The Association of State Wetland Managers Presents:

# Improving Wetland Restoration Success 2014 — 2015 Webinar Series

## *How Restoration Outcomes are Described, Judged and Explained*


***Contributors: Joy Zedler, Robin Lewis, Bruce Pruitt, Larry Urban & Richard Weber***

***Moderators: Jeanne Christie & Marla Stelk***

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# AGENDA

- **Welcome and Introductions** (5 minutes)
- **Restoration Webinar Schedule & Future Recordings** (5 minutes)
- **How Restoration Outcomes are Described, Judged and Explained** (60 minutes)
- **Question & Answer** (15)
- **Wrap up** (5 minutes)

# WEBINAR MODERATORS

Jeanne Christie,
Executive Director

Marla Stelk,
Policy Analyst

# PRESENTERS

Joy Zedler, Aldo Leopold Chair of Restoration Ecology, University of Wisconsin

Robin Lewis, Lewis Environmental Services, Inc. & Coastal Resource Group, Inc.

Bruce Pruitt, USACE Engineer Research & Development Center

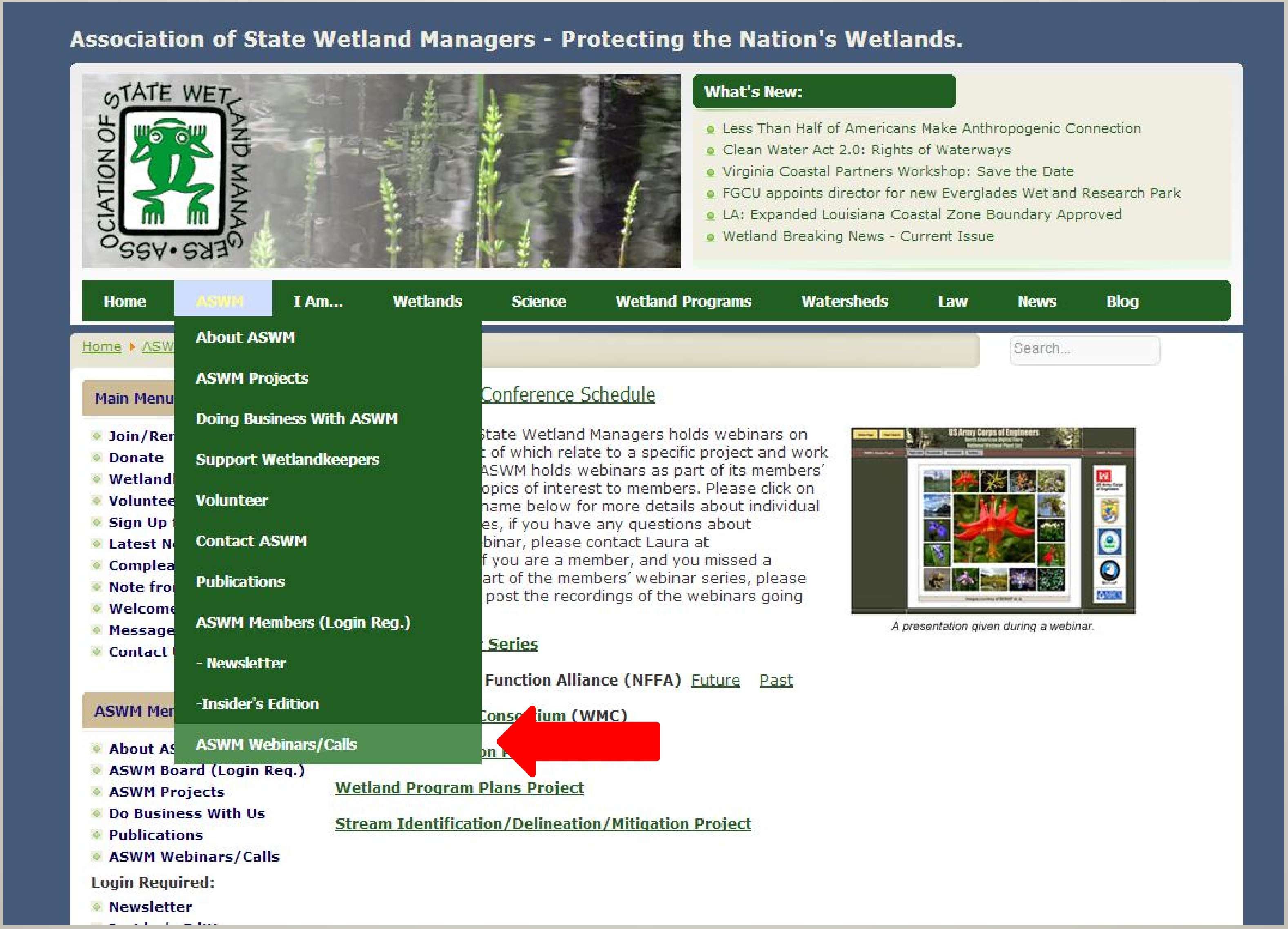
Larry Urban, Montana Department of Transportation

