USGS
science for a changing world

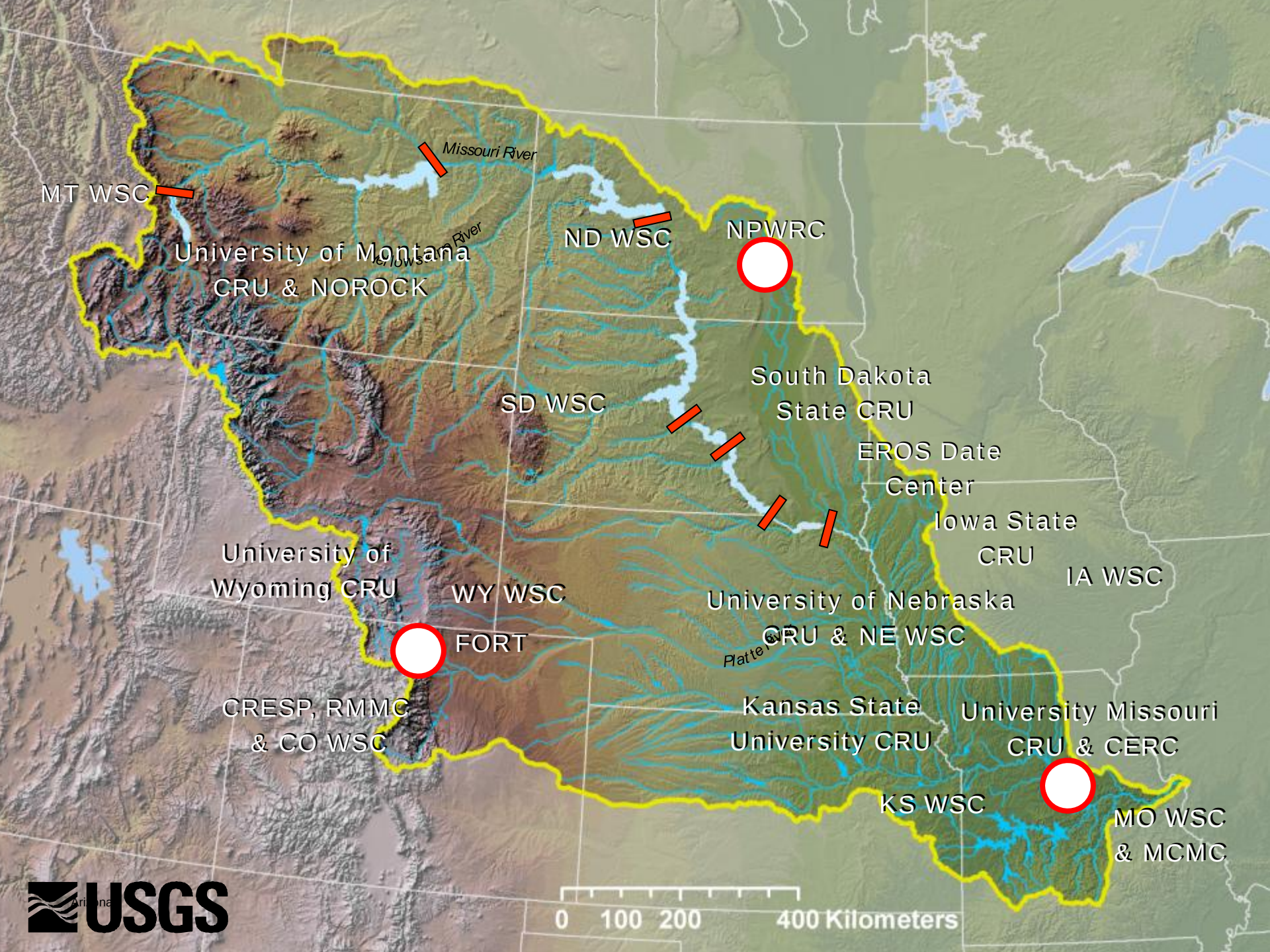
Columbia Environmental Research Center

River Studies Branch

USGS Science to Inform Adaptive Management of Natural Resources in the Missouri River

Robert B. Jacobson, Ph.D.
Supervisory Research Hydrologist
U.S. Geological Survey
Columbia, Missouri

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


Missouri River
MT WSC
University of Montana
CRU & NOROCK
ND WSC
NPWRC
SD WSC
South Dakota
State CRU
EROS Date
Center
Iowa State
CRU
IA WSC
University of
Wyoming CRU
WY WSC
FORT
University of Nebraska
CRU & NE WSC
Platte River
CRESP, RMMC
& CO WSC
Kansas State
University CRU
University Missouri
CRU & CERC
KS WSC
MO WSC
& MCMC
USGS
0 100 200 400 Kilometers

