Cultivating reproducible science and social capital in major science enterprises

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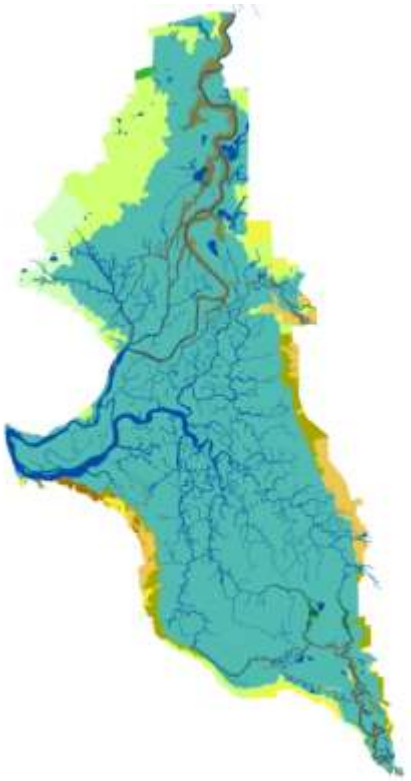
Source: California's Delta Plan (2012)

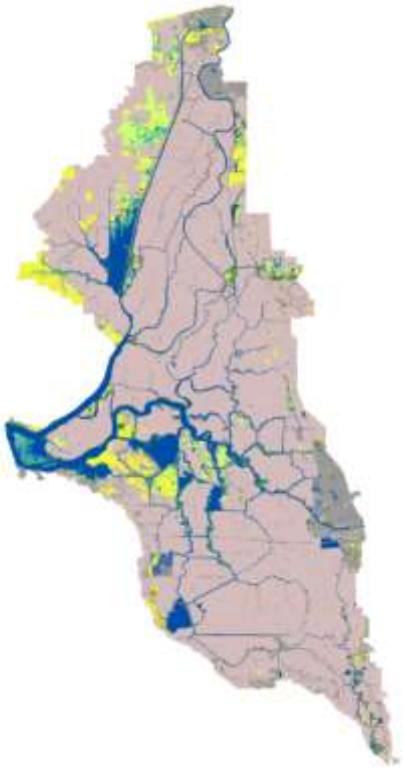
- Habitat for People
  - Agriculture
  - Recreation
- Habitat for Fish, Wildlife, and Plants
  - Brackish and Freshwater Marshes
  - Migratory Fish and Waterfowl
  - Endemic Species
- Water
  - Central Valley Project (CVP)
  - State Water Project (SWP)

Photo: Wikimedia

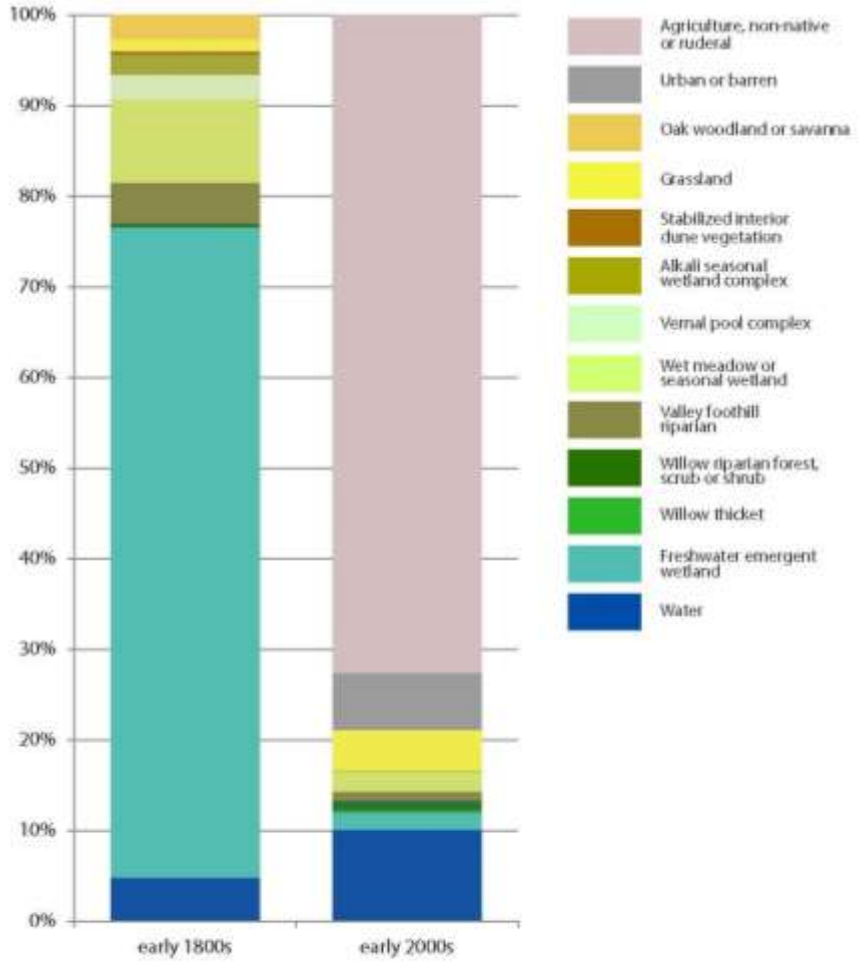
The Sacramento-San Joaquin Delta: Then and Now



