



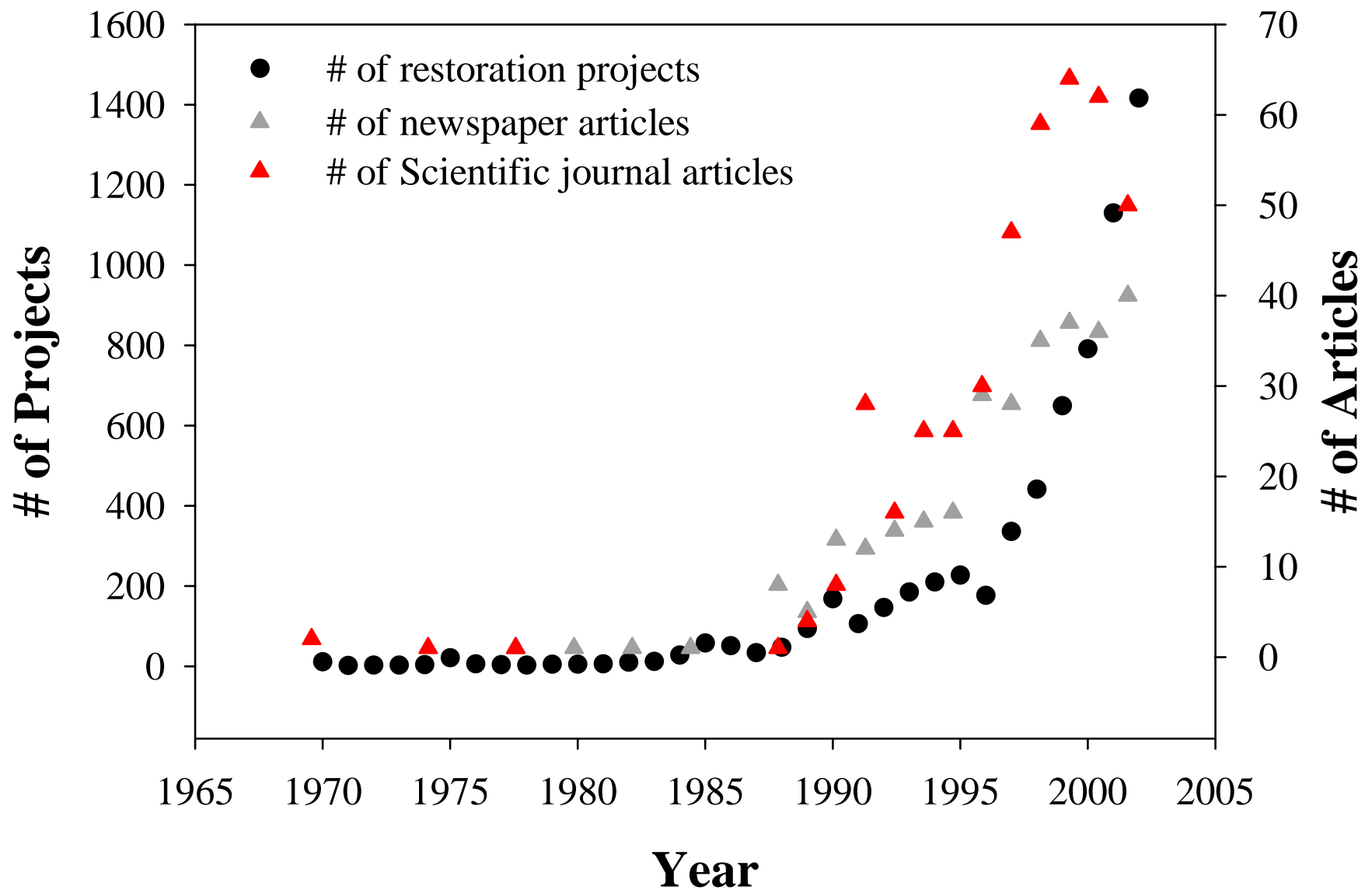
River and riparian restoration in the Southwest: A summary from the National River Restoration Science Synthesis

C. Dahm¹, J. Follstad Shah¹, S. Gloss², M. Palmer^{3,6}, J. D. Allan^{4,6} & E. Bernhardt^{5,6}

¹ University of New Mexico, Department of Biology; ² USGS University of Arizona, ³ University of Maryland, Department of Entomology; ⁴ University of Michigan, School of Natural Resources; ⁵ Duke University, Department of Biology; ⁶ National Center for Ecological Analysis and Synthesis

Corresponding author: cdahm@sevilleta.unm.edu





- **Exponential \uparrow # of river restoration projects throughout the last decade**
- **Similar \uparrow in public and scientific interest at same time (note \uparrow # of articles on “river restoration” in major newspapers & journals)**

- **Objectives:**

- Characterize modern river restoration practice
- Determine the role of the scientific method and ecological knowledge in river restoration
- Identify the common elements of successful ecological restoration of streams
- Identify critical gaps in ecological knowledge that must be filled to facilitate more effective stream restoration

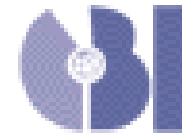
- **Phases:**

- ✓ 1: Database creation

- Collected project records for ~38,500 projects
- Designed & constructed a database to merge all records into a common format

2: Surveys of ~ 400 project managers

3: Data analysis of restoration trends/effectiveness



- **Project website:** http://www.nrrss.umd.edu/NRRSS_INDEX.htm

NRRSS Focus States / Province

Pacific Northwest

P. Goodwin, R. Jenkinson,
& S. Clayton

Central US Large Rivers

D. Galat & K. O'Donnell

Upper Midwest

J. D. Allan &
G. Alexander

Upper & Lower Chesapeake Bay

M. Palmer, D. Hart,
B. Hassett, J. Carr,
& P. Srivastava

Southeast

J. Meyer &
E. Sudduth

California

G. M. Kondolf, R.
Lave, & L. Pagano

Southwest

C. Dahm, J. Follstad
Shah, & S. Gloss

National Coordination

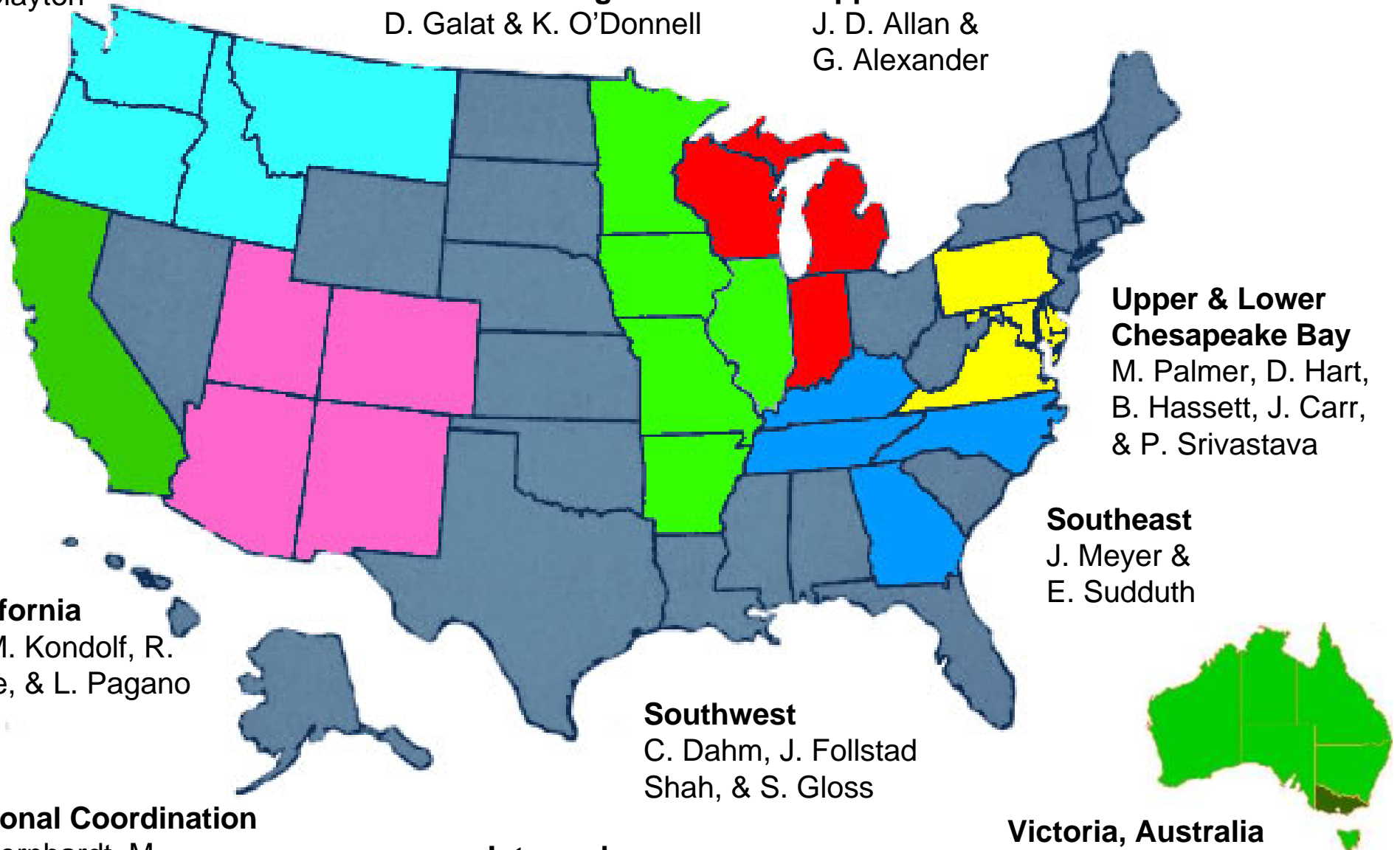
E. Bernhardt, M.
Palmer, & J. D. Allan

Internode

States in gray

Victoria, Australia

S. Lake & S. Brooks



U.S. Federal Database Sources (n=18)

