

SUSTAINABILITY INDICATORS AND WEB-BASED REPORTING FOR THE CALIFORNIA WATER PLAN ...AND BEYOND

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&

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Presentation to the California Water Quality Monitoring Council

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ACKNOWLEDGEMENTS

- UC Davis: Fraser Shilling, Lara Lacher, Susana Cardenas, David Waetjen, & Caitlin Cornwall
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- US EPA: Vance Fong & Don Hodge
- Pacific Institute: Julian Fulton & Heather Cooley

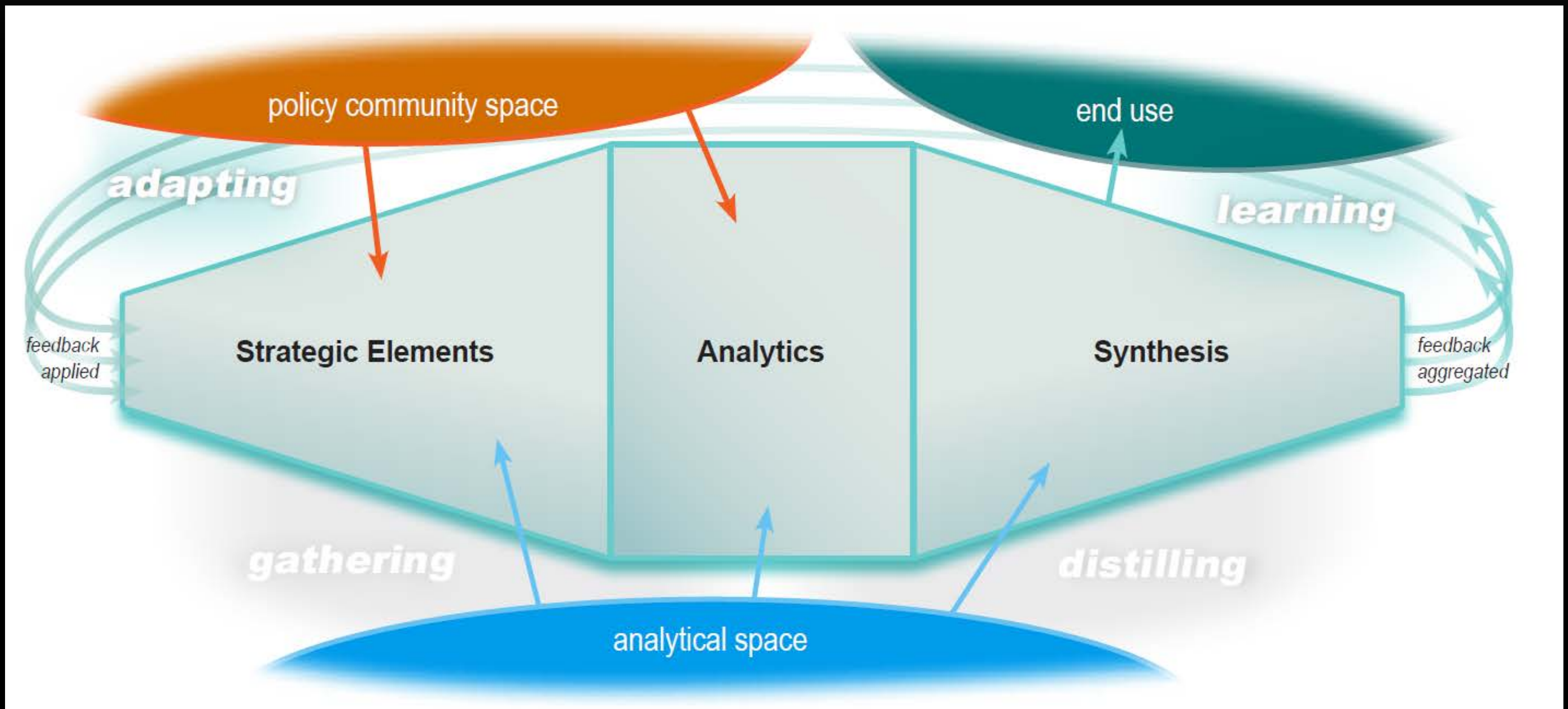
OUTLINE

- Water Plan and Sustainability Indicators Framework
 - Approach Development
 - State Pilot
 - Region Pilot
- Web-based Reporting

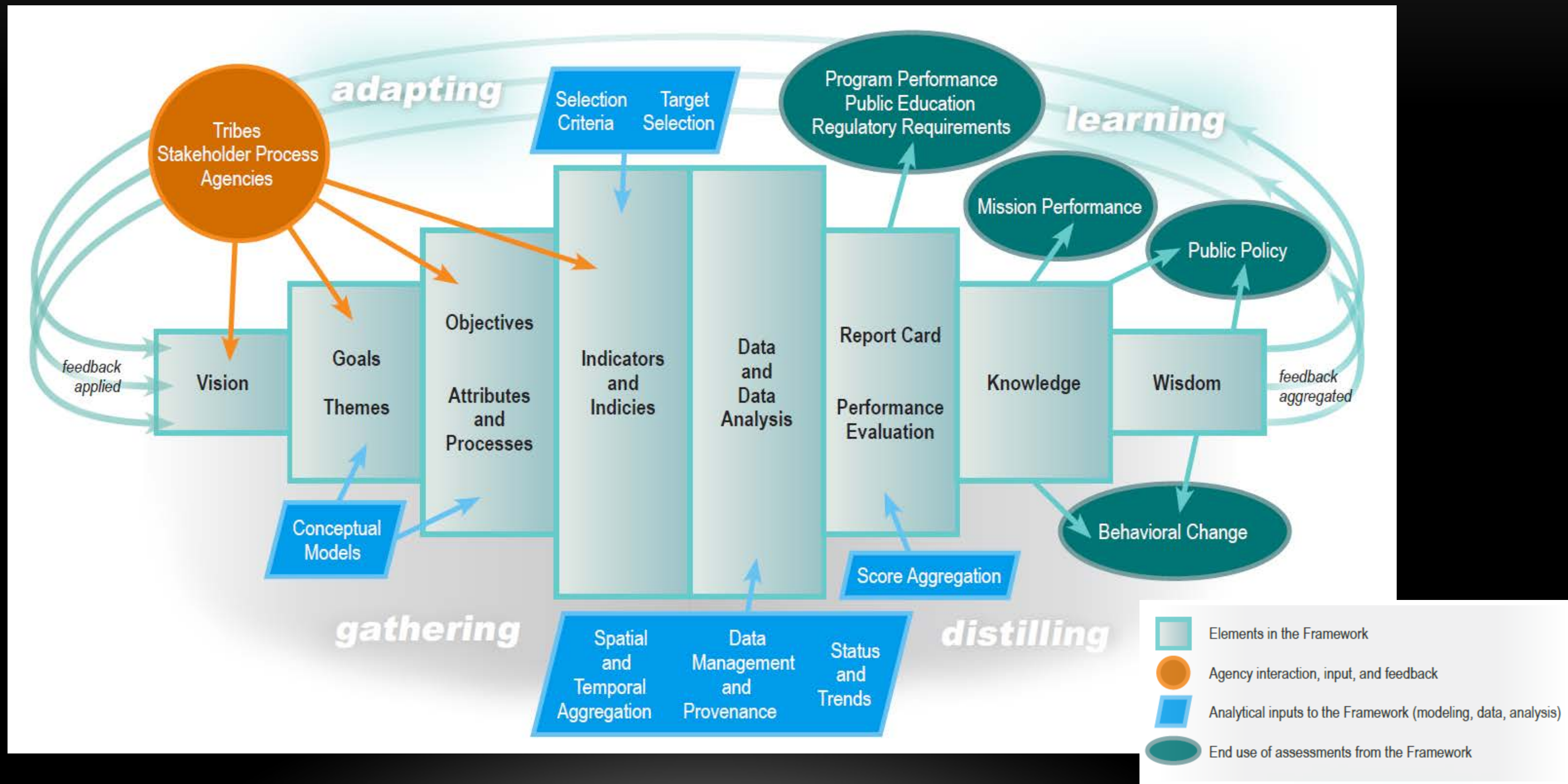
HISTORY OF THE PROJECT

- 2009 Water Plan Update: SWRR Indicators, discussion among stakeholders
- DWR developed California water sustainability indicators project charter with goals and outcomes, and looked around for ways to do this for Water Plan Update 2013.
- DWR Approached Fraser Shilling (UC Davis) because of previous projects (DWR-funded) in Napa, Feather, and Los Angeles River watersheds
- USEPA approached DWR to become a participant in the project with both funding and technical input
- DWR approached the Pacific Institute to work with the UC Davis on Water Footprint analysis.
- Sustainability Indicators Interagency Workgroup discussion/review/feedback.
- Water Plan stakeholder groups discussion/review/feedback
- Framework and approach developed in 2011
- Pilot testing in 2012-present
- Plan to complete project in September, 2013

FLOW OF INFORMATION IN FRAMEWORK



FLOW OF INFORMATION IN FRAMEWORK



Proposed Sustainability Goals and Objectives	Connection to other CWP Elements
Goal 1. Manage and make decisions about water in a way that integrates water availability, environmental conditions, and community well-being for future generations.	CWP Objectives 12,15,16
Goal 2. Improve water supply reliability to meet human needs, reduce energy demand, and restore and maintain aquatic ecosystems and processes.	CWP Objectives 2,3,7,8,9,12; RMS Reduce demand; Increase water supply
Goal 3. Improve beneficial uses and reduce impacts associated with water management.	CWP Objectives 7,13,14; RMS Operational efficiency
Goal 4. Improve quality of drinking water, irrigation water, and in-stream flows to protect human and environmental health.	CWP Objectives 4,7; RMS Water quality
Goal 5. Protect and enhance environmental conditions by improving watershed, floodplain, and aquatic condition and processes.	CWP Objectives 5,7; RMS Natural Resources
Goal 6. Integrate flood risk management with other water and land management and restoration activities.	CWP Objectives 1,6,8; RMS Improve flood
Goal 7. Employ adaptive decision-making, especially in light of uncertainties, that support integrated regional water management and flood management systems.	CWP Objective 1,10,15,16,17; various RMS

CATEGORIES/DOMAINS

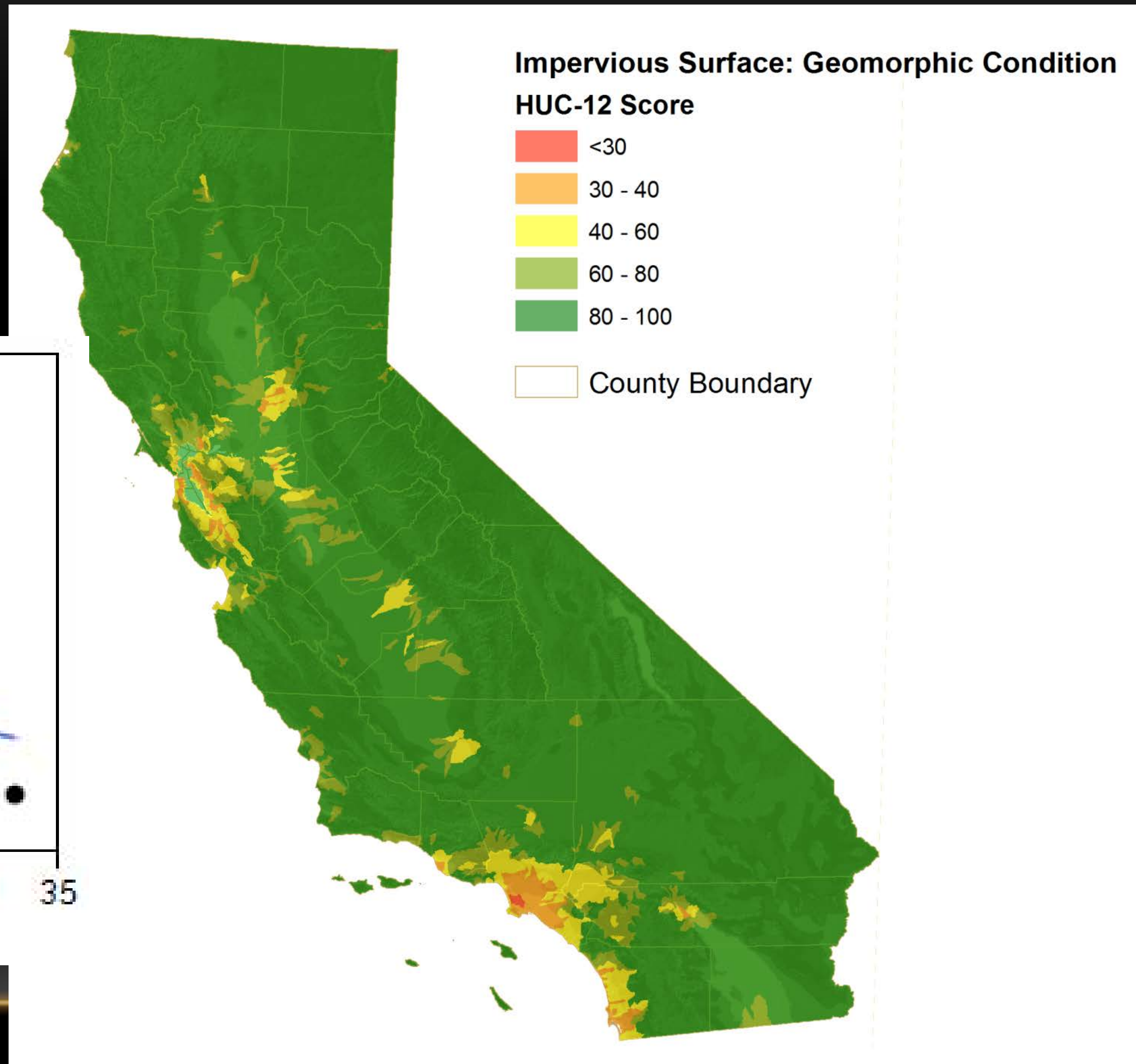
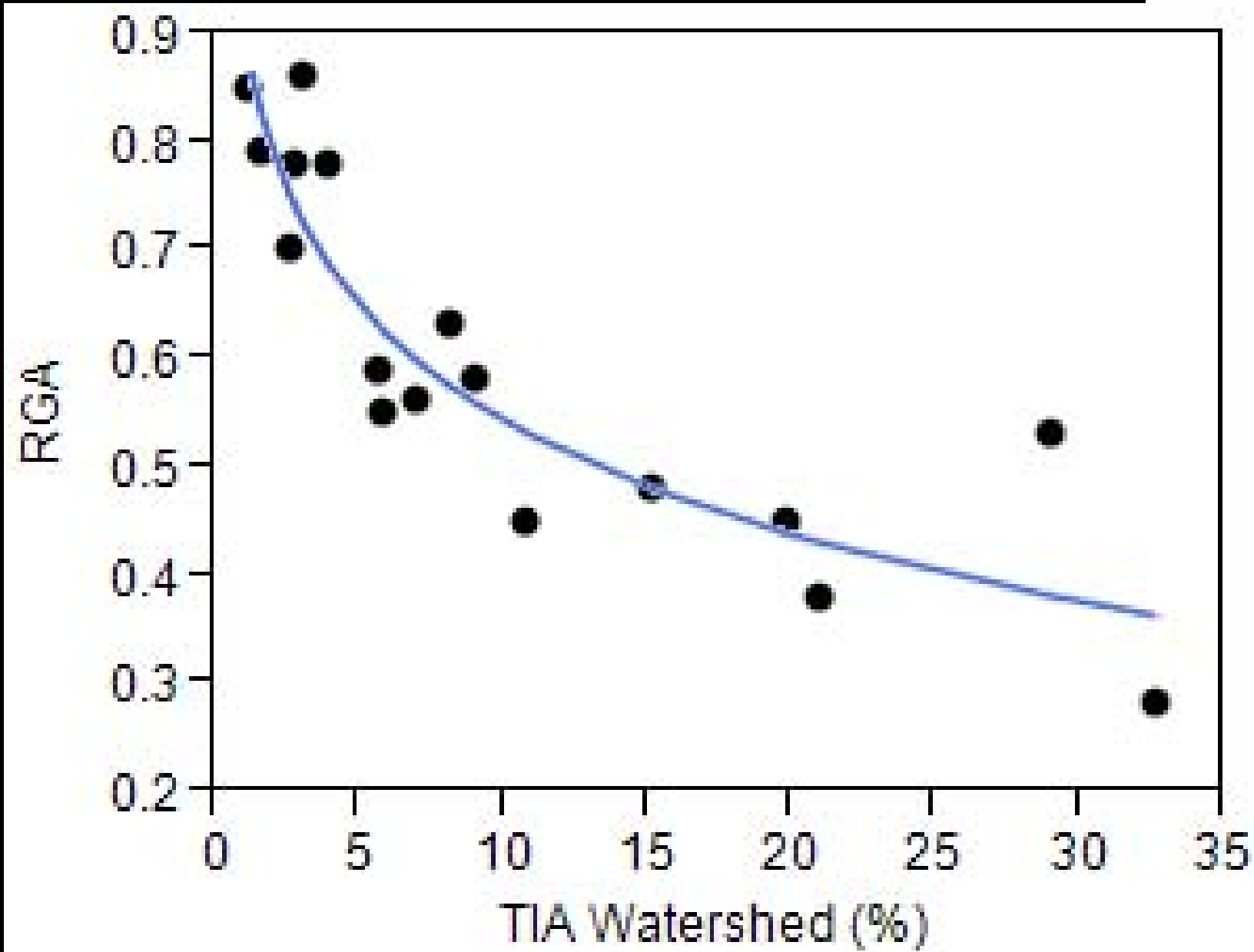
- Water Supply Reliability
- Water Quality
- Ecosystem Health
- Social Benefits and Equity
- Adaptive and Sustainable Management

STATE PILOT: INDICATORS

- Impervious surface: water quality
- Impervious surface: geomorphic processes
- Native fish community
- California Stream Condition Index
- Groundwater quality
- Water supply and use
- Public perceptions
- Water footprint, ecological footprint, plant growth index, groundwater remote sensing
- **World Resources Institute: Aqueduct Project**
- **Healthy Watershed Initiative: condition & vulnerability (still to come)**