<u>Pre-European:</u>
Mostly marshlands



<u>Now</u>
Agriculture dominated



Whipple et al. (2012)

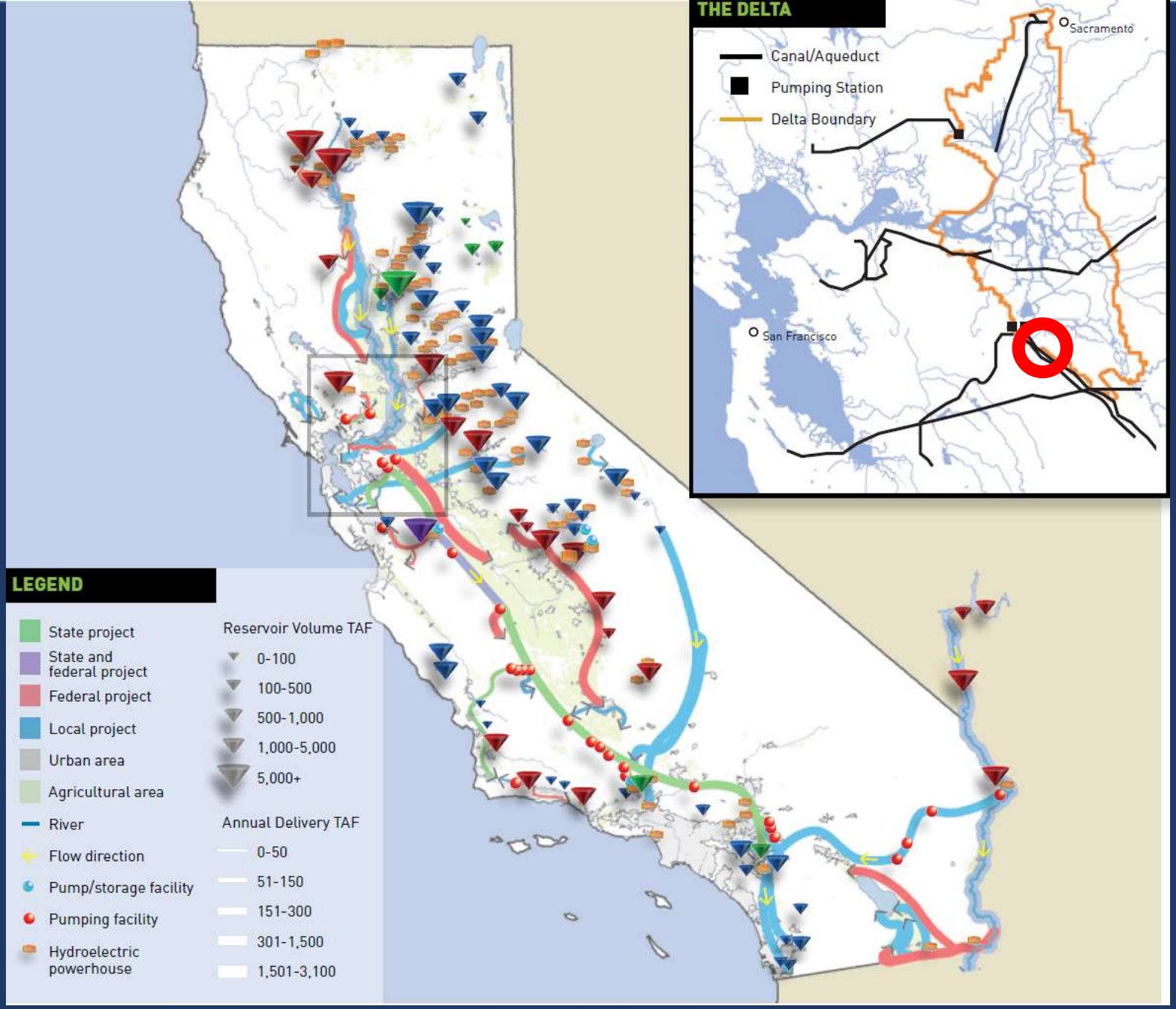
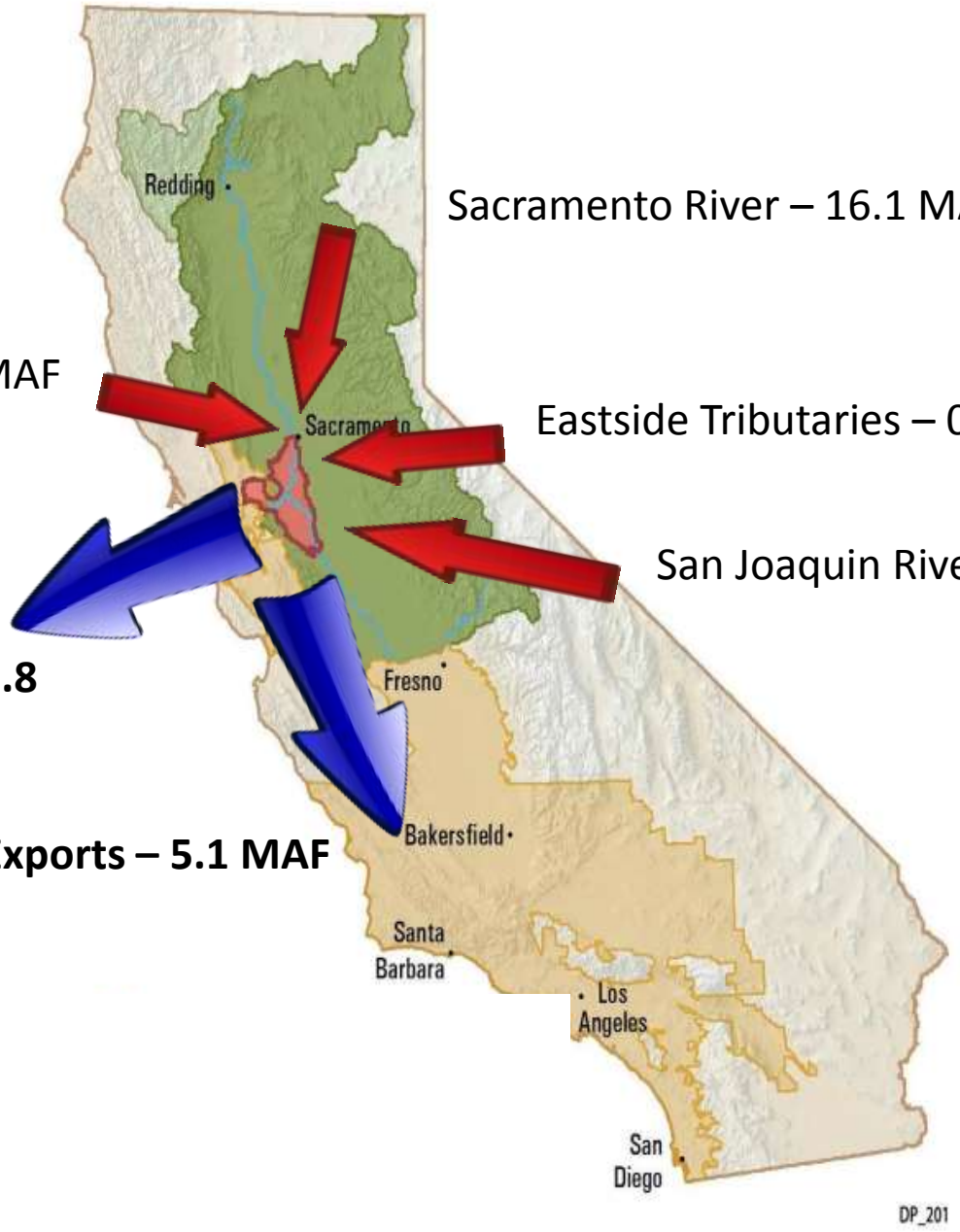


Figure adapted from Luoma et al. (2015)