Asian carps

Photo: Jim Rathert, Mo Dept. Conservation

Interior Least Tern

Photo: USACE

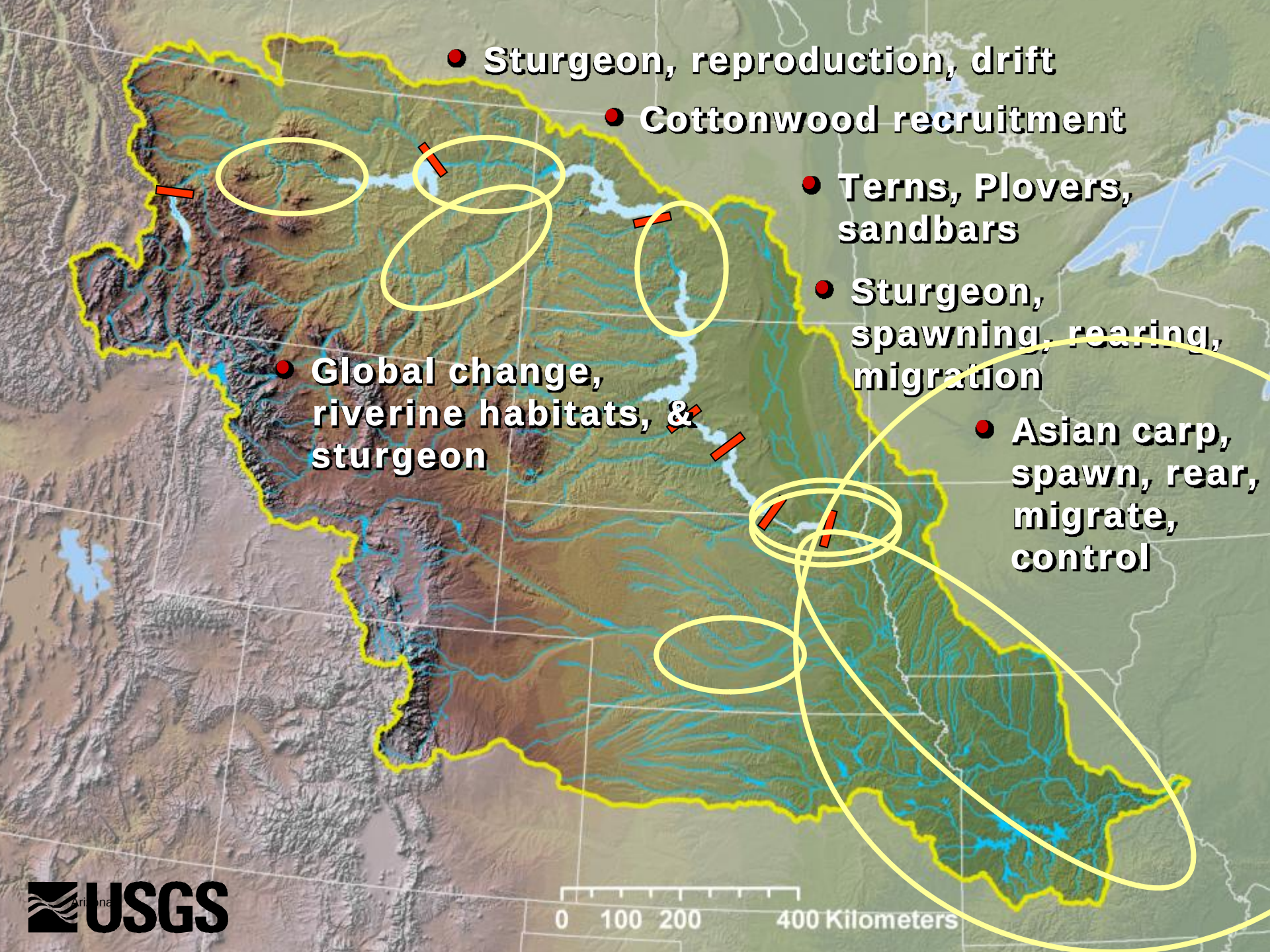
Pallid Sturgeon

Photo: USGS, Delonay

Piping Plover

Photo: USACE

USGS

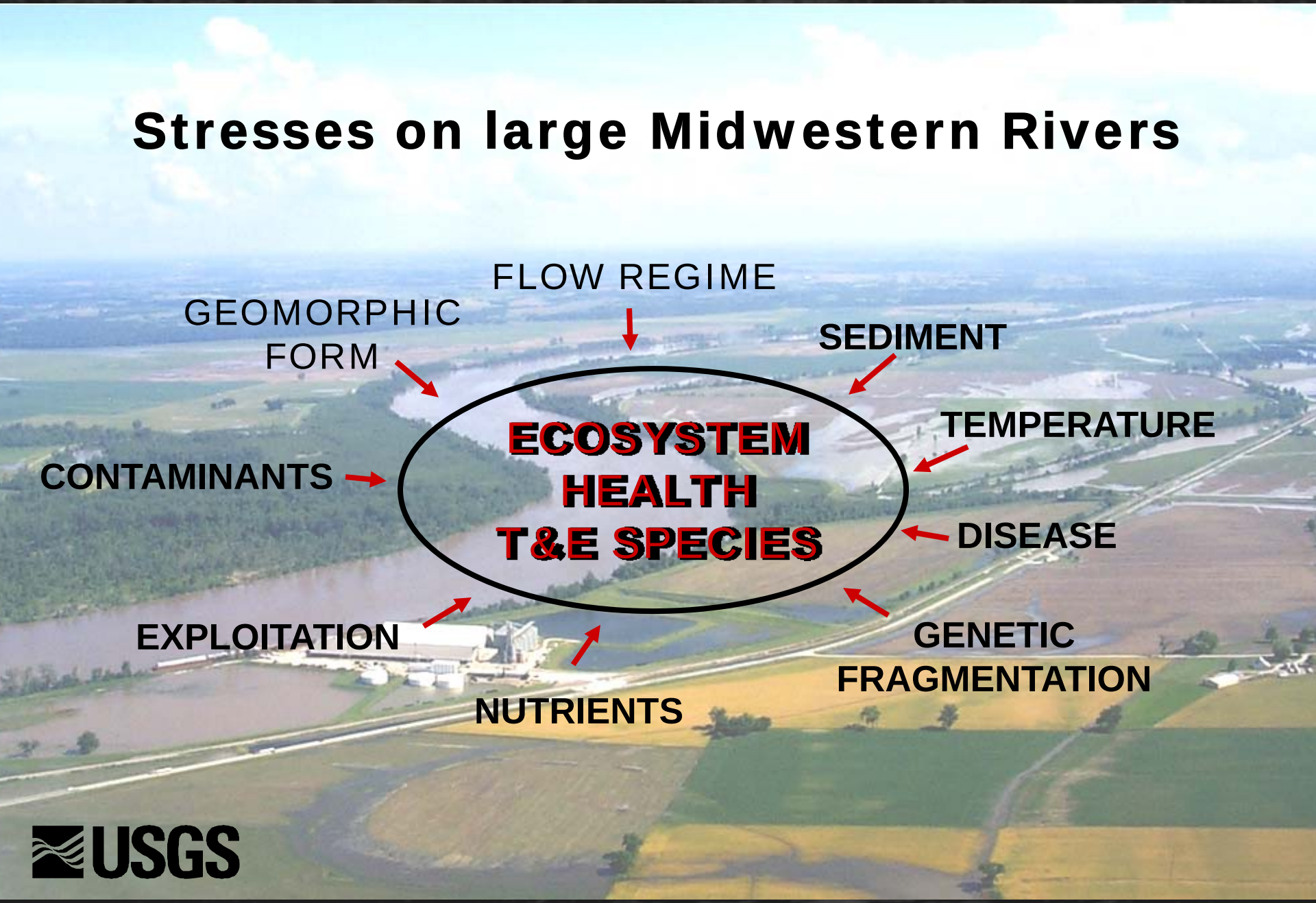

Sturgeon, reproduction, drift
Cottonwood recruitment
Terns, Plovers, sandbars
Sturgeon, spawning, rearing, migration
Asian carp, spawn, rear, migrate, control
Global change, riverine habitats, & sturgeon
USGS
0 100 200 400 Kilometers