Contributor: Richard Weber, NRCS Wetland Team, CNTSC

# WETLAND RESTORATION PROJECTS

- Convened interdisciplinary workgroup of 25 experts
- Developing monthly webinar series to run through September 2015
- Workgroup will develop a white paper based in part content of webinars and participant feedback
- To be continued through 2016 in an effort to pursue strategies that:
  - Maximize outcomes for watershed management
    - Ecosystem benefits
    - Climate change adaptation
  - Improve permit applications and review
  - Develop a national strategy for improving wetland restoration success

# WEBINAR SCHEDULE & RECORDINGS



# WEBINAR SCHEDULE & RECORDINGS

# FUTURE SCHEDULE - 2014

- **Thursday, October 2, 3:00pm eastern:**
  - History of Wetland Drainage in the U.S. (Tom Biebighauser, Wetland Restoration and Training)
- **Thursday, November 4, 3:00pm eastern:**
  - How to Prepare a Good Wetland Restoration Plan (Richard Weber, NRCS Wetland Team, CNTSC; Tom Harcarik, Ohio EPA, Division of Environmental & Financial Assistance; John Teal, Woods Hole Oceanographic Institution (Scientist Emeritus); Lisa Cowan, Studio Verde
- **Tuesday, December 9, 3:00pm eastern:**
  - Atlantic/Gulf Coast Coastal Marshes and Mangrove Restoration – Robin Lewis, Lewis Environmental Services, Inc. & Coastal Resource Group, Inc.; John Teal, Woods Hole Oceanographic Institution (Scientist Emeritus); Joseph Shisler, ARCADIS; Jim Turek, NOAA Fisheries Restoration

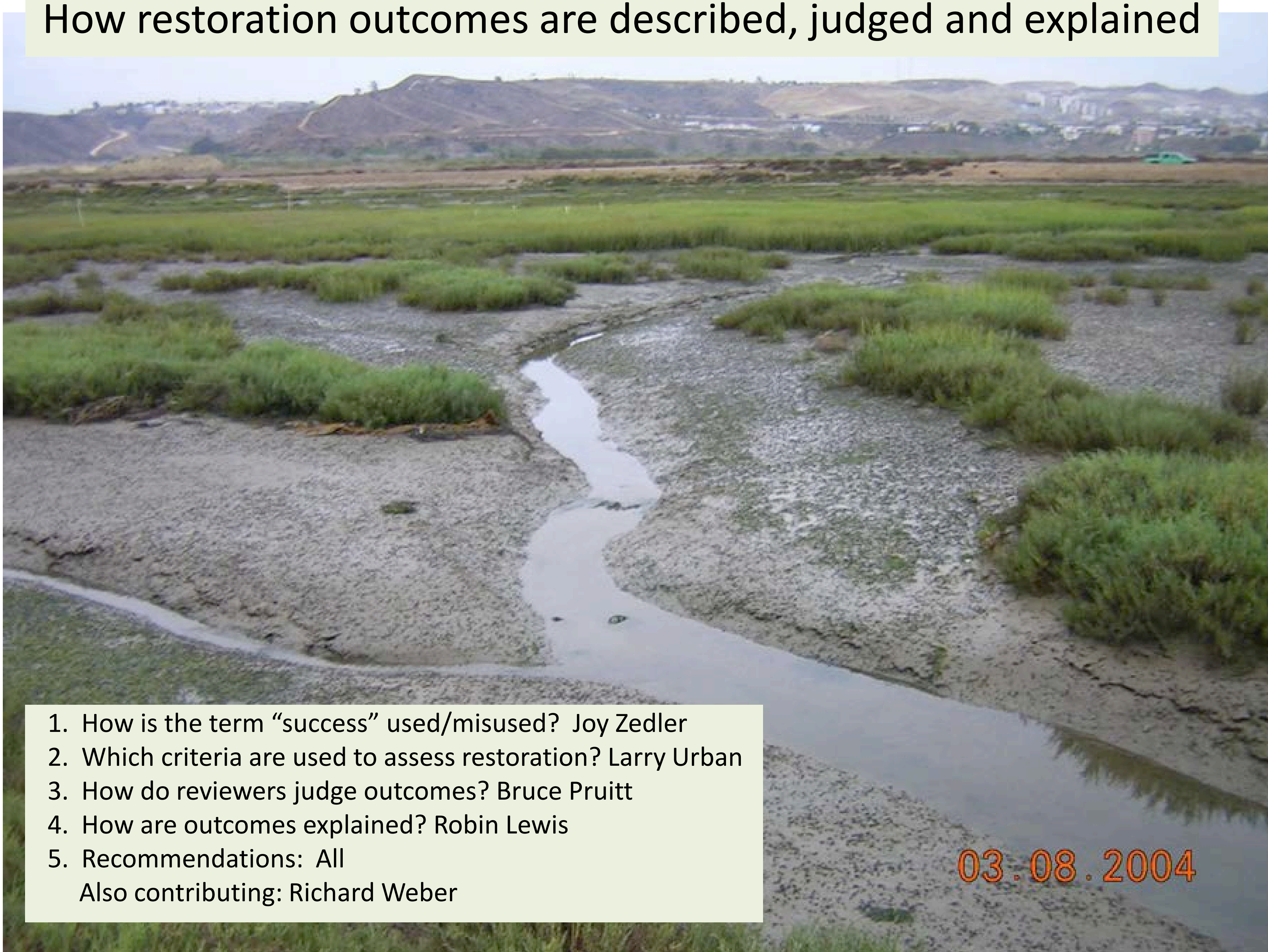
# October 2 Webinar:

## History of Wetland Drainage in the U.S.

## — Tom Biebighauser, Wetland Restoration and Training

Abstract: The main reason so many wetland projects are unsuccessful is that the builder has failed to disable historic drainage structures. People have been burying rock, wood, brick, clay, concrete, and plastic pipe in the ground to dry wetlands since Europeans began cultivating North America. This presentation will show you exactly how wetlands were drained and filled, and how you can spot the ghost of a wetland drained over 300-years ago.