Hydrology



Sacramento River – 16.1 MAF

Yolo Bypass – 1.8 MAF

Eastside Tributaries – 0.8 MAF

San Joaquin River – 3.1 MAF

Outflow to Bay – 15.8 MAF

Exports – 5.1 MAF

Source: Long term modeling based on CALSIM (DWR 2010)

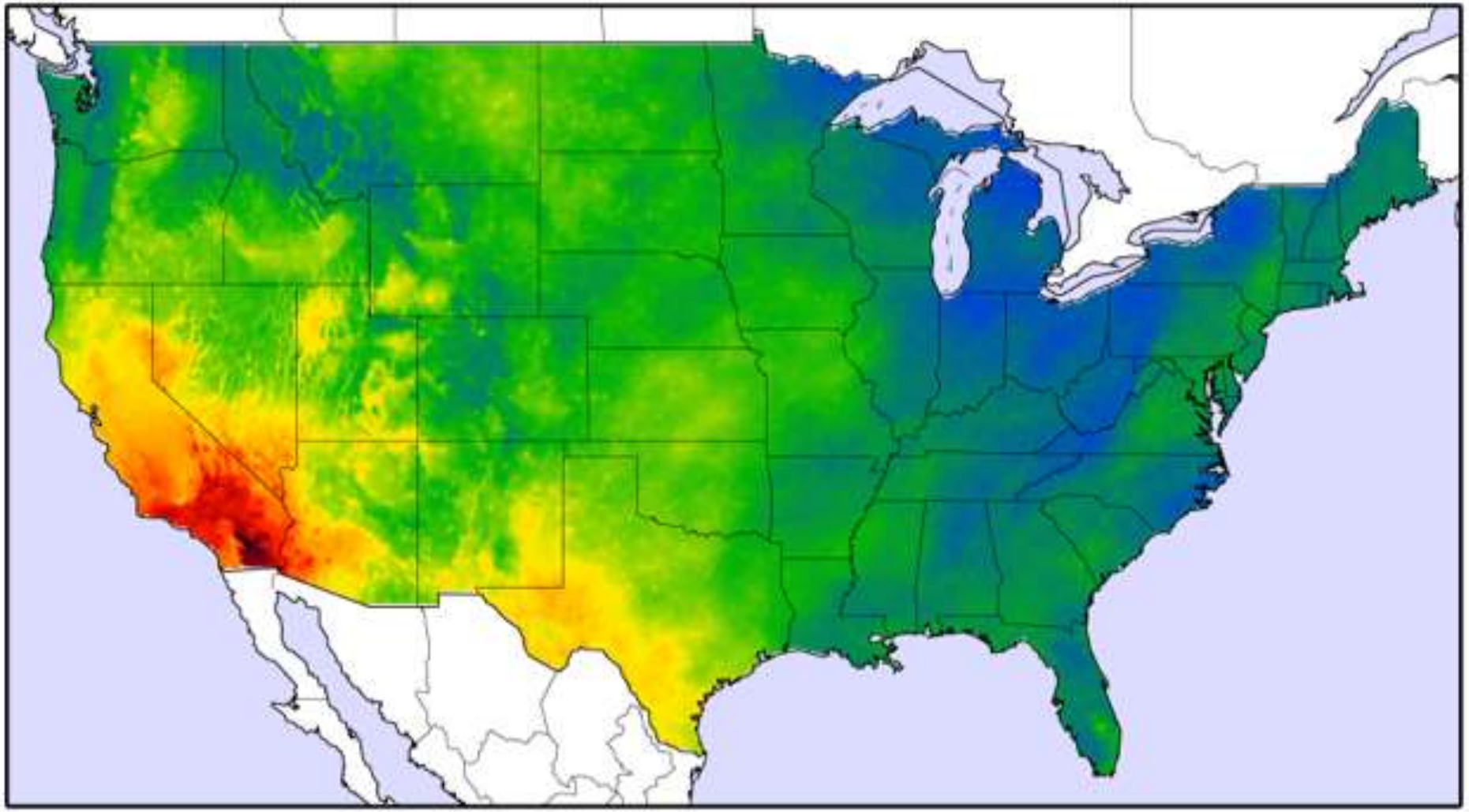
Sources and Destinations

Most of the Precipitation

Most of the Population

COEFFICIENTS OF VARIATION OF WATER-YEAR PRECIPITATION

[based on PRISM monthly precipitation totals, 1945-2015]



