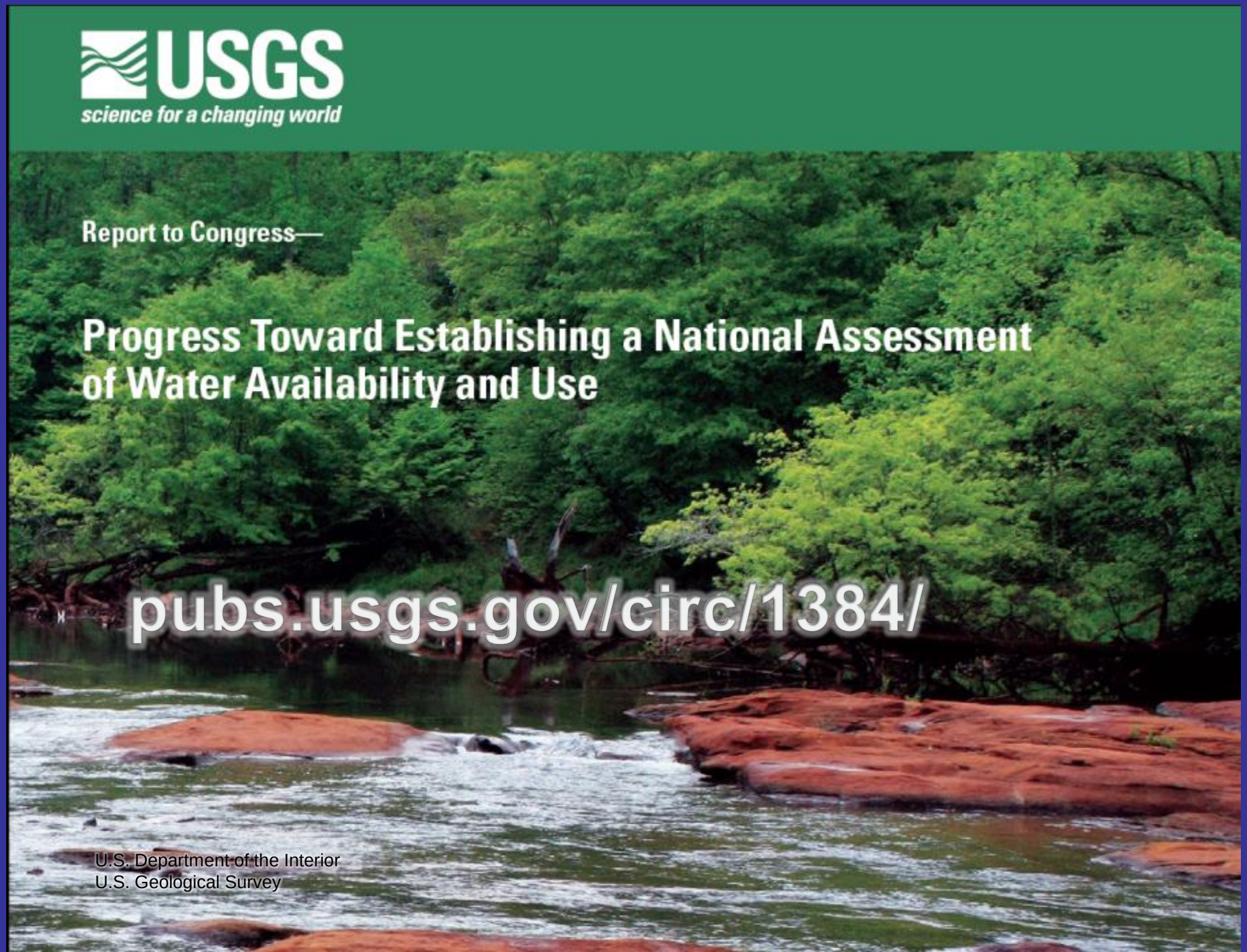

USGS
science for a changing world
Report to Congress—
Progress Toward Establishing a National Assessment of Water Availability and Use
pubs.usgs.gov/circ/1384/
U.S. Department of the Interior
U.S. Geological Survey

Our objective for the Water Census

To place technical information and tools in the hands of stakeholders, allowing them to answer questions they face about water availability:

- Does the Nation have enough freshwater to meet both human and ecological needs?
- Will this water be present to meet future needs?

SECURE Water Act
Public Law 111-11, § 9507 and 9508

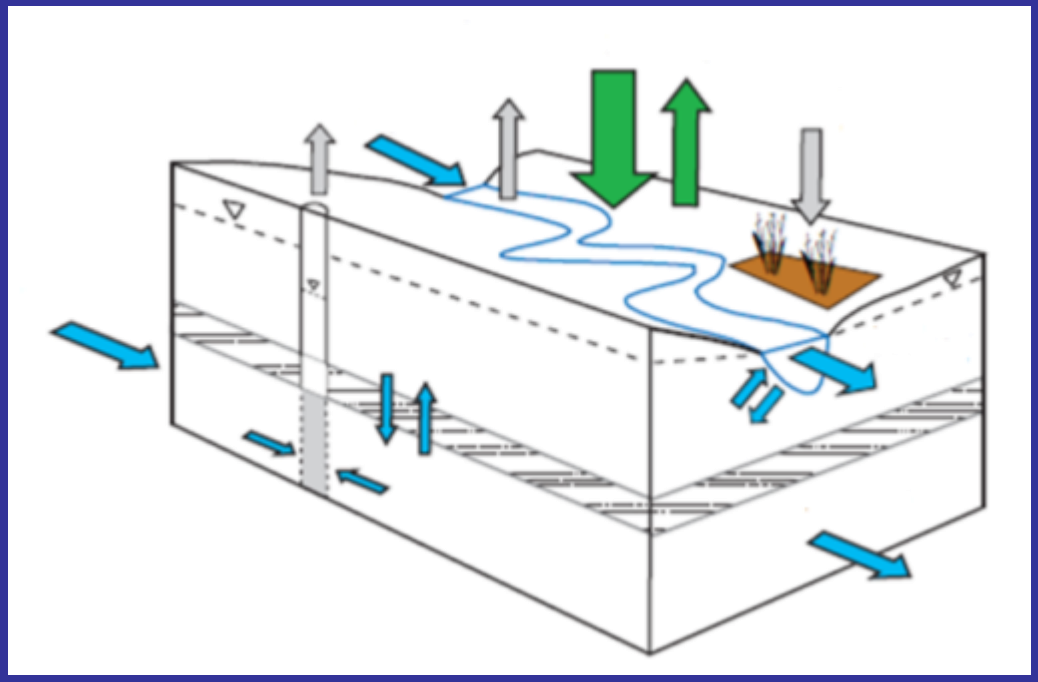
Water Availability Analysis

The process of determining the quantity and timing-characteristics of water, which is of sufficient quality, to meet both human and ecological needs.

Types of Information

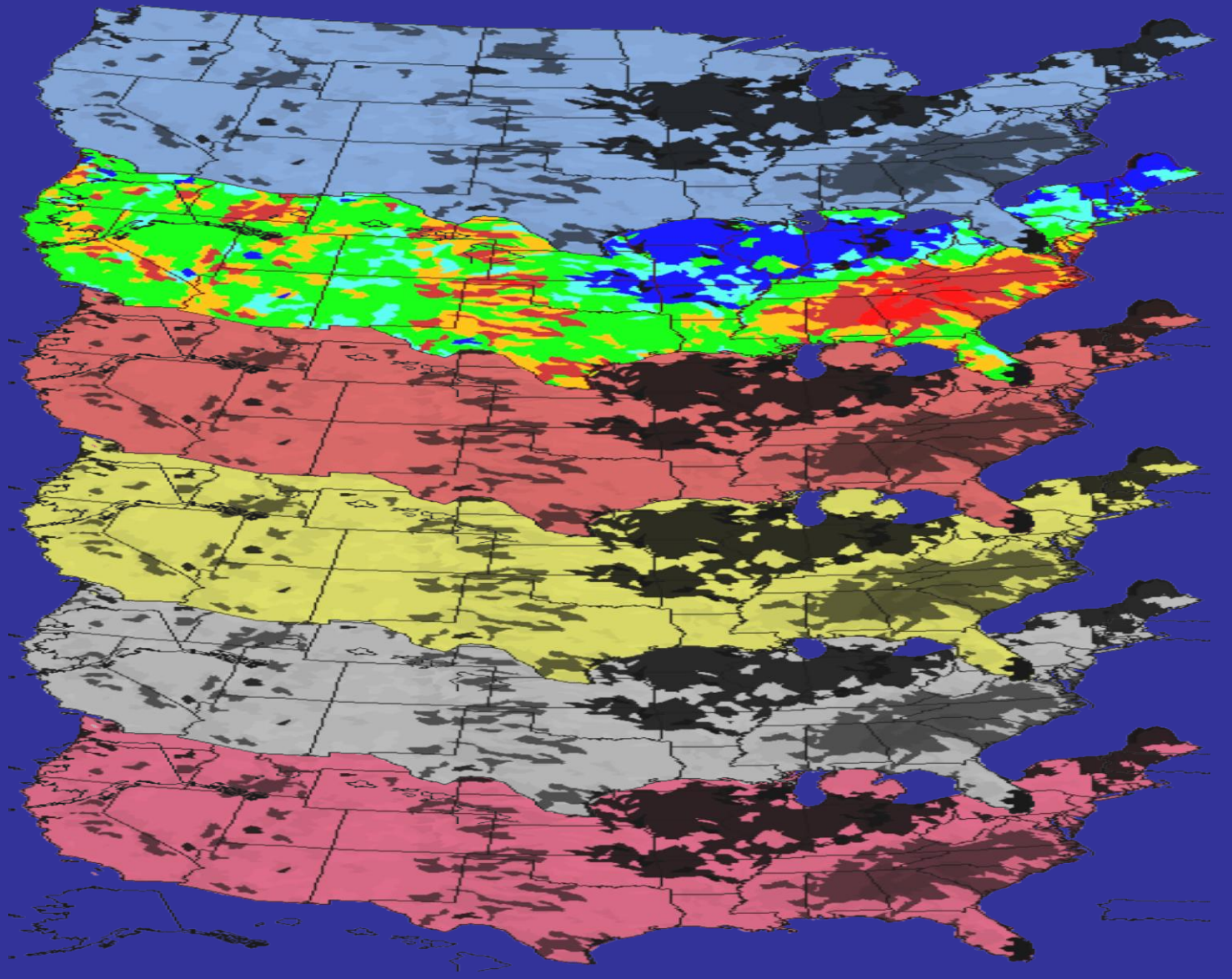
Technical
Socio-economic
Legal
Regulatory
Political

Account for water with a “budget”