Environmental Protection Agency (EPA)

5 Star Restoration Challenge grants, Grant Reporting and Tracking System (GRTS) for 319 programs, and River Corridor and Wetland Restoration

National Oceanic and Atmospheric Administration (NOAA)

Community Based Restoration and Disaster Assistance Restoration Programs

Department of Transportation (DOT)

Federal Highway Transportation Enhancement Program

Fish and Wildlife Service (FWS)

FWS HABiTS, National Fish Passage Program, Division of Bird and Habitat Conservation

Army Corps of Engineers (ACOE)

1135, Aquatic Environmental Projects by the Institute for Water Resources, Water Resources Development Act projects, Reviews of Non-Corps Restoration Projects (2)

National Park Service (NPS)

Project Management Information System

Natural Resources Conservation Service (NRCS)

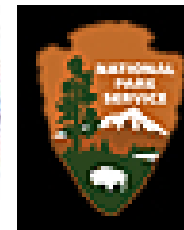
Success Stories

Cleanwater.gov (federal interagency group)

Watershed Success Stories

Coastal America (federal interagency group)

Regional Conservation Projects



SW Database Sources (n=38)

Arizona

- Arizona Department of Environmental Quality, Water Quality Improvement Grants
- Arizona Department of Water, Arizona Water Protection Fund
- Arizona State University , Center for Environmental Studies
- City of Phoenix
- Pima County Flood Control District
- Pima County Water Resources Division
- Sonoran Institute
- Tonto National Forest
- Tuscon Audubon Society
- US Bureau of Land Management, Abandoned Mine Land Program
- US Geological Survey, Grand Canyon Monitoring and Research Station

Colorado

- City and County of Denver
- Colorado Department of Public Health and Environment, Nonpoint Source Pollution Program
- Colorado Division of Water Resources/Colorado Water Conservation Board
- Colorado Division of Wildlife
- US Bureau of Land Management, Abandoned Mine Land Program
- US Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program
- US Geological Survey, Reconfigured Channel Assessment Program

SW Database Sources (n=38)

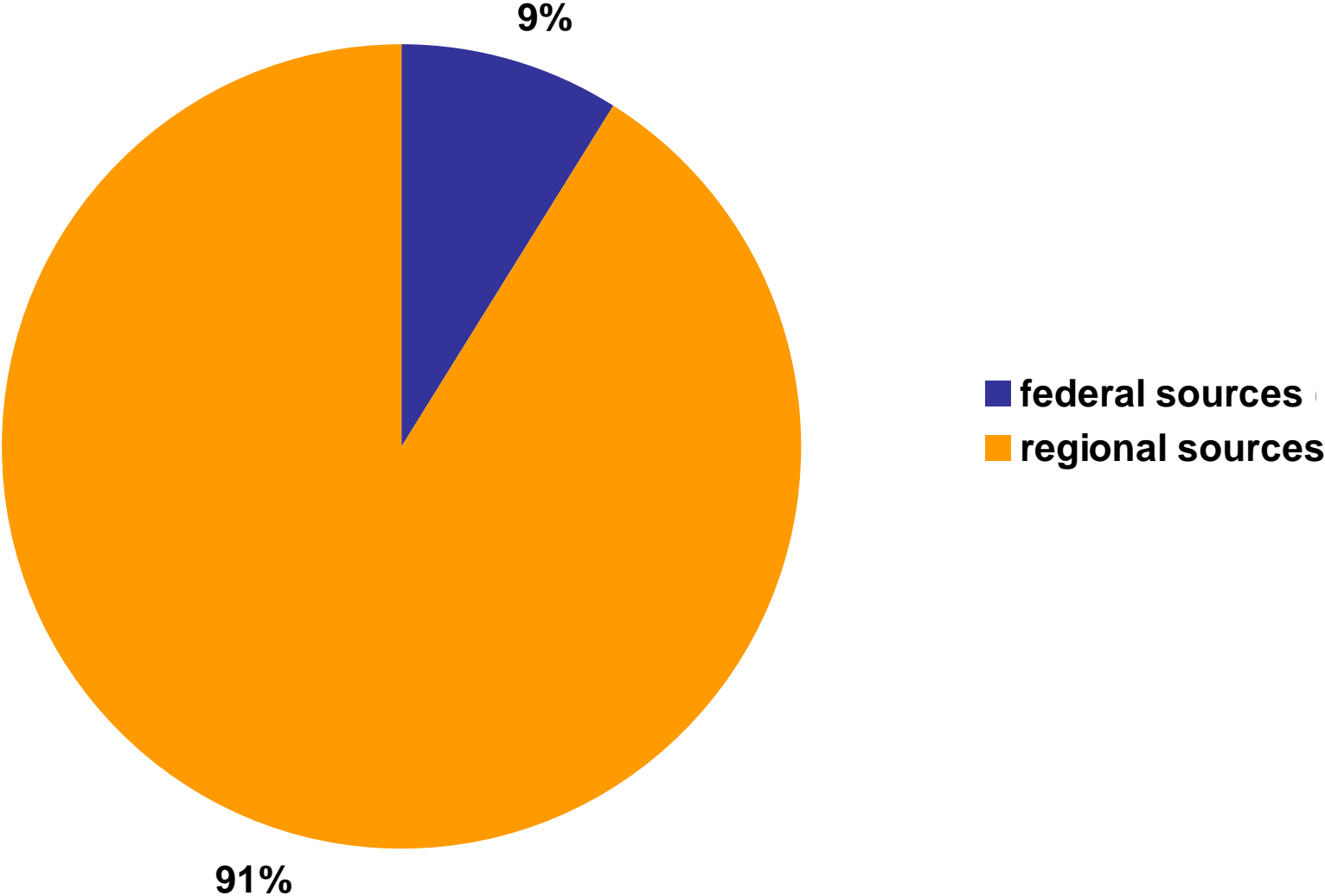
New Mexico

- **Bosque Del Apache National Wildlife Refuge**
- **Cuidad Soil and Water Conservation District**
- **Earth Works Institute**
- **Forest Guardians**
- **Hydra Aquatic, Inc.**
- **Middle Rio Grande Endangered Species Act Collaborative Workgroup**
- **New Mexico Bureau of Mines and Mineral Resources**
- **Socorro Soil and Water Conservation District**
- **The Nature Conservancy - New Mexico Chapter**
- **University of New Mexico , Water Resources Program**
- **US Army Corps of Engineers, Albuquerque District Office**
- **US Bureau of Land Management, Abandoned Mine Land Program**
- **US Bureau of Reclamation, Albuquerque River Analysis Team**
- **US Fish and Wildlife Service, Middle Rio Grande Bosque Initiative**
- **US Fish and Wildlife Service, San Juan River Basin Recovery Implementation Program**
- **World Wildlife Fund/Alliance for Rio Grande Heritage**
- **US Bureau of Reclamation, Lower Colorado Regional Office**

Utah

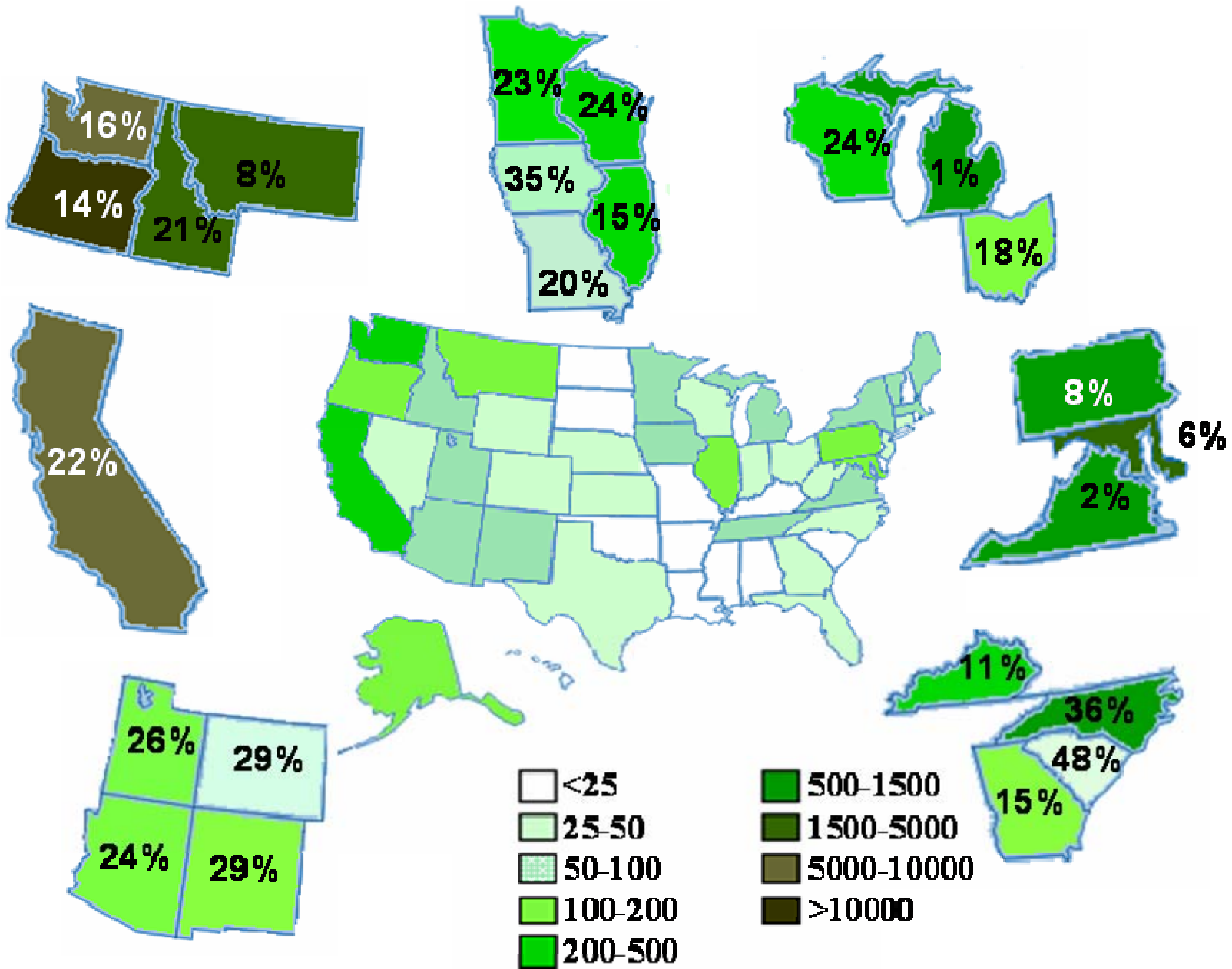
- **US Bureau of Land Management, Abandoned Mine Land Program**
- **Utah Division of Wildlife Resources**
- **Utah Reclamation Mitigation and Conservation Commission**

