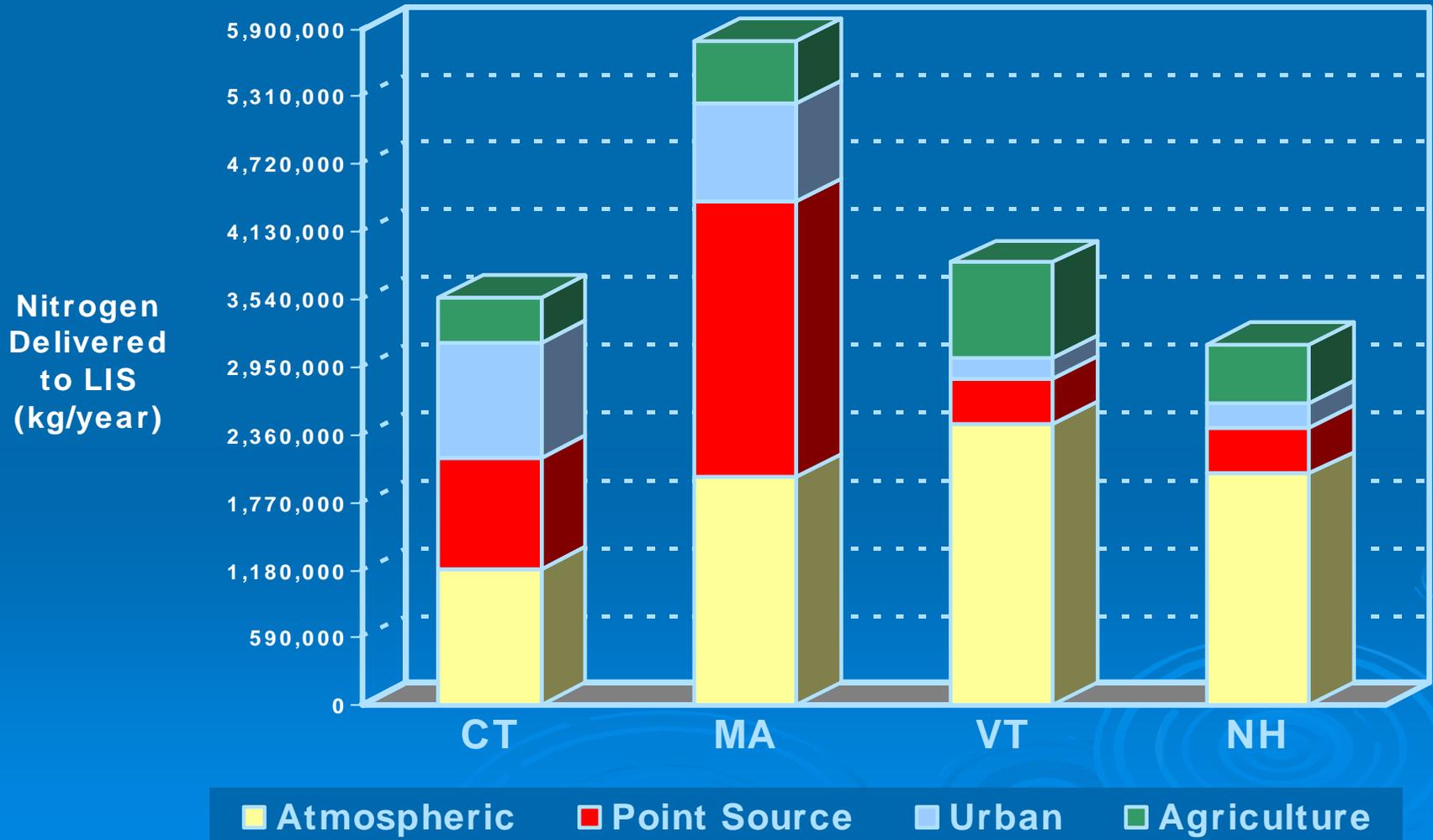
Predicted Total Nitrogen Catchment Yield