FINDINGS: IMPERVIOUS SURFACES AND GEOMORPHIC/FLOODING PROCESSES

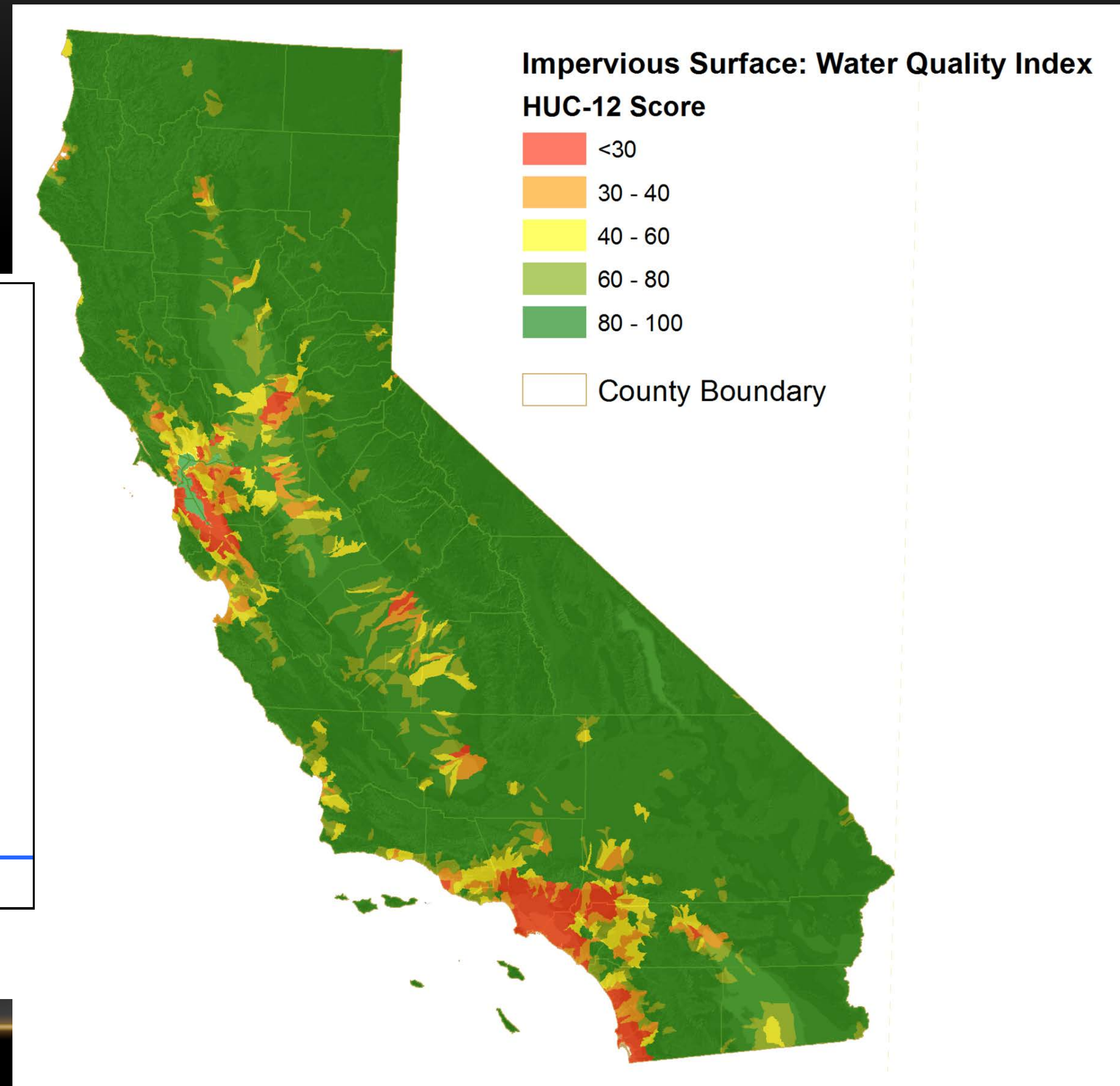
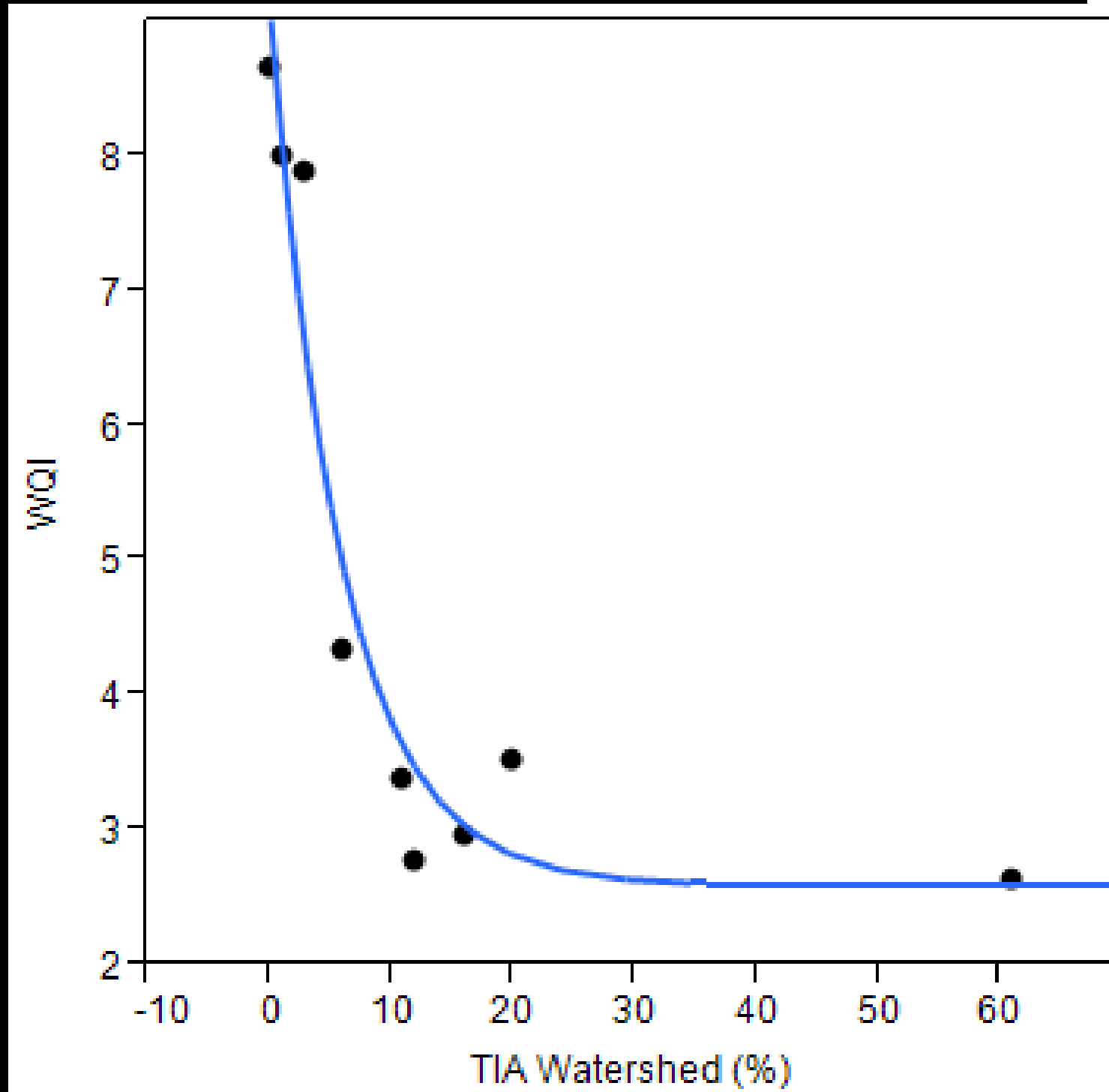
National Land Cover Database
2006



Adapted from Fitzgerald et al (2012).

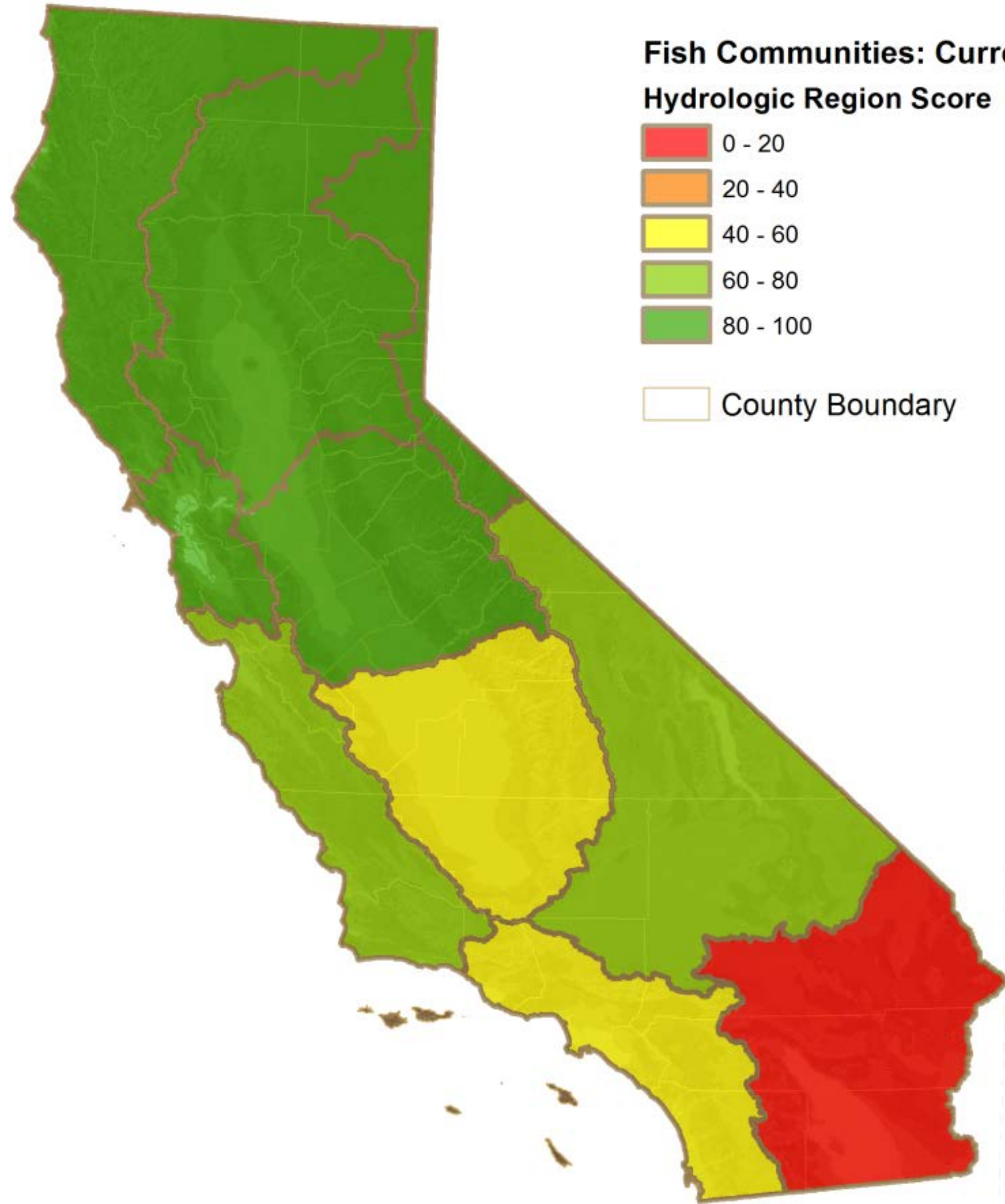
FINDINGS: IMPERVIOUS SURFACES AND WATER QUALITY

National Land Cover Database
2006

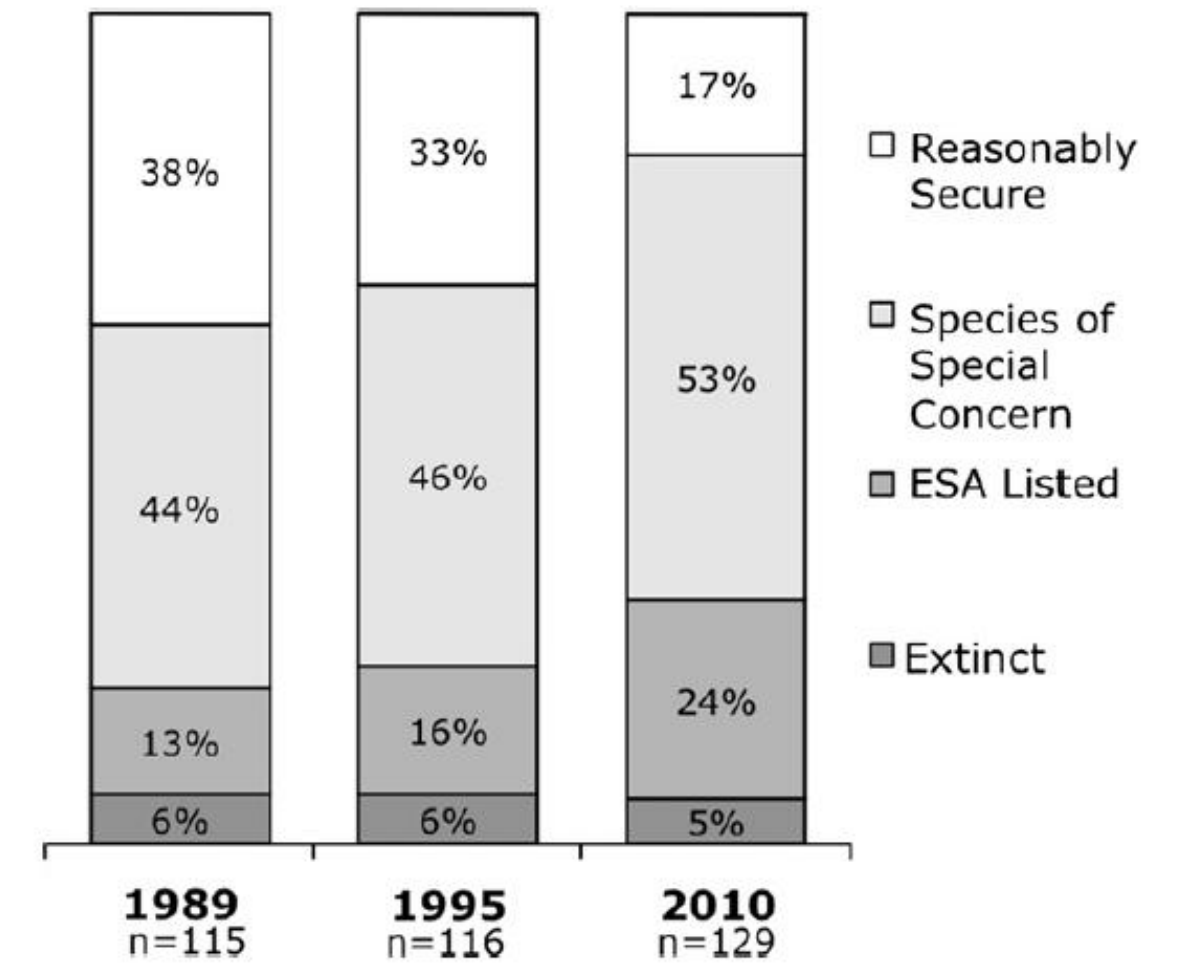


Adapted from (Schiff and Benoit 2007).