Common themes:

- Endangered, threatened, or at-risk species and their ecosystems
- Substantial uncertainties about pathways to recovery, relations to management actions
- Contentious, multi-agency, inter-jurisdictional decision-making processes: adaptive management
- Empowered, involved stakeholders
- Need for comprehensive, interdisciplinary, objective science to inform decision making

USGS

Stresses on large Midwestern Rivers



USGS

LMOR Channel Form Rehabilitation

USGS

LMOR Channel Form Rehabilitation

Side-channel Chutes

USGS

Substantial societal investments in restoration and management:

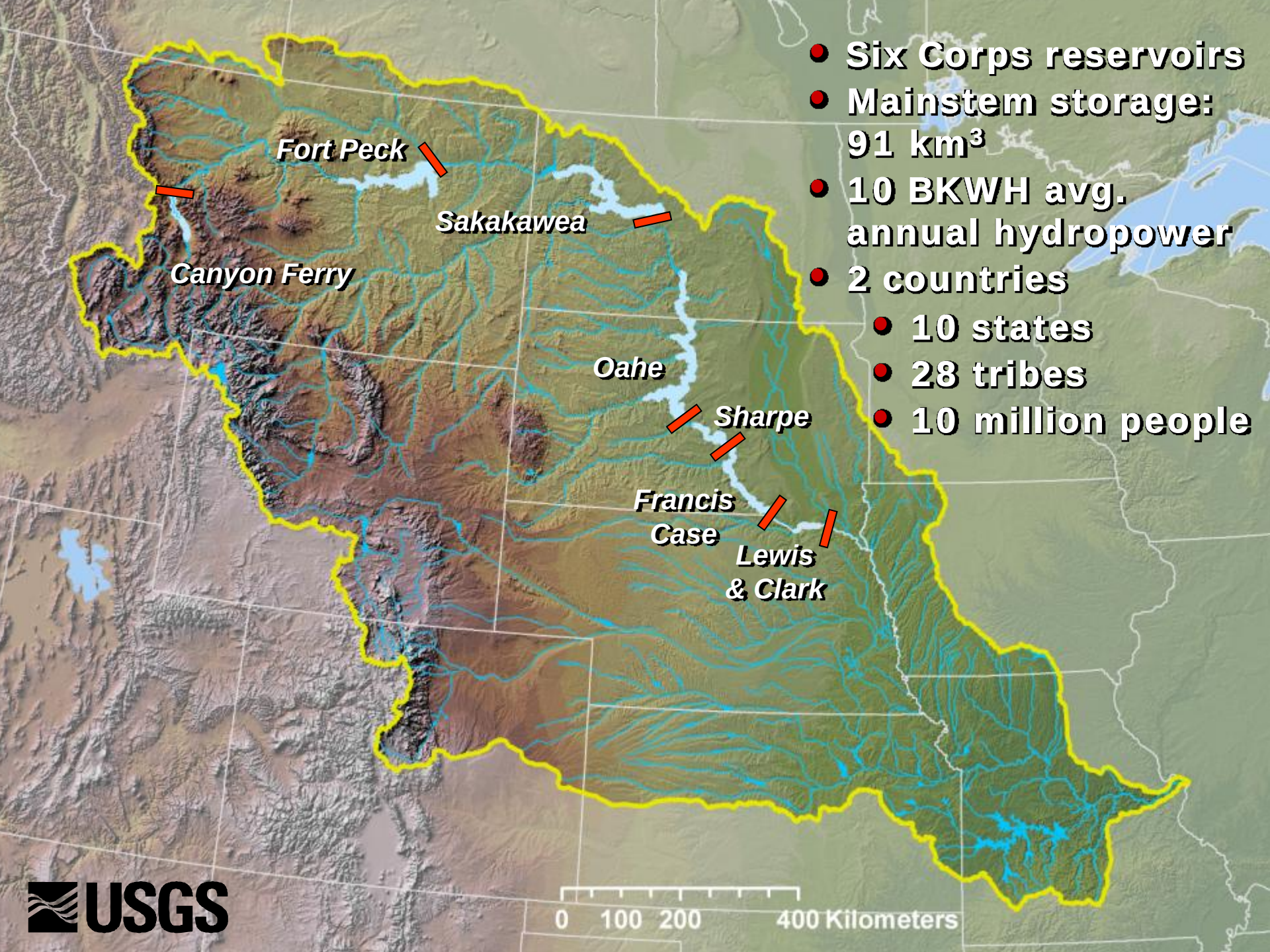
- Platte River Recovery Implementation Program:
  - $118 M over 11 years
- Missouri River Recovery Program
  - $373 M over last 7 years
  - $1.3 B estimated for “recovery”
- Great Lakes Restoration Initiative
  - $475 M in 2010
  - $78 M for invasives

USGS

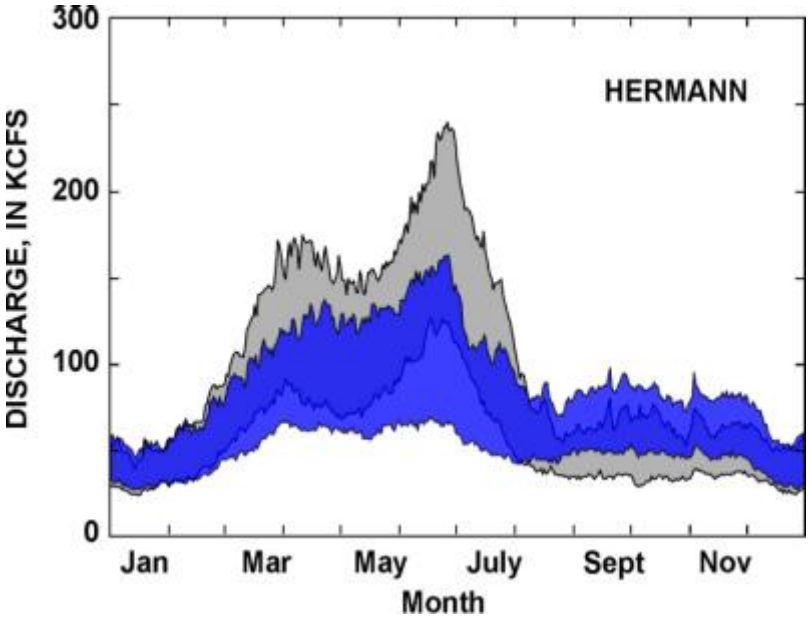
USGS Role in Adaptive Management:

- Non-aligned science: “honest broker”
- Interdisciplinary assets: biology, water, geology, geography
- Institutional depth: national laboratories, training, geographic footprint, monitoring -> research
- Publication & information mission
- Fundamental science practices: institutional peer- and agency-review policies to assure independence, credibility, quality

USGS

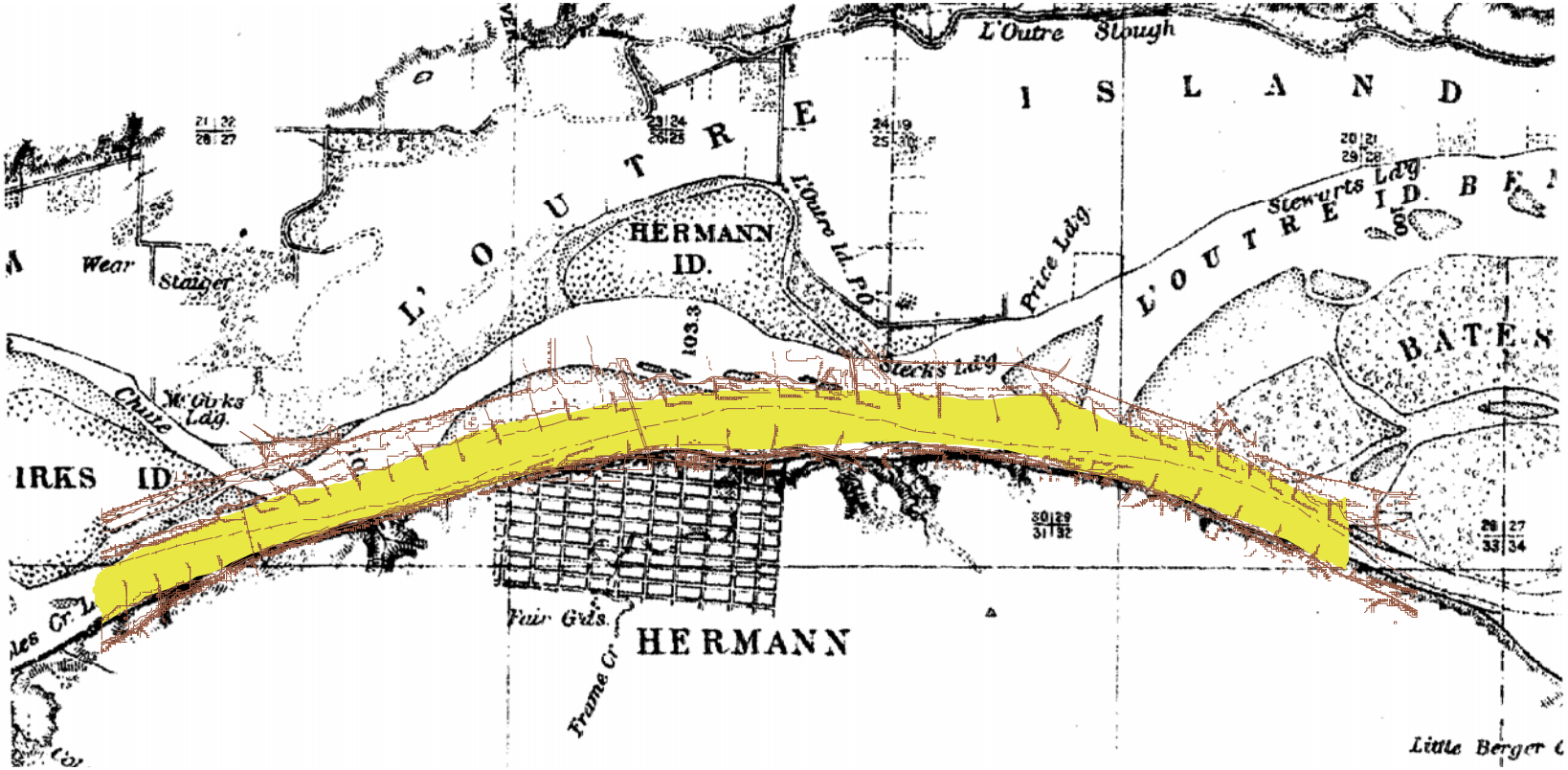

Fort Peck
Sakakawea
Canyon Ferry
Oahe
Sharpe
Francis
Case
Lewis
& Clark
Six Corps reservoirs
Mainstem storage:
91 km³
10 BKWH avg.
annual hydropower
2 countries
10 states
28 tribes
10 million people
USGS
0 100 200 400 Kilometers