Precipitation
+
Flow in
=
Evapotranspiration
+
Storage Change
+
Flow out

A Nationwide System to deliver water accounting information



Precipitation

Runoff

Baseflow

ET

Recharge

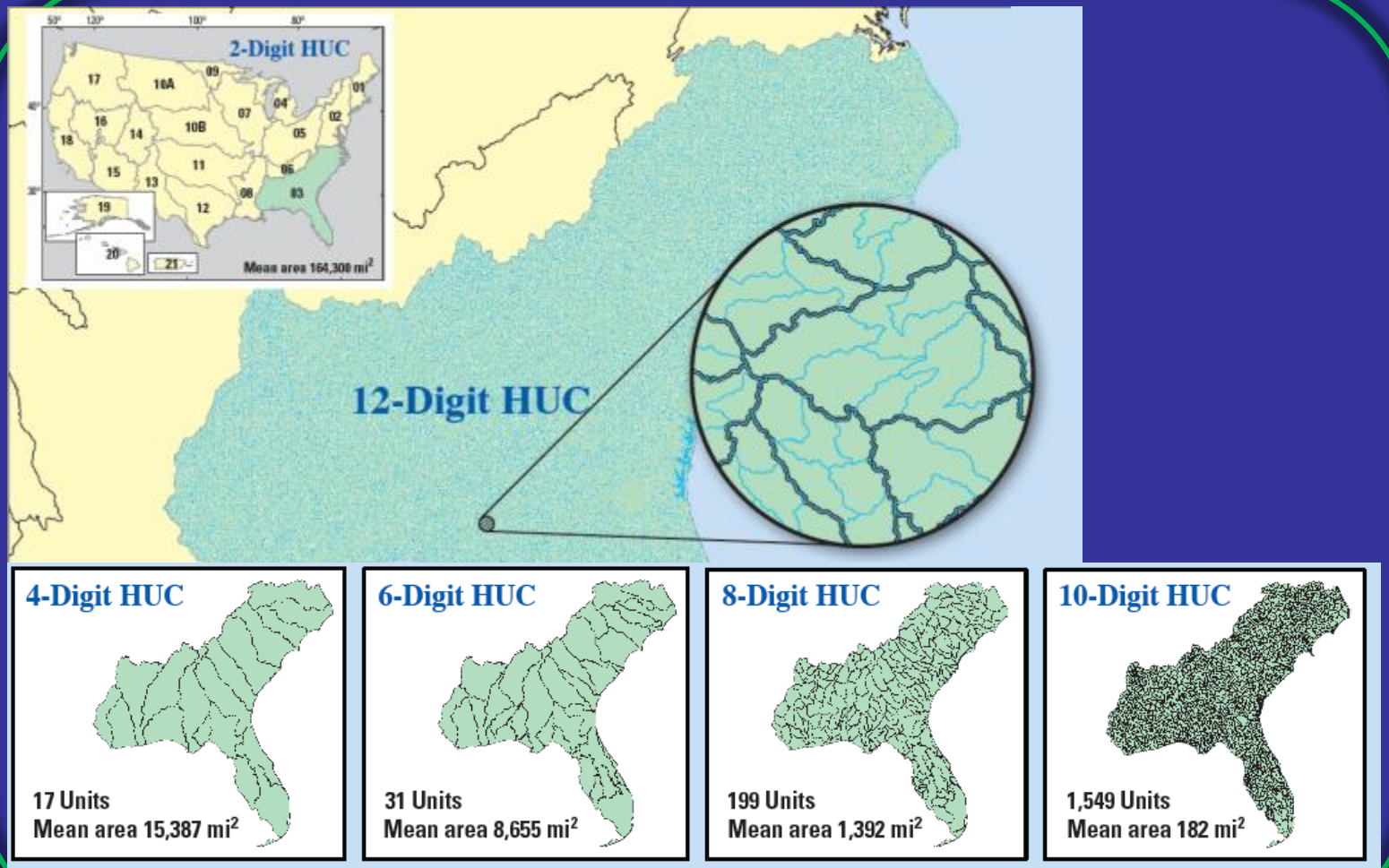
Surface Storage

Information delivery

A web application for delivering water availability information at scales that are relevant to the user

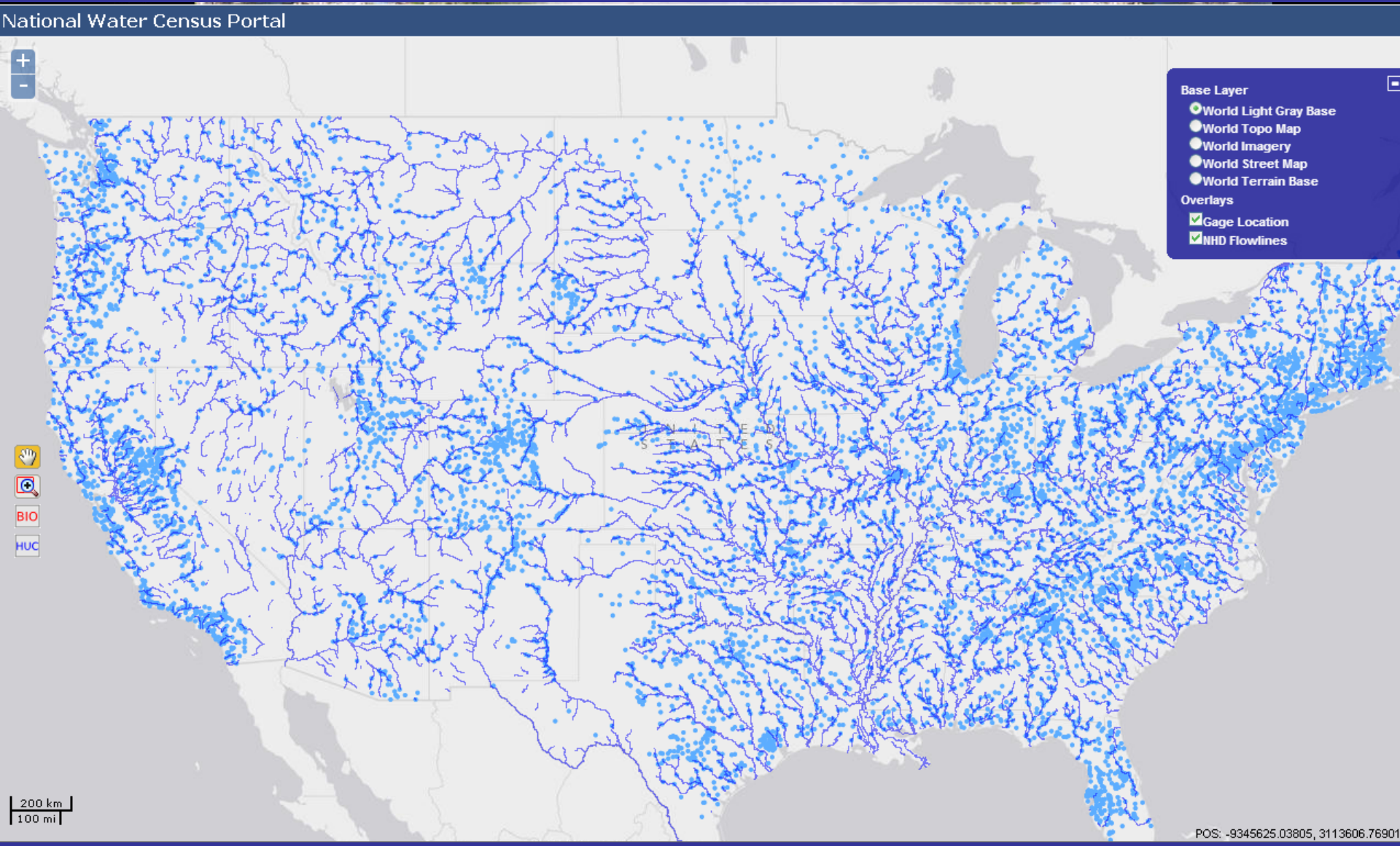
water.usgs.gov/watercensus/

Scale Matters

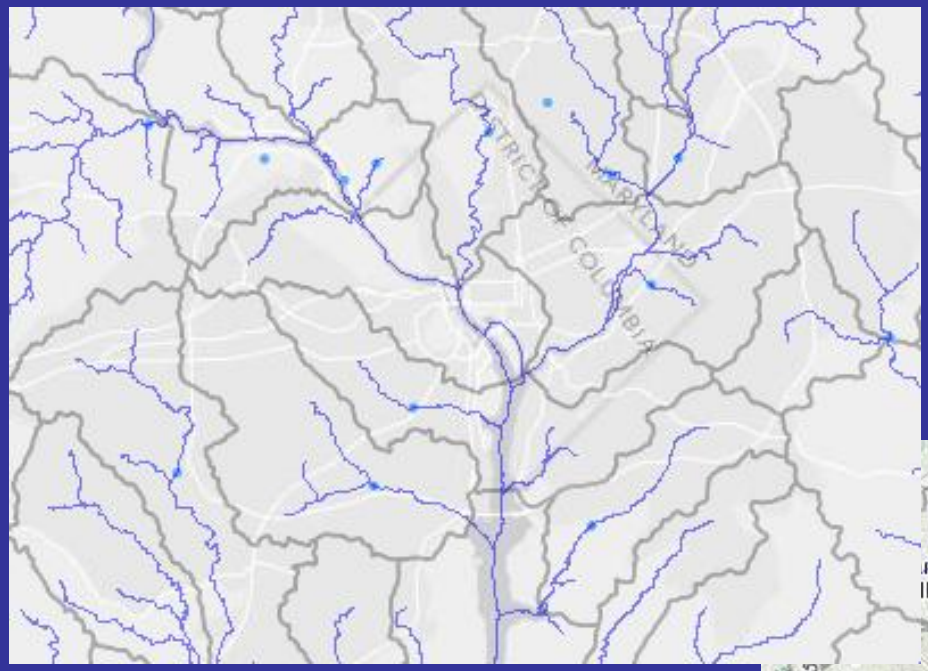


Density of hydrologic unit codes (HUCs) at different levels illustrated by using the 2-digit HUC Region 03