FINDINGS: FISH COMMUNITY INTEGRITY

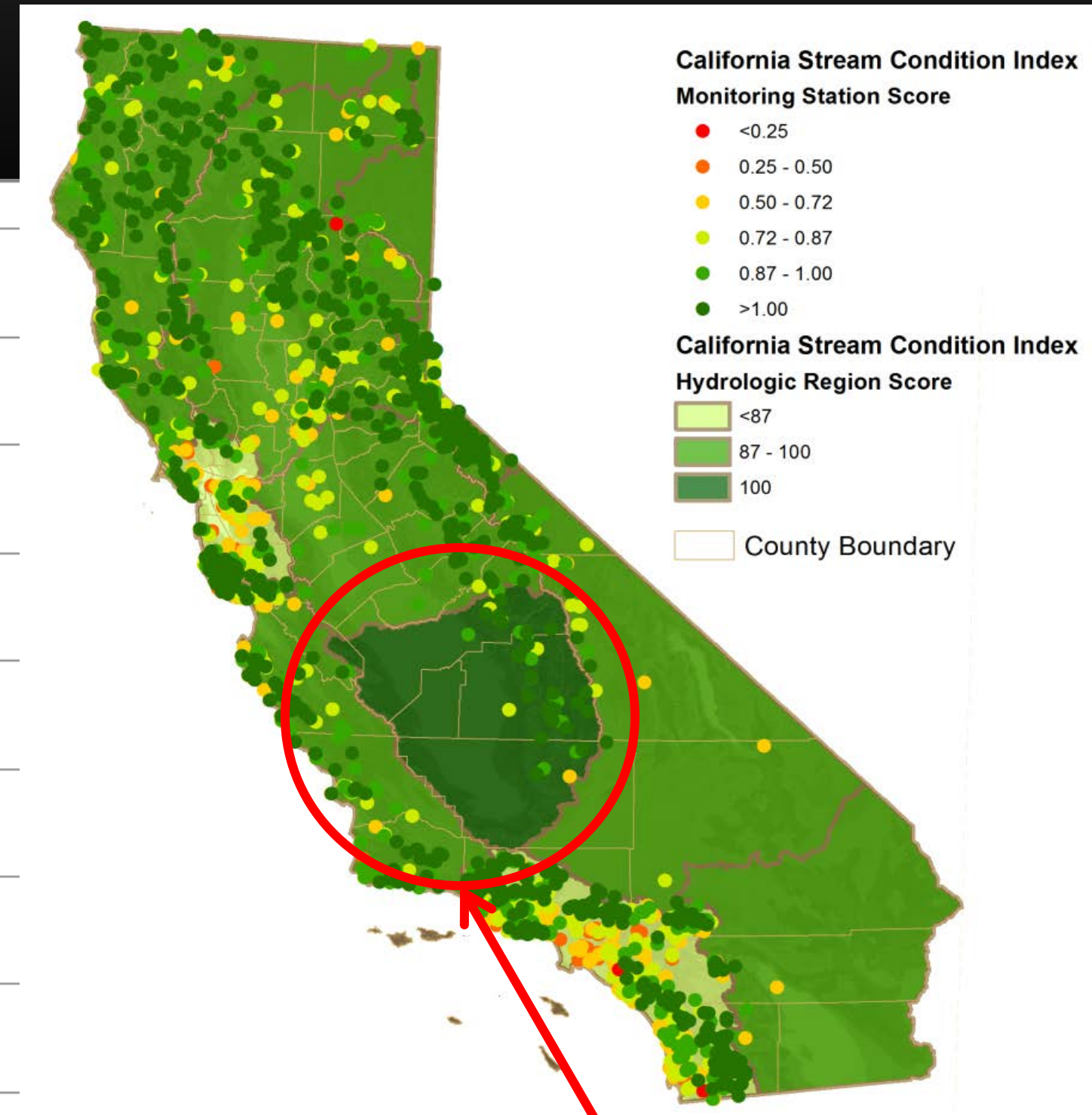
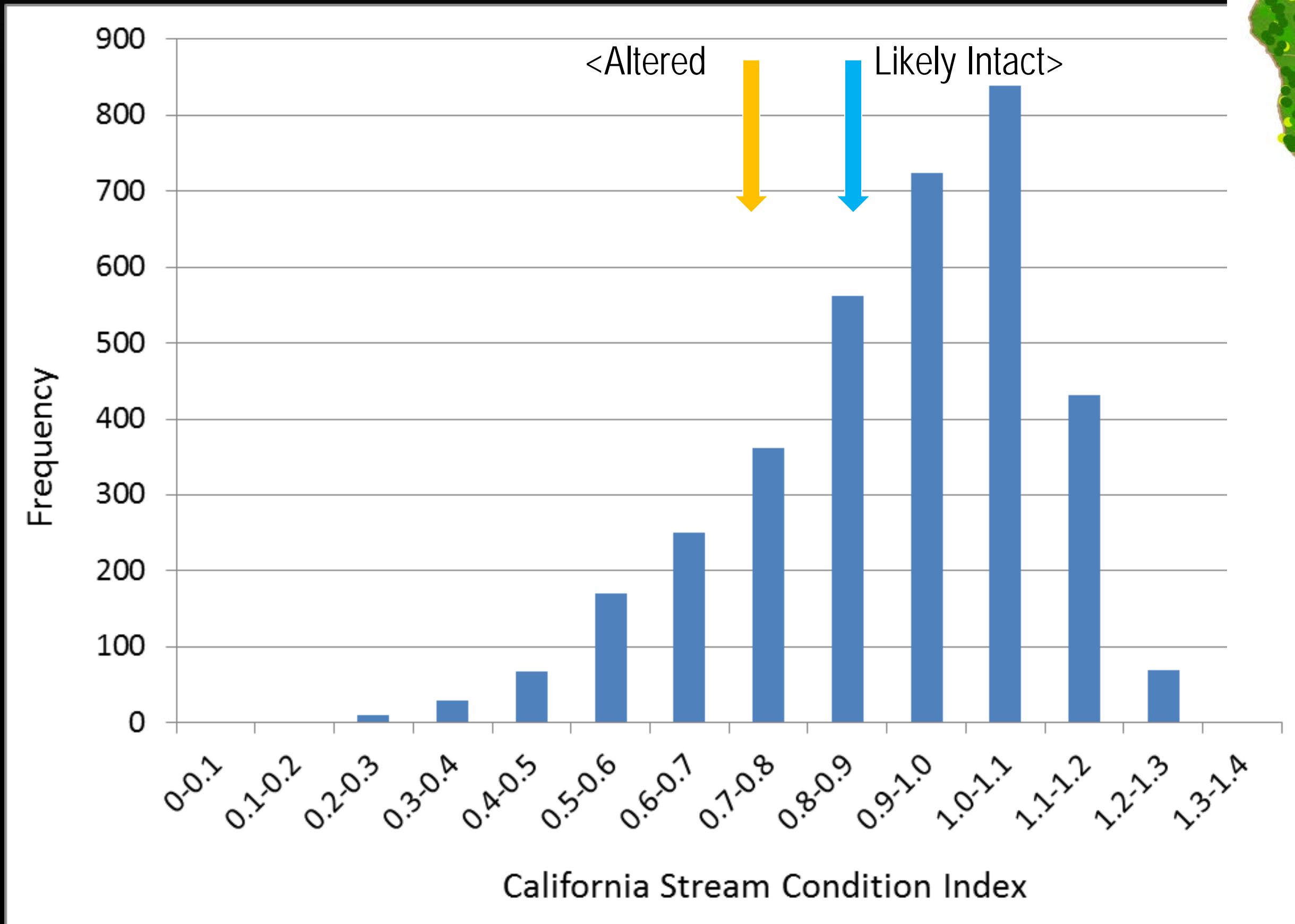


NATIVE FISH STATUS



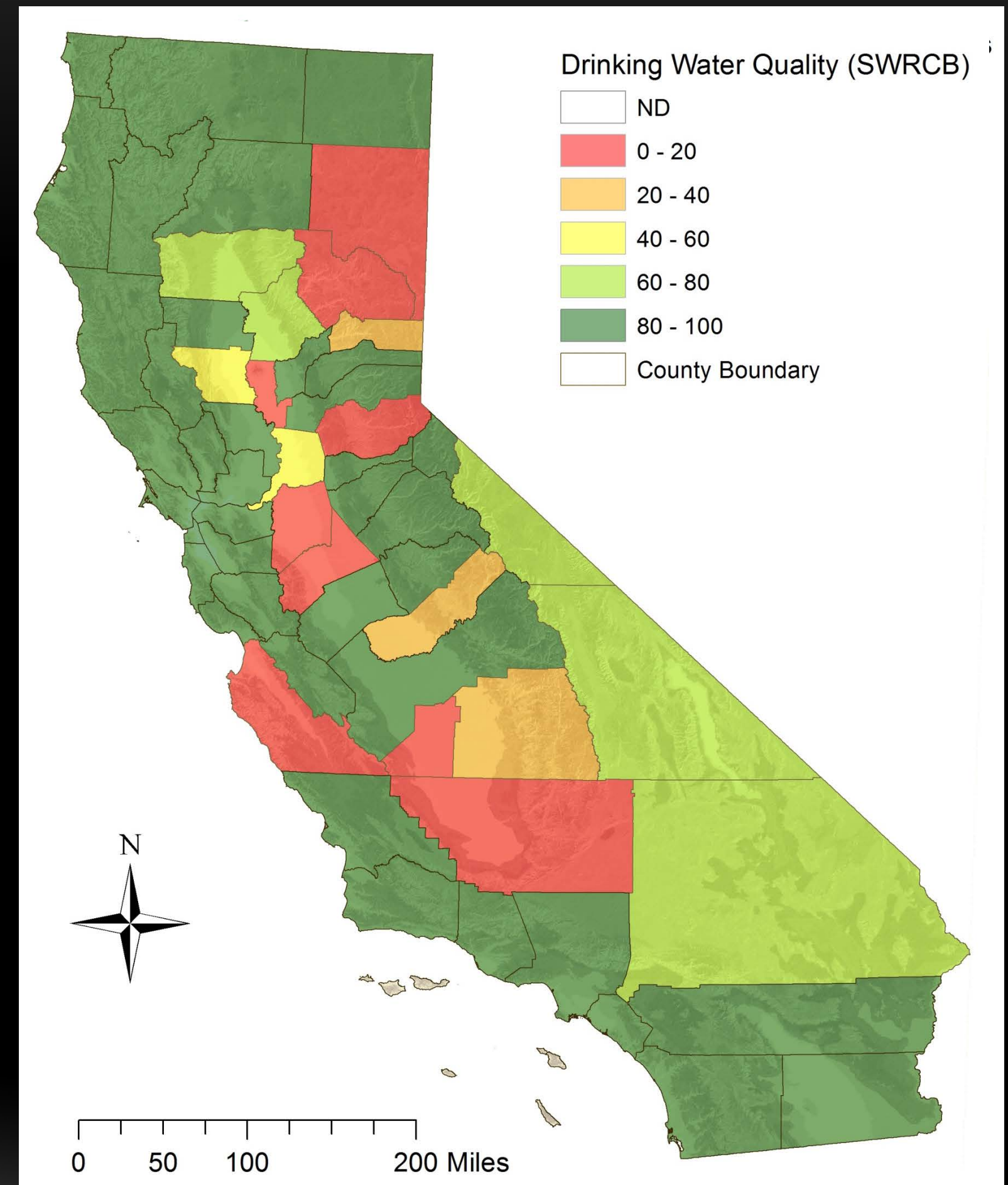
Watershed	Watershed code	Original native fish diversity	Nonnative fish diversity
Lower Klamath River	1a	20	14
Goose Lake	2a	8	11
Pit River	2b	13	15
McCloud River	2c	7	4
Sacramento/San Joaquin River	2d	29	41
Clear Lake	2e	14	18
Monterey	2f	19	20
Kern River	2g	4	7
Tomales	3a	11	7
Russian River	3b	21	19
Gualala River	3c	8	0
Garcia River	3d	8	0
Navarro River	3e	9	0
Big River	3f	8	0
Noyo River	3g	5	0
Matolle River	3h	8	0
Bear River	3i	9	0
Eel River	3j	14	10
Mad River	3k	14	8
Little	3l	9	0
Redwood	3m	12	6
Smith River	3n	12	0
Ten Mile Creek	3o	7	0
Surprise Valley	4a	3	2
Eagle Lake	4b	5	2
Susan River	4c	8	7
Truckee River	4d	8	15
Carson River	4e	8	14
Walker River	4f	8	13
Mono Lake	4g	0	6
Owens River	4h	4	14
Amargosa River	4i	3	2
Mojave River	4j	1	23
San Diego	5a	7	26
Santa Margarita	5c	9	12
Los Angeles	5d	12	34
Santa Clara	5e	7	24
Santa Inez	5f	6	16
Santa Maria	5g	7	8
San Luis Obispo	5h	7	8
Morro	5i	8	10
Big Sur	5j	6	0
Carmel River	5k	5	12
Salton Sea	6a	1	24

FINDINGS: BENTHIC MACROINVERTEBRATE COMMUNITY INTEGRITY



This unexpected result because most sites are in the foothills and mountains, not the ag areas

FINDINGS: GROUNDWATER QUALITY

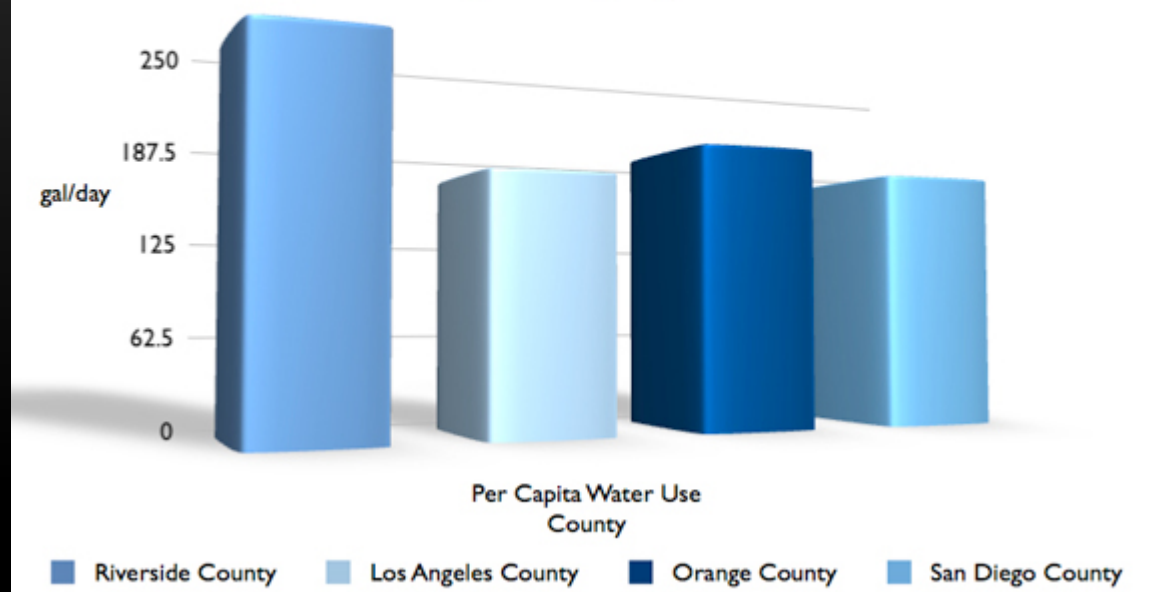


Data Sources: GAMA, CAEnviroScreen

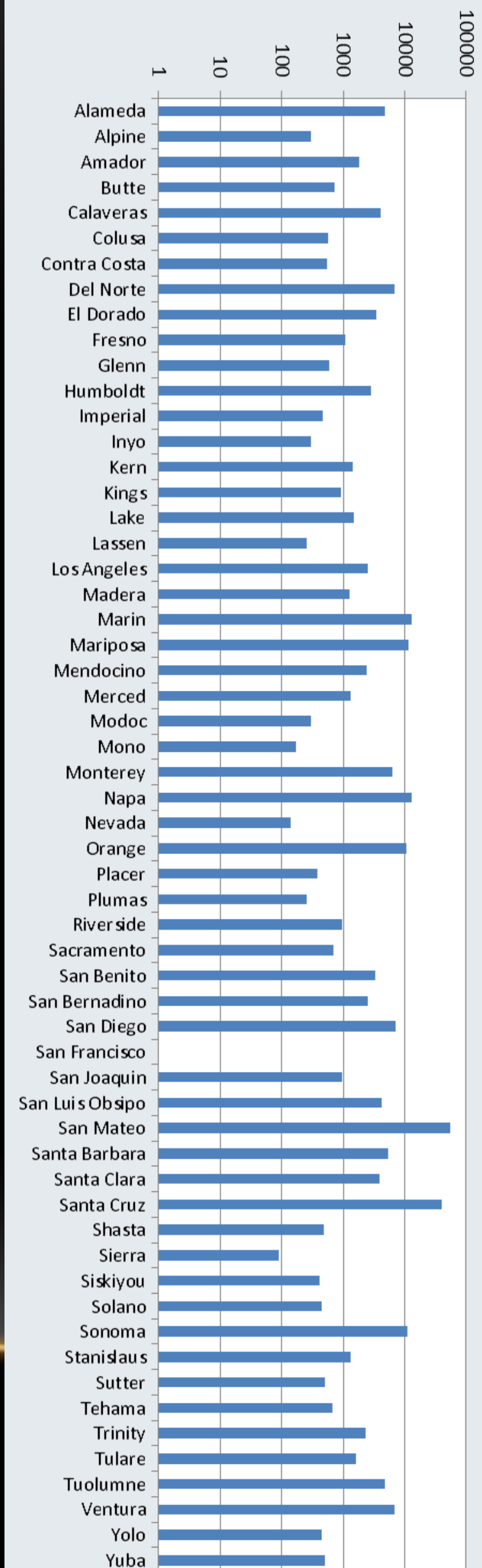
WATER SUPPLY AND USE

- Per Capita Water Use
- Agricultural water use and productivity

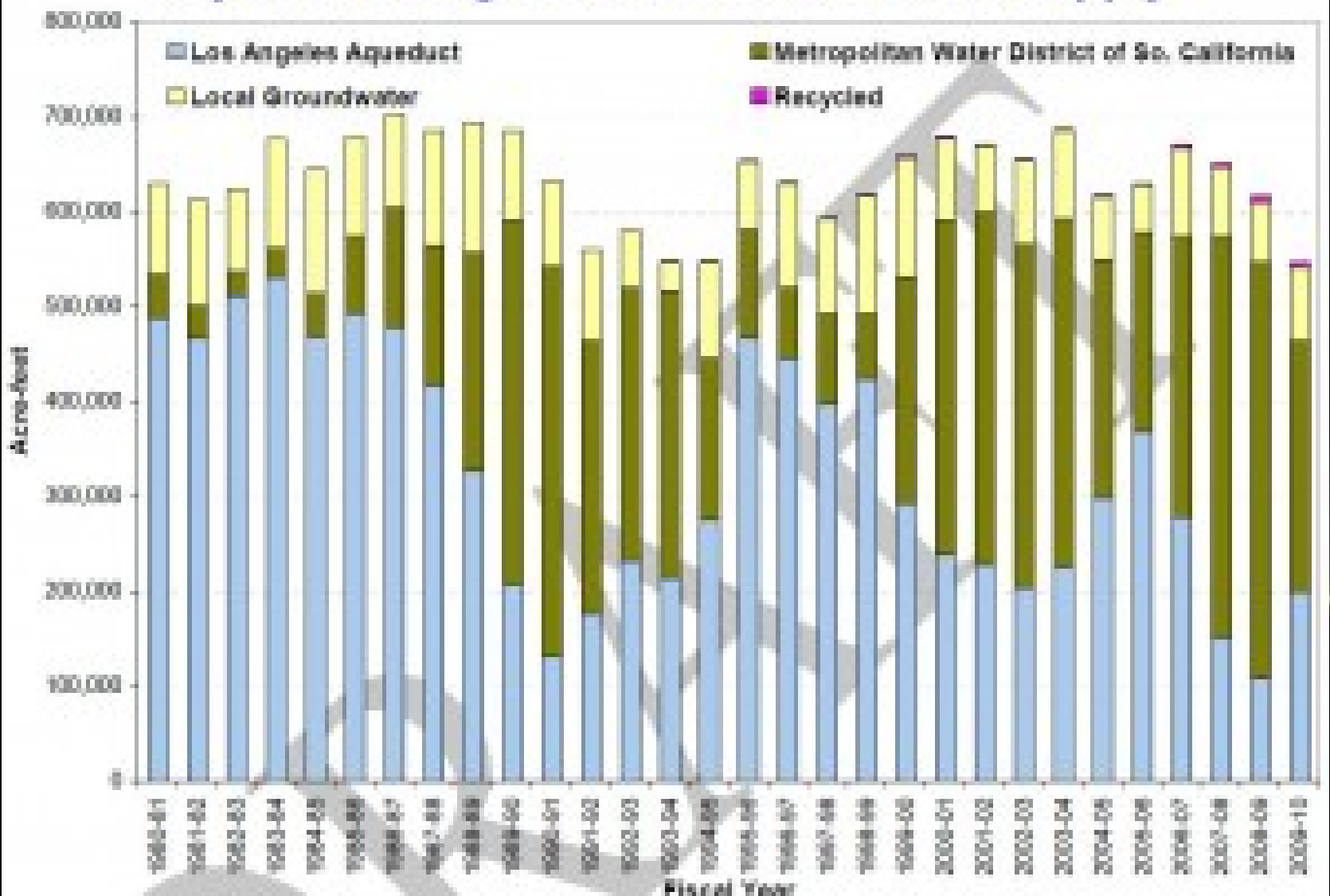
Daily Water Use By County (per capita)