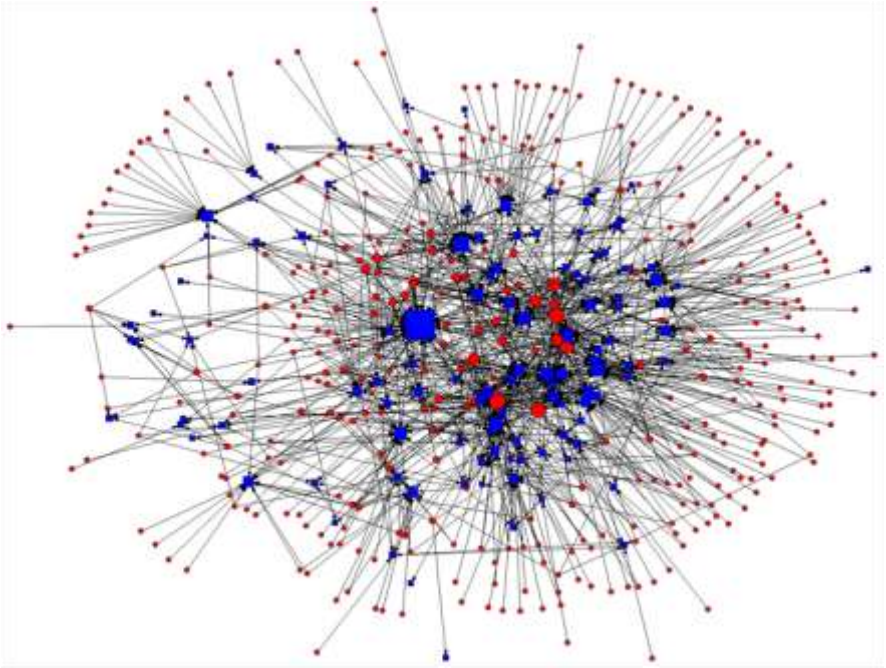
Standard deviation / Mean

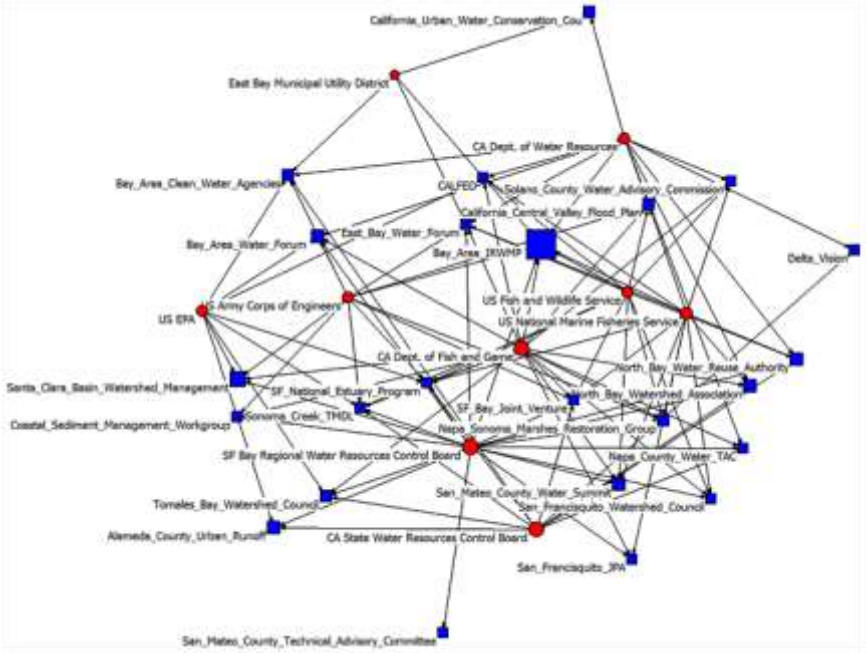
0.1 0.2 0.3 0.4 0.5 0.6 0.7

Dettinger et al. 2016

Institutional Complexity

Groups involved in San Francisco Bay-Delta Management
(Figures from Lubell et al. 2014)





All groups

Central players

Red circles = actors

Blue squares = Institutions

Slide courtesy of Ted Sommer, CA Dept of Water Resources

Delta Science Enterprise

State Agencies

- Delta Stewardship Council
-Dept Fish and Wildlife
-Dept Water Resources
- State Water Resources Control Board
-Regional WQ Board
-State Parks (DBW)