Lower Missouri Flow-Regime Gradient



USGS

Lower Missouri River at Hermann, Missouri
Missouri River Commission Maps - 1894



0 2 4 6 kilometers

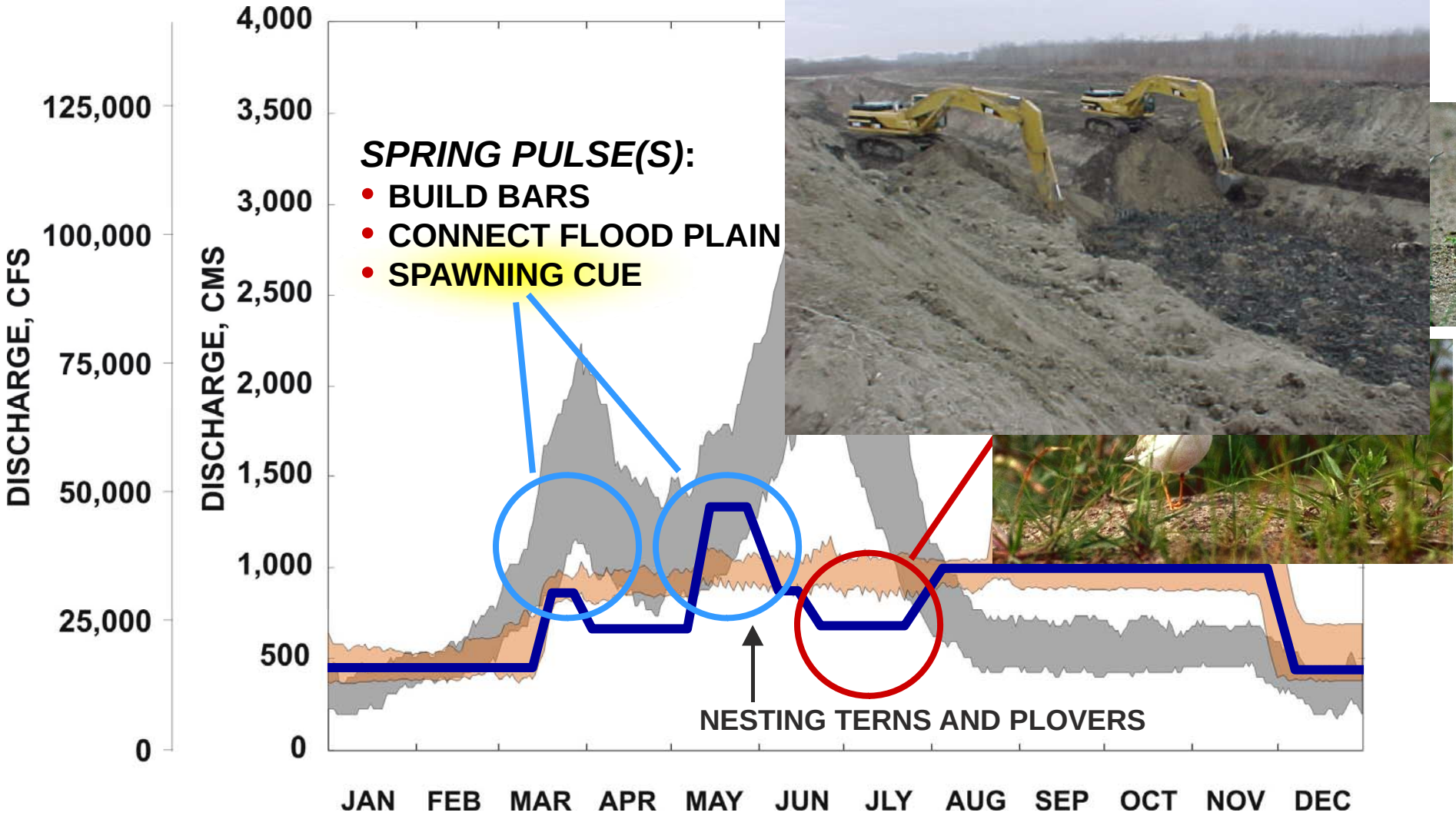
USGS

Historical and 1994-2006 Annual Suspended Sediment Fluxes, Millions Mg * year^{-1}

Gage	1994-2006	S.E.	Historical	S.E.	Percent
Yankton	0.24	0.03	121.0	--	0.2%
Omaha	18.6	2.2	148.8	--	12.5%
St. Joseph	27.6	1.9	270.2	12.0	11.8%
Kansas City	41.9	3.0	280.2	39.7	14.1%
Hermann	55.2	4.4	326.0	11.6	16.9%

USGS

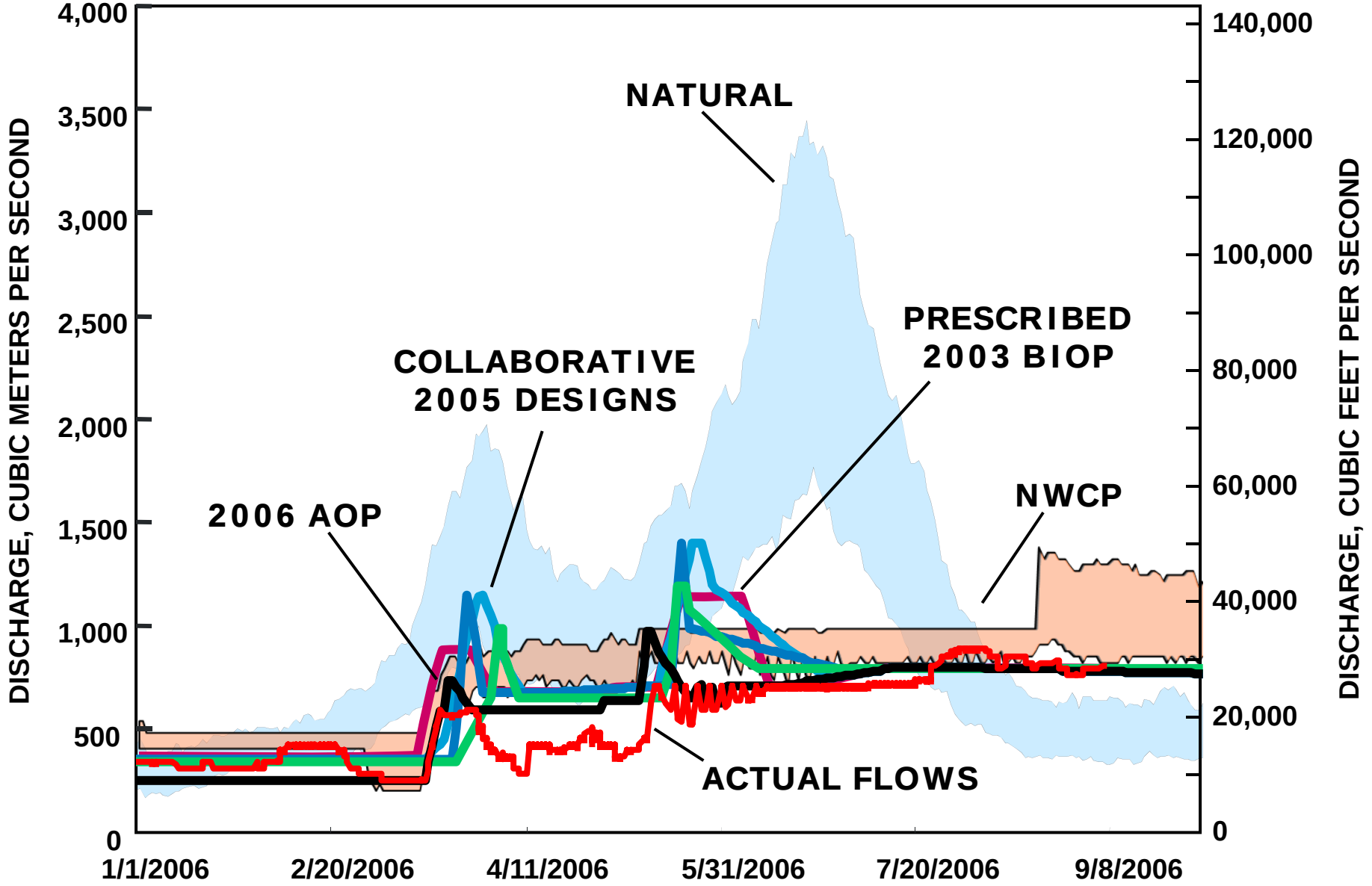
Ecological Functions and Flow-Regime Naturalization