Distribution of projects by data source

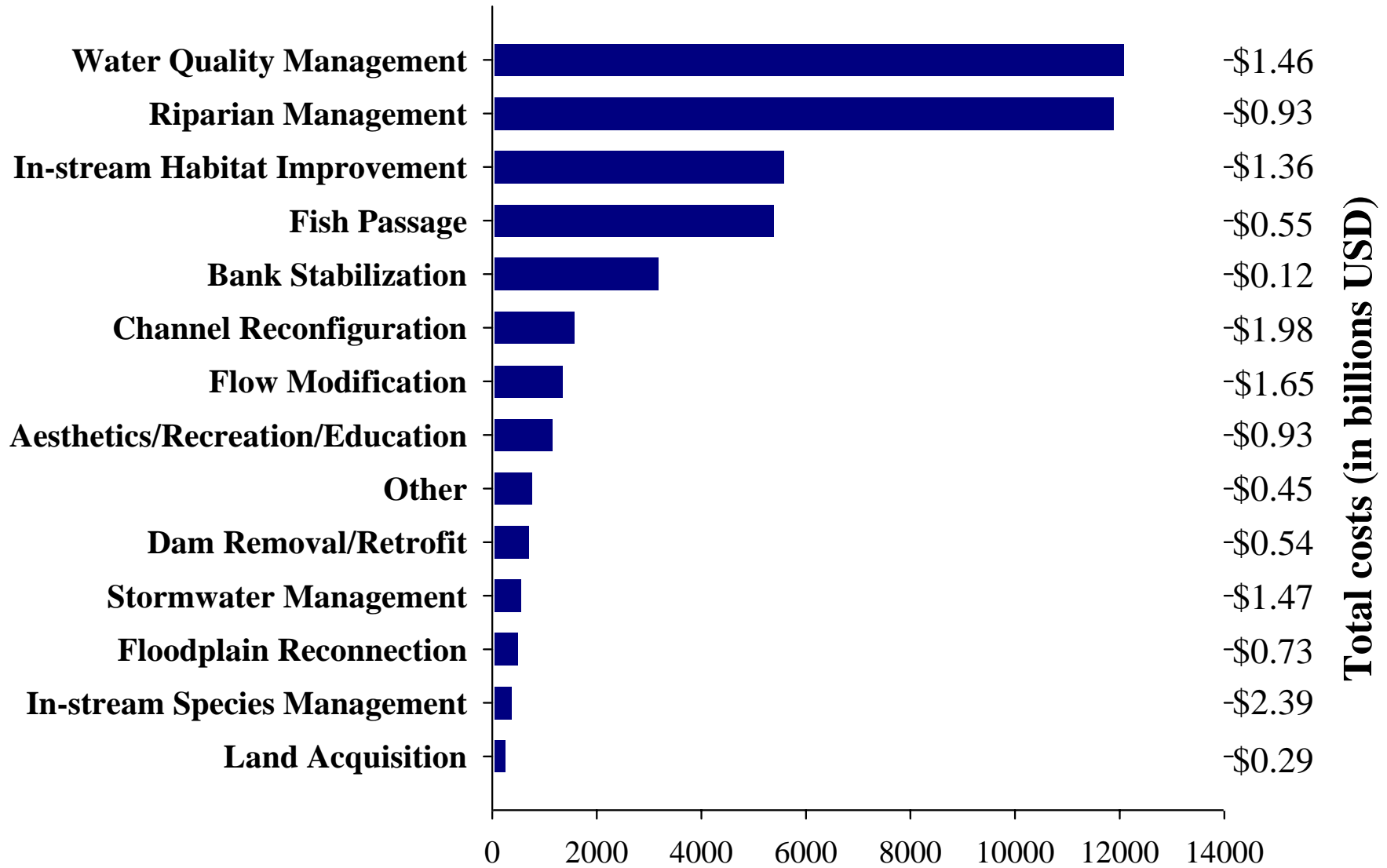


Regional data sources are much more data-rich than federal data sources.

National and Node level project densities (n = 38,533) & percentage of projects monitored by state