NGOs

-Nature Conservancy
-American Rivers
-San Francisco Estuary Institute
-CalTrout

Public Water Agencies & Utilities

-EBMUD
-MWD
-SLDMWA
-KCWA
-Regional San

Universities

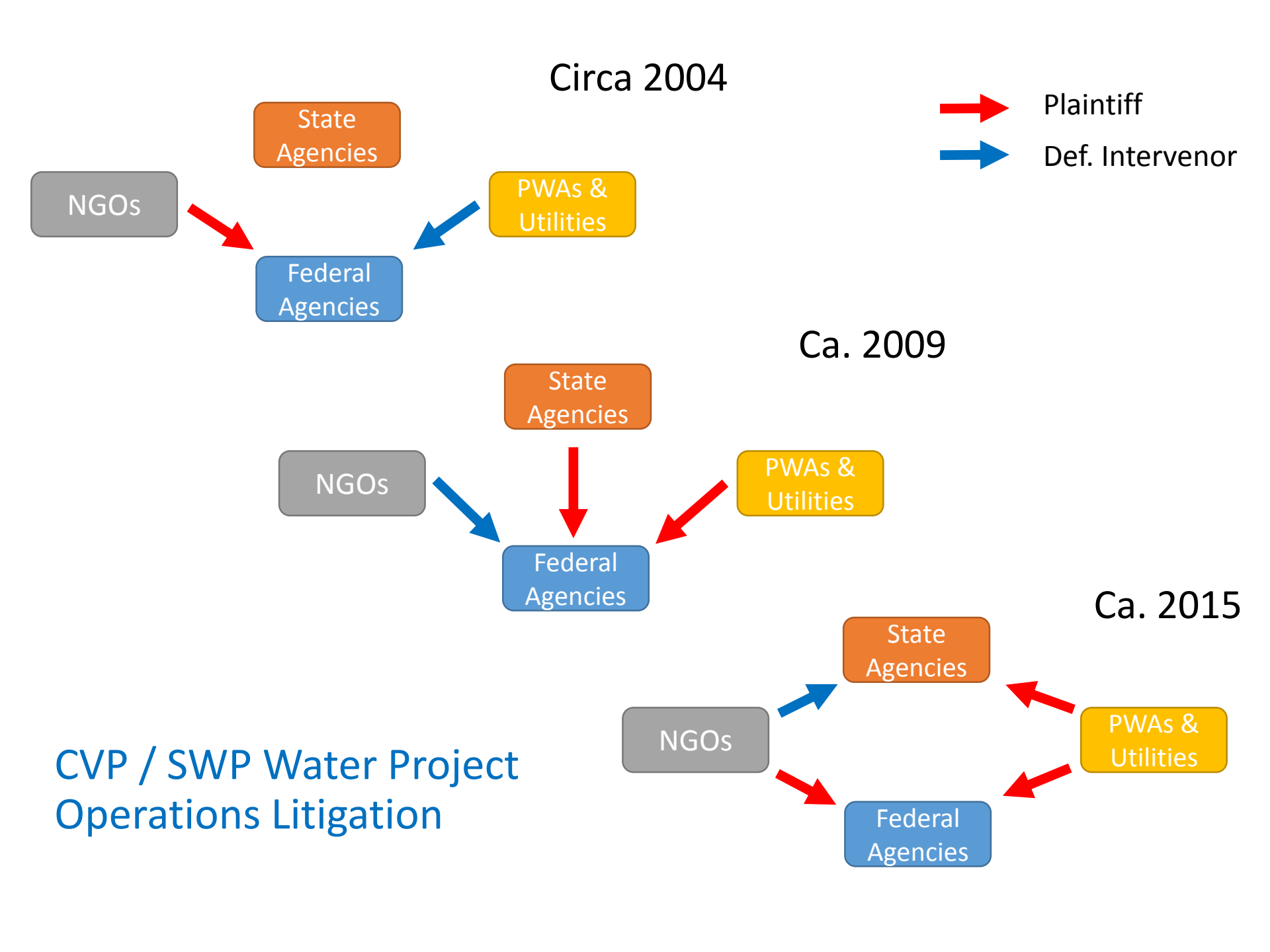
-UC Davis
-UC Berkeley
-UC Santa Cruz
-SFSU
-Stanford University
-CS Maritime Academy
-Univ. Washington

Federal Agencies

-USFWS
-NMFS/NOAA
-USGS
-USBR
-USEPA
-ACOE

Consultants

[Many]