# How restoration outcomes are described, judged and explained




1. How is the term “success” used/misused? Joy Zedler
2. Which criteria are used to assess restoration? Larry Urban
3. How do reviewers judge outcomes? Bruce Pruitt
4. How are outcomes explained? Robin Lewis
5. Recommendations: All

Also contributing: Richard Weber

# 1. How is "success" used/misused? J. Zedler

I restored it, so it's a success.

We spent a million bucks, so it's a $ucce$$.

**It's green, so it's a success.**

I took a course in restoration, so it's a success.

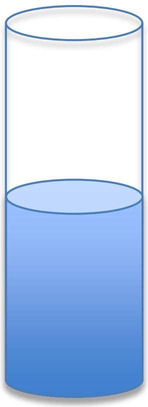
Mom likes it, so it's a success.

I saw a marsh bird, so it's a success.

If NOTHING is right,
It's still "on its way to success"

# Do data support “success”?

Jones & Schmitz (2009) “We provide **startling evidence** that …**recovery is possible and can be rapid**, …giving much **hope** for humankind…..”



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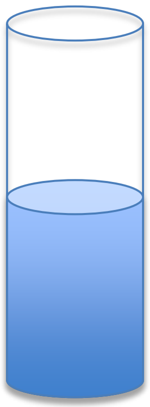
Reviewed 240 studies from 1910-2008

20% used pre-perturbation data and 58% used reference sites.

“Accordingly, the possibility existed that authors relied on an implicit and **subjective definition of recovery…**.”

Jones HP, Schmitz OJ (2009)
Rapid Recovery of Damaged Ecosystemss

# A global meta-analysis of 621 wetlands



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"even a century after restoration efforts,
**biological structure**
(driven mostly by plant assemblages), and
**biogeochemical functioning**
(driven primarily by the storage of carbon in wetland soils),
**remained on average 26% and 23% lower, respectively, than in reference sites."**

"Restoration performance is limited**:** current restoration practice **fails to recover original levels of wetland ecosystem functions, even after many decades**."

Moreno-Mateos et al. 2012

Abstracts In 2 restoration journals, 2000-06:

| | |
|---|---|
| used “success” | 116 |
| used “failure” | 10 |

Zedler, J. 2007

| Informal poll, 7/14/2014 | Google hits | Web of Science |
|---|---|---|
| – “ecological restoration success” | 530,000 | 4 |
| – “ecological restoration failure” | 4 | 0 |

Reality -- or reluctance to say “failure”?

# When is non-compliance a "failure" ?

COMPLIANCE: All criteria met …….

and acres restored > acres lost …..

NON-COMPLIANCE:

- No criteria met ……………………….
- Some criteria met ……………………
- Some criteria nearly met …………
- All criteria nearly met ……………..
- All criteria met or nearly met ……
- Acres restored < acres lost ……

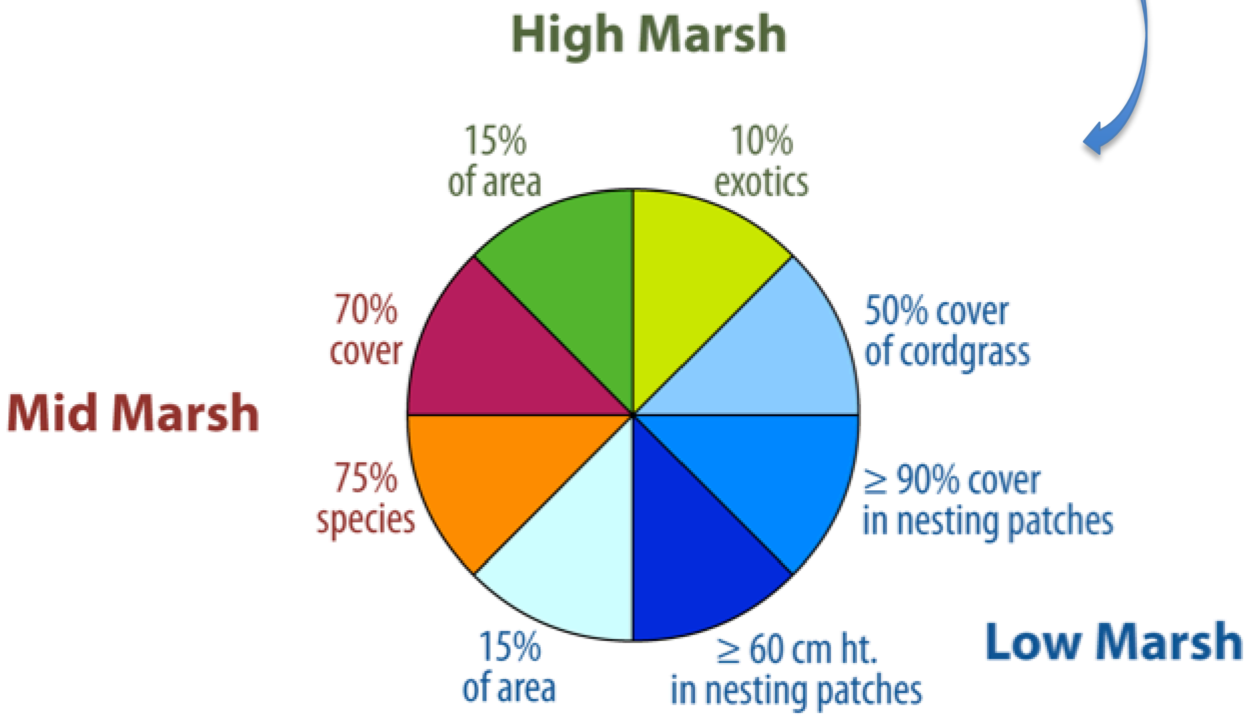
How would you judge the following example?