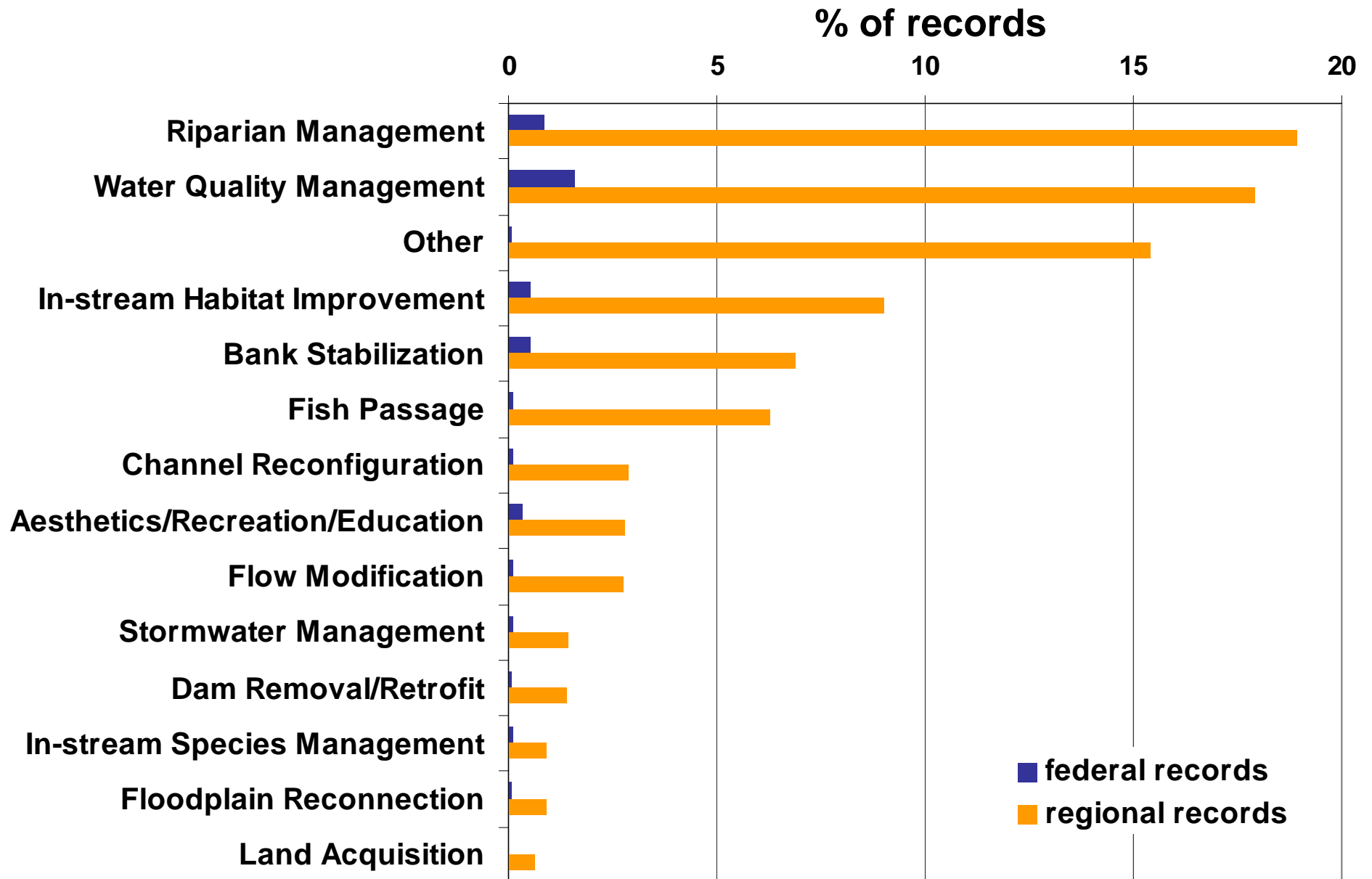
Distribution of Project Intents



Reported total = \$8 billion
Estimated total = \$15-17 billion

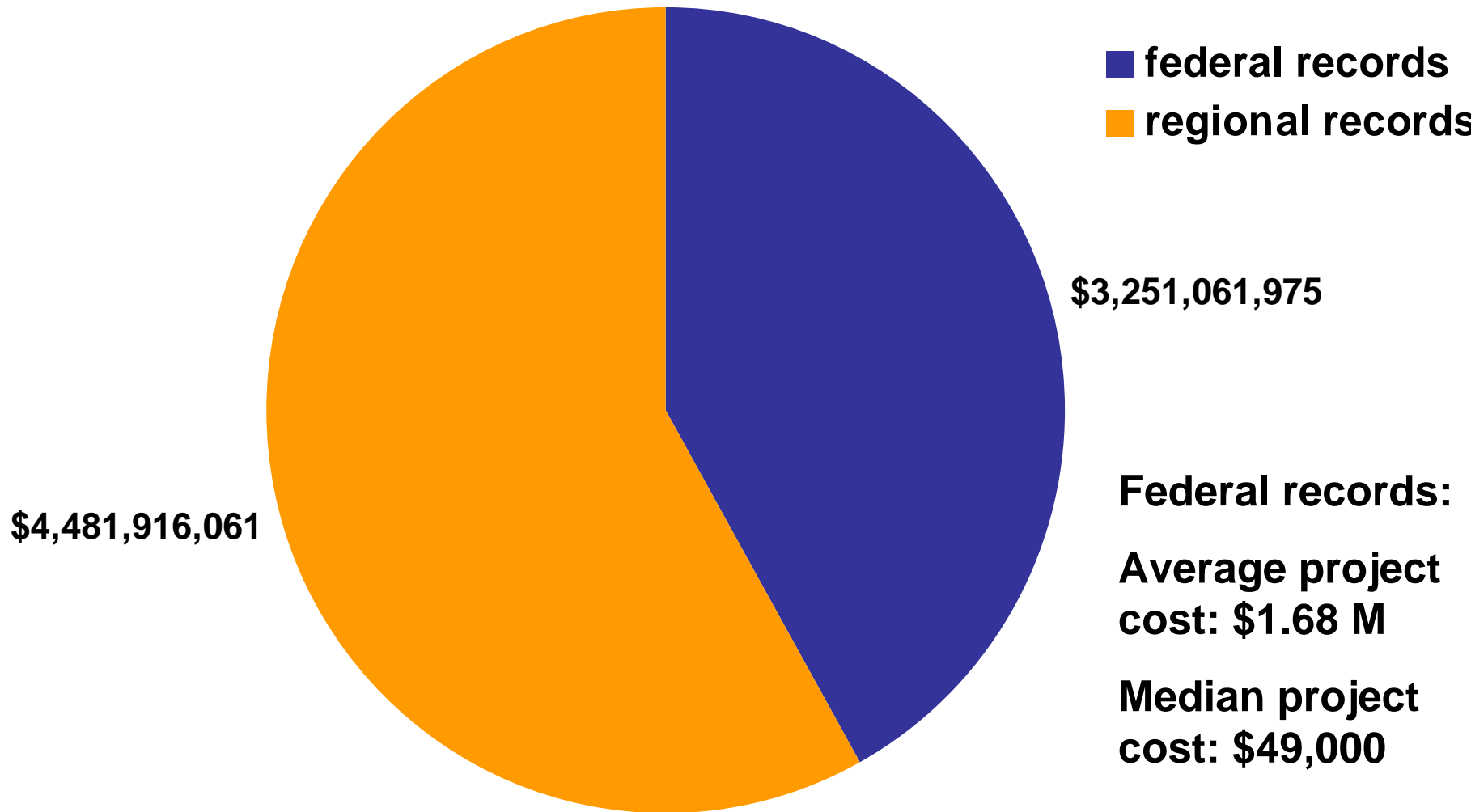
Number of Project Records

Project distribution by intent and data source

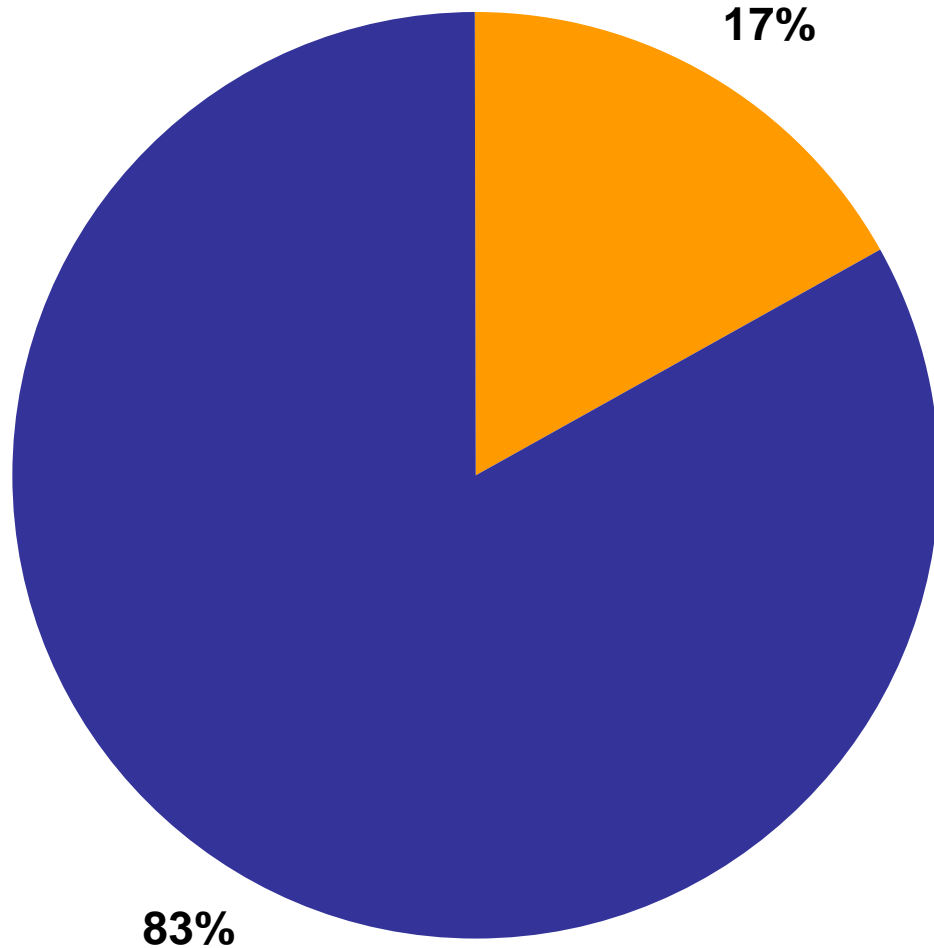


Distribution of project costs by data source

- federal records
- regional records

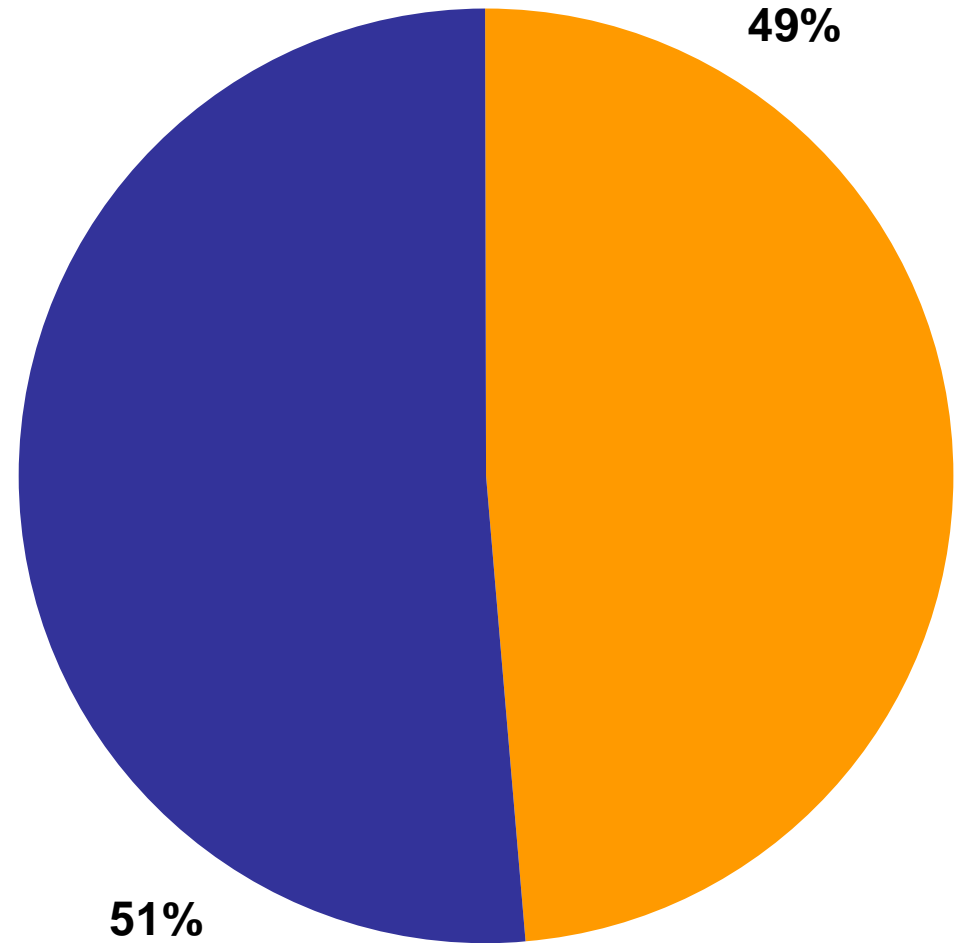