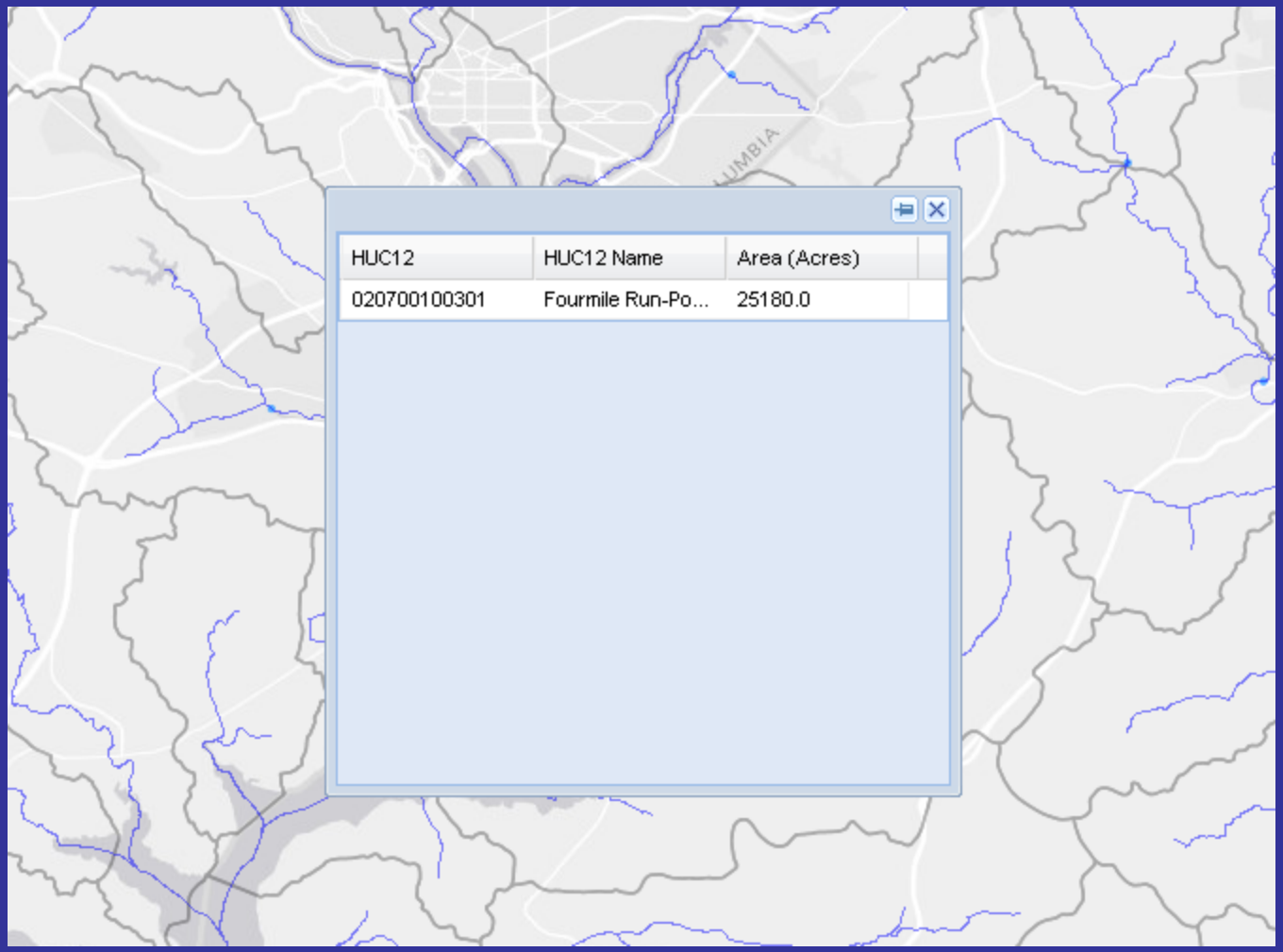
National Water Census Data Portal



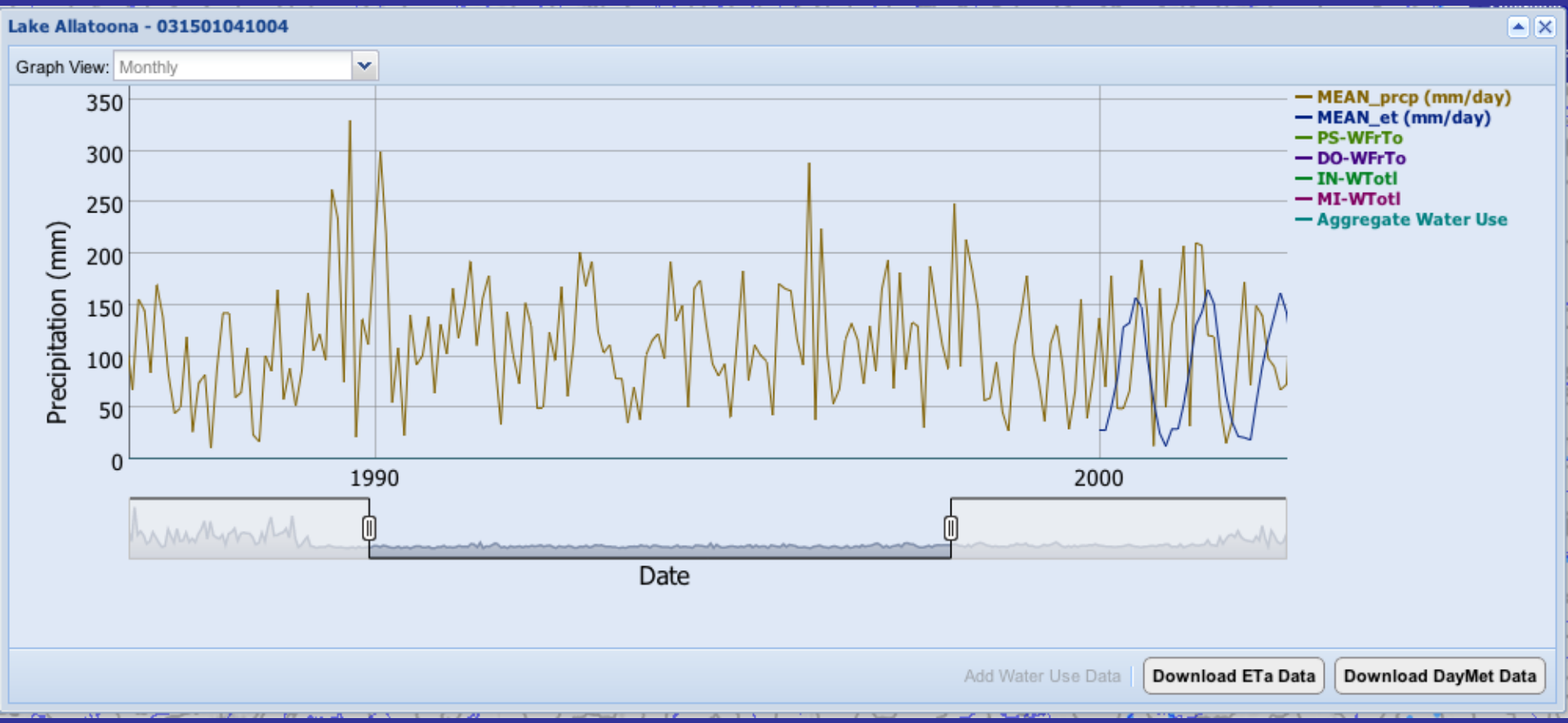
National Water Census Data Portal



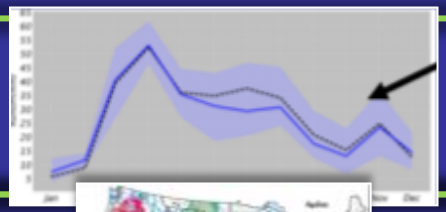
National Water Census Data Portal



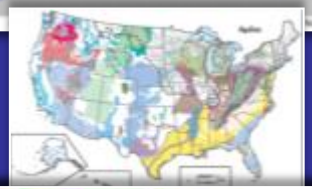
National Water Census Data Portal



Five Areas of Nationwide Topical Work

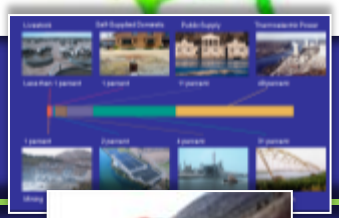


Estimation of Flow at Ungaged Locations



Groundwater Information

Estimation of Evapotranspiration

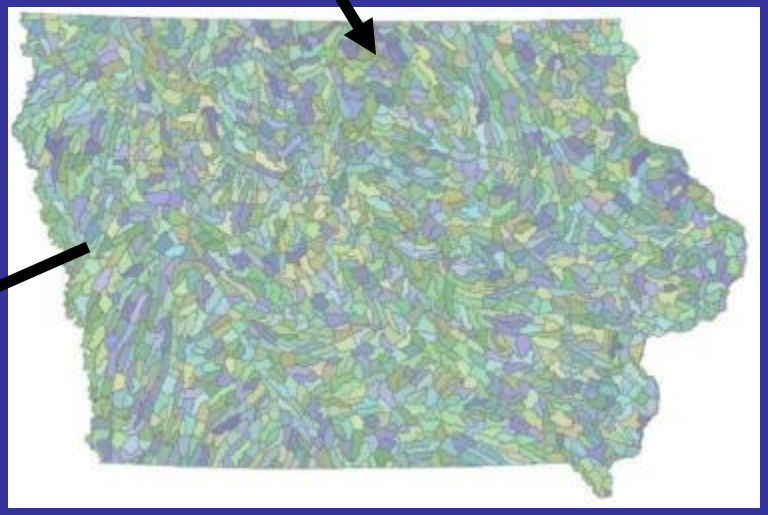


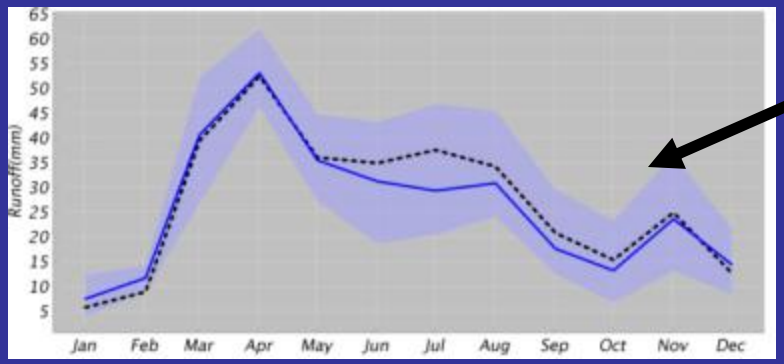
Water Use

Ecological Water Science

Surface Water Models
Estimating Flows at Ungaged Locations

Models provide us a means of estimating streamflow for time periods where we don't have record or places where we don't have monitoring capabilities.

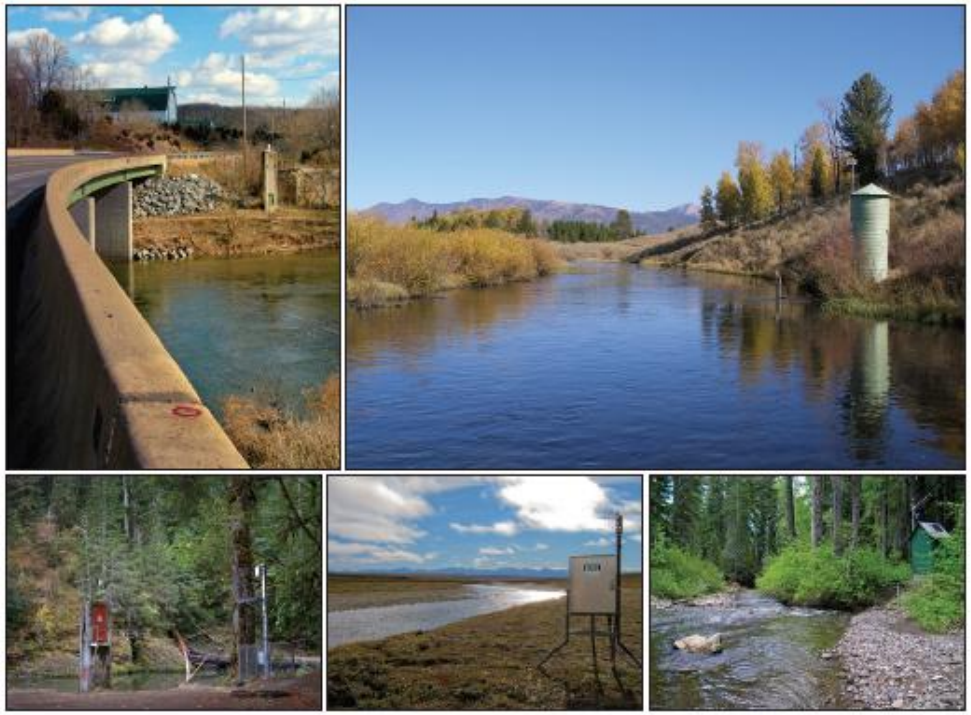




USGS
science for a changing world

Prepared in cooperation with the U.S. Fish and Wildlife Service

A National Streamflow Network Gap Analysis



Scientific Investigations Report 2013–5013

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

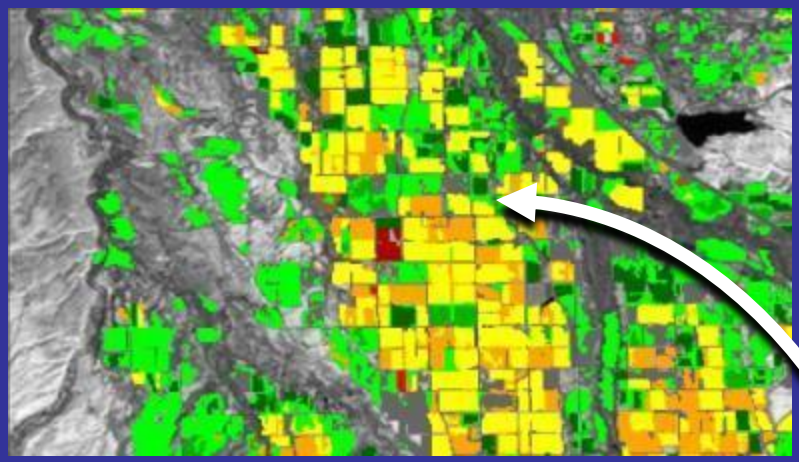
Estimating Flows at Ungaged Areas – Selection of models