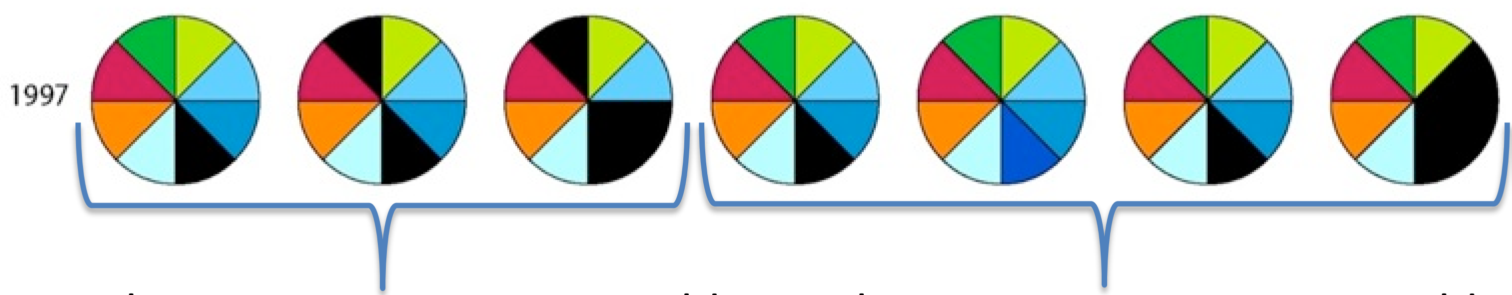
# Federally endangered bird in San Diego Bay:

## 2.5-acre “home ranges” each with 8 criteria

Light-footed clapper ra
(*Rallus longirostris levi*

Black = not met




In 1997: 3 home ranges were 8 yrs old

4 home ranges were 13 yrs old

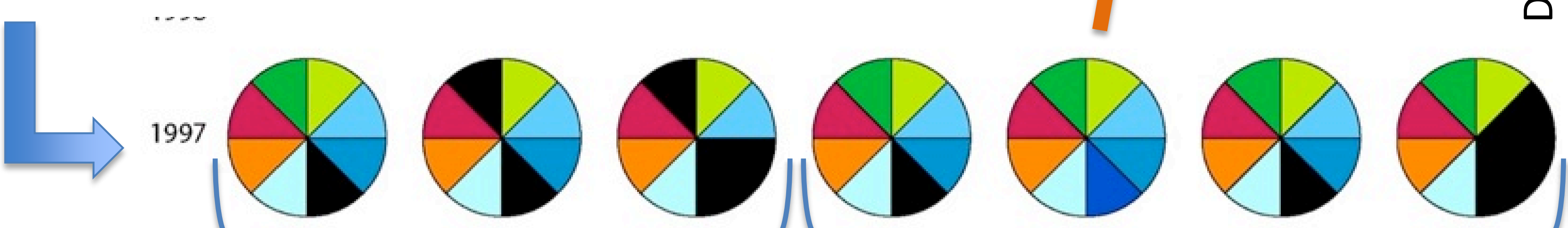
Data summaries by PERL (K. Boyer, J. Zedler, et al.)

# USFWS judged it "not in compliance." Cordgrass was too short for nesting.

Light-footed clapper rail never nested*;* data from 1997 were good predictors

Only 1 of 7 "home ranges" met all 8 criteria

Black = not met




In 2014: 3 home ranges are 25 yrs old

4 home ranges are 30 yrs old

Data summaries by PERL (K. Boyer, J. Zedler, et al.)