Federal records



Regional records

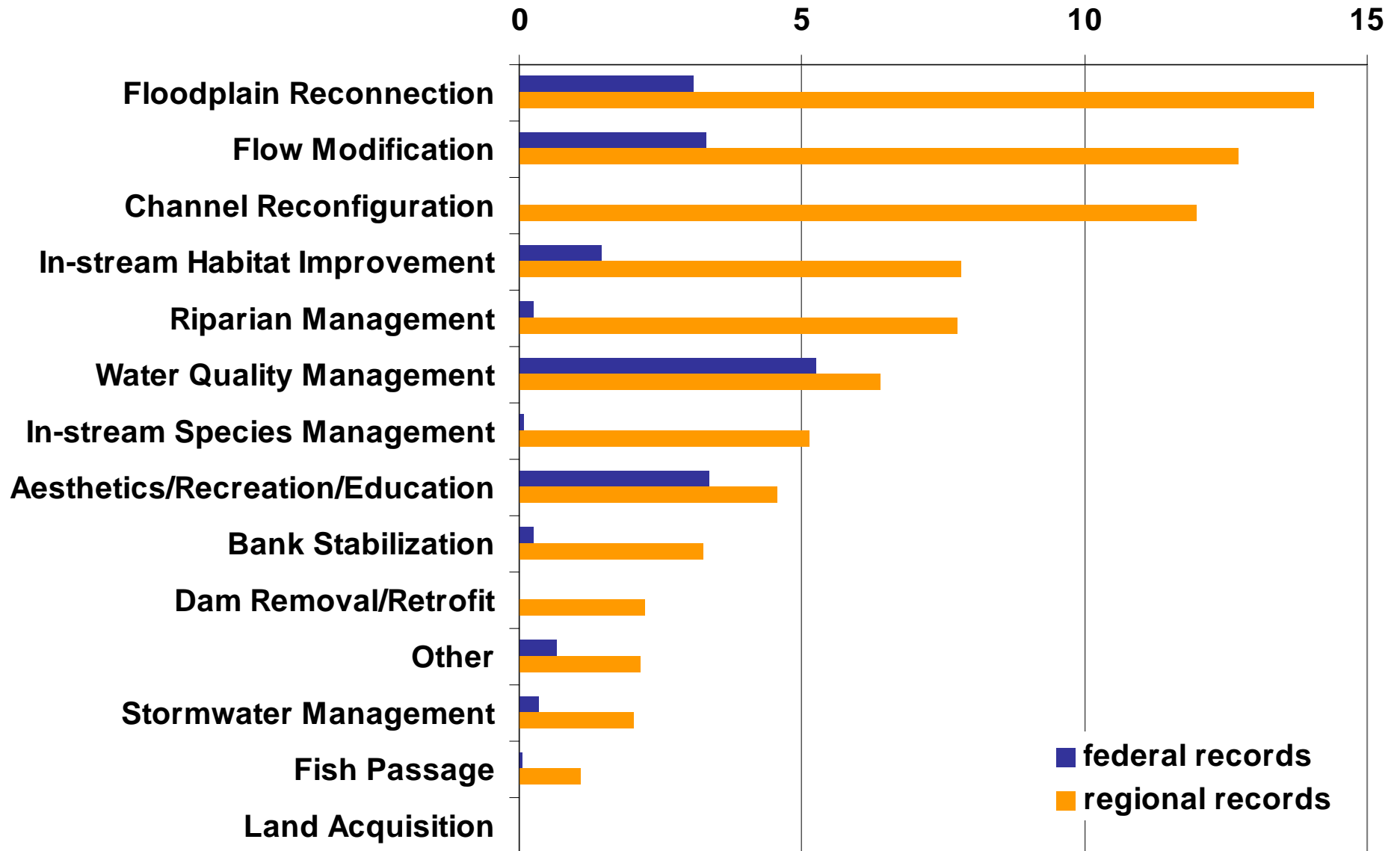
- no cost information
- with cost information



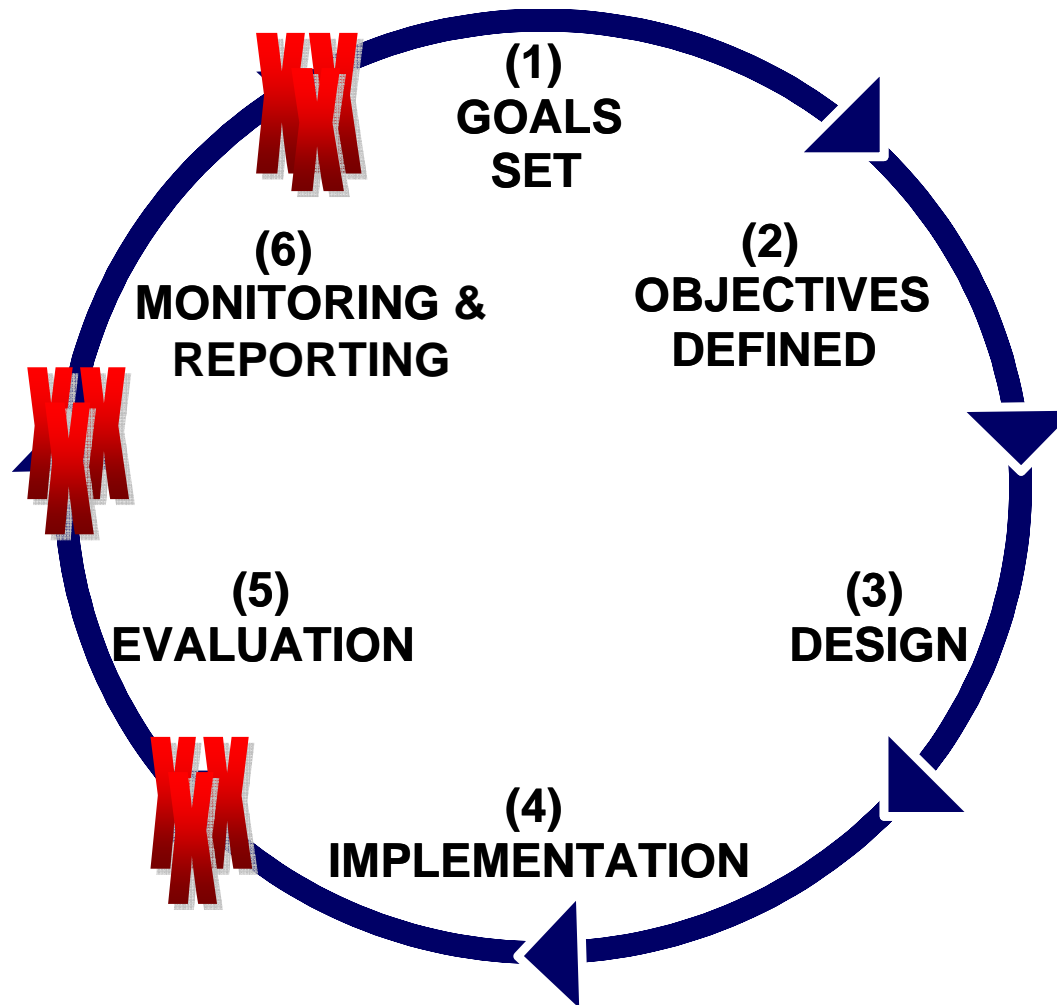
Although federal records are fewer in number, they capture project costs better than regional records.

Allocation of restoration project costs

% of reported project costs



What about monitoring and evaluation?