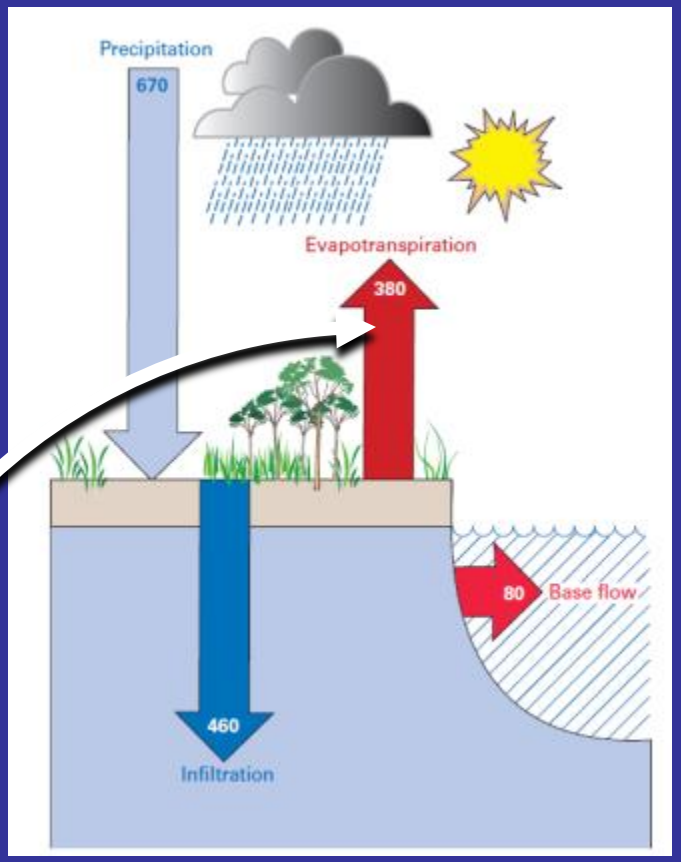
Locations of Model Comparison Tests:

- SE Basins including ACF, ACT, Tennessee
- Midwest – Iowa
- Rocky Mountains
- Desert Southwest
- Pacific Northwest

Testing to be completed by end of 2014 and models selected.

ET





Water Use Effort:

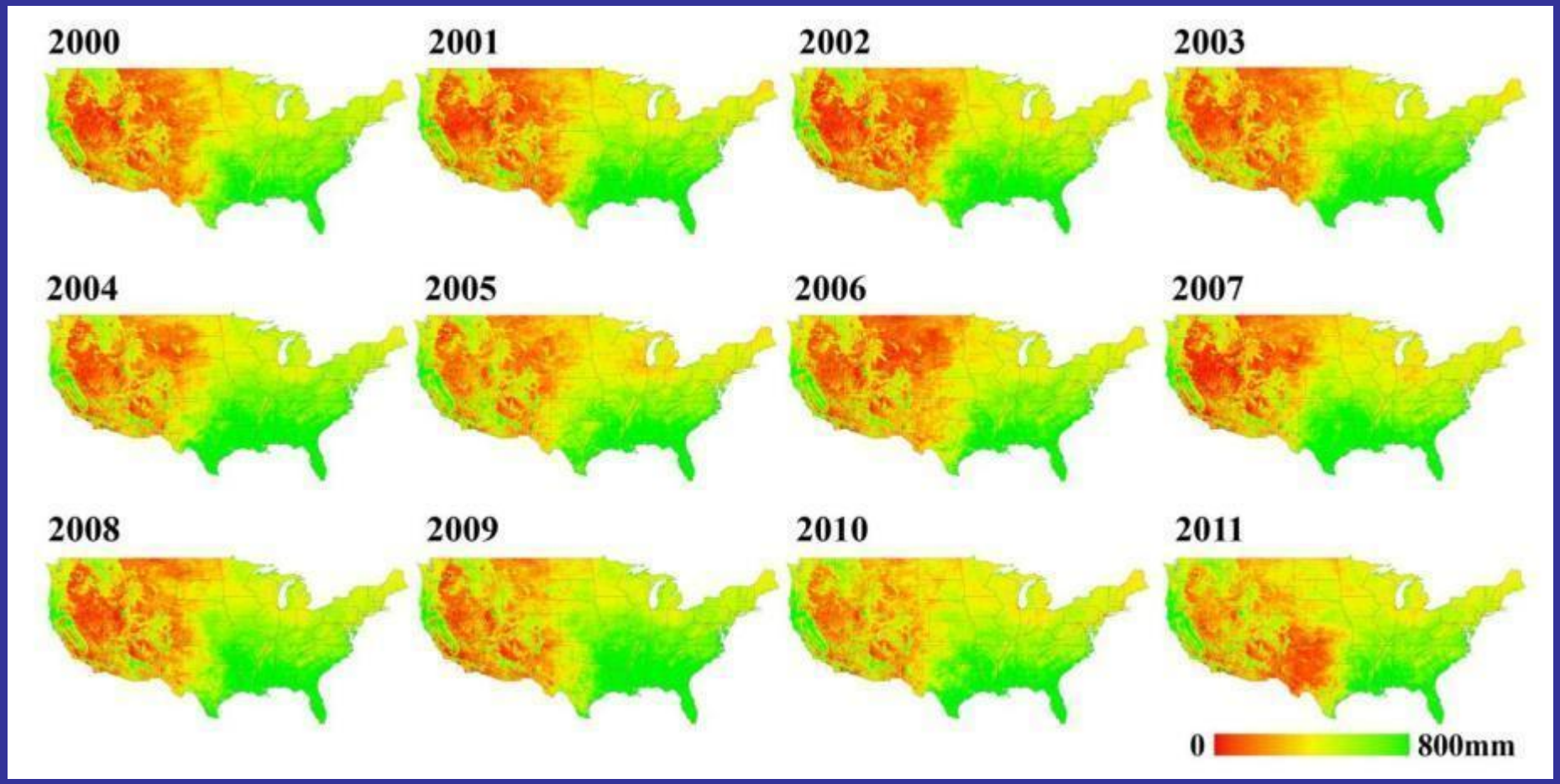
For irrigation water use to estimate consumptive use.

Water Budget Effort:

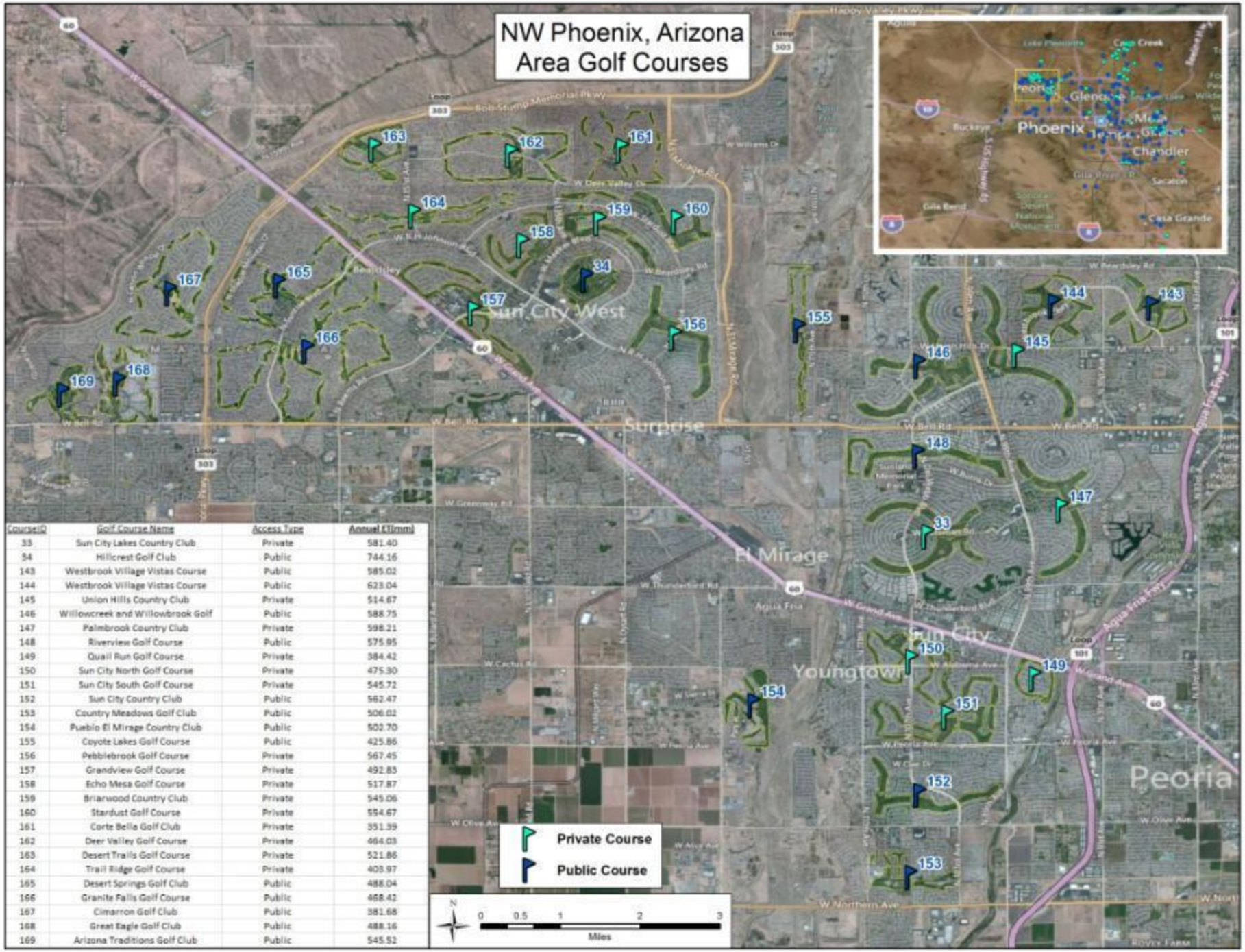
Total ET as a component of the water budget.