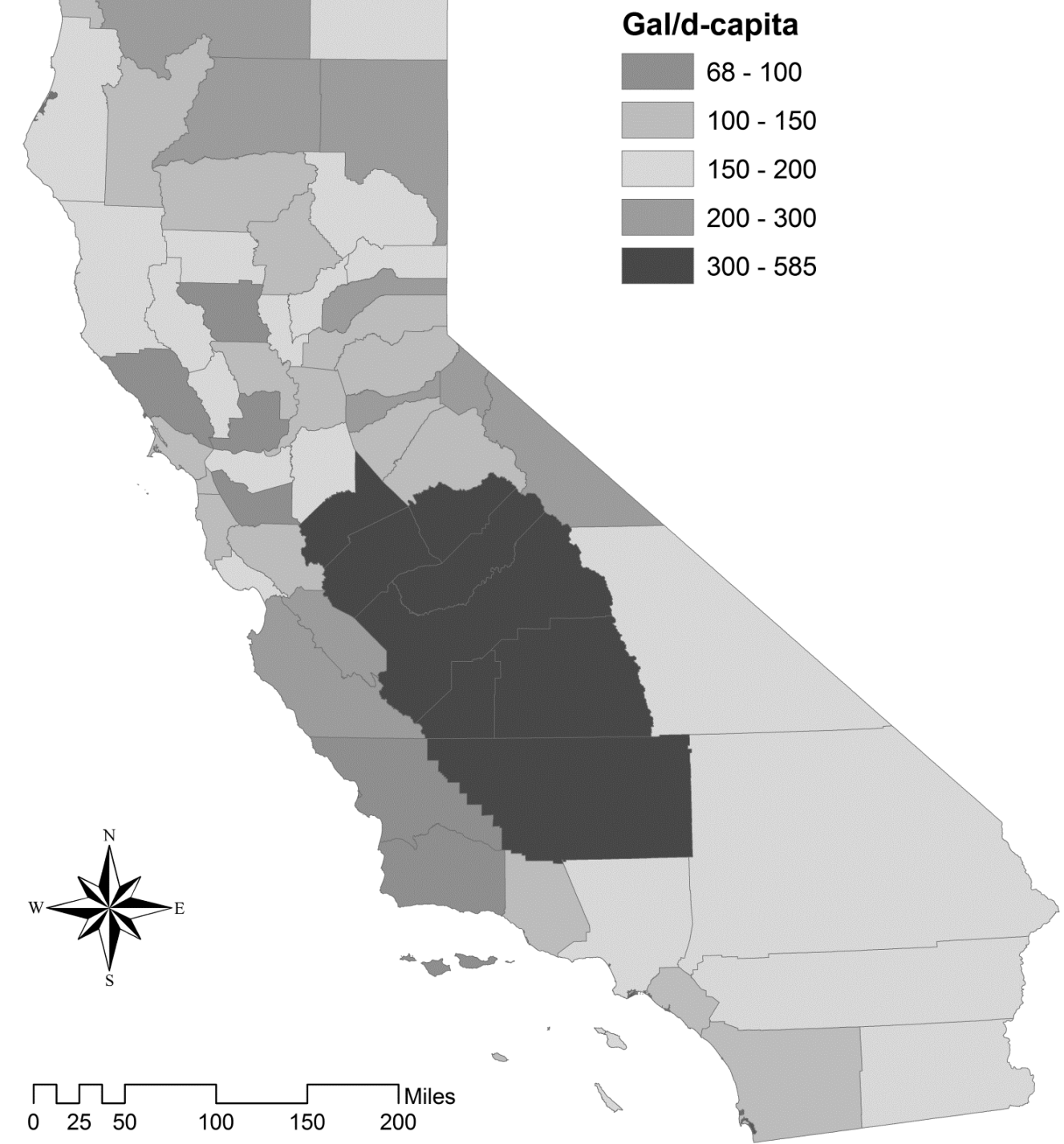
Agricultural Productivity (\$/ac-ft)



City of Los Angeles Sources of Water Supply



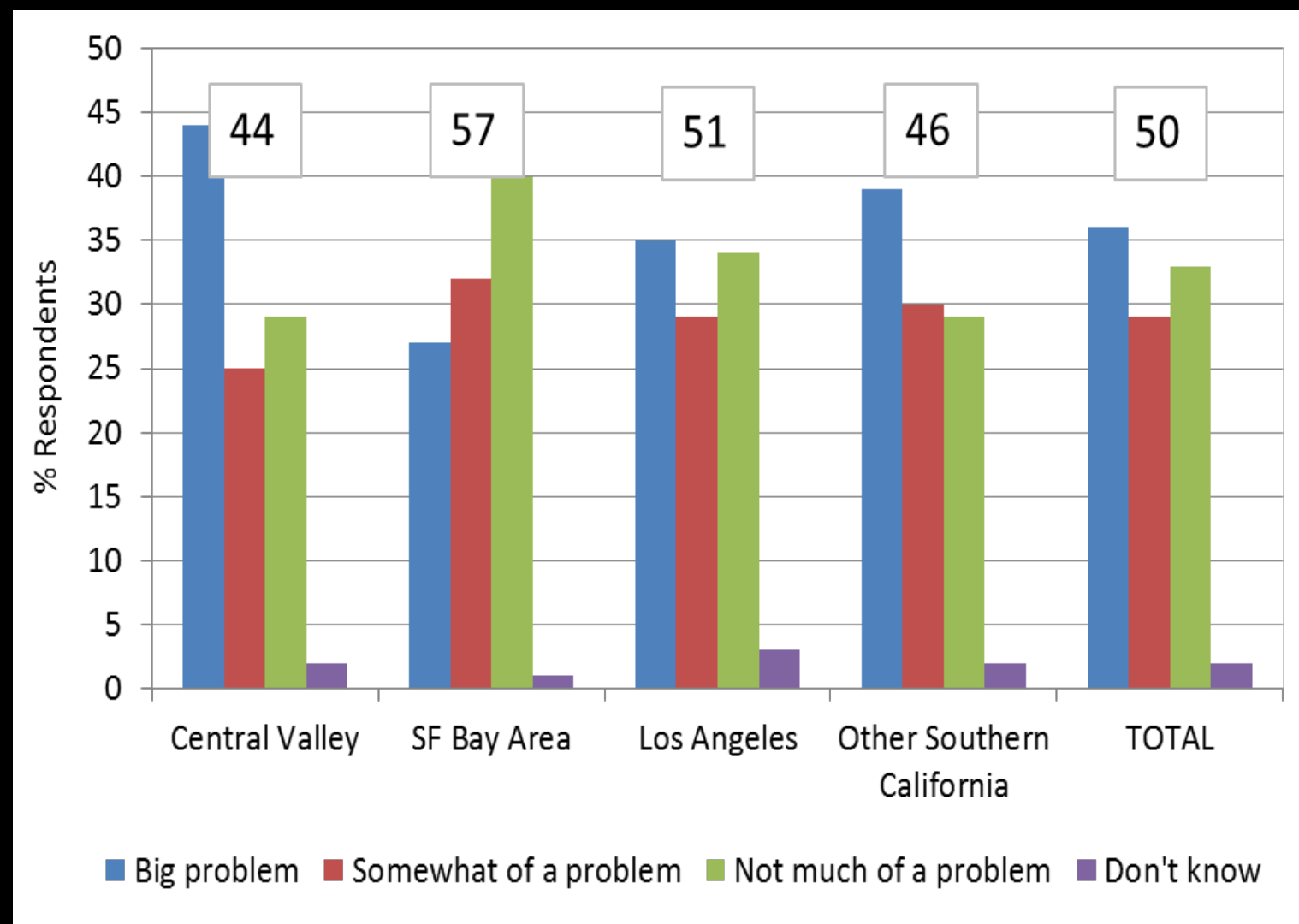
Water Use by County



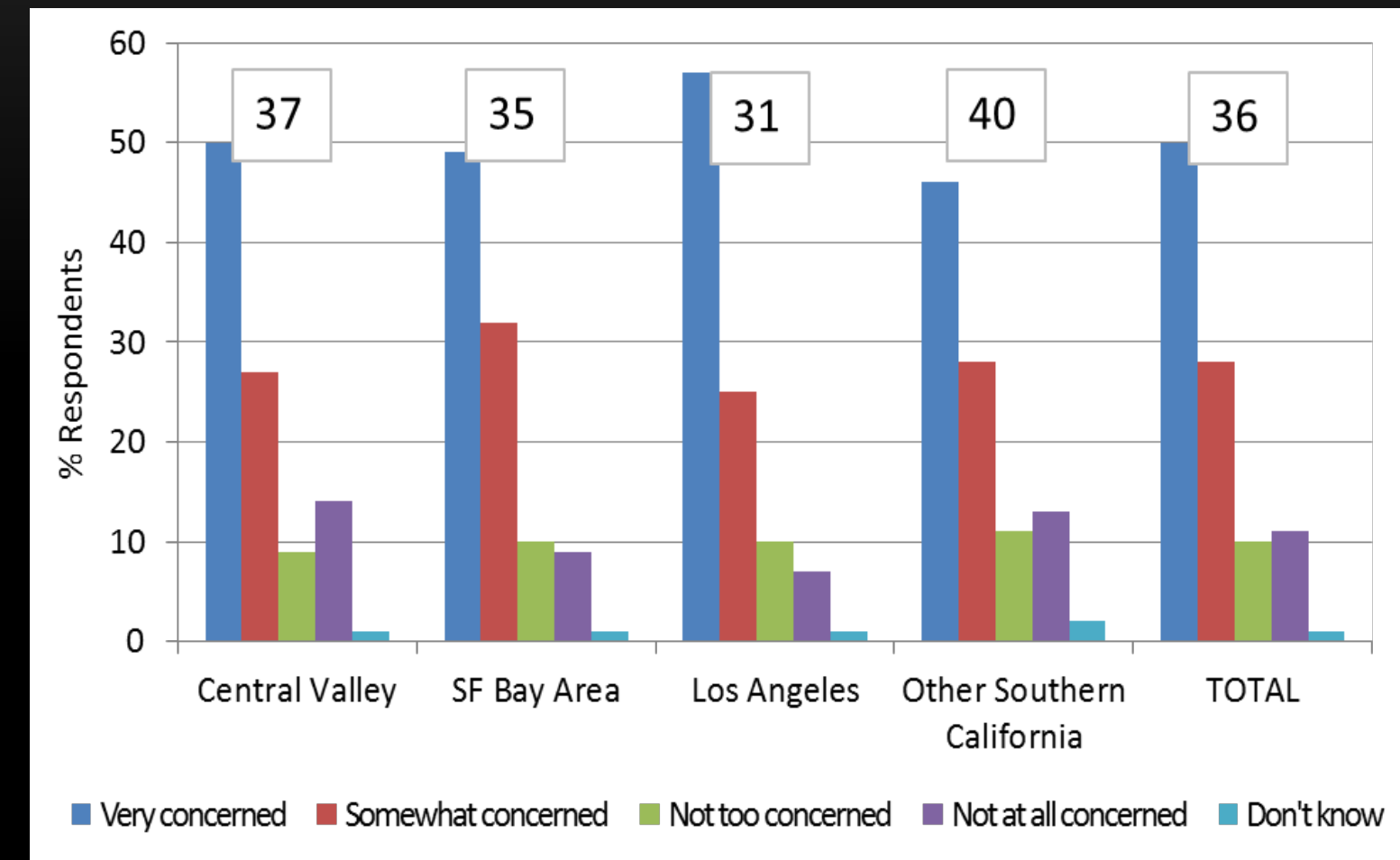
Water use data was obtained from the US Geological Survey's National Water Use Information Program. (<http://water.usgs.gov/watuse/wunwup.html>)

FINDINGS: PUBLIC VIEWS ON WATER SYSTEMS AND INVESTMENTS

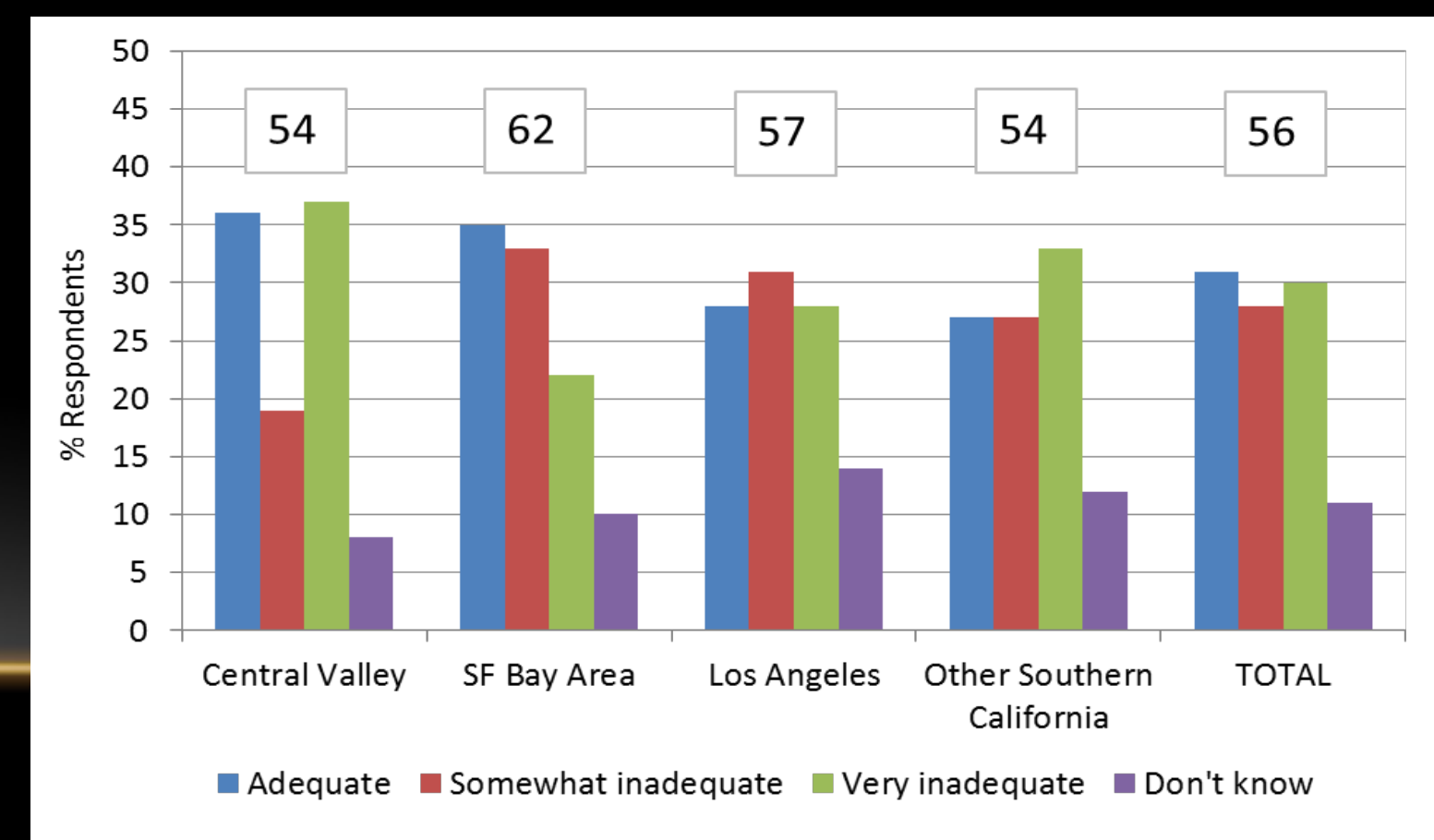
Public Perception by Region of Seriousness of Threats to the Public Water Supply (December 2012, sample = 7,315)



Public Perception of Effects of Climate Change on Future Water Supplies (July 2011, sample = 4,580)

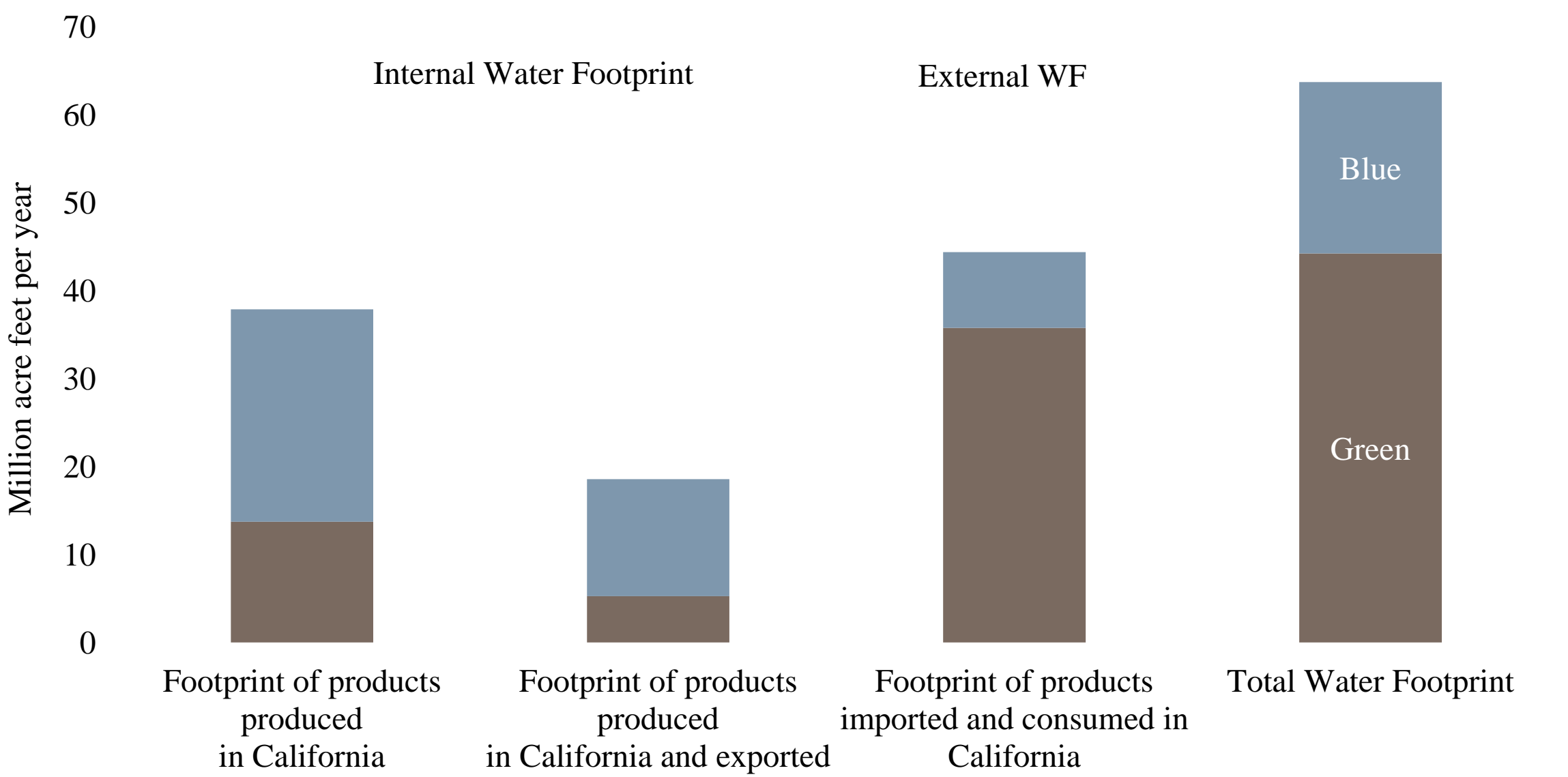


Public Perception of Security of Future Water Supplies (December 2009, sample = 1,825)