Common monitoring activities

Monitoring category

of monitoring occurrences

0

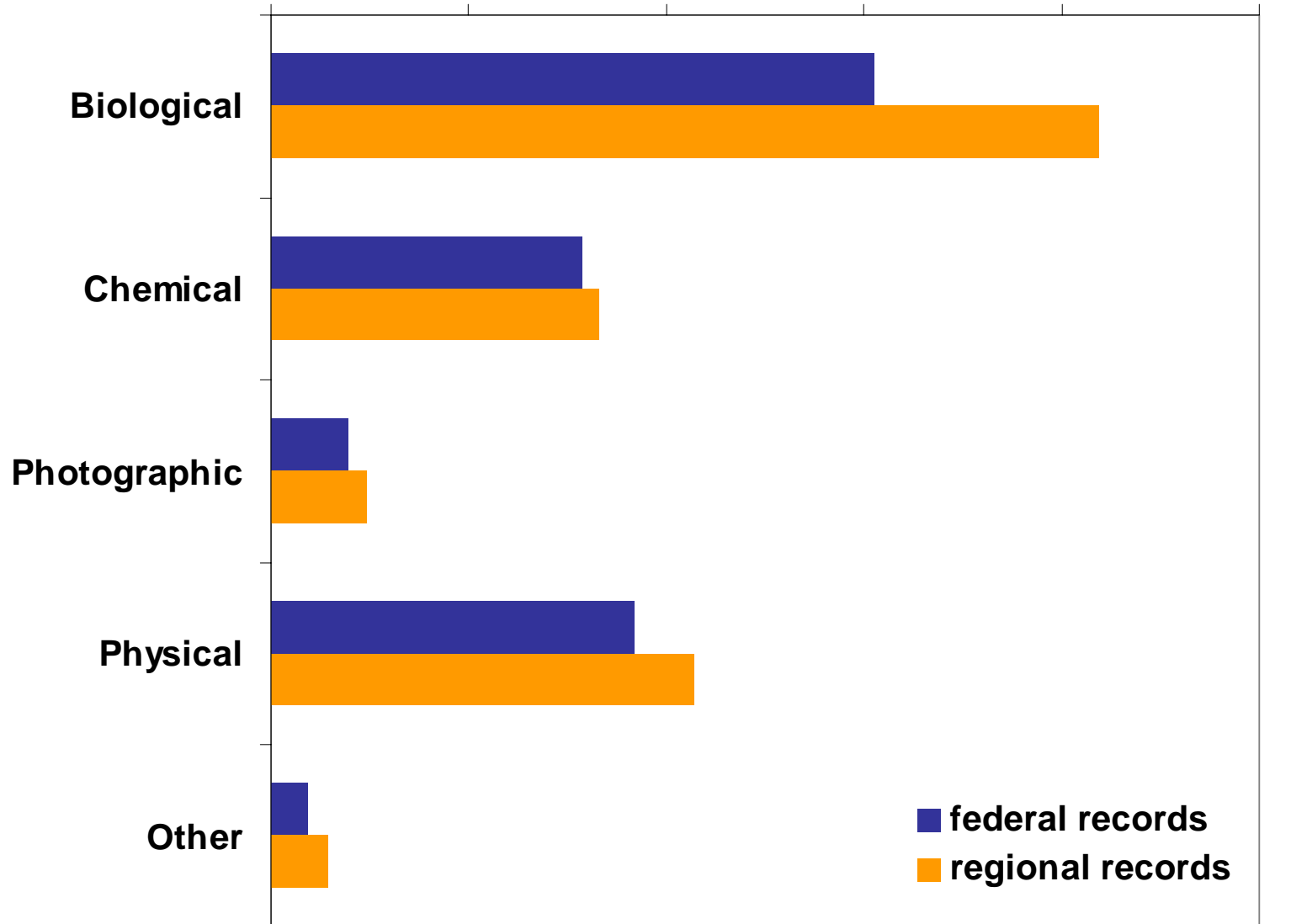
100

200

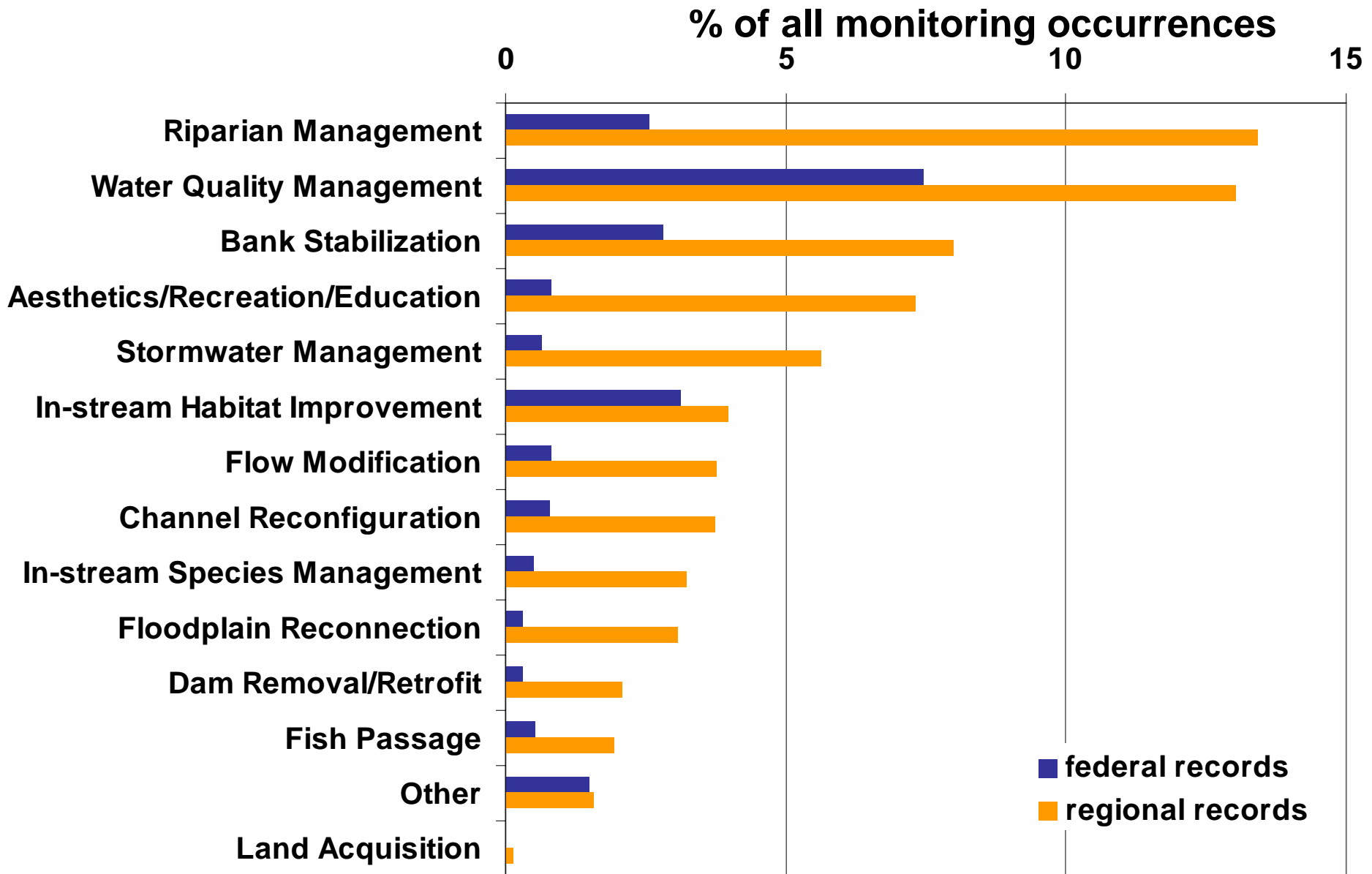
300

400

500

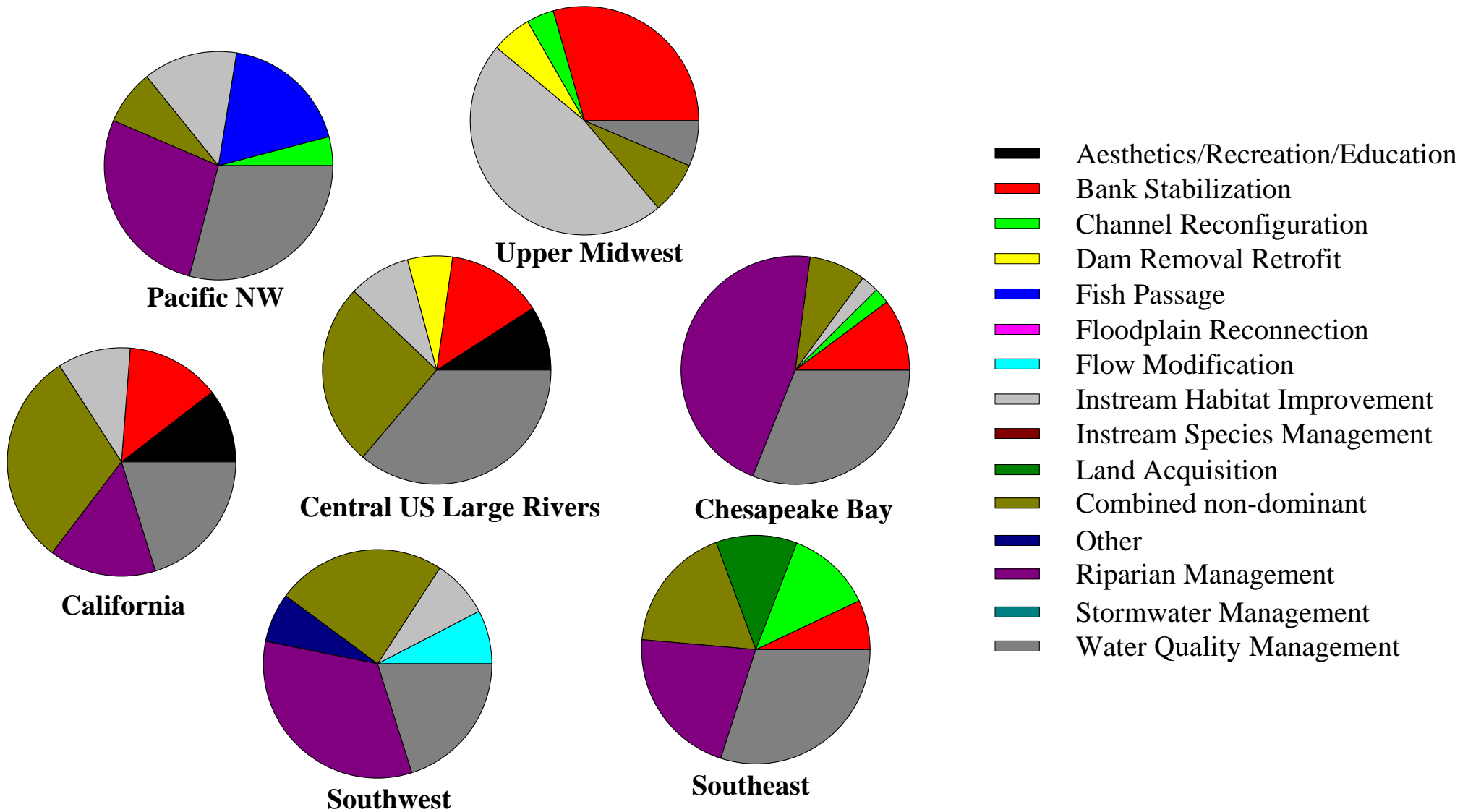


Monitoring by intent and data source