Small Watershed Scale

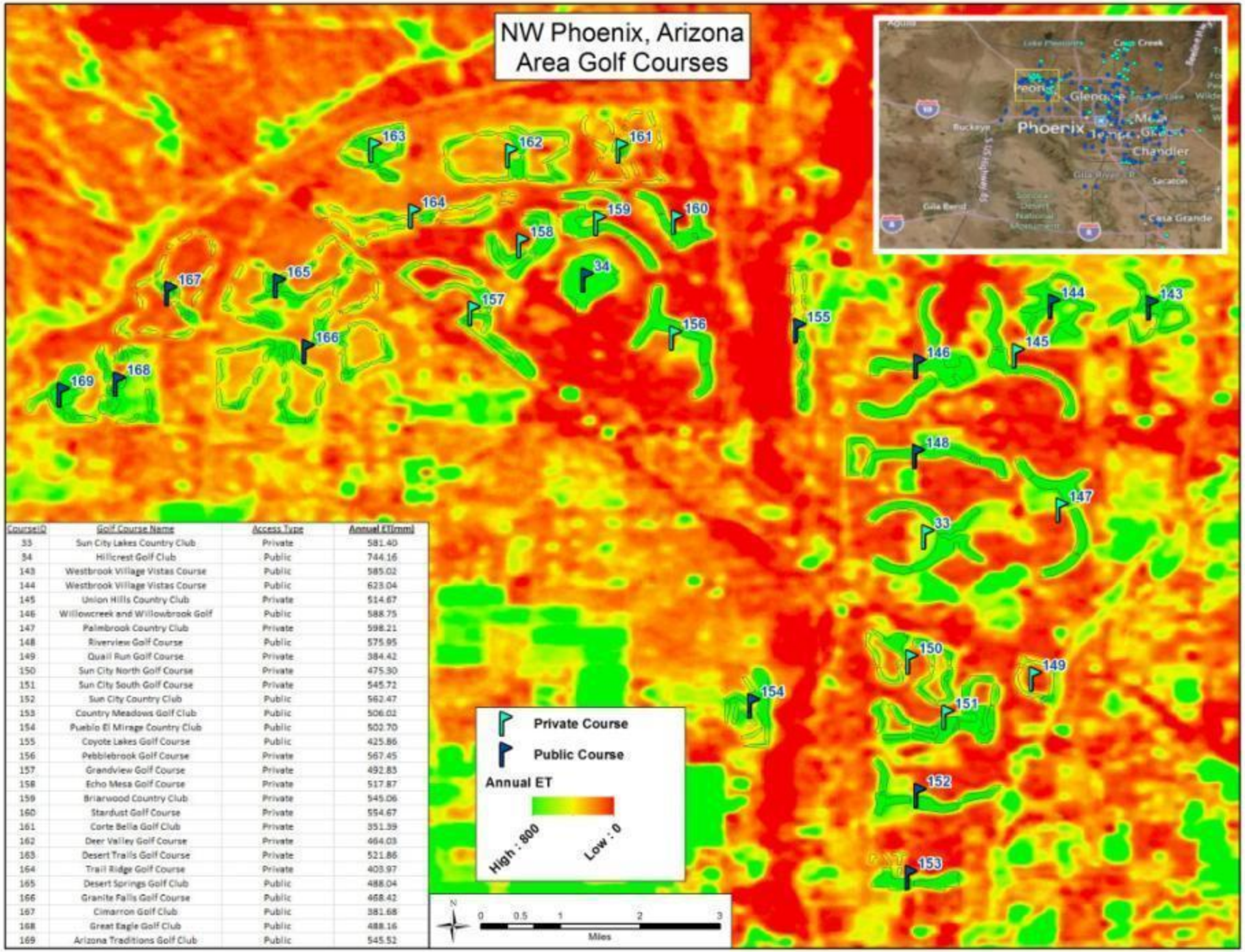
Annual and Monthly ET Totals from MODIS



Senay, Gabriel B., Stefanie Bohms, Ramesh K. Singh, Prasanna H. Gowda, Naga M. Velpuri, Henok Alemu, James P. Verdin. 2013. Operational Evapotranspiration Mapping Using Remote Sensing and Weather Datasets: A New Parameterization for the SSEB Approach. Journal of the American Water Resources Association (JAWRA). 49(3):577-591



CourseID	Golf Course Name	Access Type	Annual ET(mm)
33	Sun City Lakes Country Club	Private	581.40
34	Hillcrest Golf Club	Public	744.16
143	Westbrook Village Vistas Course	Public	585.02
144	Westbrook Village Vistas Course	Public	623.04
145	Union Hills Country Club	Private	514.67
146	Willowcreek and Willowbrook Golf	Public	588.75
147	Palmbrook Country Club	Private	598.21
148	Riverview Golf Course	Public	575.95
149	Quail Run Golf Course	Private	384.42
150	Sun City North Golf Course	Private	475.30
151	Sun City South Golf Course	Private	545.72
152	Sun City Country Club	Public	562.47
153	Country Meadows Golf Club	Public	506.02
154	Pueblo El Mirage Country Club	Public	502.70
155	Coyote Lakes Golf Course	Public	425.86
156	Pebblebrook Golf Course	Private	567.45
157	Grandview Golf Course	Private	492.83
158	Echo Mesa Golf Course	Private	517.87
159	Briarwood Country Club	Private	545.06
160	Stardust Golf Course	Private	554.67
161	Corte Bella Golf Club	Private	351.39
162	Deer Valley Golf Course	Private	464.03
163	Desert Trails Golf Course	Private	521.86
164	Trail Ridge Golf Course	Private	403.97
165	Desert Springs Golf Club	Public	488.04
166	Granite Falls Golf Course	Public	468.42
167	Cimarron Golf Club	Public	381.68
168	Great Eagle Golf Club	Public	488.16
169	Arizona Traditions Golf Club	Public	545.51



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169	Arizona Traditions Golf Club	Public	545.51