Circa 2004
Plaintiff
Def. Intervenor
State Agencies
NGOs
PWAs & Utilities
Federal Agencies
Ca. 2009
State Agencies
NGOs
PWAs & Utilities
Federal Agencies
Ca. 2015
State Agencies
NGOs
PWAs & Utilities
Federal Agencies
CVP / SWP Water Project Operations Litigation

Science Enterprise Concerns

Costs of Conflict

- Research quality issues
- Social capital erosion / cynicism
- CA: “One Delta One Science”

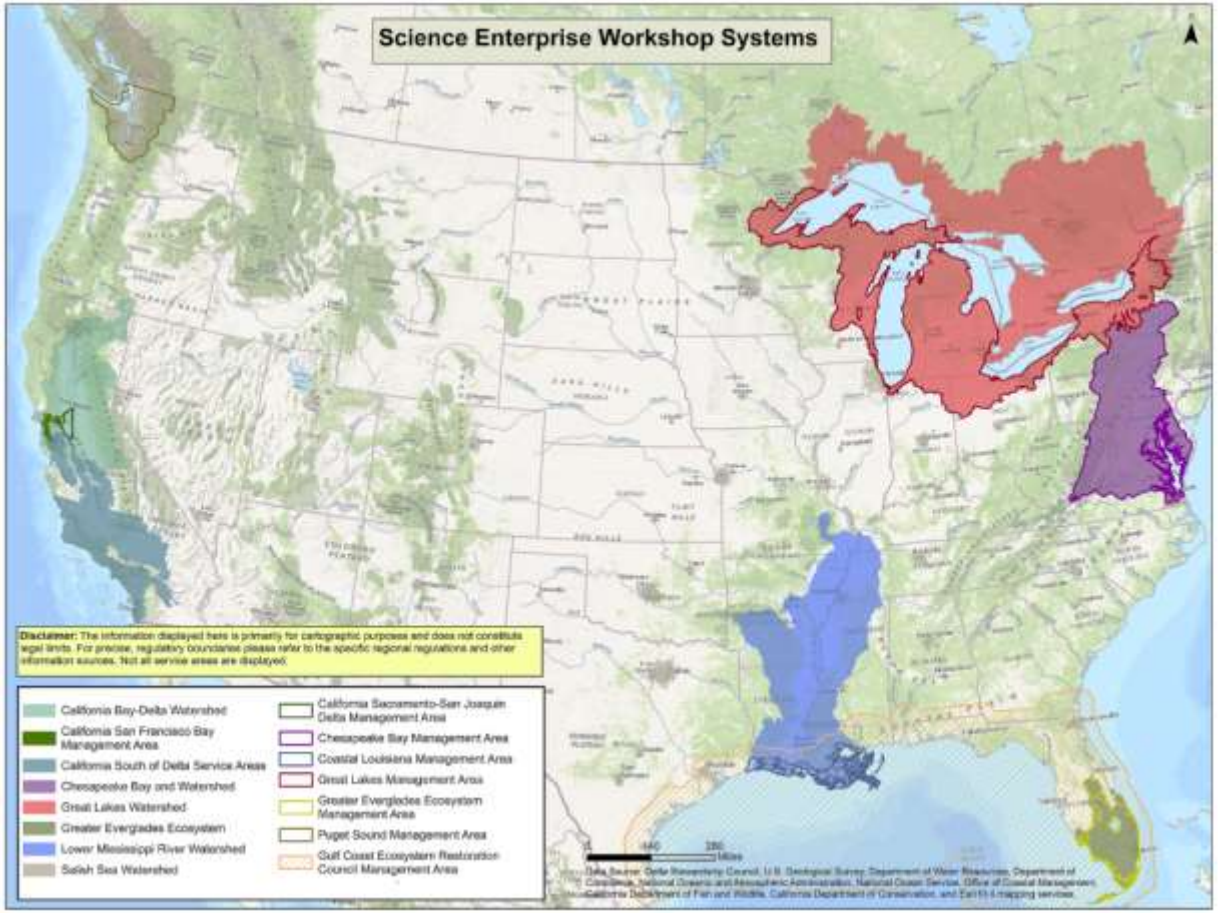
Efficiency

- Spending money wisely and efficiently?
- Program inertia
- Research-mgmt need alignment

Reach

- Can we answer the hard questions?