Contributions to Total Nitrogen from each source

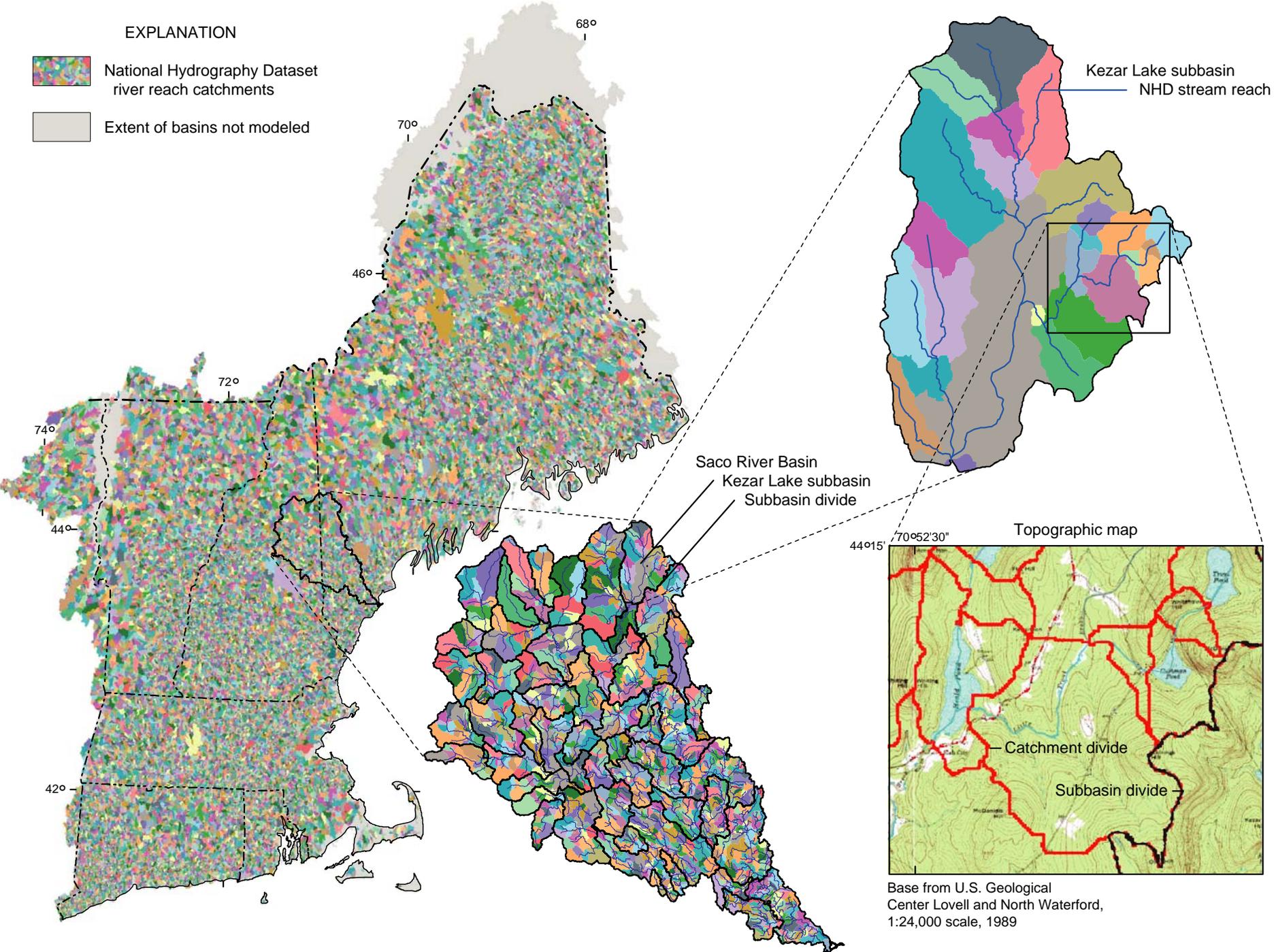


Predicted Nitrogen Load Delivered to LIS from Connecticut River Watershed States



EXPLANATION

-  National Hydrography Dataset river reach catchments
-  Extent of basins not modeled



Base from U.S. Geological Center Lovell and North Waterford, 1:24,000 scale, 1989

Where to get NHDPlus Data, Documentation, Presentations, Exercises and Tools

Current Web Site: <http://www.horizon-systems.com/nhdplus>

Future Web Site: <http://www.epa.gov/waters>

FTP Site: <ftp://ftp.horizon-systems.com/nhdplus>

Fall 2006: In the Waters Database

NHDPlus Distribution Units

Major Drainage Areas and Hydrologic Regions