Water Use

Livestock

Less than 1 percent

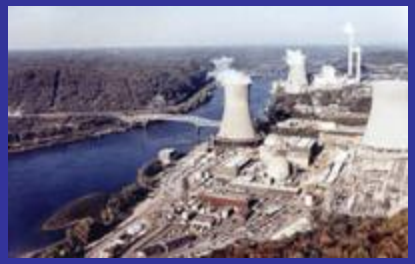
Self-Supplied Domestic

1 percent

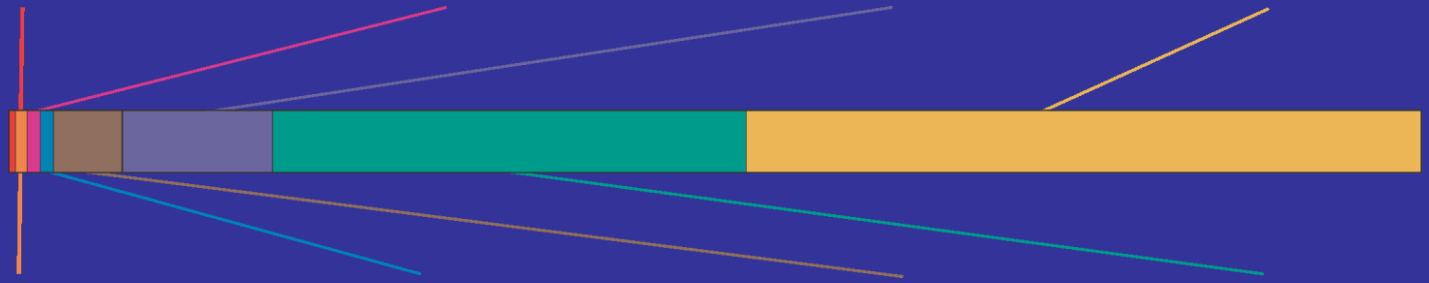
Public Supply

11 percent

Thermoelectric Power



49 percent



1 percent

Mining

2 percent

Aquaculture

4 percent

Self-Supplied Industrial

31 percent

Irrigation

Thermoelectric Withdrawals

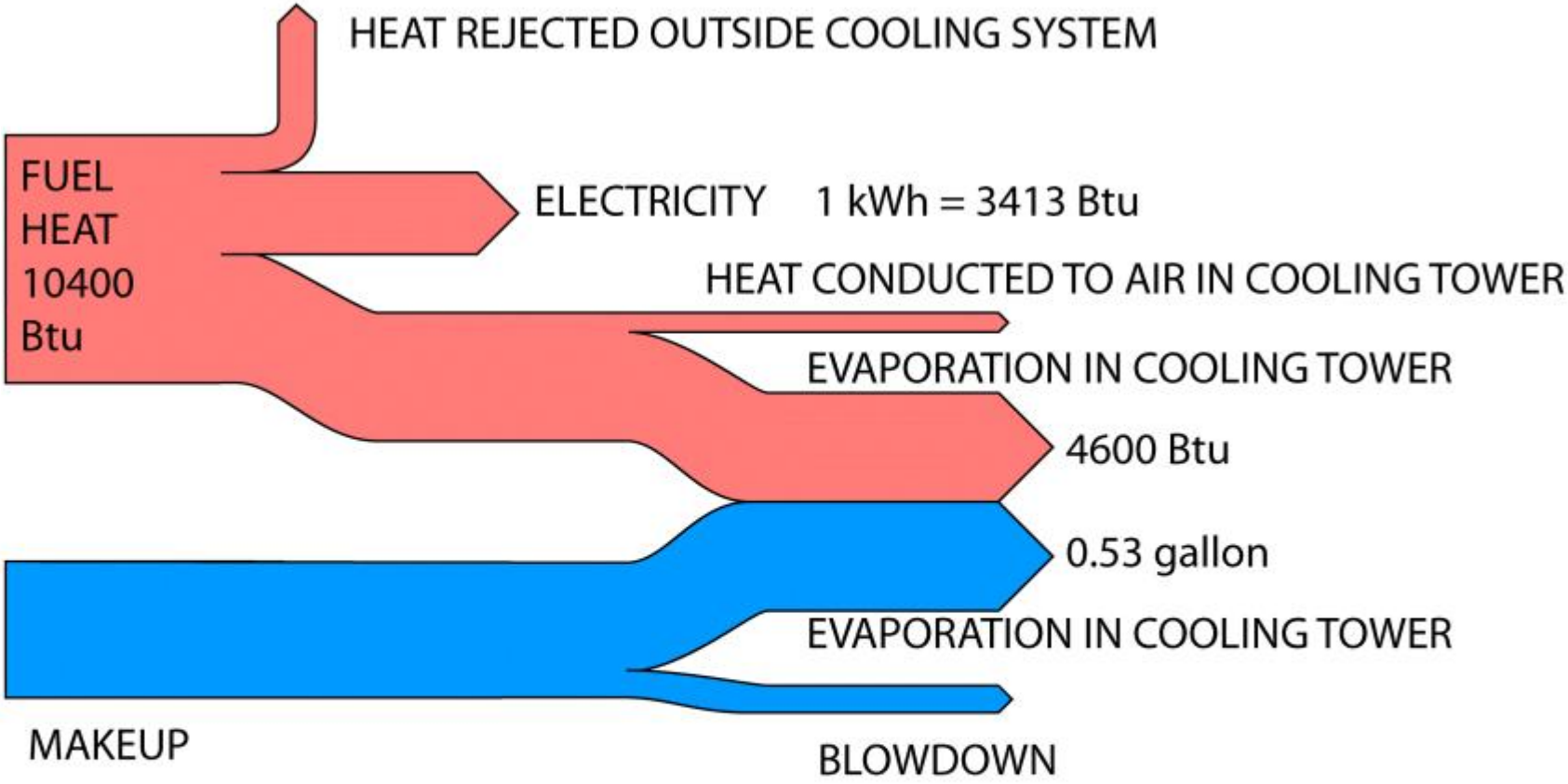
USGS
science for a changing world

USGS National Water Census and National Streamflow Information Program

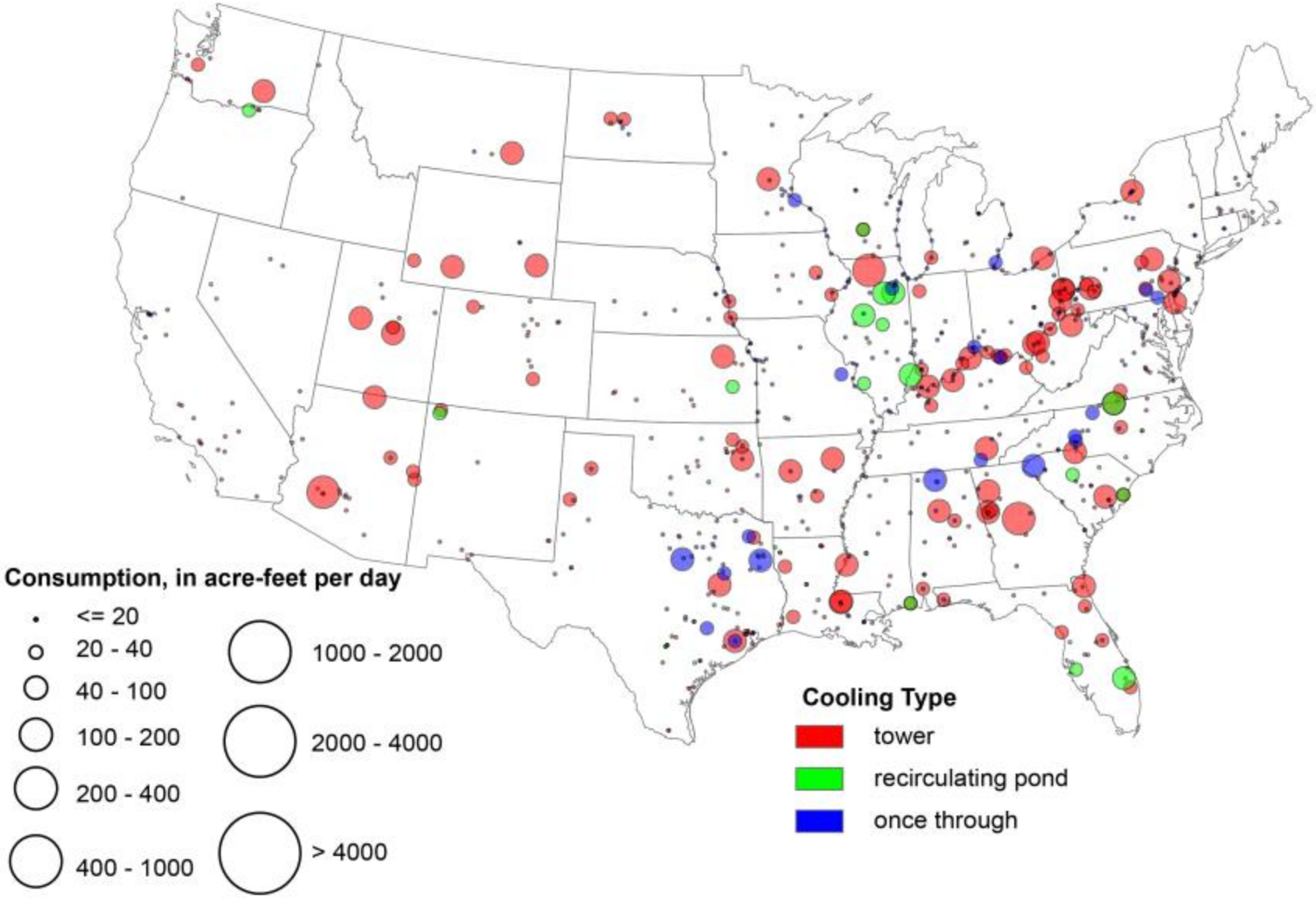
Methods for Estimating Water Consumption for Thermoelectric Power Plants in the United States

Scientific Investigations Report 2013–5188

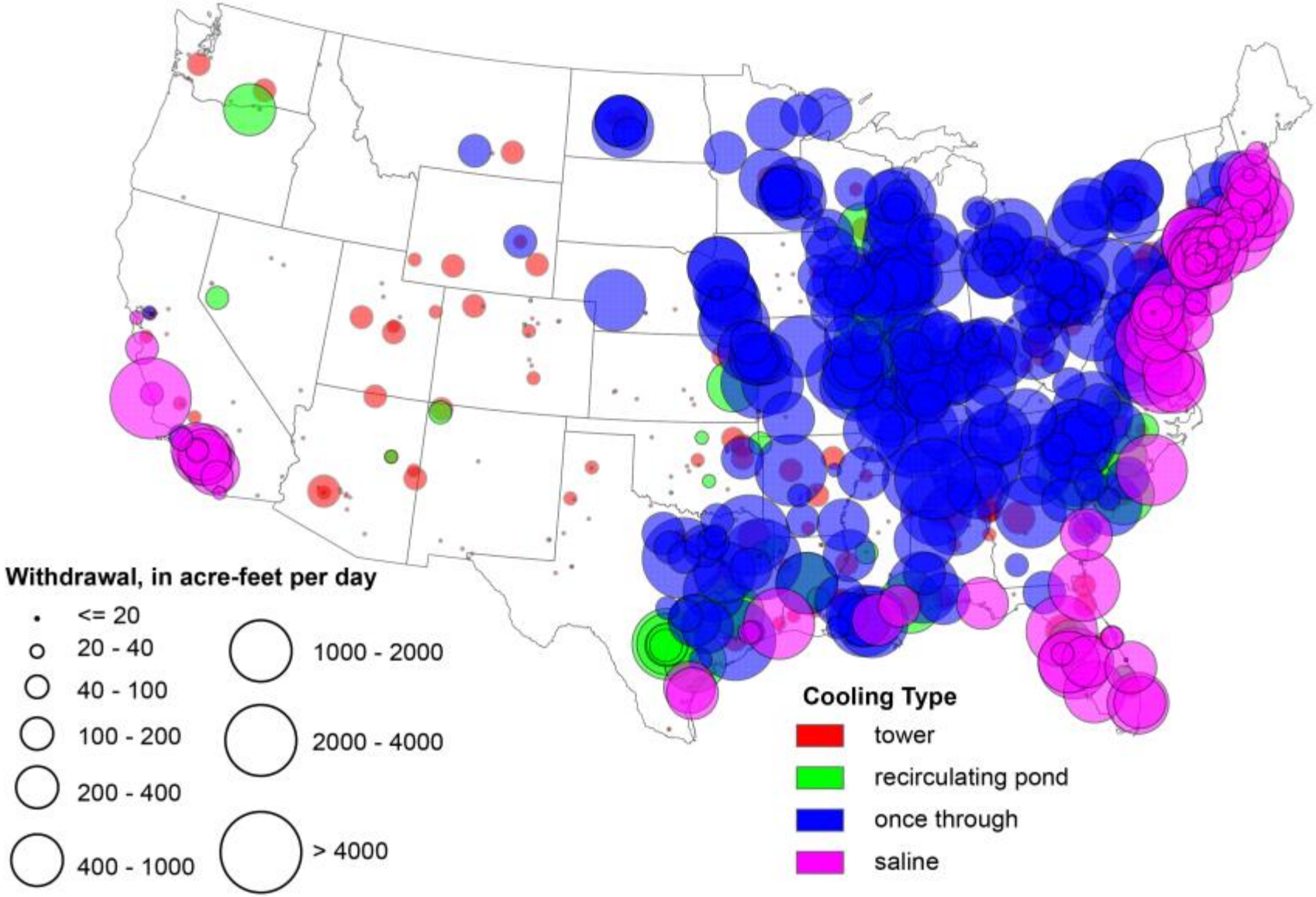
U.S. Department of the Interior
U.S. Geological Survey


HEAT REJECTED OUTSIDE COOLING SYSTEM
FUEL
HEAT
10400
Btu
ELECTRICITY
1 kWh = 3413 Btu
HEAT CONDUCTED TO AIR IN COOLING TOWER
EVAPORATION IN COOLING TOWER
4600 Btu
0.53 gallon
EVAPORATION IN COOLING TOWER
MAKEUP
BLOWDOWN

Consumptive Use



Thermoelectric Withdrawals



Flows Needs for Wildlife and Habitat

- Classify streams - hydro-ecological type
- Tools to systematically assess ecological affects of hydrologic alteration
- Develop flow alteration – ecological response relationships by “h-e” type

RIVER RESEARCH AND APPLICATIONS

River Res. Applic. (2013)

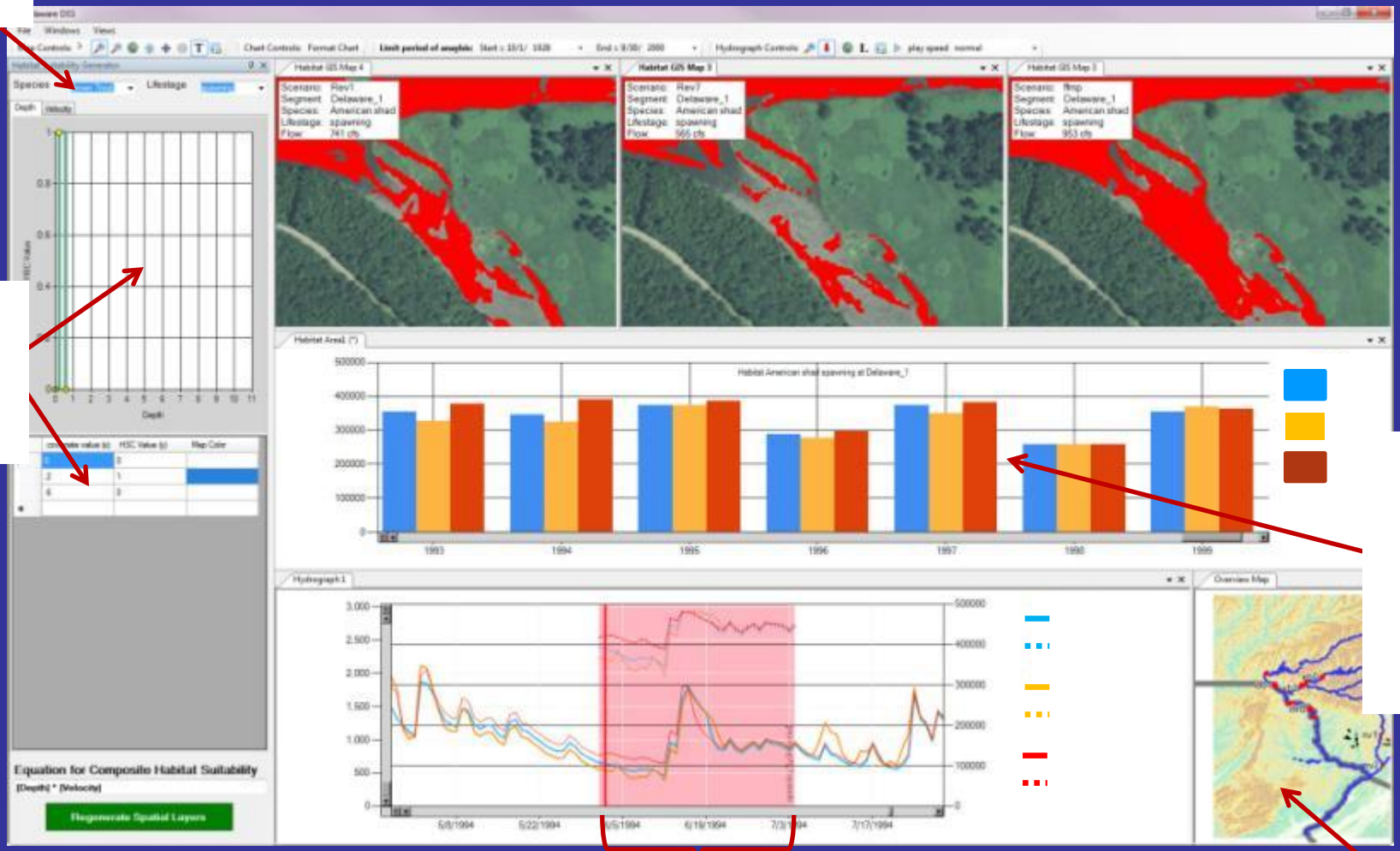
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/rra.2710