The Science Enterprise Workshop
November 1-2, 2016
Davis, California



Delta Stewardship Council

USGS science for a changing world

The Science Enterprise Workshop

Featured Regional Systems

Coastal Louisiana
Denise Reed, Water Institute of the Gulf

Puget Sound
Bill Labiosa, USGS, and Scott Redman, Puget Sound Partnership

Chesapeake Bay
Scott Phillips, USGS

Florida Everglades
Nick Aumen, USGS

Great Lakes
Jon Hortness, USGS

San Francisco Bay-Delta
Ted Sommer, CA Dept. of Water Resources, and Josh Collins, Ph.D., San Francisco Estuary Institute

The Science Enterprise Workshop

Panels

Panel 1: Science Strategies in Large Programs

Panel 2: Governance and Adaptive Management

Panel 3: Funding and Resource Allocation

Panel 4: Legitimacy, Co-Production, and Communication

Delta Stewardship Council

USGS science for a changing world

For Each Region

- History of regional programs development
- Major resource management issues
- Current science enterprise structure
- Funding for Science
- Important tools for implementing science
- Communications and co-production

“Signature” Panel Questions

- Science Strategies Panel: “What is important in developing science strategy for a basin, and how can a strategy be made adaptable?”

- Governance and Adaptive Management Panel: “How is adaptive management framed from your perspective and those that you advise or work with?”

- Funding and Resource Allocation Panel: “How do we evolve our science programs to support [changing] resource system goals?”

- Legitimacy, Co-Production, and Communication Panel: “How would you balance this three-legged stool of credibility, salience, and legitimacy?”

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Advance briefing paper, videographic record, and proceedings report at:
http://deltacouncil.ca.gov/sci-enterprise

Delta Stewardship Council

USGS science for a changing world

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What We Heard: #1

Integrated modeling and forecasting are valuable

- Integrated Environmental Modeling a theme in multiple systems
  - Forecasting can provide a structured approach to conveying uncertainty about future events

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What We Heard: #2

Independent review/oversight processes benefit everyone

- Uniform enforcement of practice norms
- BRAC-style program audits
- “Saying what needs to be said”
- Social capital enhancer

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What We Heard: #3

Communication is critical and often under-emphasized

- Transparency/public engagement and understanding
- Essential to making science “useable” as opposed to merely “useful”
- Communication of uncertainty

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What We Heard: #4

Integrate social science with natural science and engineering to understand full scope of management issues

- Social factors underappreciated
- Interplay of resource management and conservation goals and objectives
- Economics and priority setting

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What We Heard: #5

Be willing to do adaptive management

- AM is a *management* undertaking that often requires hard decisions
- Realism about probative value and likely timeliness of research

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What We Heard: #6

Competitive funding mechanisms can be a valuable component of an enterprise-level science plan

- Increased access to “best and brightest”
- Management challenges – usability, timeliness
- Can require strong science leadership to be used most effectively

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What We Heard: #7

Clear leadership that includes real engagement at the highest levels

- Forward orientation
- Unpopular decisions
- Leverage/reach

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What We Heard (California Bay-Delta):

- More integration is needed between Bay and Delta

POLLS

Key Components of Effective Science Enterprise	Level of Importance (scale 1 – 5)
Clear communication on importance of scientific findings	**4.66**
Clear leadership and decision making structure with responsibility at highest level	**4.57**
Integrated Modeling & Forecasting	**4.39**
Integration of social sciences	**4.21**
Peer-review, over-the-shoulder, process	**4.14**
Competative science funding to attract brightest and best	**4.12**
Willingness to do adaptive management	**4.02**

Lessons Learned for California Bay-Delta	Level of Importance (scale 1-5)
Clear communication on importance of scientific findings	**4.53**
Clear leadership and decision making structure with responsibility at highest level	**4.49**
More integration between the Bay (lower estuary) and Delta (upper estuary)	**4.39**
Integration of social sciences	**4.38**
Integrated Modeling & Forecasting	**4.19**
More focus on climate change impacts on the Delta	**4.13**
Competative science funding to attract brightest and best	**4.02**
Willingness to do adaptive management	**4**
Peer-review, over-the-shoulder, process	**3.93**

What's Next?

Workshop outcomes are being digested

Agencies could do these without $$ or new authority:

- Standardized fundamental practices
- Rigorous, transparent program audits
- Improved stakeholder participation

With new authorization:

- Stakeholder-involved program decisionmaking

Thanks for your attention!

Photo: Wikimedia

Thanks to my workshop co-lead, Jessica Law

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Slide acknowledgments: Jessica Law, Ted Sommer, Josh Collins