

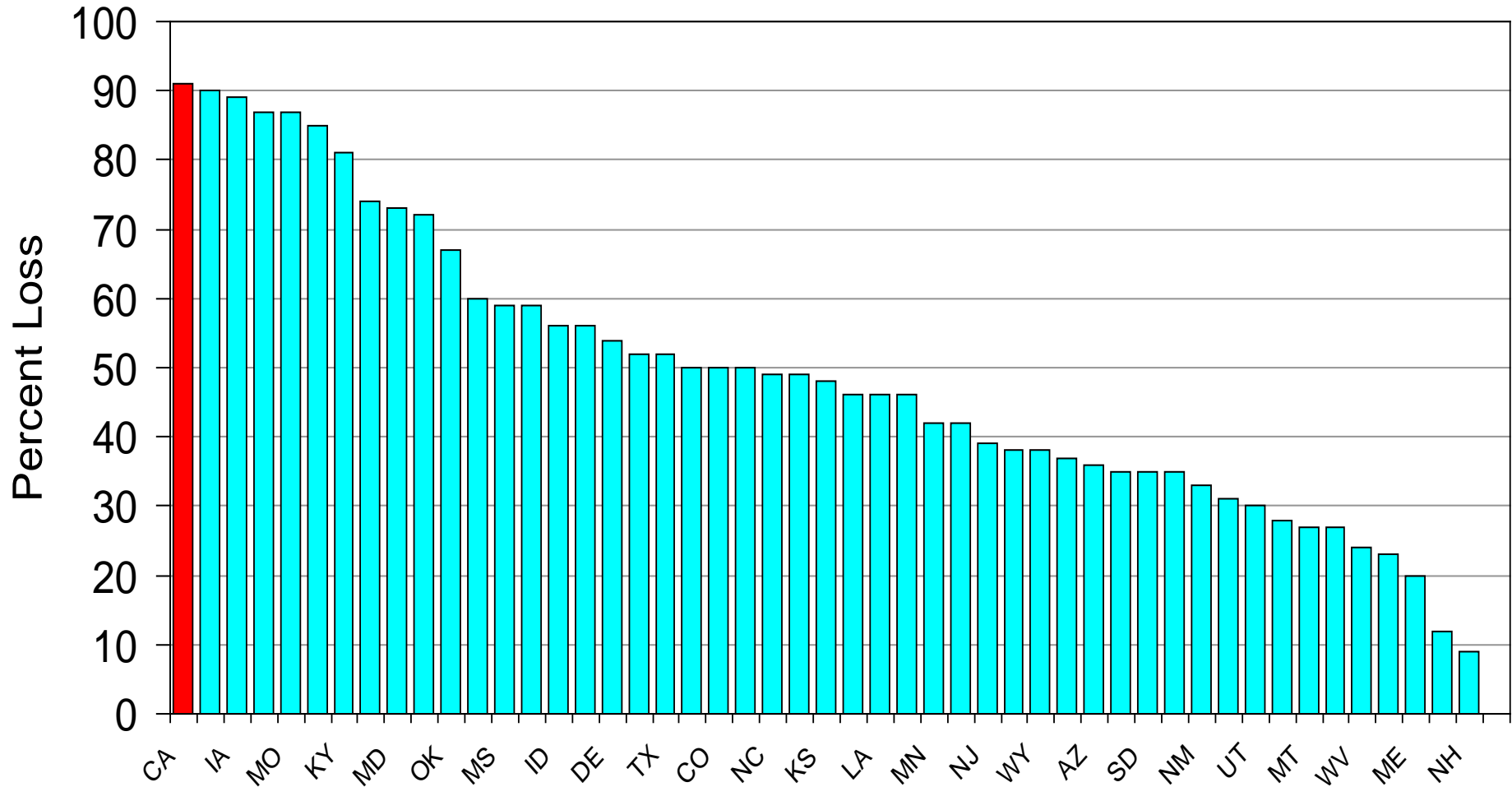
# Effective Monitoring of Wetland Restoration



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August 3, 2015

# Wetland loss in U.S. over last 200 years



Source: Dahl and Johnson 1991

# Wetland functions and services

- Primary productivity
- Nutrient cycling
- Wildlife habitat
- Migratory birds
- Flood control
- Groundwater recharge
- Water quality improvement
- Erosion control



# Why do we restore wetlands?

## Current Approach

- Regulatory requirements
  - Clean Water Act (§404 and §401)
- Ecosystem improvement
  - Coastal Conservancy, The Nature Conservancy, Ducks Unlimited