AN OBJECTIVE AND PARSIMONIOUS APPROACH FOR CLASSIFYING NATURAL FLOW REGIMES AT A CONTINENTAL SCALE

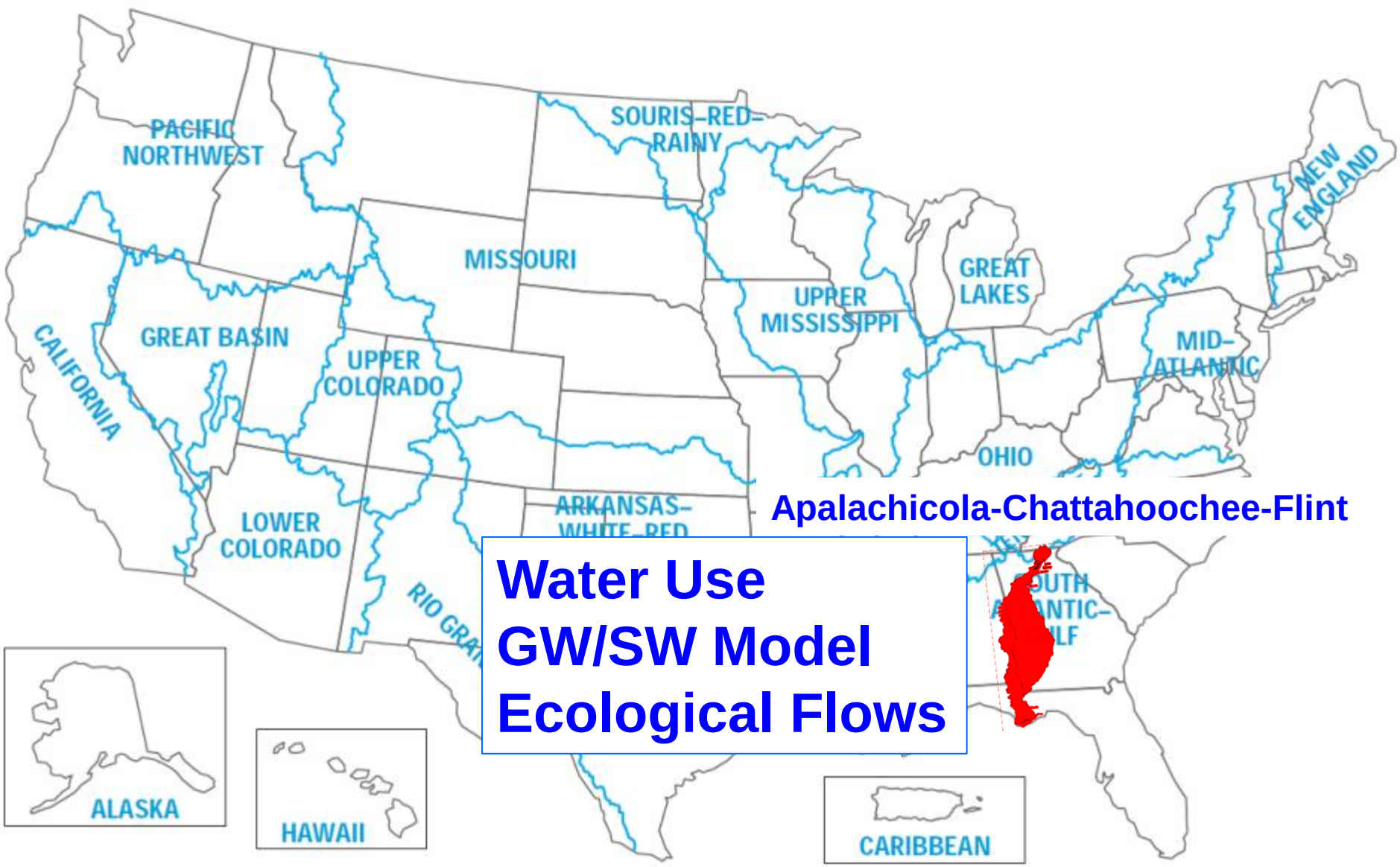
S. A. ARCHFIELD[a*], J. G. KENNEN[b], D. M. CARLISLE[c] AND D. M. WOLOCK[d]

[a] *Massachusetts-Rhode Island Water Science Center, US Geological Survey, Northborough, Massachusetts USA*
[b] *New Jersey Water Science Center, US Geological Survey, West Trenton, New Jersey USA*
[c] *National Center, US Geological Survey, Reston, Virginia USA*
[d] *Kansas Water Science Center, US Geological Survey, Lawrence, Kansas USA*

Article first published online: 30 Sept. 2013 | DOI: 10.1002/rra.2710


Species
Lifestage
Depth
Velocity
Equation for Composite Habitat Suitability
[Depth] * [Velocity]
Regenerate Spatial Layers
Habitat GIS Map 4
Habitat GIS Map 3
Habitat GIS Map 1
Scenario: Rev1
Segment: Delaware_1
Species: American shad
Lifestage: spawning
Flow: 741 cfs
Scenario: Rev7
Segment: Delaware_1
Species: American shad
Lifestage: spawning
Flow: 565 cfs
Scenario: ffmp
Segment: Delaware_1
Species: American shad
Lifestage: spawning
Flow: 953 cfs
Habitat Area1 (*)
Habitat American shad spawning at Delaware_1
1993
1994
1995
1996
1997
1998
1999
Hydrograph 1
5/8/1994
5/22/1994
6/19/1994
7/17/1994
Overview Map