# Regulatory use of “success”

- Regulators use identifiable and measureable
  - **performance standards,** which “are observable or measurable physical (including hydrological), chemical and/or biological attributes that are used to determine if a compensatory mitigation project meets its objectives.” [2008 Mitigation Rule; 33CFR332]

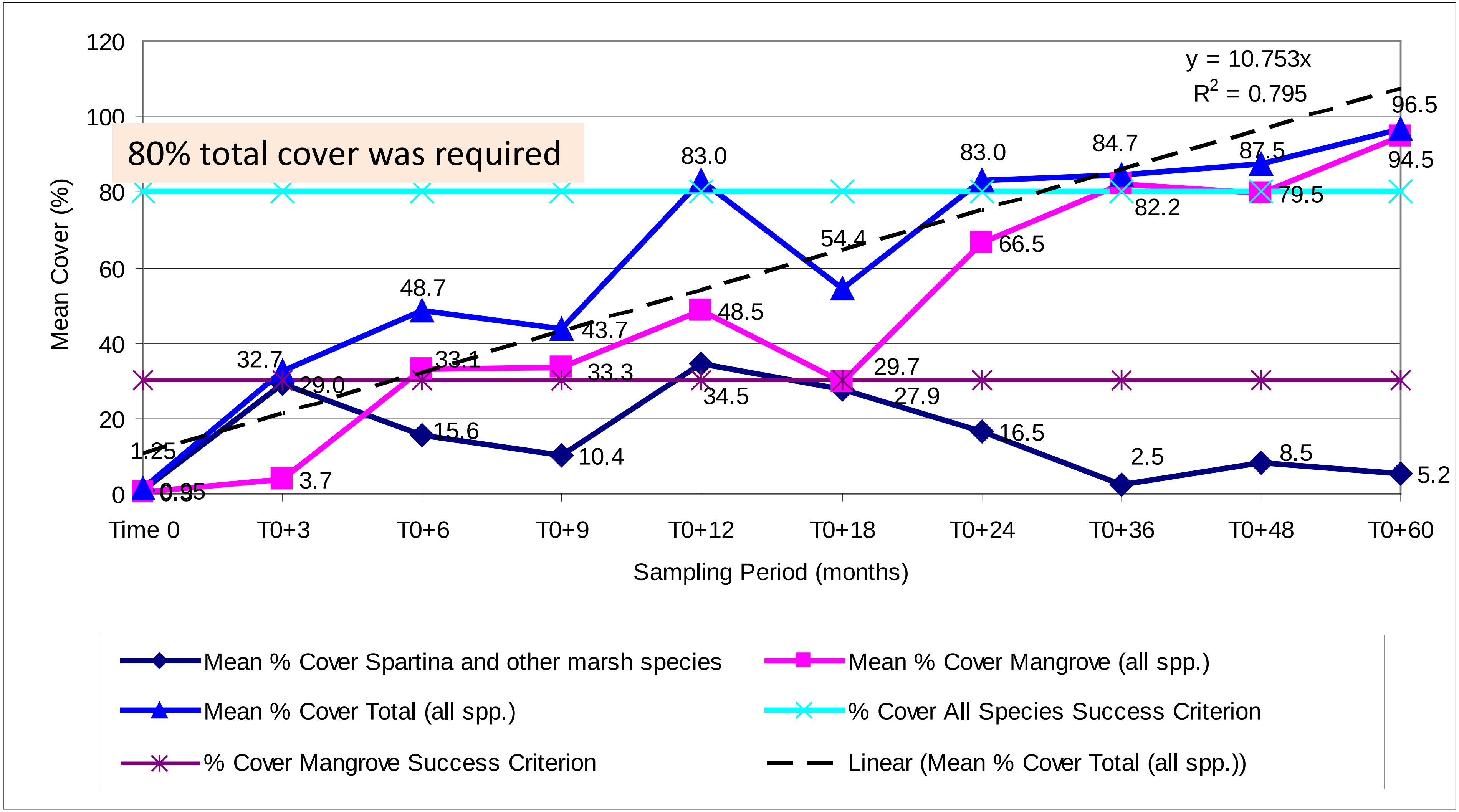
  Or

  - compare with **reference aquatic resources,** which “represent the full range of variability exhibited by a regional class of aquatic resources as a result of natural processes and anthropogenic disturbances." [2008 Mitigation Rule; 33CFR332]

The site must perform pre-determined functions or perform as in reference conditions.


Gathering data

# Changes in % plant cover over time




From Lewis et al. 2005

Lewis defines success as ‘the achievement of quantitative criteria established during design and permitting of a project and before construction begins, and measured and reported regularly during project monitoring.’ If success criteria are quantitative and measurable, scientists can measure and report them.

Zedler avoids the term:  Scientists measure conditions, structure, processes, ecosystem development, similarity to reference sites, and potential for self-sustainability – scientists do not measure “success.”

Compromise: Use “success” only if it adds more than confusion.

1. How is the term "success" used/misused?
2. Which criteria are used to assess restoration? Larry Urban


http://www.fws.gov/northeast/nyfo/partnerswetland.htm

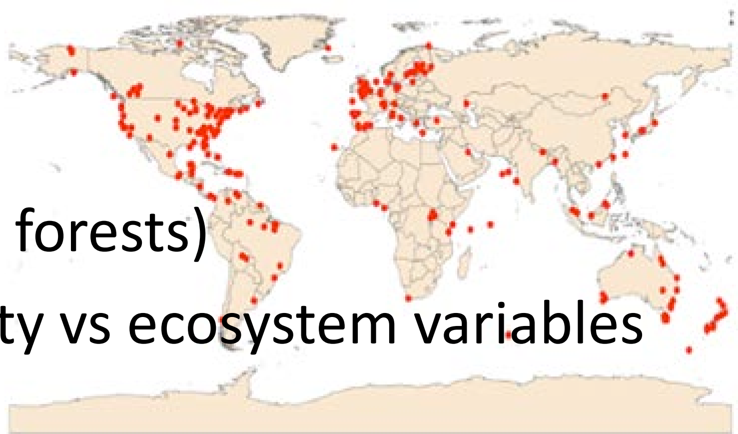
## Jones & Schmitz (2009): 240 terrestrial & aquatic studies, 1910-2008

**Many variables, no simple indicators**:

No consensus on which of 94 variables best predict recovery.