USGS

USGS

Flow-Regime Implementation

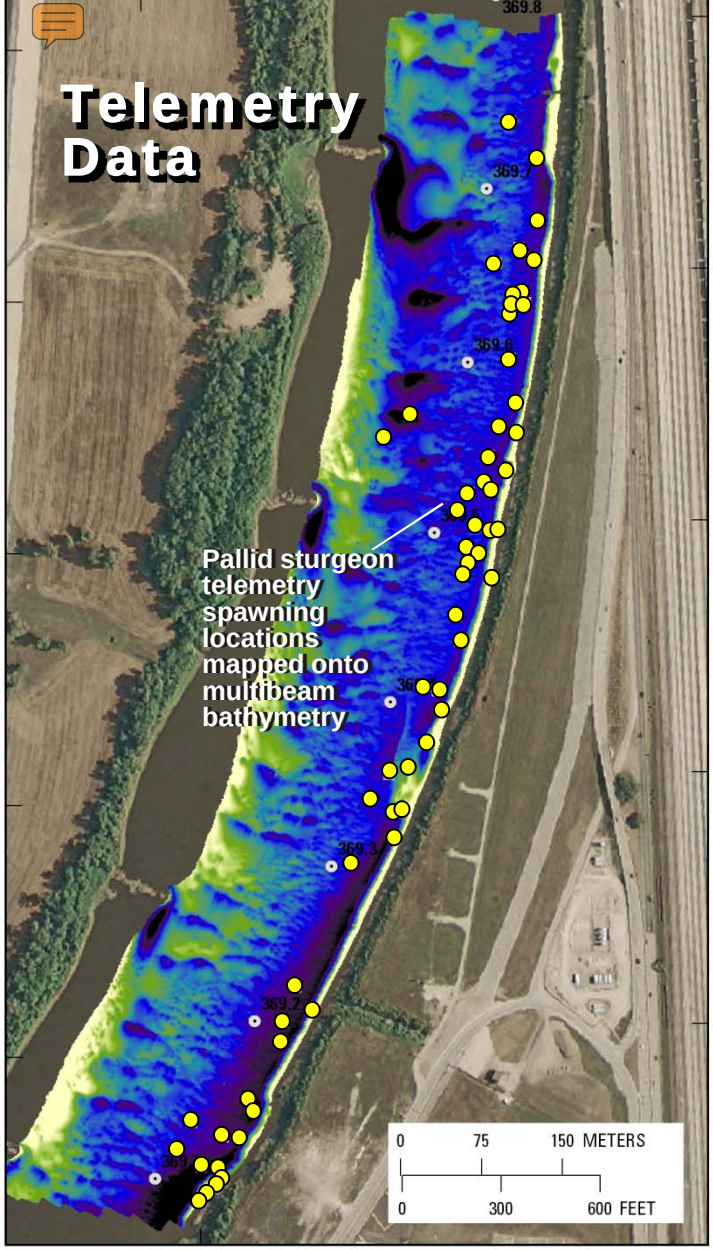


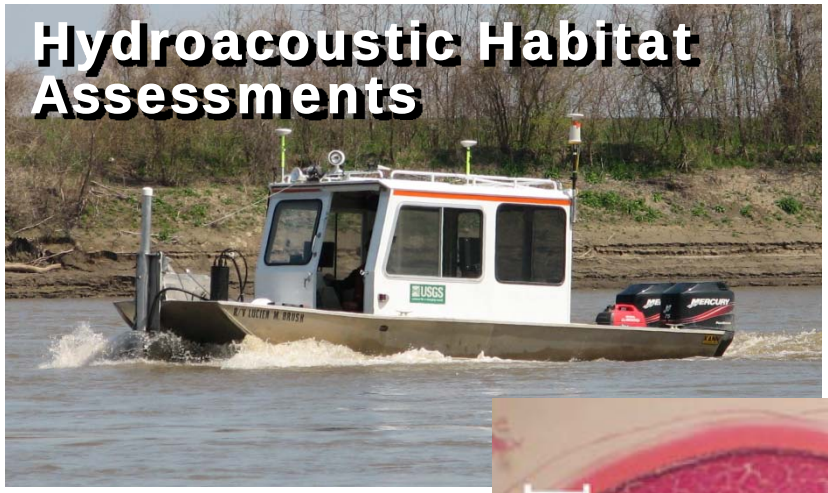
USGS

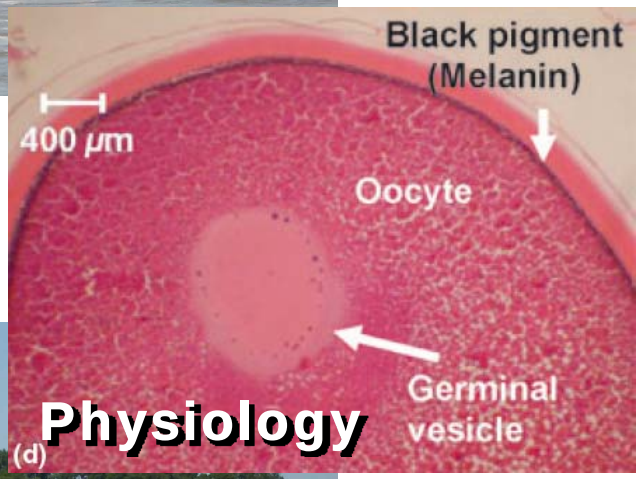
CSRP Study Approach

USGS

U.S. FISH & WILDLIFE SERVICE

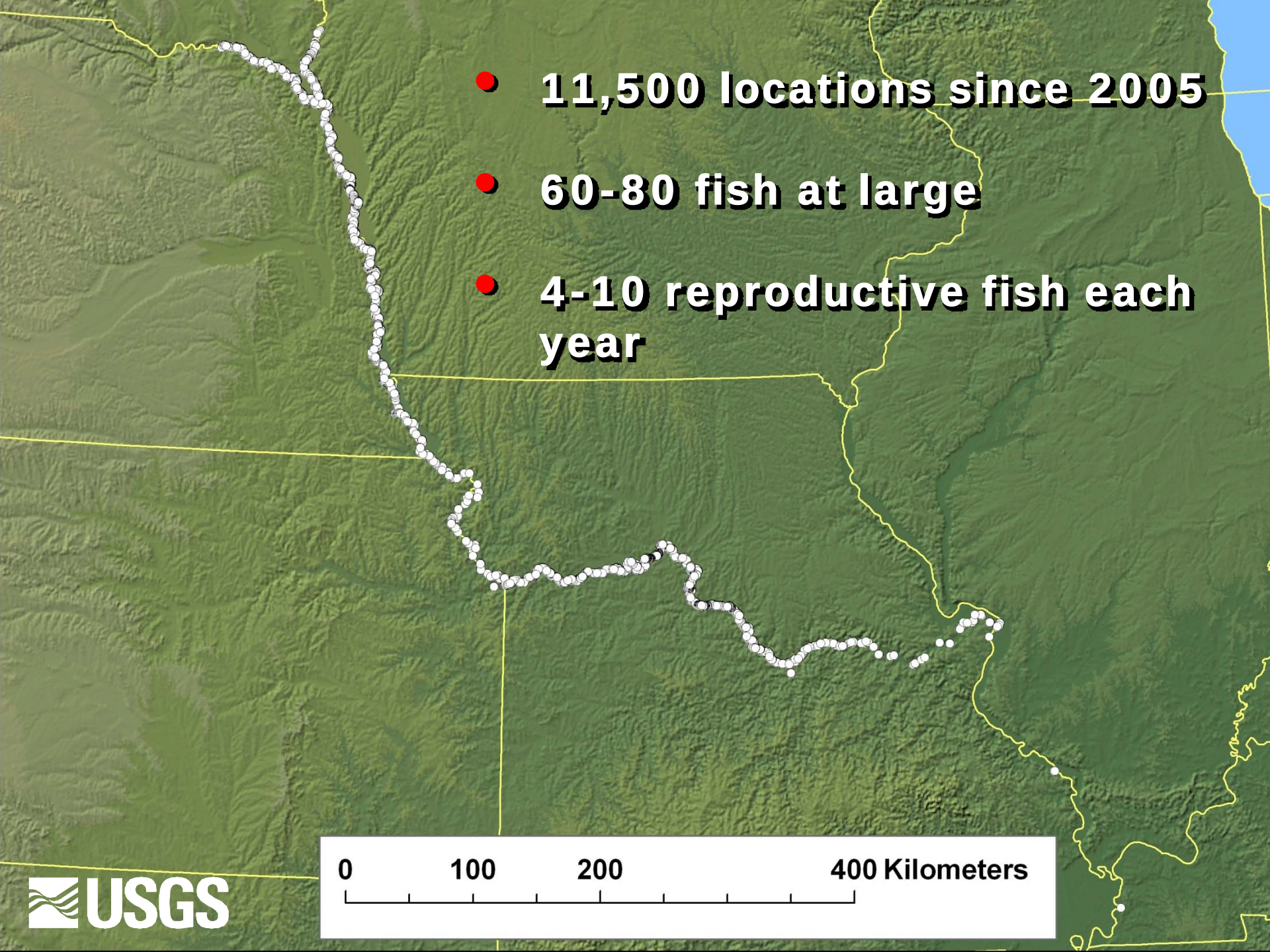


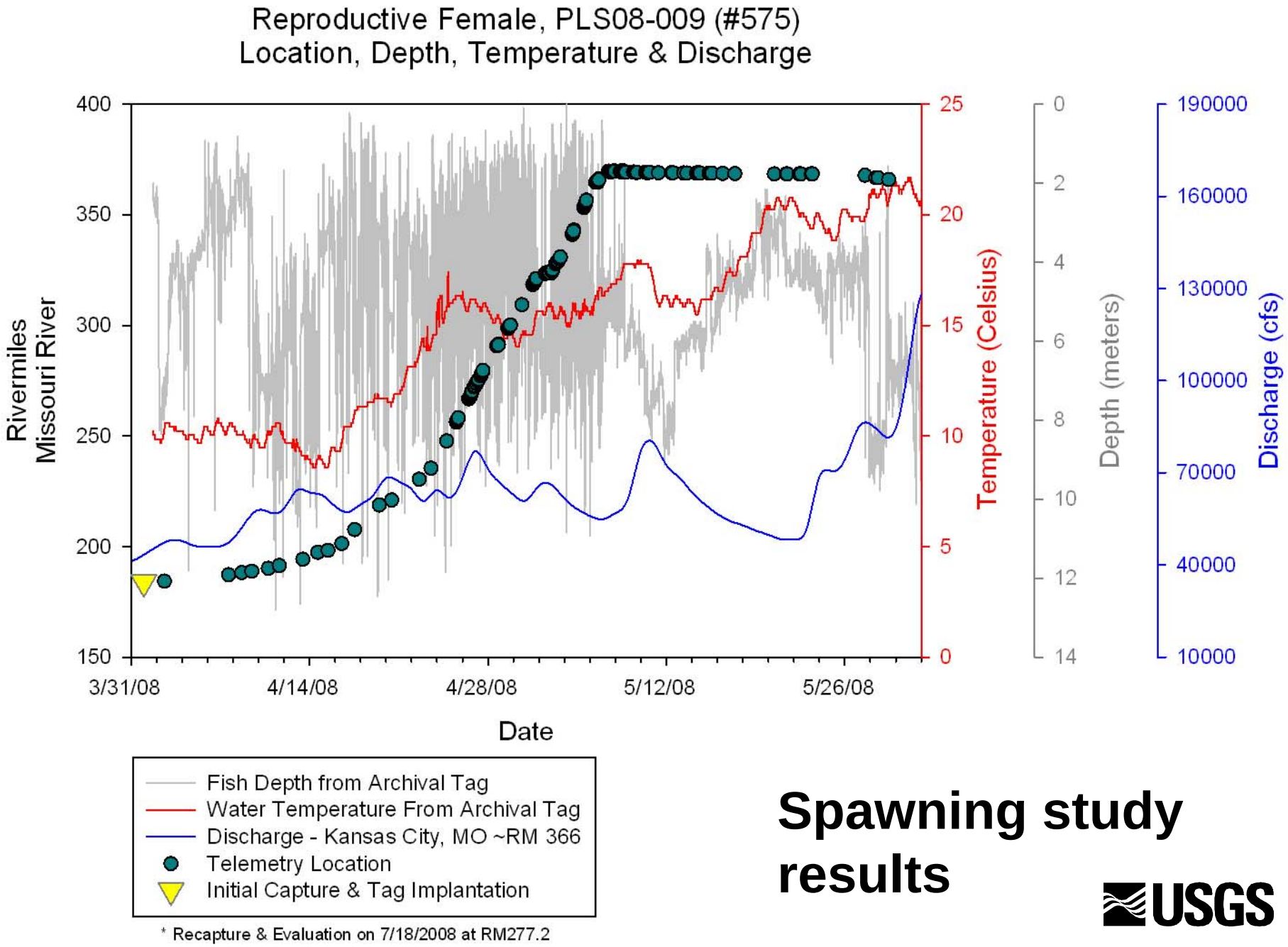




USGS

U.S. FISH & WILDLIFE SERVICE


11,500 locations since 2005
60-80 fish at large
4-10 reproductive fish each year
0
100
200
400 Kilometers
USGS



Spawning study results

USGS

Pallid sturgeon progress:

- Sturgeon are spawning, even hatchery
- Sturgeon spawn many places over many weeks
- So far, migrations do not appear to be linked to flow pulses; temperature dominates
- Drift requires 300 – 1300 km
- Spawning habitats are not limiting
- Spawning, migration habitats are not sensitive to flow pulses
- Substantial numbers of intersex fish

USGS

Pallid sturgeon progress:

- Limits of field experimental design, few adaptive management experiments –> more replicates -> long time
- Density dependence: too much spawning habitat?
- Energy requirements for migration?
- Males and endocrine disruption?
- Egg, larvae transport and fate?
- Water quality and recruitment?
- Flow regime, morphology, & prey base?

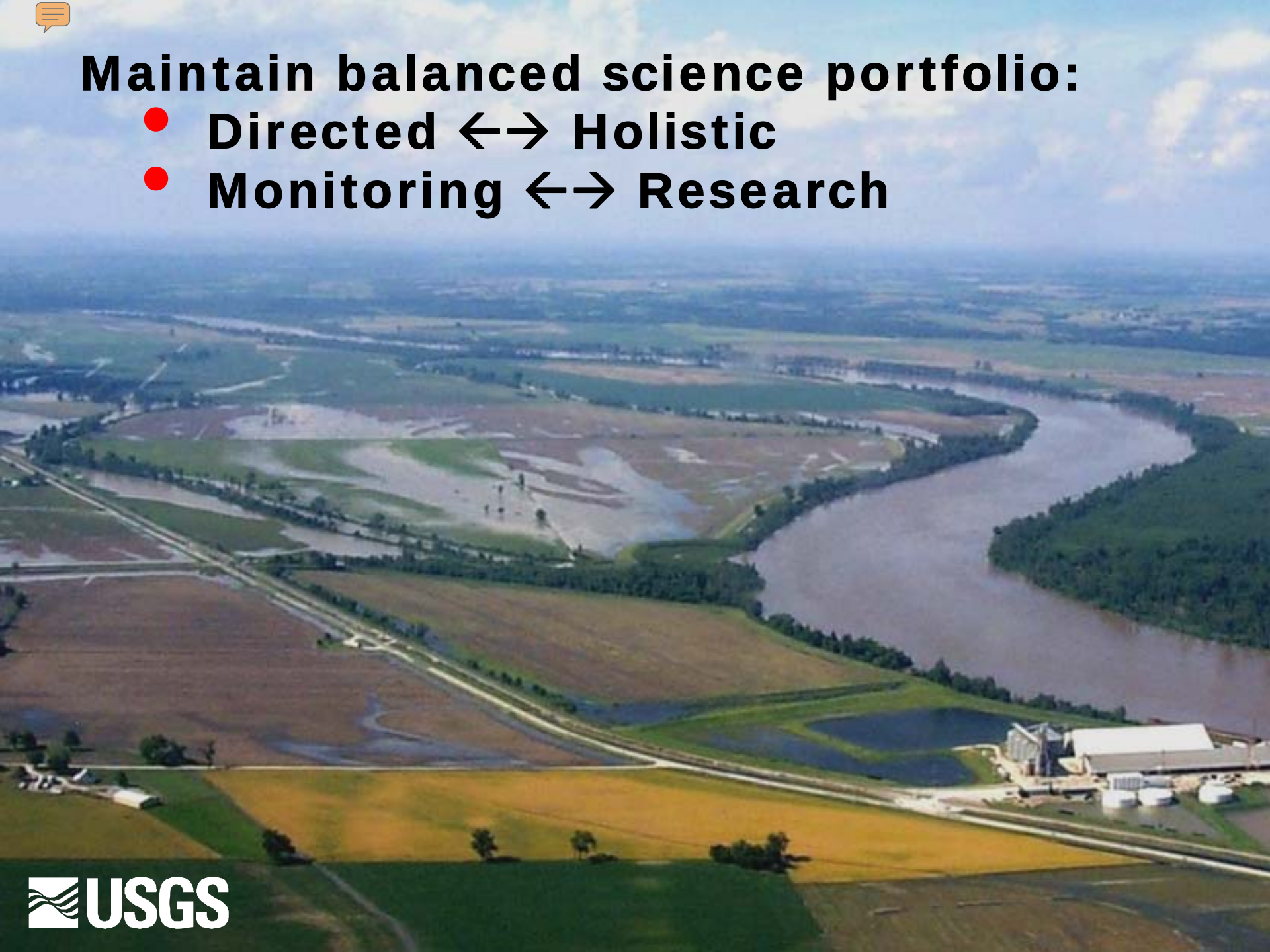
USGS

Adaptive management and science:

- Surprises complicate management
- When is science actionable?

Maintain balanced science portfolio:

- Directed ←→ Holistic
- Monitoring ←→ Research



USGS

Develop, maintain functional collaborations:

- Partnership model
- Flexibility and communications

USGS