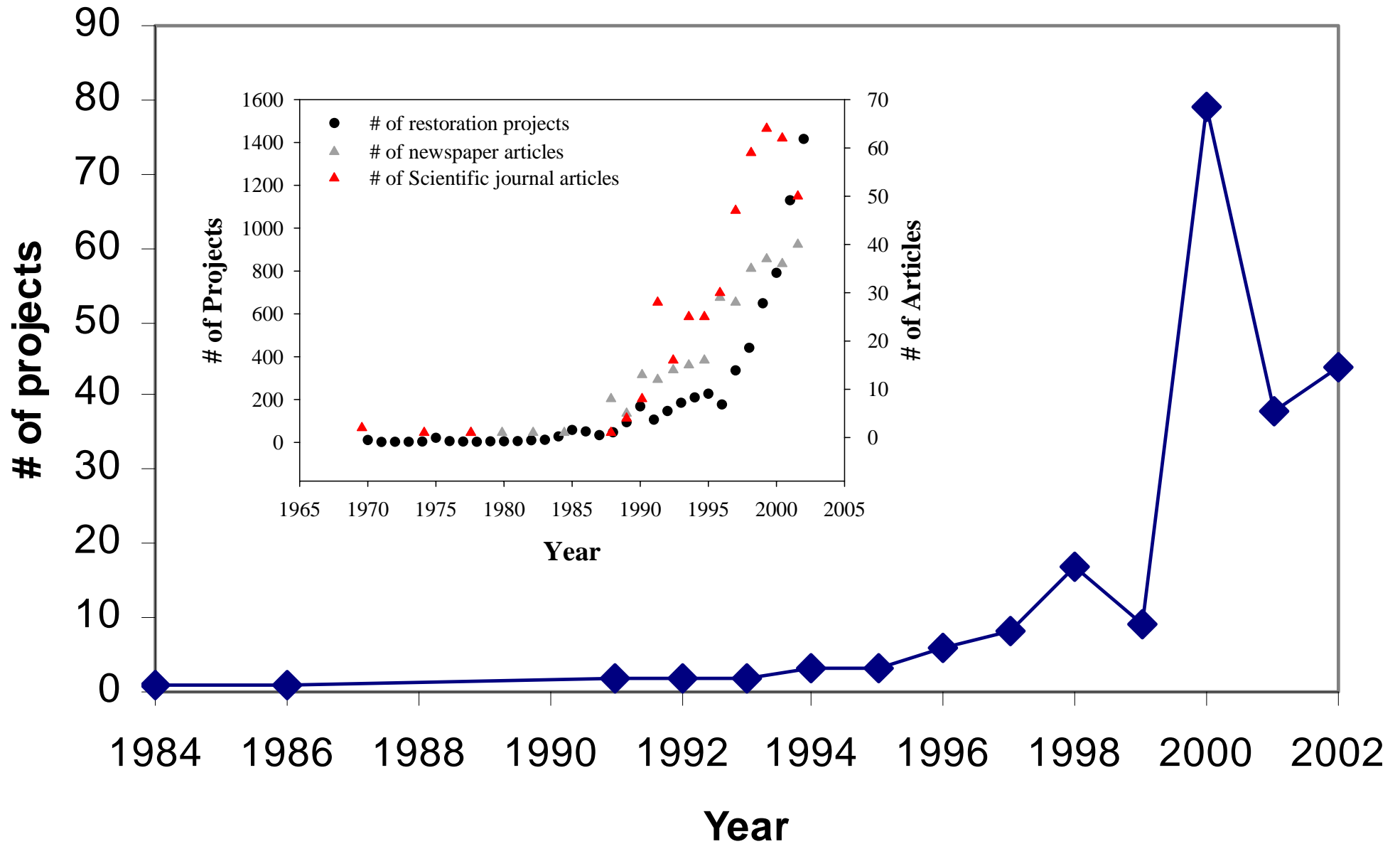


**Only 14% of all records indicate that monitoring has occurred
(22% federal & 10% regional records)**

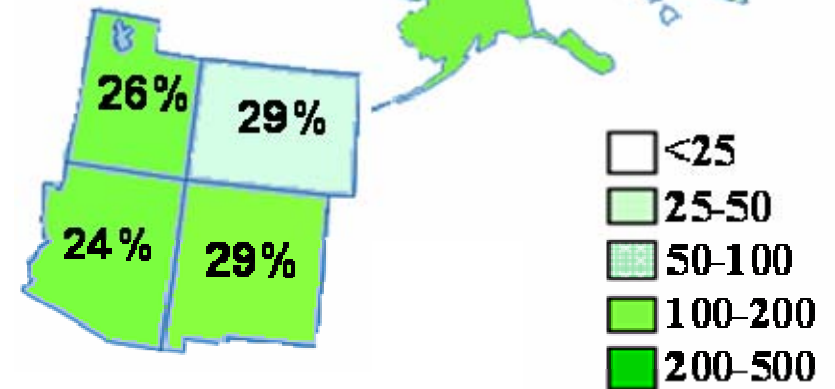
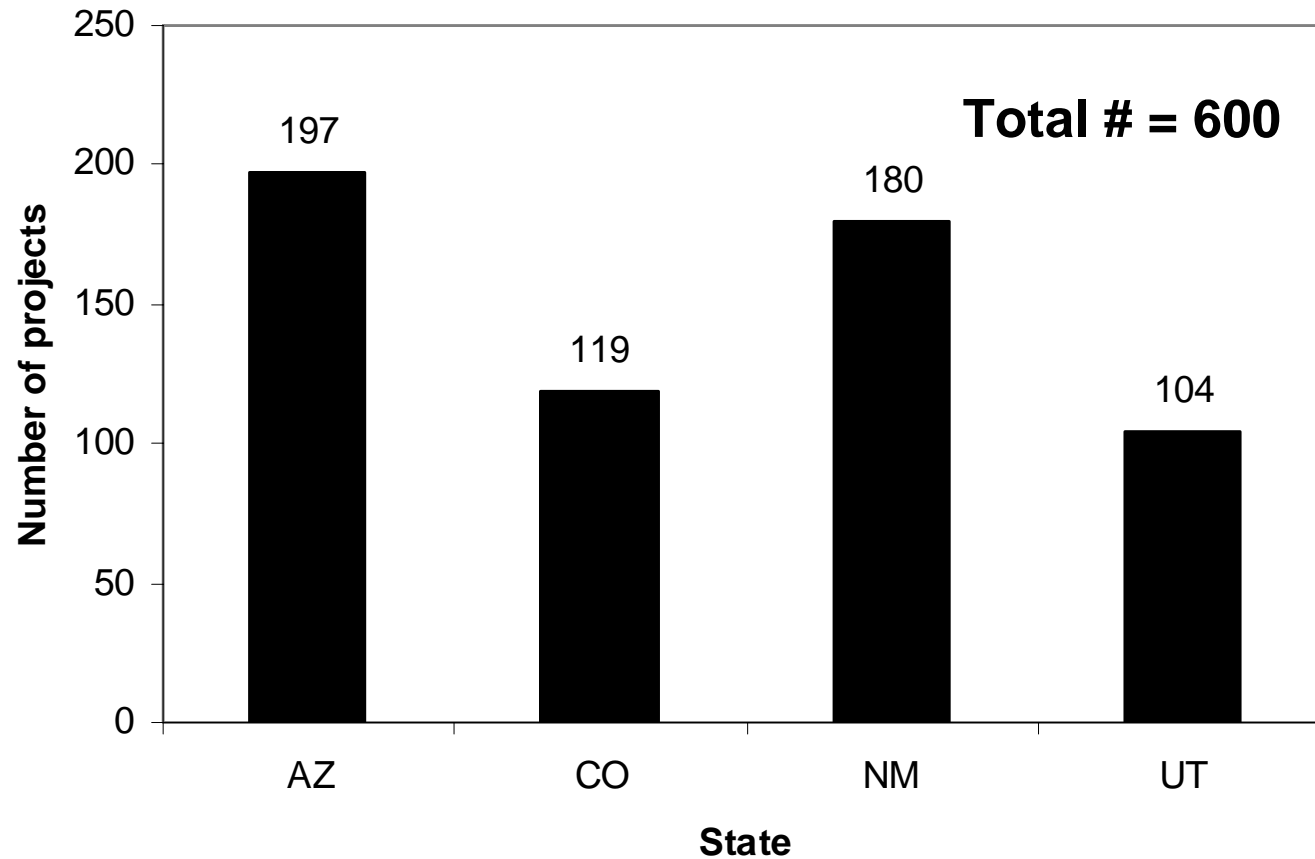
Regional differences in the distribution of types of restoration efforts