A dilemma: 94 variables could not be monitored in a single project.

- 83 studies demonstrated recovery for all variables,
- 90 studies reported a mixture, and
- 67 studies reported no recovery



**Large range in recovery time** 10-40 yrs (for forests)

- No diff in recovery time for community vs ecosystem variables

Jones HP, Schmitz OJ (2009) Rapid Recovery of Damaged Ecosystems. PLoS ONE 4(5): e5653.

# Moreno-Mateos (2012): 621 wetlands

J. Desmond sampling fish; photo: JZ

## “Restoration performance is limited.”

Biological structure & biogeochemical functioning averaged 26% % 23% <ref sites.

| **Wetland structure & function** | **Most common variables measured** |
|---|---|
| Hydrology | Water level, flooding regime, water storage |
| Biological components | |
| Vertebrates | Abundance, density, species richness, occupancy |
| Macroinvertebrates | Density, abundance, species richness |
| Plants | Plant cover, species richness, biomass, abundance |
| Biogeochemistry | |
| C storage & cycling | Soil total & organic C, respiration rate, mineralization rate |
| N storage & cycling | “ “ N, denitrification, & nitrification |
| P storage | “ “ P, Ca-Fe-Al bonded P |
| Other elements storage | Salinity, soil Fe, Al, Ca, K,Mn, Mg, water dissolved $O_2$ |
| Organic matter accumulation | Soil org. matter, bulk density, soil texture, soil moisture |

# In Montana… (Urban, 2014)


- HGM is used only in a cursory manner
  - Too time-consuming and costly
  - Riverine HGM model is solely for big rivers
  - Doesn't describe MT wetlands well
- The Cowardin and LLWW* systems most accurately reflect the kinds and types of wetlandsin Montana.
- MDT has used the Montana Wetland Assessment Method (MWAM) since 1989
  - determines functionality of wetlands impacted by transportation projects
  - 4 revisions address changes in wetland science; latest in 2009
  - incorporates some mechanisms of HGM matrixes

- MWAM Manual: http://www.mdt.mt.gov/other/environmental/external/wetlands/2008_wetland_assessment/2008_mwam_manual.pdf
- Electronic Form: http://app.mdt.mt.gov/wetlands-form/

*Landscape position, landform, water flow path and water body type (Tiner)

# In general… (Urban, 2014)

- Restoration efforts should focus on restoring degraded/damaged wetland and stream systems.
- Reference wetlands should only be used as a tool for planning wetland restoration activities.
- A reference wetland will always be ahead of a newly restored wetland based upon its "maturity"
- To make a comparison of them is an injustice to both as even reference wetlands change…..

# Restoration of Degraded Wetlands
# Big Hole Grazing Association Site

**Plugged Drainage Ditch in Fall 2007 – Hydrology returned**


**By 2011 – Hydrophytic Vegetation quickly re-established.**


Reference Wetland in Bitterroot Valley after forest fires
of 2000 and 2001 Spring runoff. Note 4ft high T-post.

# Ruiz-Jaen & Aide (2005 review): Few measures per site

Most frequent restoration technique
-- planting seedlings 56%, direct seeding 31%, both 13%.

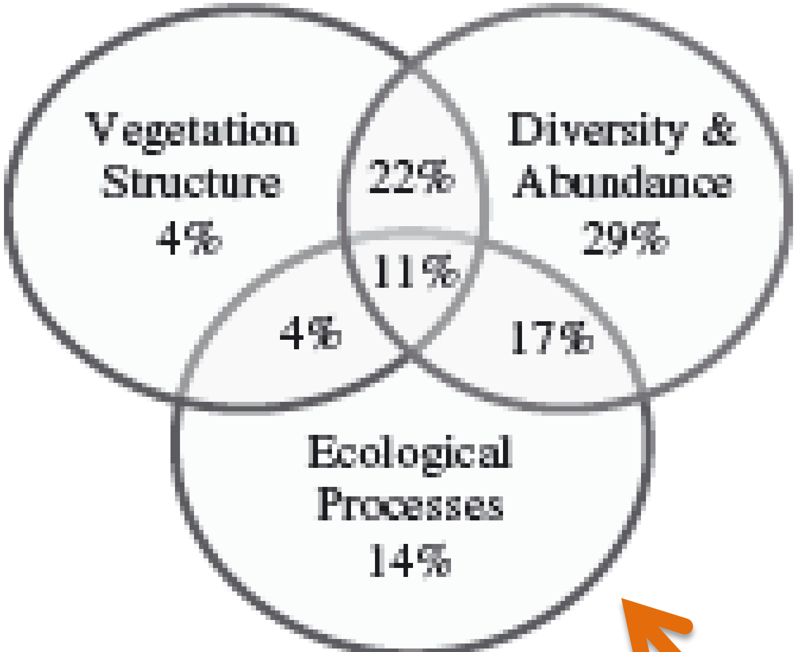
## Number of attributes measured

-- One: 2 studies 3%, diversity
-- Two: 40 studies 59%
28 diversity + vegetation structure, 6 diversity and ecological processes, and 6 vegetation structure and ecological processes
- Three: 26 studies (38%) --8 of which = wetland

**Details** Of 468 **pub's in *Restoration Ecology* (1993–2003):**
68 evaluated restoration "success" after seeding or planting
N. America 53%, Australia 19%, Europe 16%, Africa 4%, S. America 4%, Asia 3%.