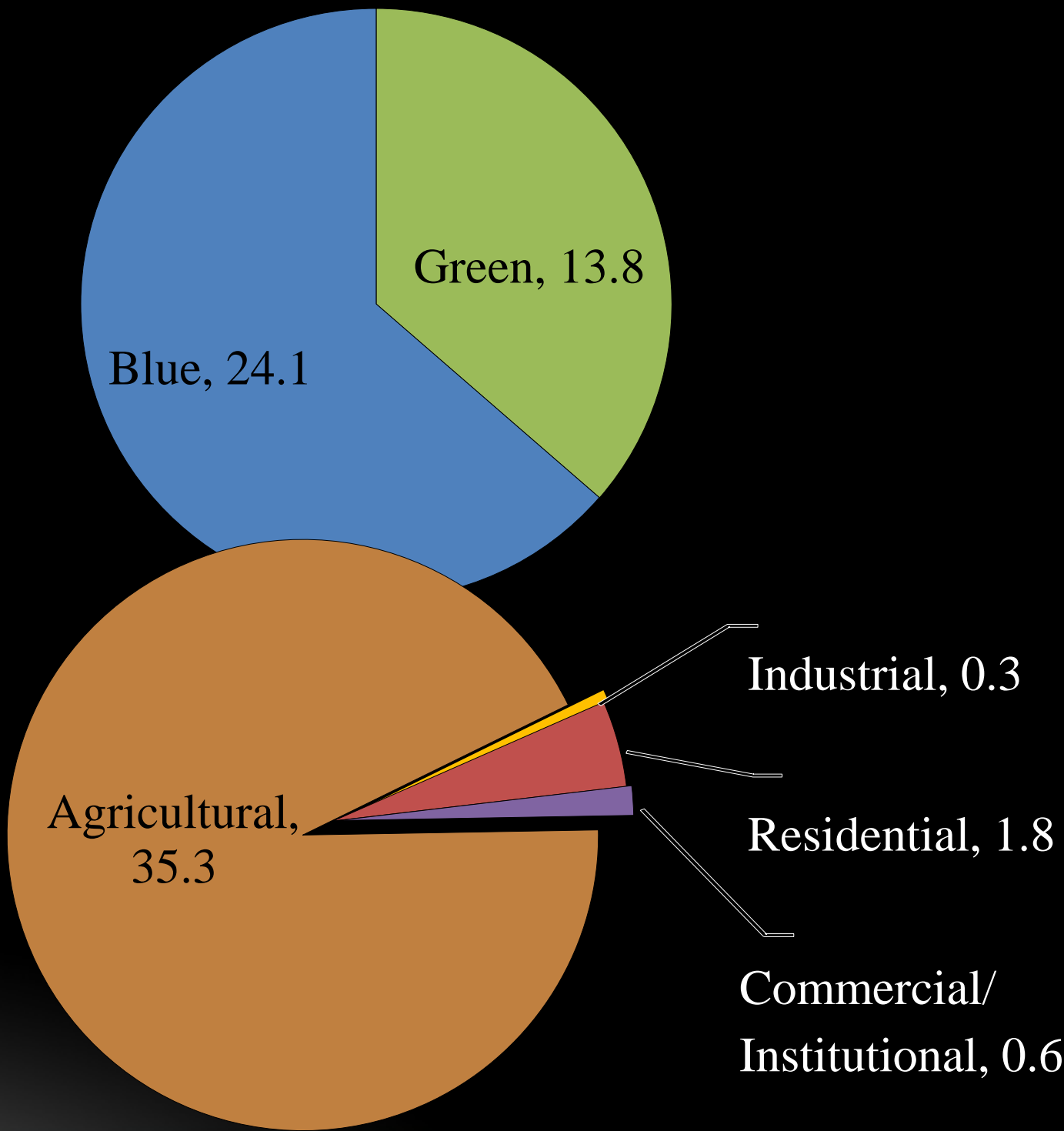


Data Source: Public Policy Institute of California

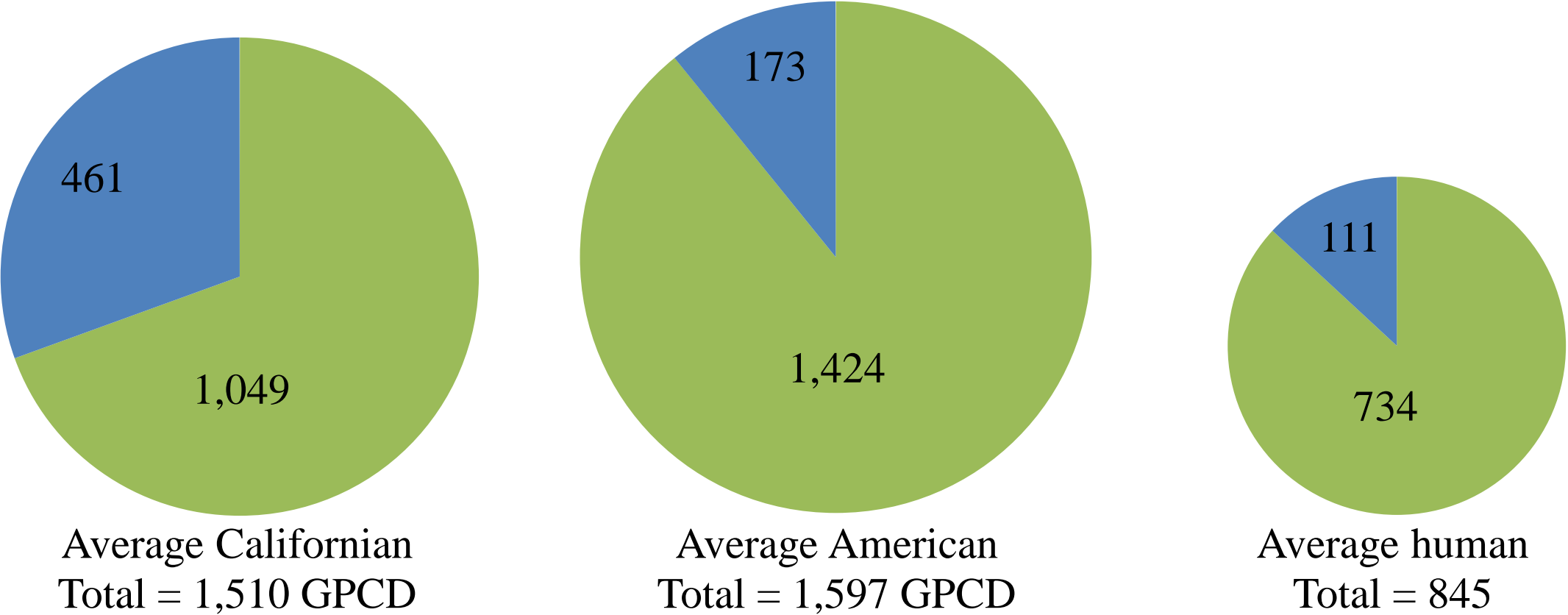
FINDINGS: WATER FOOTPRINT



The blue and green water footprints of

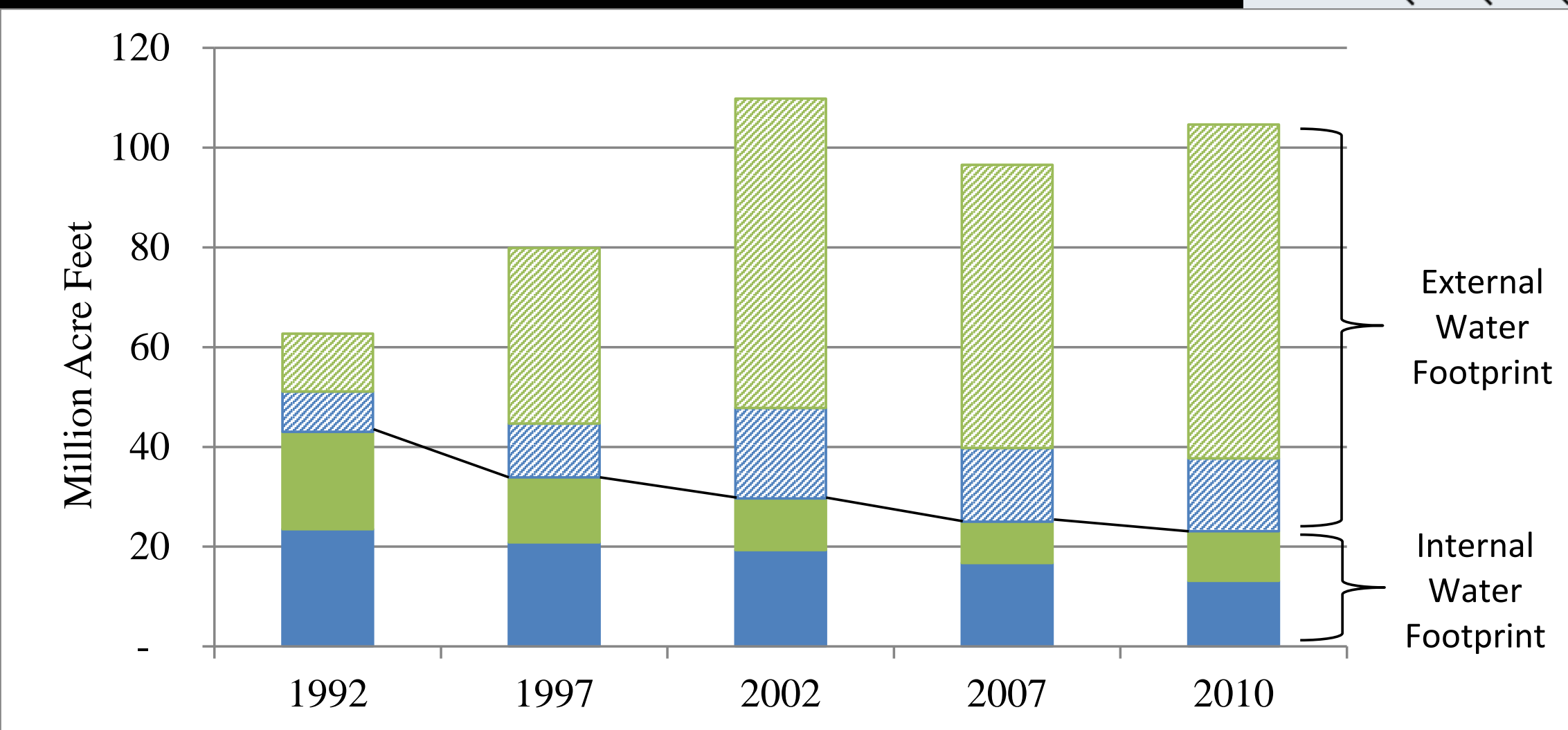
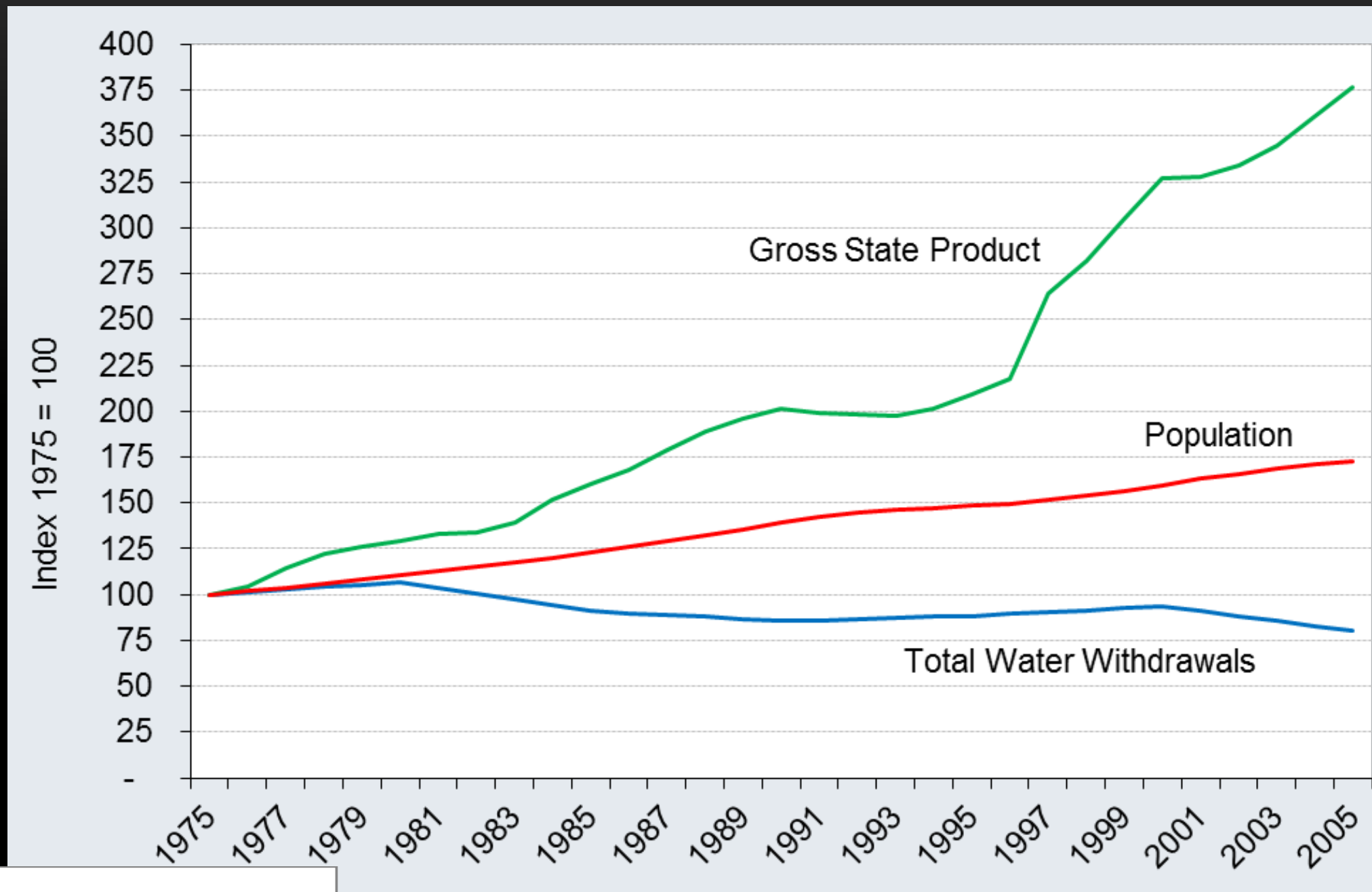


The blue and green water footprints of the average Californian compared to the average American and average human. Values in gallons per capita daily (GPCD)



WATER FOOTPRINT

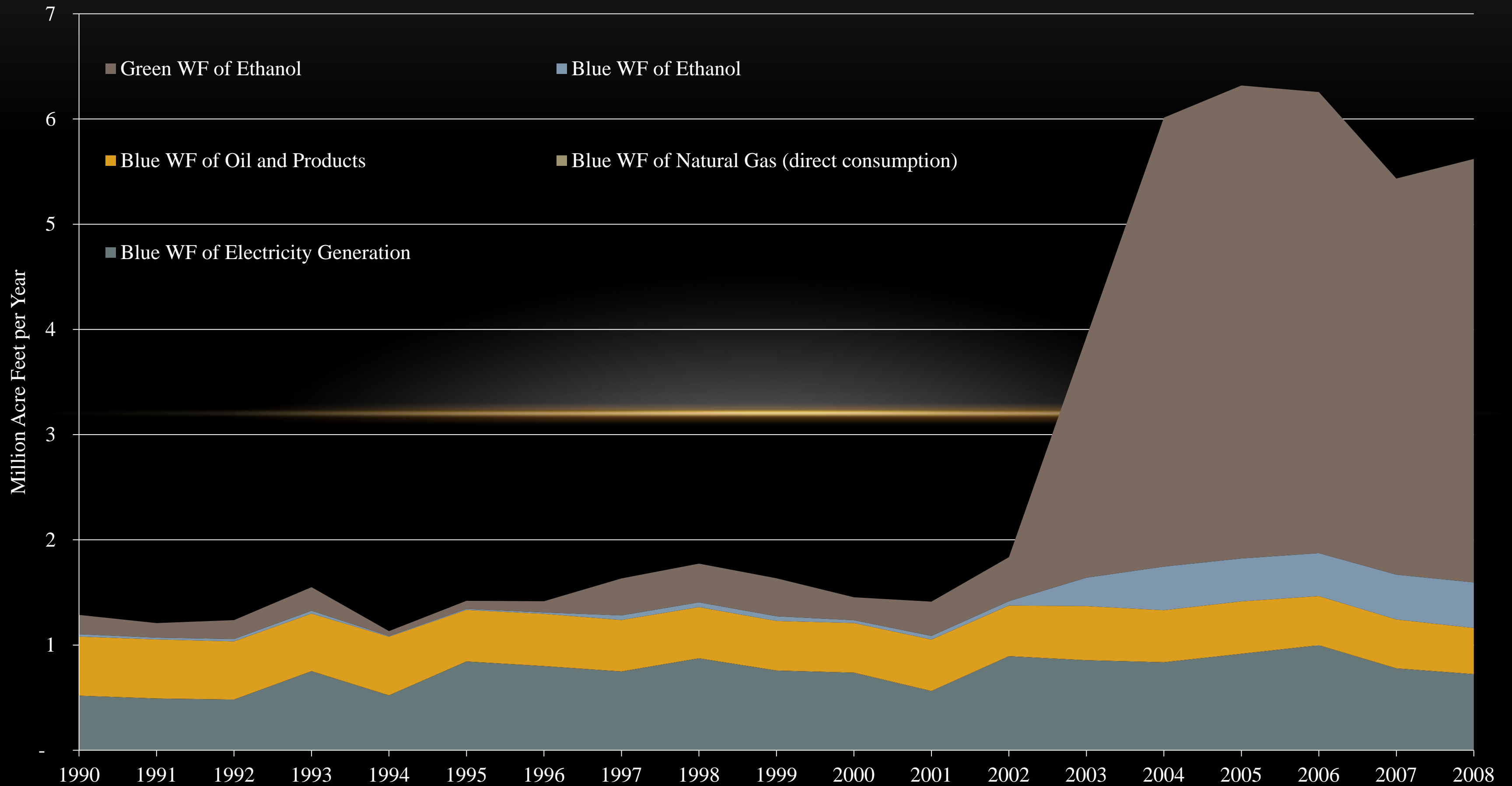
Trends: important change in the fate of blue and green water in imports and exports.