Number of Southwest restoration projects through time



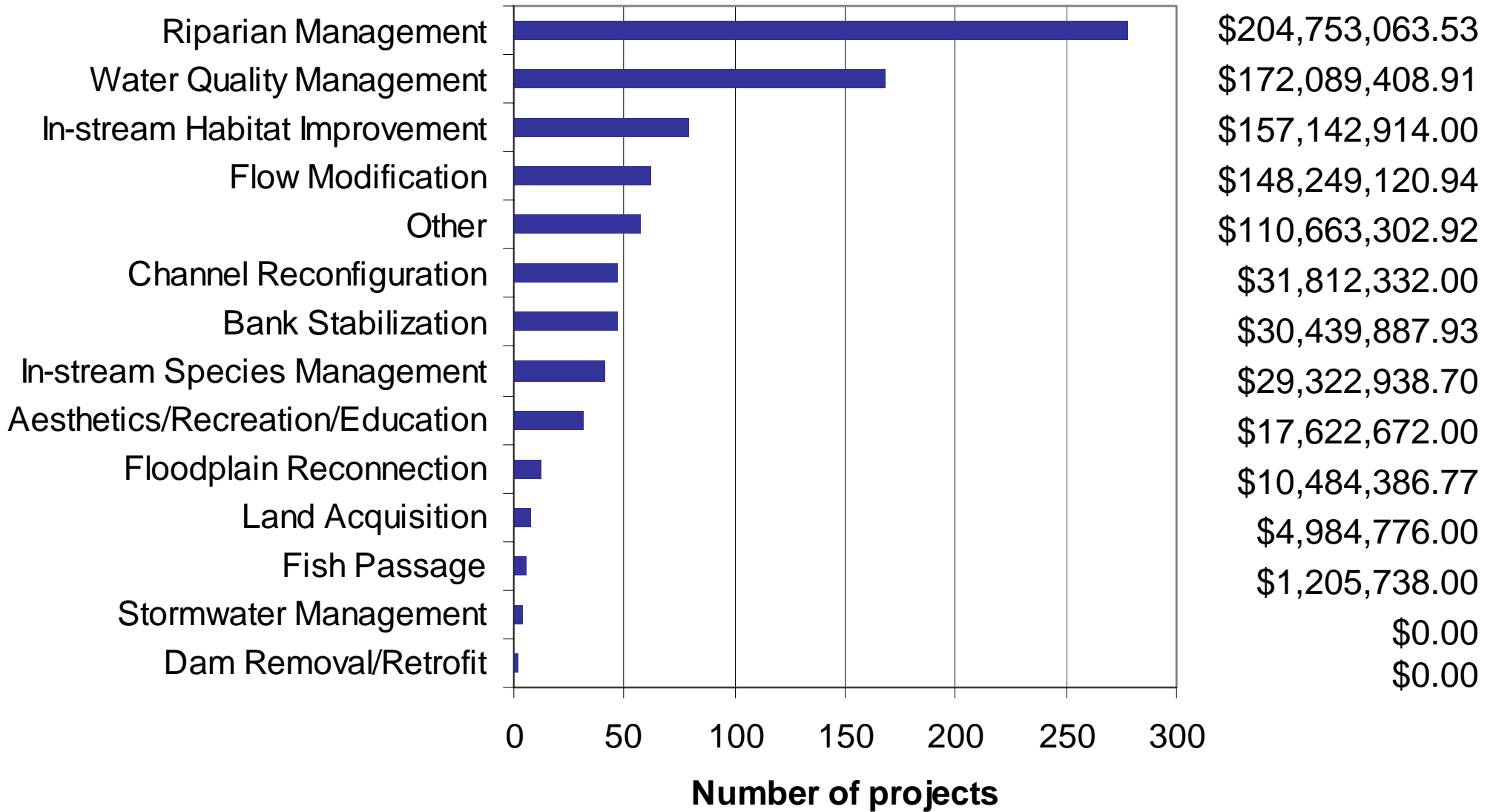
Distribution of projects & % monitoring occurrence by state



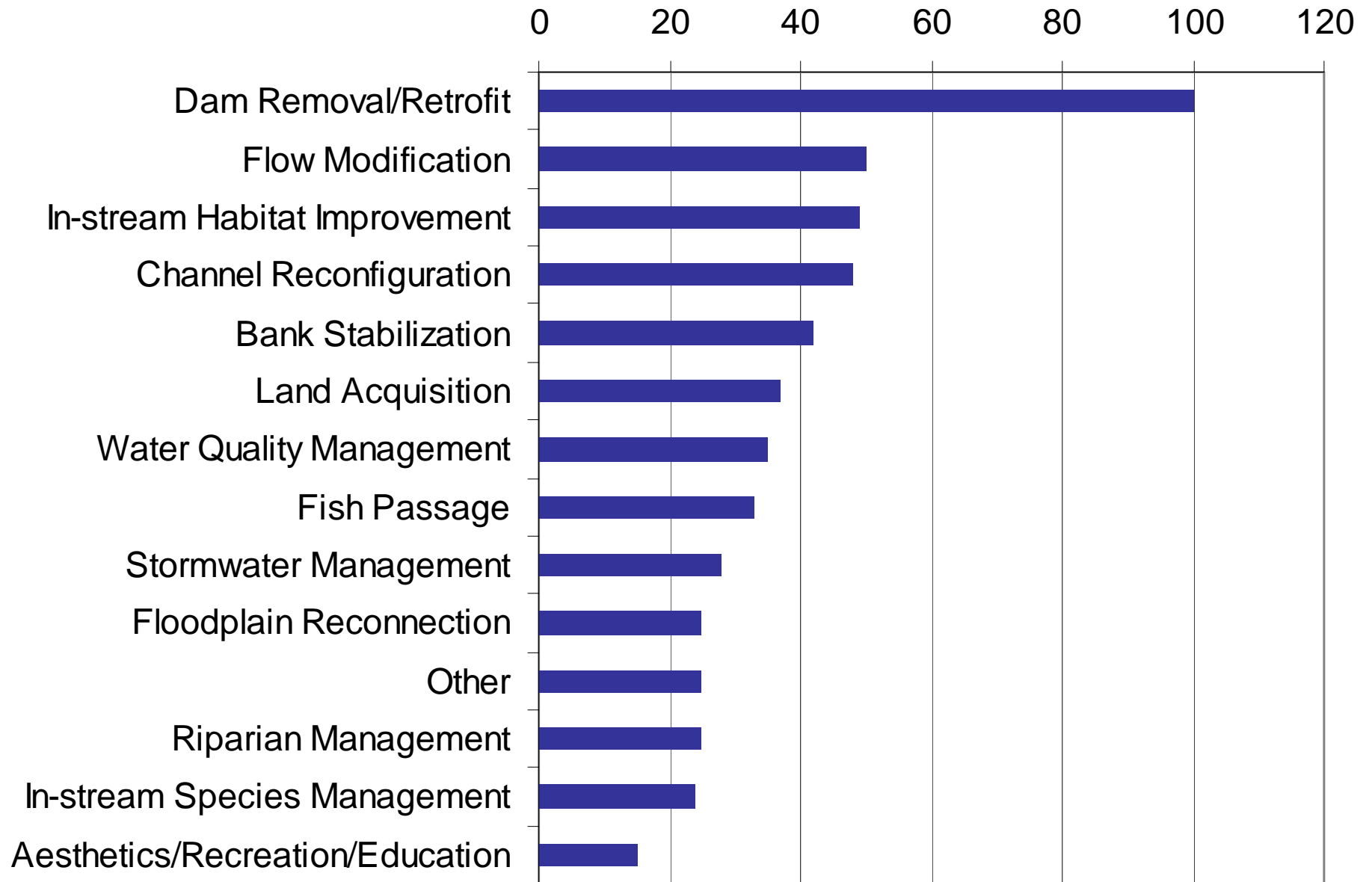
Summary Statistics

- 73% of projects with cost information
- Total reported cost: \$492 million
- Total estimated cost: \$503-\$668 million
- Median cost: \$69,466
- Mean cost: \$1,135,640
- Range of costs: \$1,648-\$116 million

Distribution and total cost of SW projects by intent



% of projects monitored in SW by intent



Overall monitoring of SW projects: 28%

Take home points:

- **Federal databases ...**
 - reflect only a small fraction of the total # of restoration projects
 - but comprise a significant fraction for some regions (e.g., Southwest)
 - are better at tracking cost & monitoring information than regional sources
- **Differences between federal and regional data sources and between the regions themselves exist because of ...**
 - different definitions of restoration by state
 - different regional management goals
 - different levels of coordination / cooperation between regional management authorities
- **Future challenges**
 - ↑ restoration activity in watersheds at risk
 - ↑ pre AND post project assessment as part of restoration design
 - ↑ reporting & tracking of restoration activities; database access
 - ↑ the efficiency (least # of fields with most information) and quality of restoration data collection & storage

Funding Acknowledgements:

NCEAS (NSF DEB-94-21535)

American Rivers

USGS National Biological Information Infrastructure

Cal-FED

C.S. Mott Foundation

David and Lucile Packard Foundation

Altria

IGERT Freshwater Sciences Interdisciplinary Doctoral Program
(NSF DGE-9972810)

Distribution and total cost of SW projects by intent