Ecosystem type
-- wetlands (19%= under-represented), grassland (16%). montane forest (13%).
Previous land use
-- mining (36%) [6 were wetland]; agriculture (18%).

# Wortley et al. 2013 review




301 global studies in 71 journals, 2008-12

From 31 countries
Modal age of projects: 5–10 years
Forests 50%; Grasslands 22%; Riparian 9%;
Woodlands, shrublands and savannas 20%
Degradation: Agriculture and grazing 44%
Technique to restore: Planting 63%
Reference or control site for comparison: 74%
No ref site 26%; but 68% tracked development

various combinations of attributes

e. info@artsurgery.co.uk

Authors suggest adding
socioeconomic measures
into monitoring/evaluation practices.

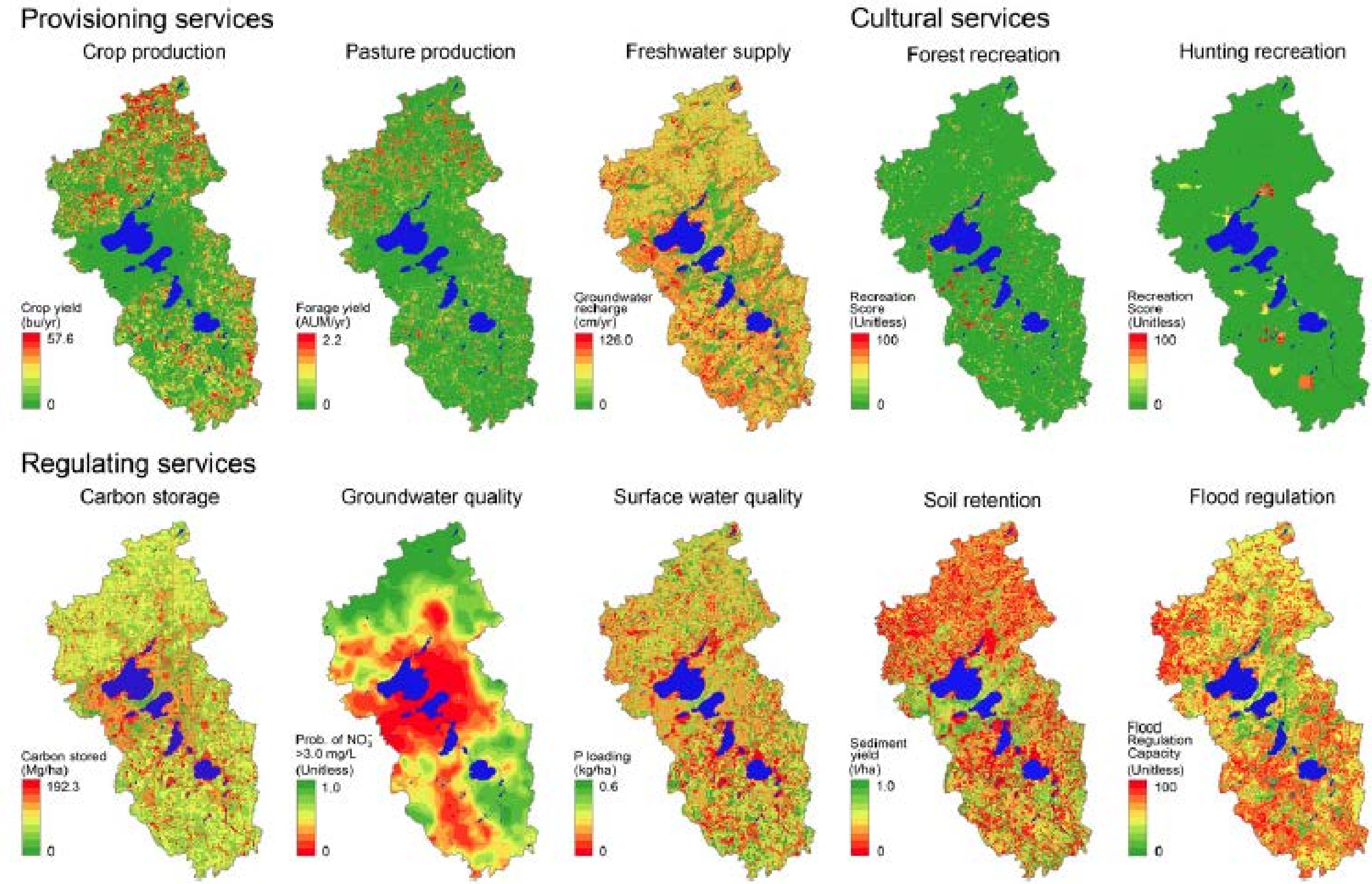
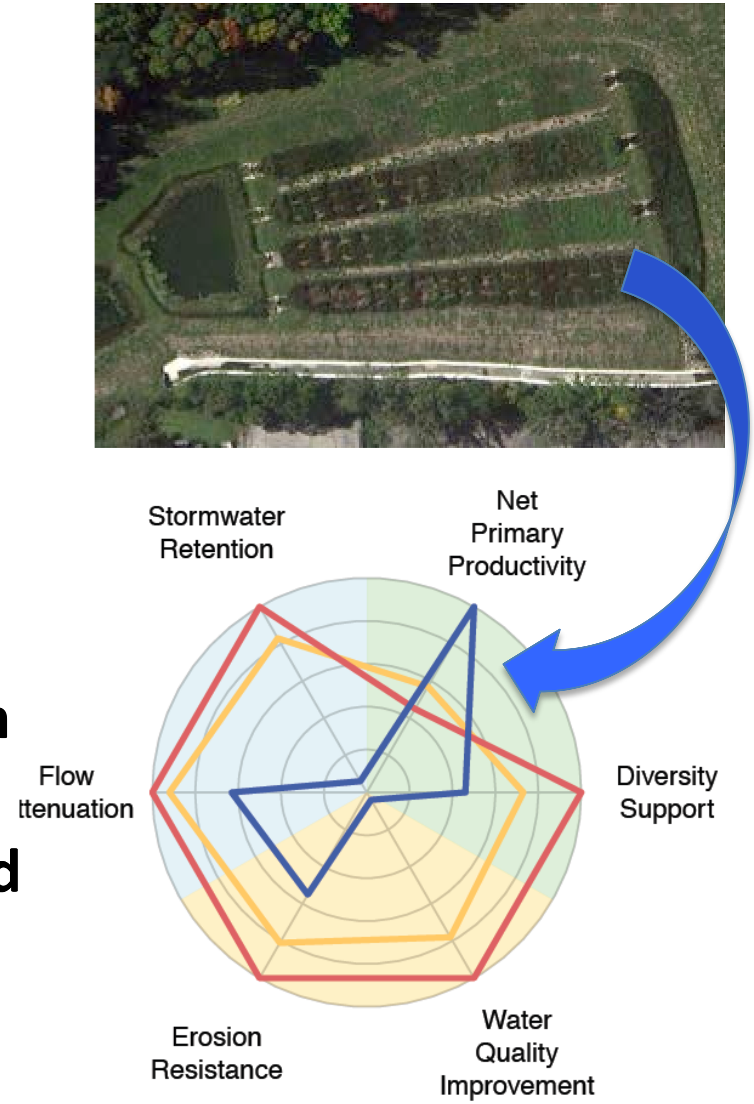