Data Source: Pacific Institute, 2013

Figure X: Trend of California's Water Footprint

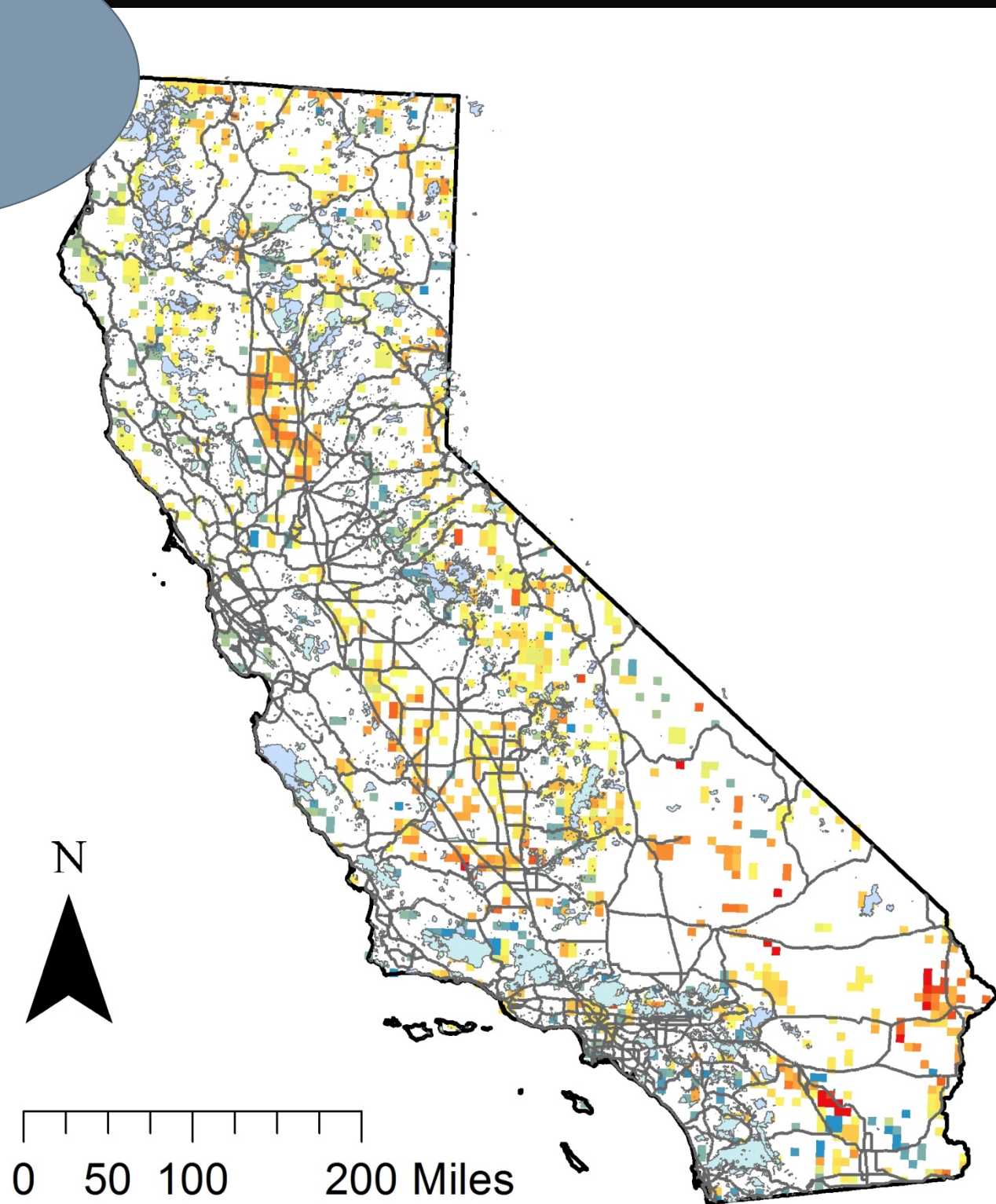
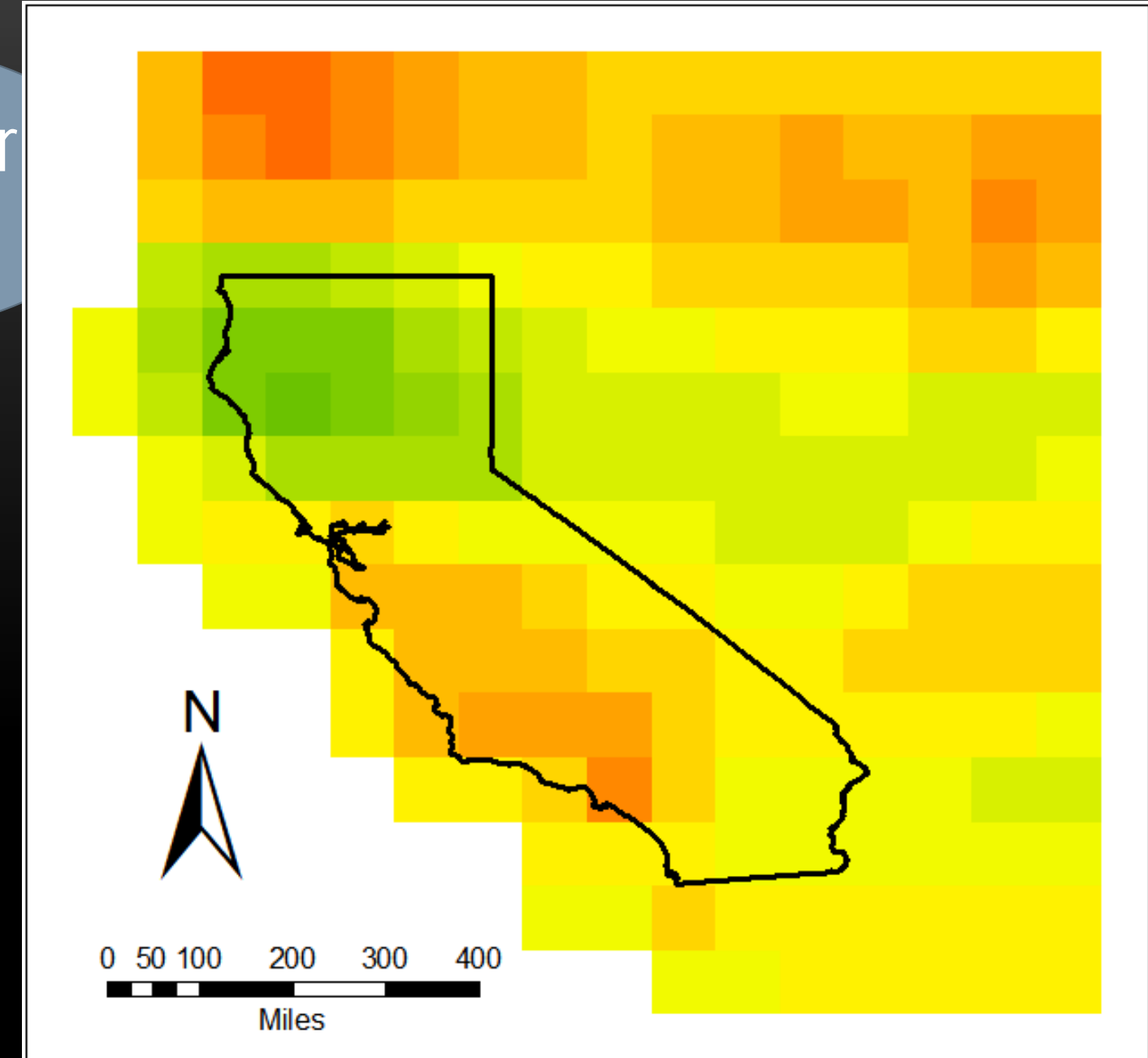
Water Footprint of Energy



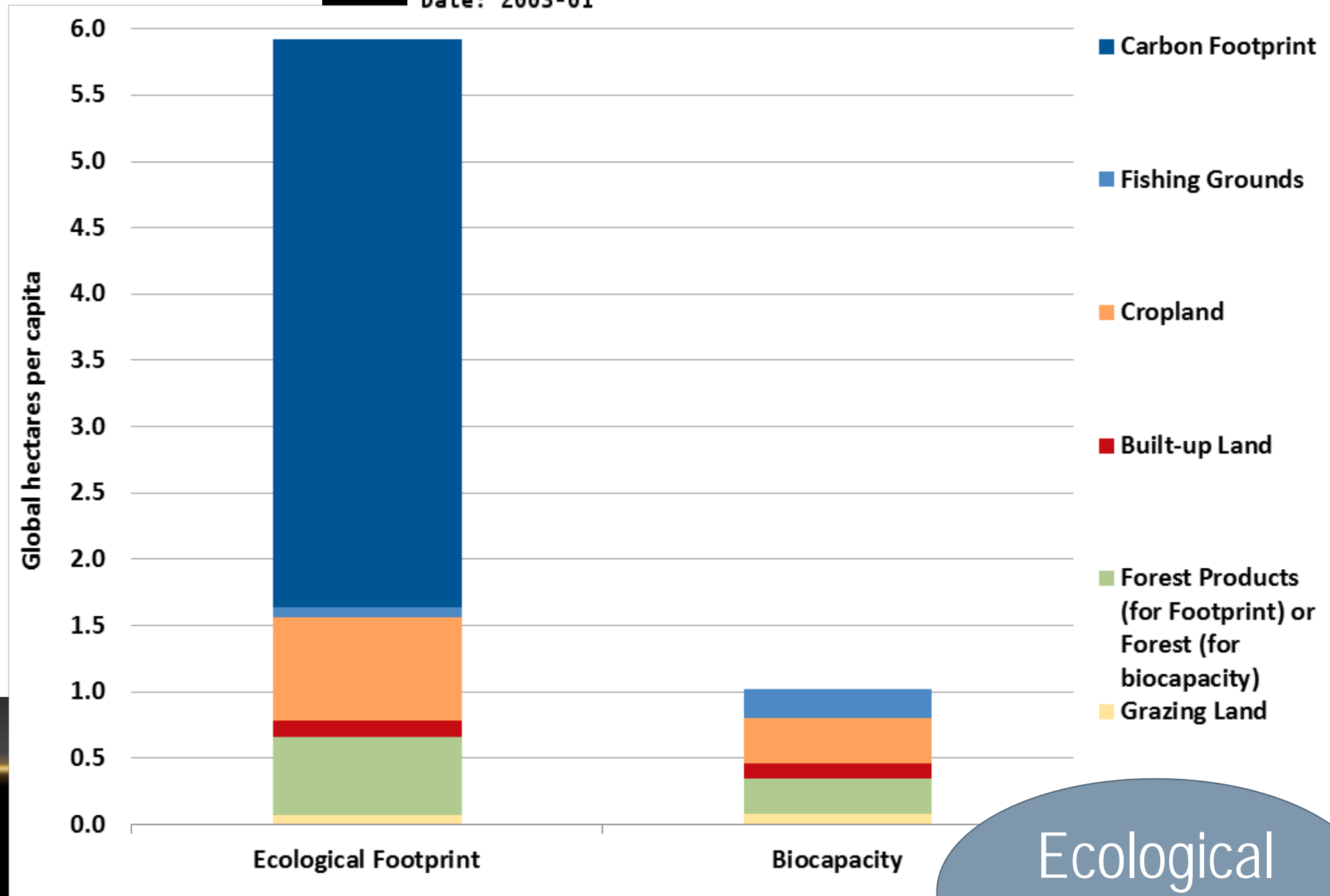
Data Source: Pacific Institute, 2013

Groundwater
-GRACE

Plant
Growth
Index



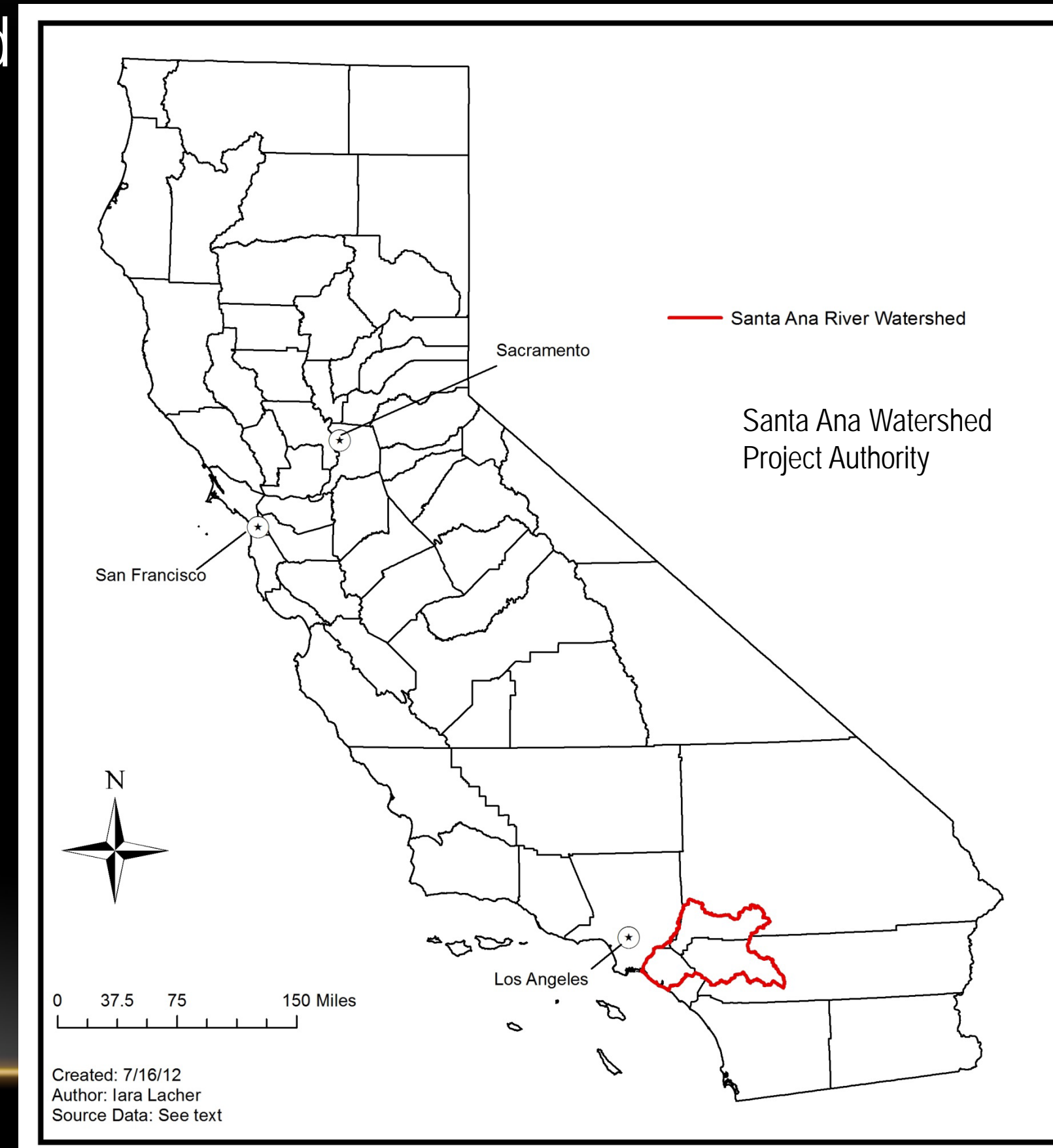
Date: 2003-01



Ecological
Footprint

REGION PILOT

- Partnership with Santa Ana Watershed Project Authority and Council for Watershed Health
- Associated with the "One Water One Watershed 2.0" process