# Why do we restore wetlands?

## New Opportunities

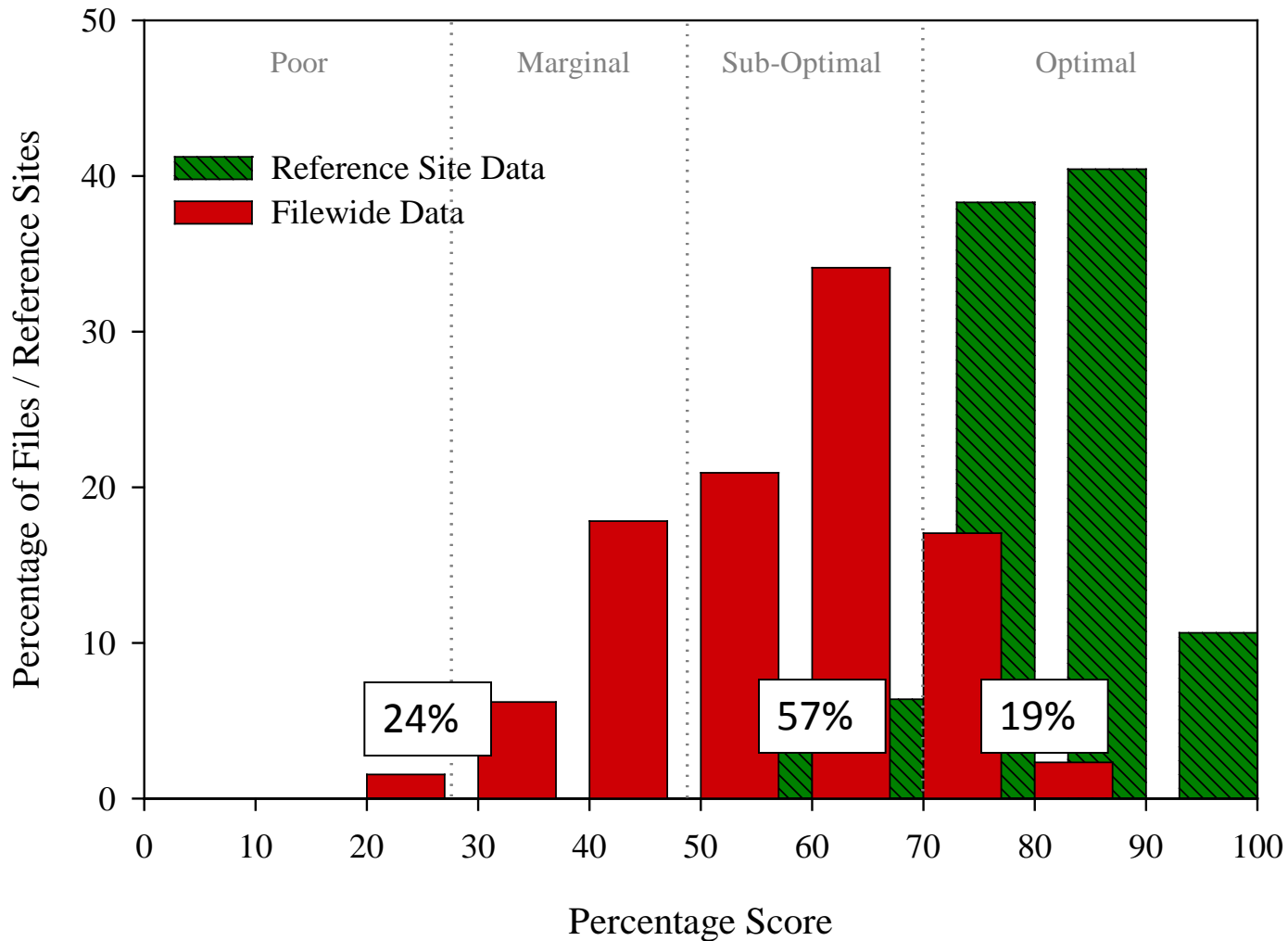
- Regulatory requirements
  - Clean Water Act (§404 and §401)
  - Stormwater management
  - Water quality trading credits
  - ???
- Ecosystem improvement
  - Coastal Conservancy, The Nature Conservancy, Ducks Unlimited
  - Payment for Ecosystem Services (PES)
    - Carbon sequestration

# How well does wetland restoration work?

It depends on the type of project and its goals

- Few compensatory mitigation wetlands function as well as natural wetlands
  - Mitigation wetlands need to replace lost functions and values (and services)
  - Mitigation wetlands should function like natural wetlands

# Summary of CA Compensatory Mitigation Study



# How well does restoration work?

## Lessons from compensatory mitigation

- Focus on fundamental wetland processes
  - For compensatory mitigation the focus of permit conditions was on vegetation and invasive plant species, which could be addressed without having the processes that are essential for wetland function
- Restored wetlands *can* provide enhanced wetland functions and services
- Wetland restoration is complex and outcome is not assured, so monitoring is critical