Focus Area Studies within Water Resource Regions

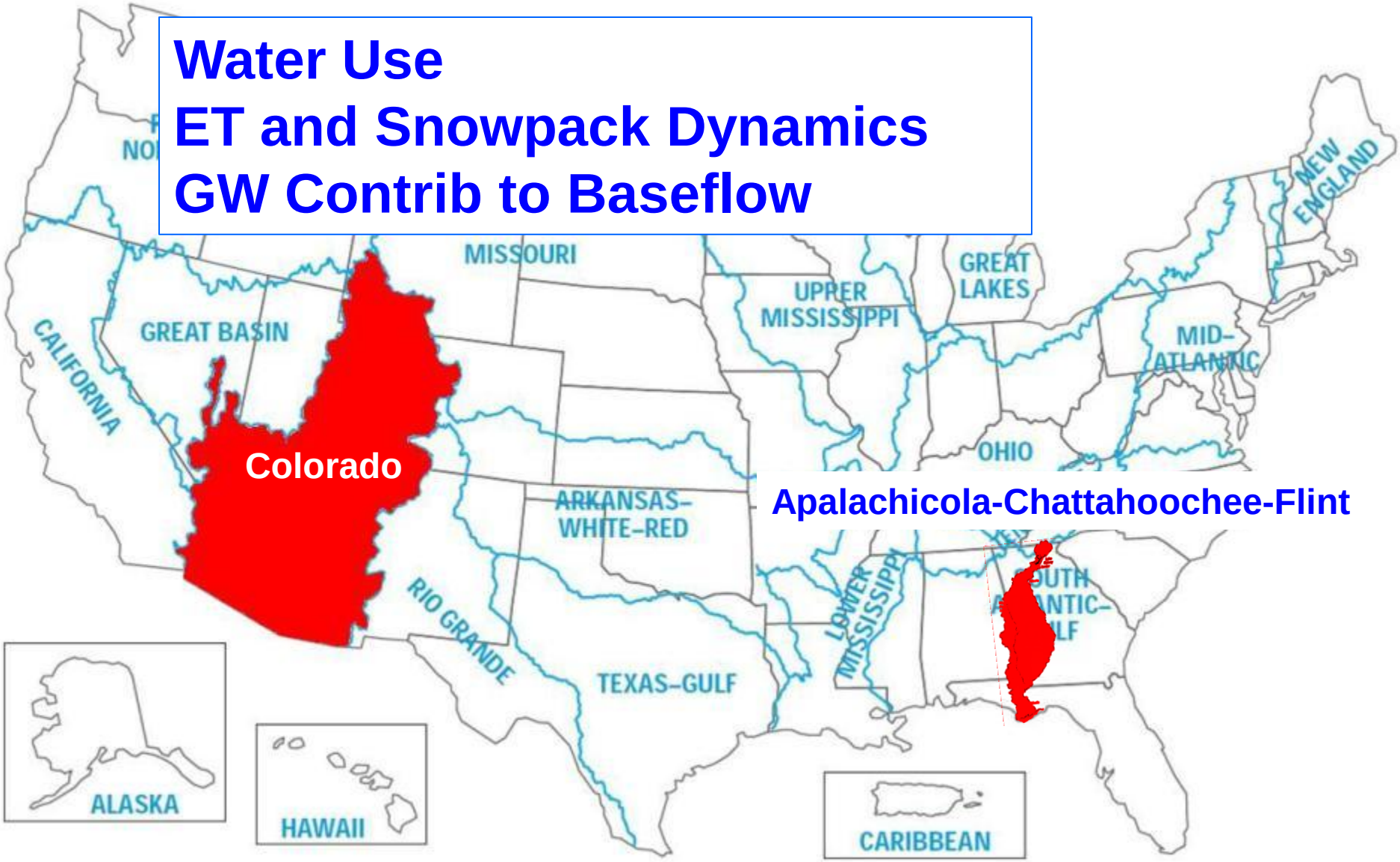


Apalachicola-Chattahoochee-Flint

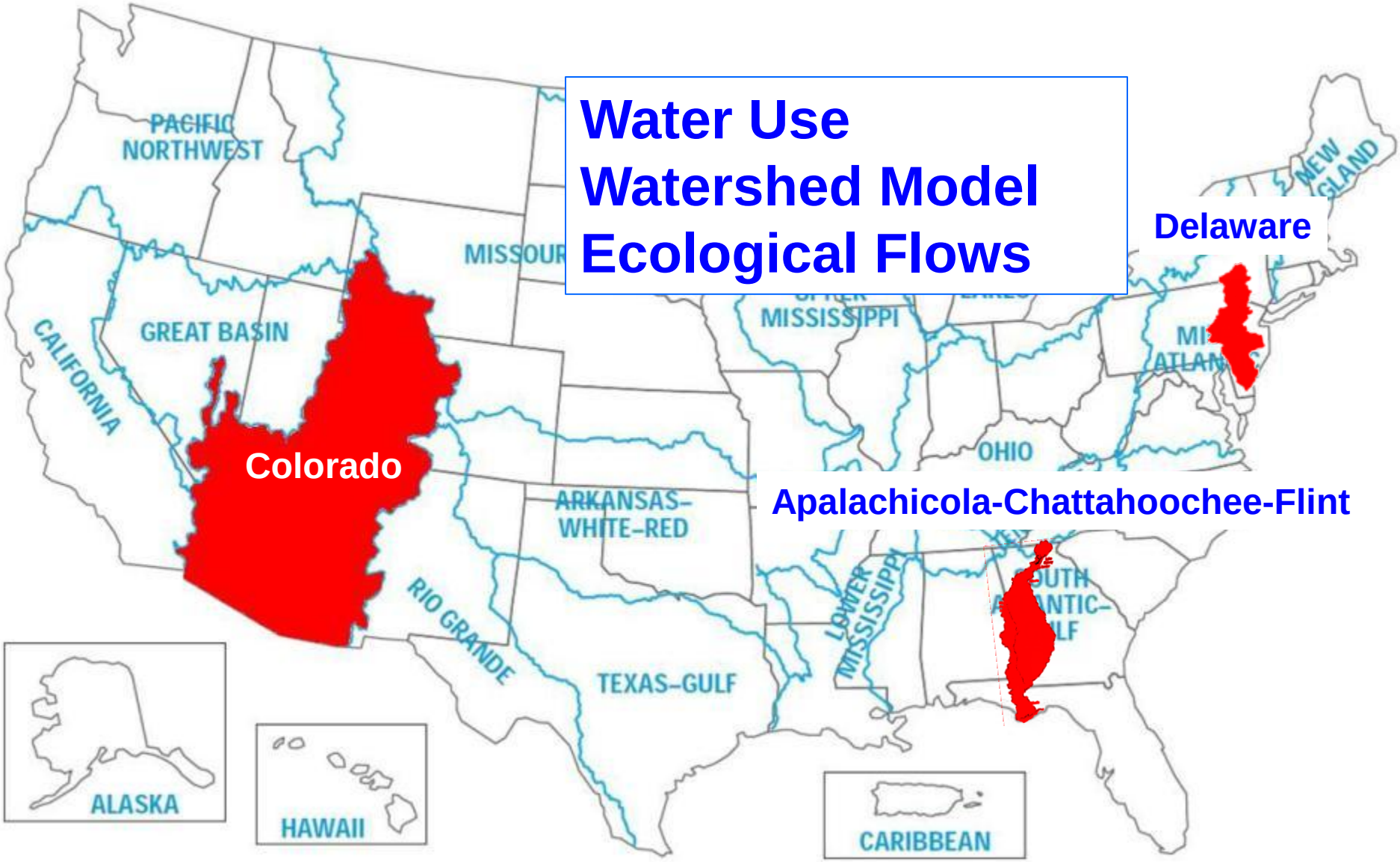
Water Use
GW/SW Model
Ecological Flows

Focus Area Studies within Water Resource Regions

Water Use
ET and Snowpack Dynamics
GW Contrib to Baseflow

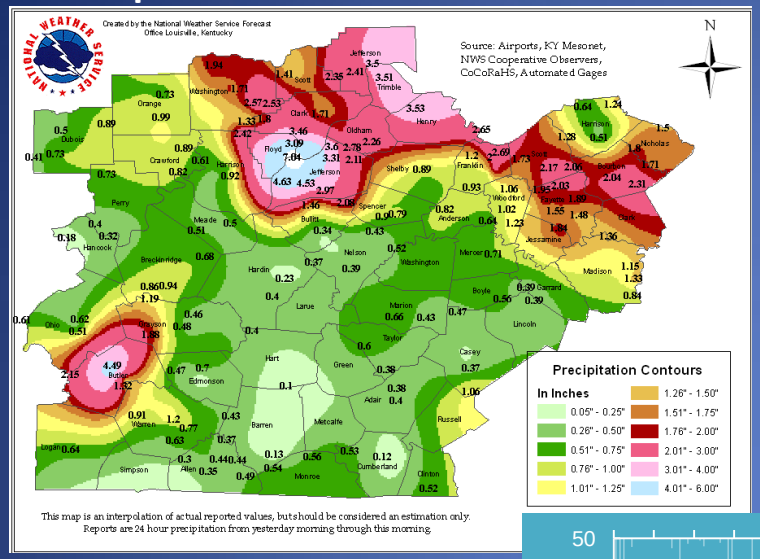


Focus Area Studies within Water Resource Regions



WATER – A decision support tool

Precipitation Record or Forecast

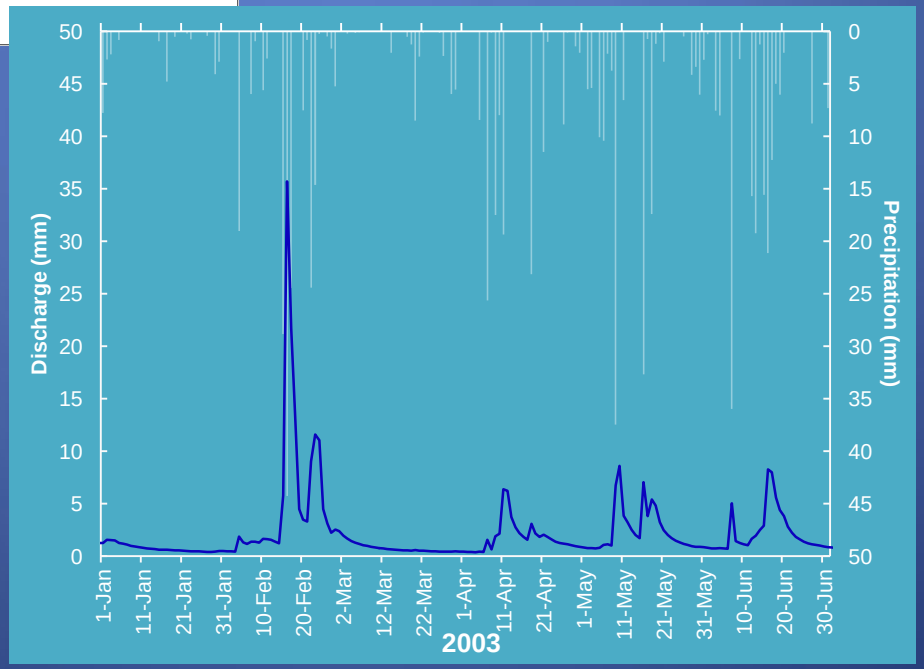


Current Condition Gaged Streams

Long-term Flow Record

Current Conditions Ungaged Streams

Hydrograph



Landscape Characterization

Land Management and Water Allocation

Potential Climate Change

Water Availability

Reservoirs and Routing

Initial work focusing on basin areas upstream of reservoirs.

Eventually:

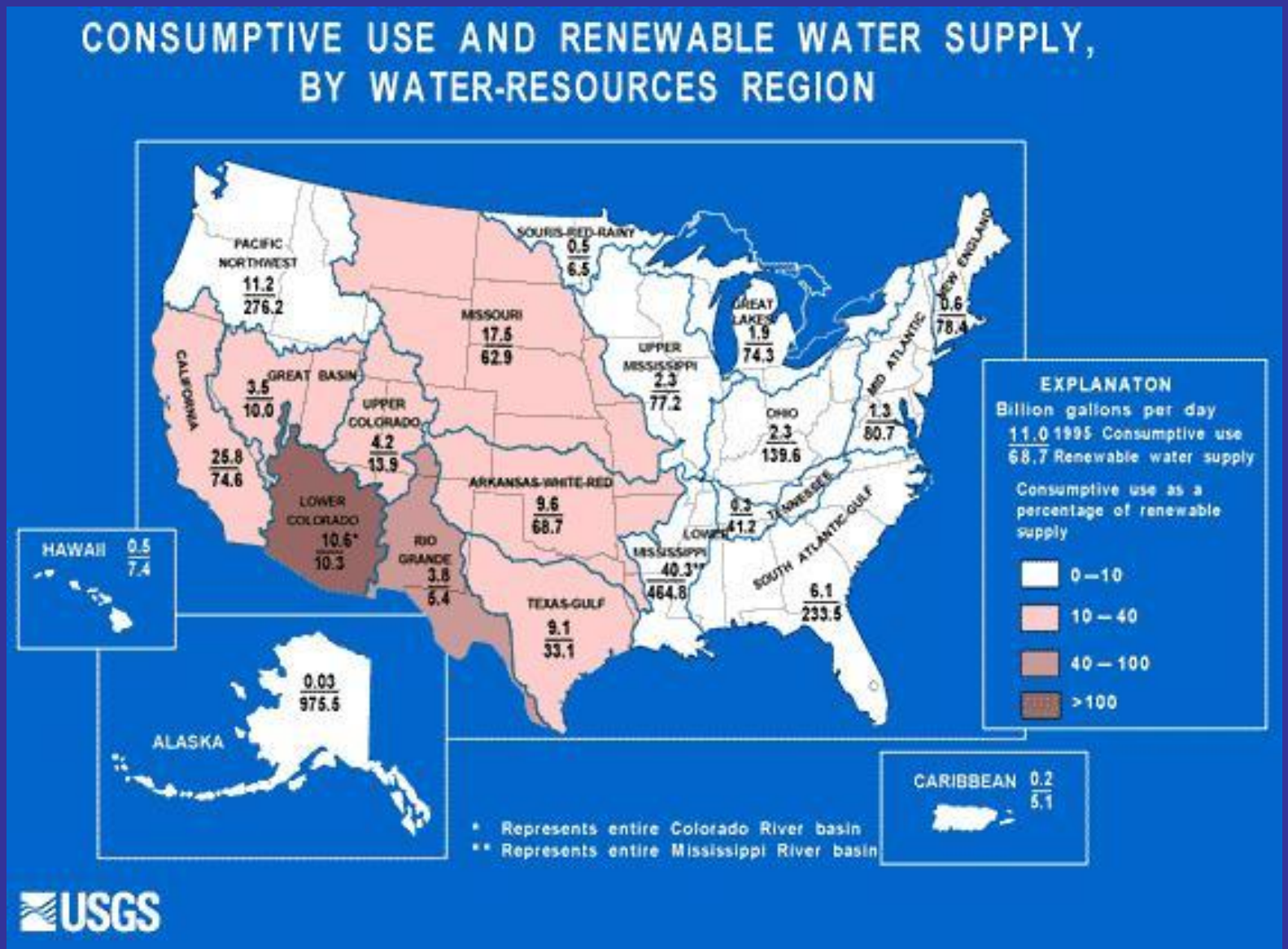
- WATER export to OASIS
- Use OASIS decision points for routing of basins

How does all this factor into indicators?

- With complete water budget information, you can start relating all kinds of hydrologic factors and ratios to water availability.

- Consumptive and Depletive Uses as a Percentage of Total Precipitation plus Imports minus Evapotransporation
- Consumptive and Depletive Uses related to measures of Streamflow Variability
- Affects of Streamflow Variability on maintenance of hydroecological classification.

You can reproduce maps like this with recent data, at much finer scapes.



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Trenton, New Jersey 08628

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eevenson@usgs.gov