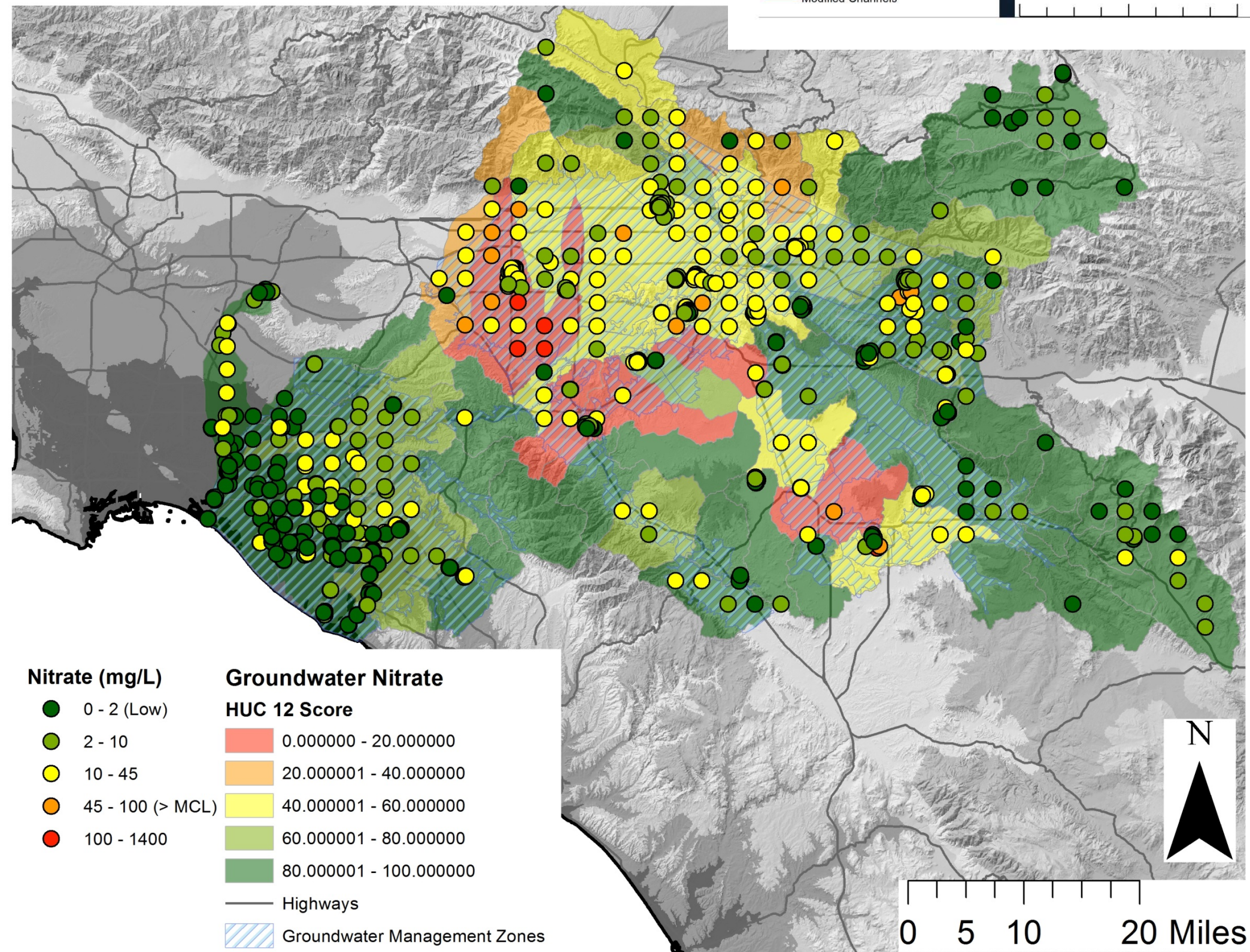
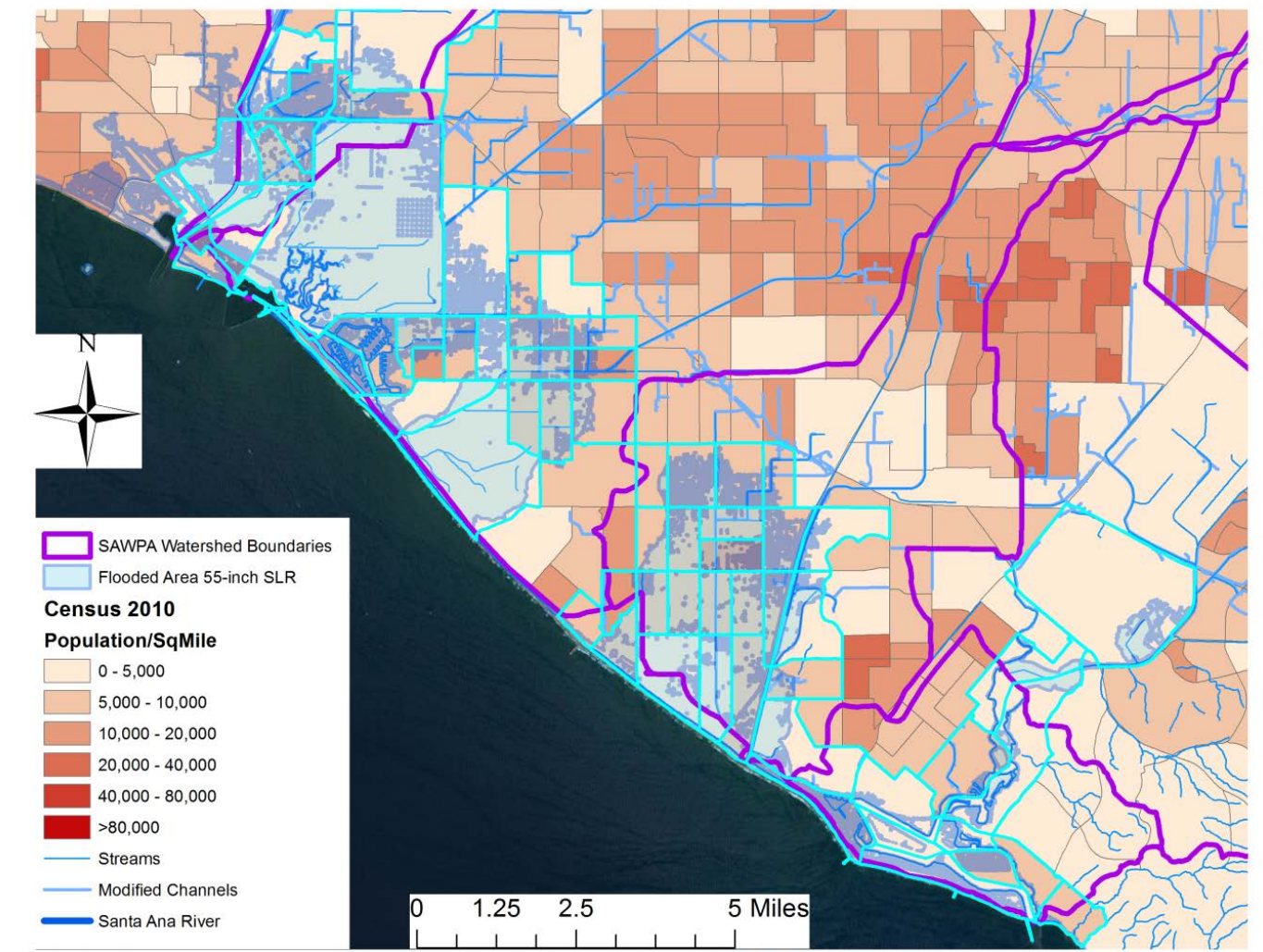
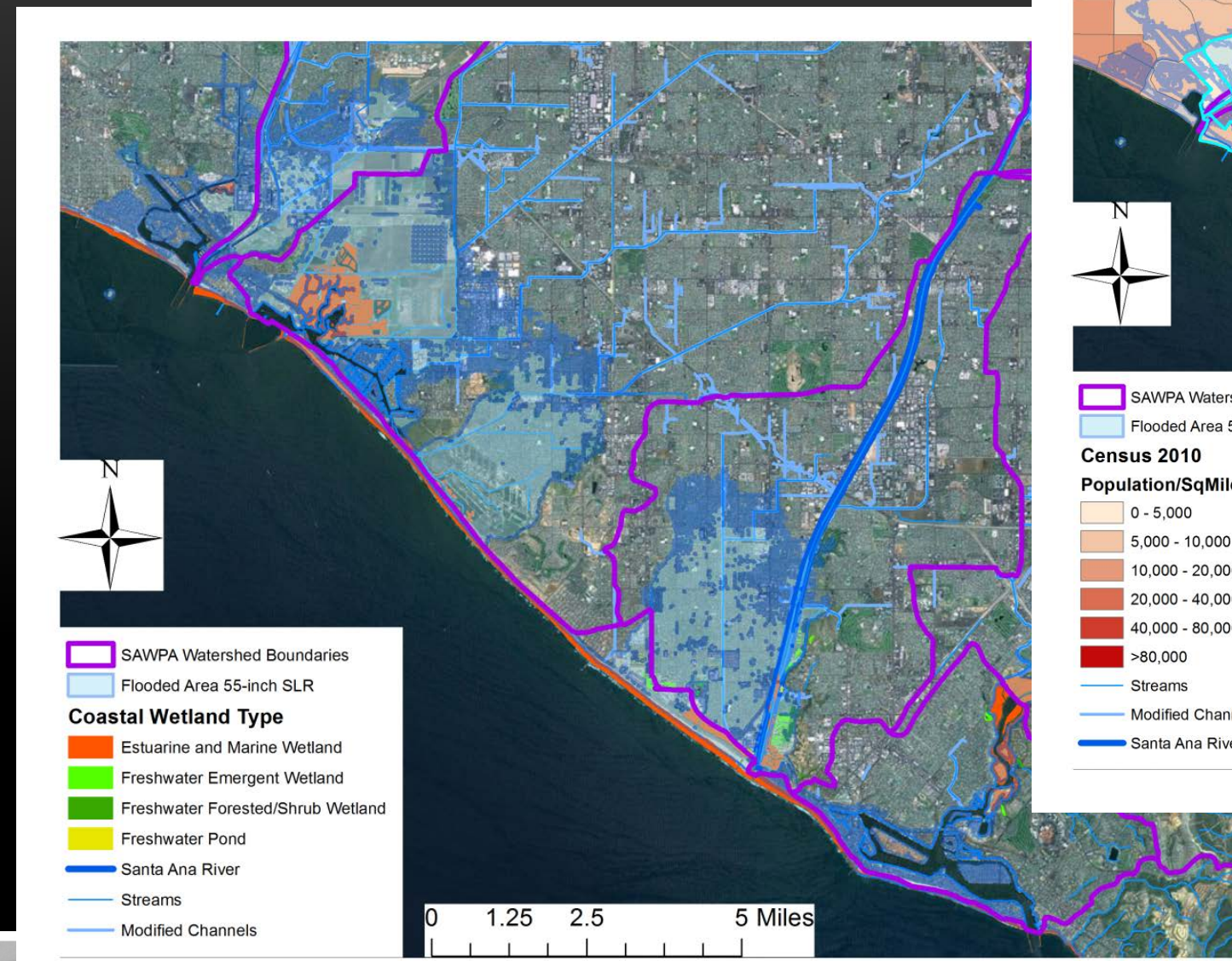
SAWPA INDICATORS

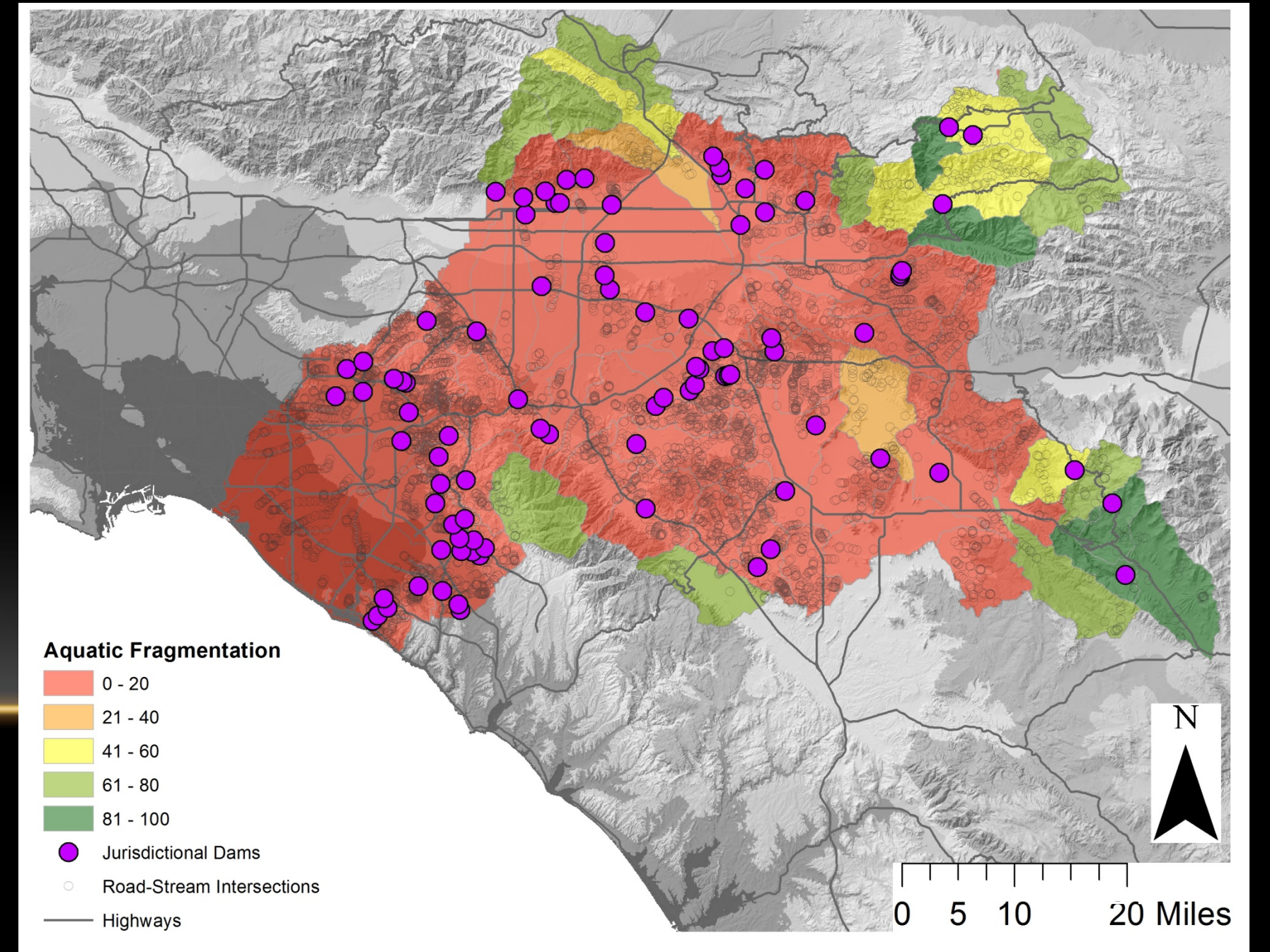
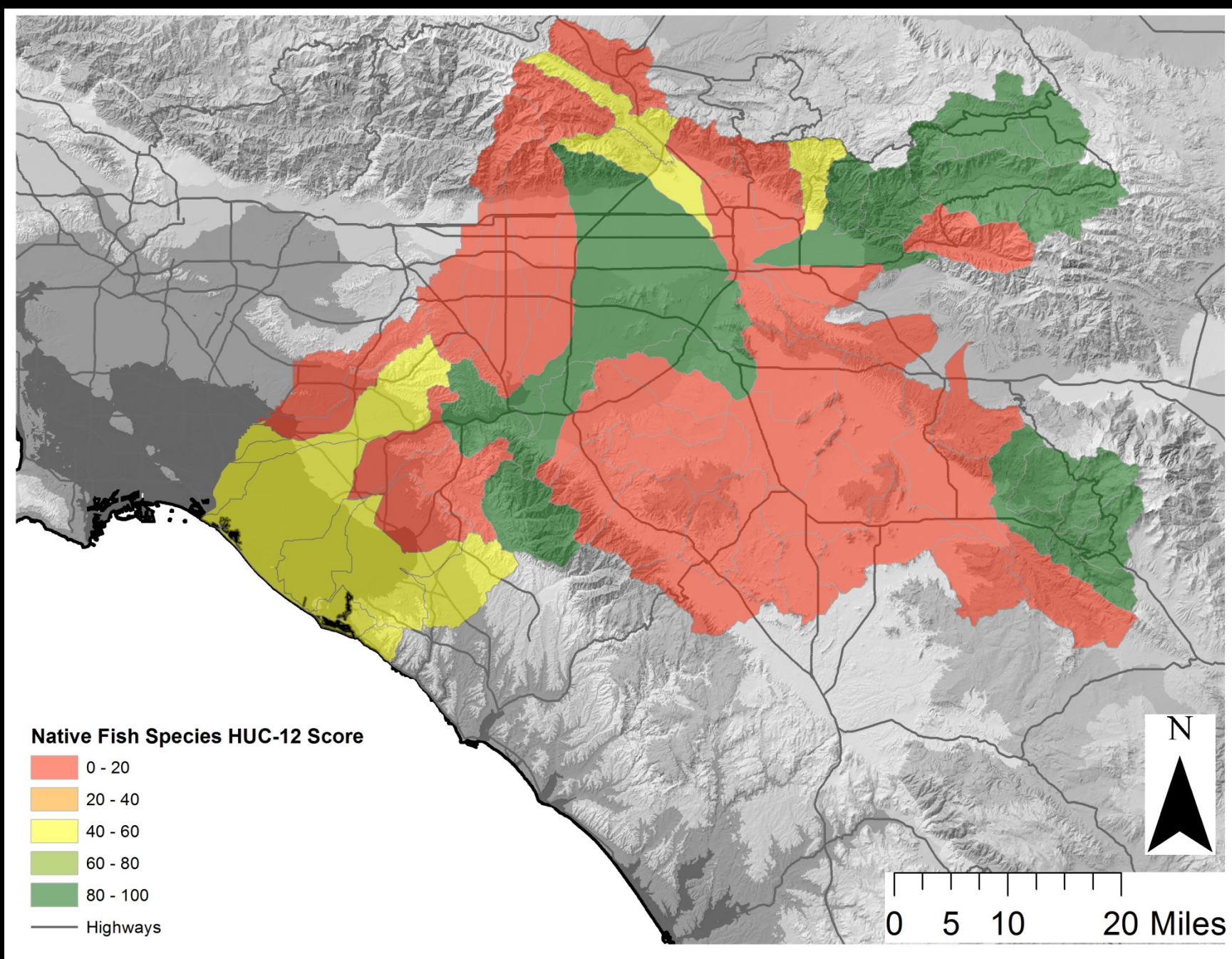
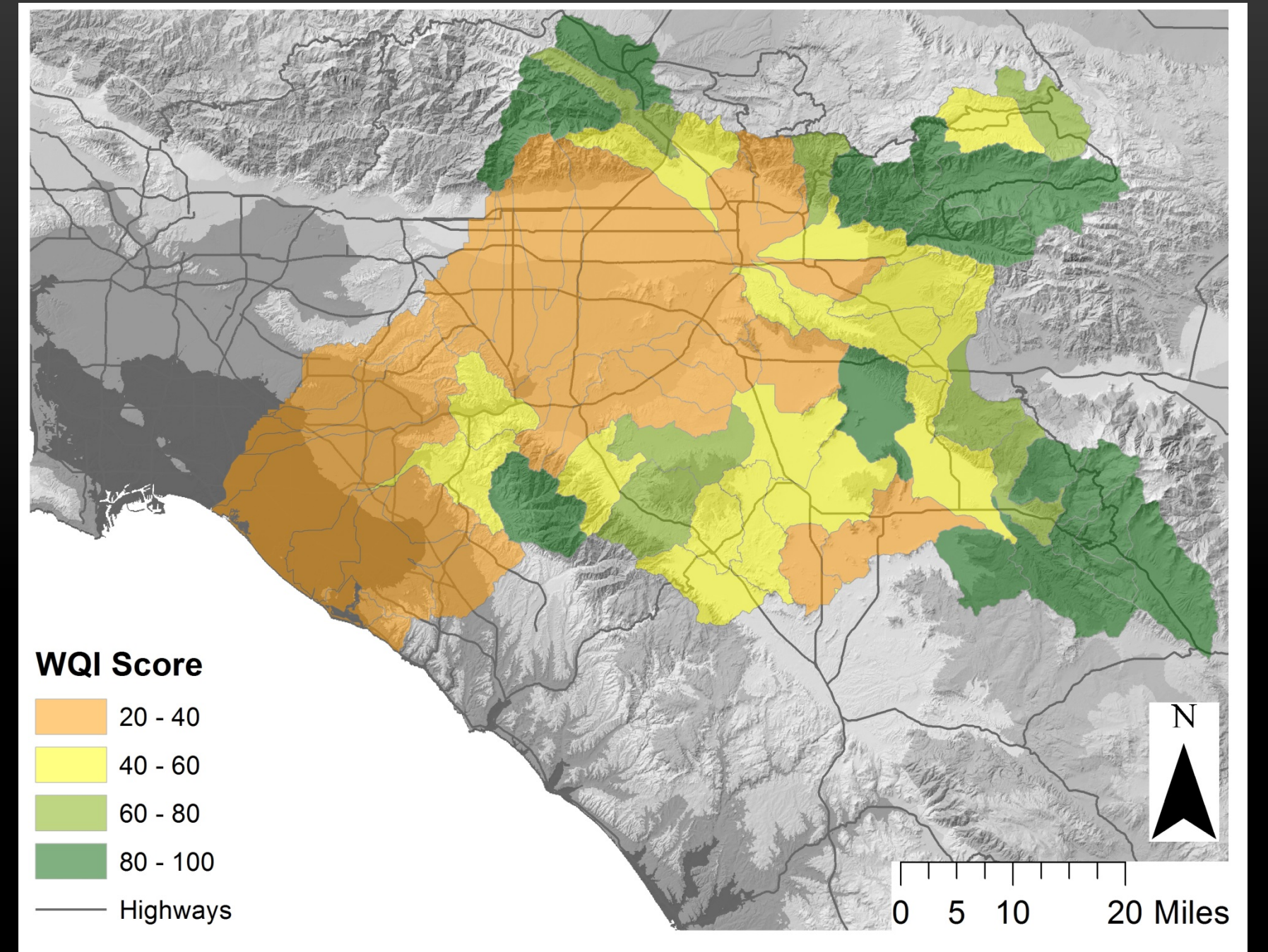
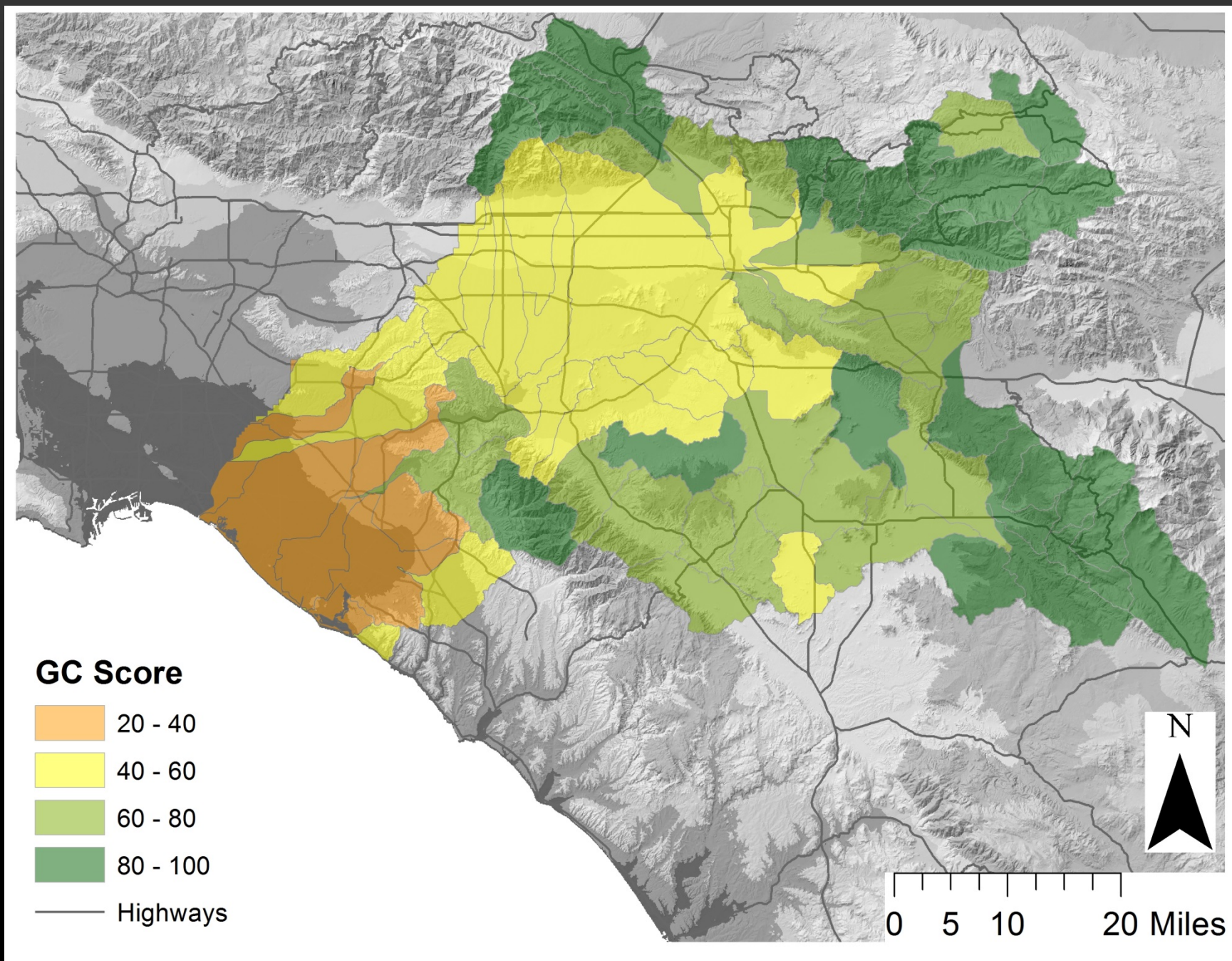
From an original set of 39 indicators