# How should restored wetlands be monitored?

It depends on the project

- Two types of monitoring
  - Compliance monitoring
    - For wetlands restored as a regulatory requirement, need to ensure the requirements are met
    - For wetlands restored as PES, need to ensure that services are provided
  - Functional or condition monitoring
    - For wetlands restored for ecosystem benefits, want to understand how well wetland functions and why

# How should restored wetlands be monitored?

It depends on the project

- Different intensities of monitoring
  - Rapid assessment vs. detailed assessment
  - Short-term vs. long-term
- Huge benefits from standardized monitoring approaches
  - Core and project-specific monitoring

# Core monitoring

- Core information should be collected at all restoration projects
- Need consistency to be able to compare outcomes
- Core monitoring can provide essential information in a consistent manner
  - This could include a rapid assessment method like the California Rapid Assessment Method (CRAM)
- The Southern California Wetlands Recovery Project has been working to develop core monitoring protocols

# Assessing wetland condition

## *California Rapid Assessment Method (CRAM)*

- 15 individual metrics scored in 4 attributes
  - Landscape context
  - Hydrology
  - Physical structure
  - Biological structure
- Scores combined into one total score plus 4 attributes
- Total score can range from 15 to 100



CRAM = 78



CRAM = 51



CRAM = 32

# Project-specific monitoring

- Detailed monitoring requirements depend on project goals
  - Project-specific goals (e.g., salmonids, endangered species)
  - Permit conditions
  - Verification (e.g., carbon sequestration projects)
- Do not need to monitoring the same parameters over the same time period for all projects
  - Intensified monitoring at target sites



# Monitoring period

- Typical 5-year monitoring period is not long enough to assess long-term performance of a restoration project
- Need to develop inexpensive ways to track projects over a long period
  - Remote sensing
  - Performance curves
- Monitor focal projects over extended period

# Adaptive management

- Monitor to improve performance of a particular project
  - Identify problems, help determine how to fix them
- Monitor to improve future performance of a program or type of restoration
  - Learn from experience
  - Avoid previous problems
  - Identify most effective approaches

# Monitoring Challenges

## Keeping track of project outcomes

- No Net Loss or Net Gain
  - Need to have good records
  - Need to have a regular state-wide assessment
- Need a comprehensive, centralized database
  - Have some databases for some types of projects
    - State and federal databases of mitigation projects
  - EcoAtlas provides a comprehensive database

# Keeping track of project outcomes

## No Net Loss or Net Gain

- Need to have good records of acreage
  - Need clear, consistent categories
  - Need to be clear about what counts: not all acres are the same
    - Not all compensatory mitigation acreage should count
      - Enhancement, preservation and upland projects do not lead to wetland gains
    - Do you want golf course lakes to count?
- Should include functions and services, not just acres

Where are the aquatic resources and how are they doing?

# EcoAtlas

[About EcoAtlas](#)

California EcoAtlas provides access to information for effective wetland management. The maps and tools can be used to create a complete picture of aquatic resources in the landscape by integrating stream and wetland maps, restoration information, and monitoring results with land use, transportation, and other information important to the state's wetlands.

- **Projects:** Restoration project maps, plans, contact information, and a library of project files.
- **Resource Extent:** Maps of aquatic resource extent and special habitats of interest.
- **Condition:** Assessment and monitoring data including relevant water quality and California Rapid Assessment Method (CRAM) data.

- Compilation of different databases
- Ability to add new project information



Statewide



Map

Projects

Summaries

Ecoregions

Water Board Regions

- 📍 🌐 📊 Klamath/North Coast
- 📍 🌐 📊 Bay/Delta
- 📍 🌐 📊 Central Coast
- 📍 🌐 📊 Modoc
- 📍 🌐 📊 South Coast
- 📍 🌐 📊 Sierra
- 📍 🌐 📊 Sacramento Valley
- 📍 🌐 📊 Mojave
- 📍 🌐 📊 San Joaquin Valley
- 📍 🌐 📊 Colorado Desert

# Monitoring Challenges

## Cost

- Monitoring can be expensive, and there is always a desire to maximize the restoration effort
- Need to develop low-cost monitoring protocols
  - Standardized protocols
  - New approaches (e.g., aerial assessments)
- Need to be strategic about what is monitored where
  - Develop sampling schemes for representative sites

# Conclusions

- Need a state-wide monitoring strategy
- Implement tiered monitoring
  - Core monitoring at all projects
    - Acreage and Basic conditions
  - Flexible additional monitoring
- Need to be innovative
  - Centralized independent monitoring, funding
  - Develop new monitoring approaches, sampling designs
  - Actually implement adaptive management