Analyzed by SAWPA, UCD, and CWH



- Proportion of Water Use from Imported and Recycled Sources
- Water Use (per capita)
- Local Water Supply Reserves
- Adoption of Sustainable Water Rates
- Water Availability and Stress (WRI Aqueduct 2.0)
- Annual Water Resource Energy Use Relative to Rolling Average
- Stream Network with Natural Substrate Benthos
- Impervious Surface: Water Quality Index and Geomorphic Condition
- Coastal Impacts from Sea Level Rise
- Aquatic Habitat Fragmentation
- Open Space for Recreation
- Invasive Species and Native Landscapes
- Area with Restoration Projects and Conservation Agreements
- Exceedance of Water Quality Objectives in Watershed
- Exceedance of Groundwater Salinity Standards
- Exceedance of Water Quality Objectives at Discharge
- Exceedance of Water Quality Objectives at Recreation Sites
- Biological Condition Index
- OWOW (Stakeholder-Community) Participation



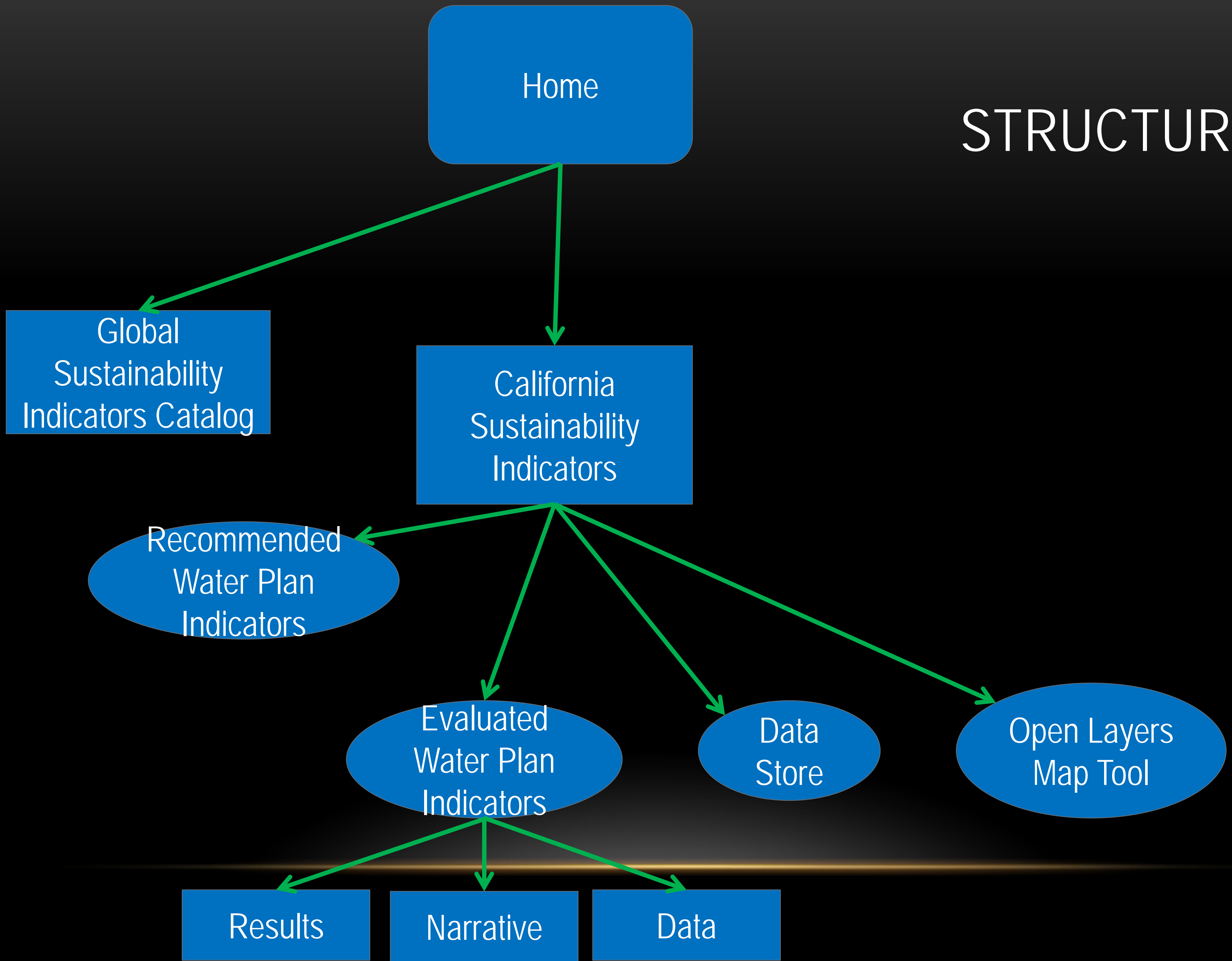


WEB-BASED DECISION SUPPORT TOOL

- Global indicators catalog
- Water Plan indicators
- Evaluated indicators at state and region scales
- Geo-portal
- What-if scenarios

<http://indicators.ucdavis.edu>

STRUCTURE



Indicators by Goal

Goals Categories Tree 1 Tree 2 Tree 3 Tree 4

This page lists the set of system-wide indicators, organized under each of the 8 sustainability goals & objectives and are examples of indicators appropriate for each objective. The indicators and their component metrics were drawn from existing indicator frameworks that deal with water management, water quality, watersheds, regional sustainability, and ecosystem health. It is a list of indicators so far, not all possible or even best indicators.

Goal 1: Sustainable Water Management

- Aquifer Declines**
Number and estimated capacity of basins with years-long aquifer declines (known as overdraft) or projected future declines.
- Benefits from Water Management**
Equitable distribution of economic and health benefits from water management.
- Completion of Stewardship Actions**
The completion of restoration recommendations and key actions during the implementation phase of the process.
- Drought Resilience**
The maximum severity of drought during which core water demands can still be met, including social and environmental minimum requirements
- Energy Requirements for Water Delivery**
Energy required per unit of clean drinking water delivered.
- Equitable Decision-Making Process**
Equitable decision-making process for water management, diversity of participating organizations.
- Flood Resilience**
The maximum flood that can be experienced without exceeding some amount (e.g., \$10 million) in damages.
- Greenhouse Gas Emissions**

Indicators

- Abundance of Key Native Species
- Abundance of Key Non-Native Species
- Abundance of Native Aquatic Species
- Adaptive Management under Changing Conditions
- Affordable Water Prices
- Amount of Industrial Pollutants Released
- Aquatic Fragmentation
- Aquifer Declines
- Benefits from Water Management
- California Stream Condition Index
- Channel Alteration
- Collaboration between Scientists and Policy Makers
- Communication of Uncertainty
- Completion of Stewardship Actions
- Conservation and Restoration Projects
- Data Sharing and Distribution
- Delta: Agricultural Improvements
- Delta: Dependent Industrial Production
- Delta: Fishing
- Delta: Percent Water Supplied
- Delta: Recreational Use
- Delta: Recycled Water Usage
- Delta: Water Quality and Irrigated Lands
- Delta: Water Usage
- Drought Resilience
- Earthquake Resilience
- Energy Requirements for Water Delivery
- Equitable Access to Clean Water
- Equitable Decision-Making Process

Global Sustainability Indicator Catalog

Home Frameworks and Assessments Indicators Organizations

Home

Frameworks and Assessments

A Framework For Assessing and Reporting on Ecological Condition: An SAB Report
A key priority for EPA is to base Agency actions on sound scientific data, analyses, and interpretations. The SAB provides a mechanism for the Agency to receive peer review and other advice designed to make a positive difference in the production and use of science at EPA.

Chesapeake Bay Program -- Bay Barometer
The Chesapeake Bay Program is a regional partnership that leads and directs Chesapeake Bay restoration and protection. Bay Program partners include federal and state agencies, local governments, non-profit organizations and academic institutions. Staff members work at the Bay Program's Annapolis, Maryland, office and at partner organizations throughout the Bay watershed.

Environmental Performance Index
The Environmental Performance Index (EPI) ranks countries on performance indicators tracked across policy categories that cover both environmental public health and ecosystem vitality. These indicators provide a gauge at a national government scale to how close countries are to establish environmental policy goals.

EPA's Report on the Environment
The Report on the Environment (ROE) presents the best available indicators of information on national conditions and trends in air, water, land, human health, and ecological systems that address 23 questions EPA considers mission critical to protecting our environment and human health.

Great Central Valley Indicator Reports

Goals | Beta -- California W...

Content Structure People Configuration Reports Help

nd content

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-- California Water Sustainability

Support Tool and Sustainability Indicator Frameworks

Home Projects Maps Goals Indicators Catalog

Central Valley series. The themes are updated in
ing, Public Health and Access to Care, and

the Atlantic Slope
ally appropriate, economically reasonable, and
and sustainability of aquatic ecosystems. These
stuarine segments and small watersheds, with

n 2000 and initiated in 2001. The objective of
sis for action needed to enhance the
has involved the work of more than 1,060

Goals

- Goal 1: Sustainable Water Management**
Manage and make decisions about water in a way that integrates water availability, environmental conditions, and community well-being for future generations.
- Goal 2: Improve Water Supply Reliability**
Improve water supply reliability to meet human needs, reduce energy demand, and restore and maintain aquatic ecosystems and processes.
- Goal 3: Contribute to Social and Ecological Benefits from Water Management**
Improve beneficial uses and reduce impacts associated with water management
- Goal 4: Increase Quality of Water**
Improve quality of drinking water, irrigation water, and in-stream flows to protect human and environmental health
- Goal 5: Safeguard Environmental Health**
Protect and enhance environmental conditions by improving watershed, floodplain, and aquatic condition and processes
- Goal 6: Integrate Flood Management Activities**
Integrate flood risk management with other water and land management and restoration activities
- Goal 7: Improve Adaptive Decision Making**
Employ adaptive decision-making, especially in light of uncertainties, that support integrated regional water management and flood management system

Goals

- Goal 1: Sustainable Water Management
- Goal 2: Improve Water Supply Reliability
- Goal 3: Contribute to Social and Ecological Benefits from Water Management
- Goal 4: Increase Quality of Water

Indicator Categories

- Adaptive and Sustainable Management
- Ecosystem Health
- Social Benefits and Equity
- Water Quality
- Water Supply Reliability



Mapping Interface

View Edit Outline Revisions Log

Legend

- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

Base Layer

- MapQuest OSM
- MapQuest Open Aerial
- MapBox World Bright
- Google Maps Satellite
- Google Maps Physical
- Google Maps Normal
- Google Maps Hybrid

Overlays

- Stream Condition Index
- Native Fish Communities
- California USGS Stream Gages
- California National Forests
- California Jurisdictional Dams
- California County Boundaries
- California

Beta -- California Water Sustainability

Decision Support Tool and Sustainability Indicator Frameworks

Home Projects Maps Goals Indicators Catalog

Home » Indicators

Indicators Tree

Goals Categories Tree 1 Tree 2 Tree 3 Tree 4

This page provides an interactive hierarchy (tree structure) which you can use to browse the goals, categories, and indicators. Clicking on the branch or root nodes will collapse or expand the tree, while clicking on an indicator node will take you to that indicator's page.

- California Water Sustainability
 - Goal 1: Sustainable Water Management
 - Adaptive and Sustainable Management
 - Social Benefits and Equity
 - Water Quality
 - Water Supply Reliability
 - Goal 2: Improve Water Supply Reliability
 - Adaptive and Sustainable Management
 - Ecosystem Health
 - Energy Requirements for Water Delivery
 - Public Awareness of Source Water Protection
 - Water Travel Distance
 - Social Benefits and Equity
 - Forest Land Conversion
 - Managed Geomorphic Flows
 - Water Stress Index
 - Water Supply Reliability
 - Affordable Water Prices
 - Delta: Percent Water Supplied
 - Delta: Water Usage
 - Drought Resilience
 - Earthquake Resilience

...AND BEYOND

- Strategic Growth Council
- Water Plan Resource Management Strategies and Future Scenarios.
- Water Quality, Watershed Health, WQ Compliance and Reporting ... etc.

<http://indicators.ucdavis.edu>

<http://www.waterplan.water.ca.gov/>

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