**Fig. 1.** Spatial distributions of 10 ecosystem services in the Yahara Watershed, Wisconsin, for 2006. Red indicates areas with high supply and green indicates low supply of ecosystem services.

Many ecosystem functions can be estimated using **models**
(e.g., water quality improvement in a large watershed with wetlands and 4 lakes)
(Qiu & Turner 2013)

# Measuring ecosystem services involves multiple experts, time, money

A 2-yr study captured multiple storm inflows
(Doherty et al. Online/2014. *Ecosystems*)
6 investigators, 3 disciplines
Botany, Civil & Environ. Engr., Biolog. Systems Engr.
Millions of measurements:
2.3 million of water level,
912 stormwater contaminant loads at swale inlets and outlets,
576 plant abundance and diversity,
141 soil stability




Replicate wetlands initially differed **only in hydroperiod**.
One (blue line) **ponded water and produced the most biomass (NPP).**
NPP **did not correlate with** 5 other ecosystem functions.

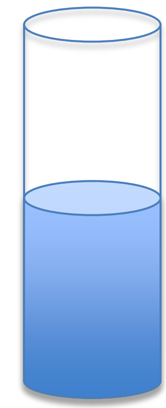
1. How is the term "success" used/misused?
2. Which criteria are used to assess restoration?
3. How do reviewers judge outcomes? Bruce Pruitt


Rapid Recovery of Damaged Ecosystems

Holly P. Jones*, Oswald J. Schmitz

Abstract

Structural and Functional Loss in Restored Wetland Ecosystems



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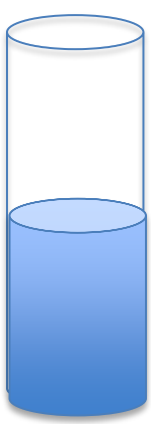

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Data agree that not all criteria were fully met; **yet perceptions differ**

# De Steven and Gramling (2012. Wetlands 32:593-604)

Review of >100 wetlands restored under the Wetlands Reserve Program
- across the Southeast Piedmont–Coastal Plain
  - Four HGM types
  - Diverse pre-restoration conditions:
    - Nearly half were retired from active agriculture;
    - drained vegetated wetlands
    - forested bottomlands

Outcomes
- Depressions and flats typically were restored.
- Low-order riparian sites & prior-agriculture floodplains had enhanced water retention.
- Timber-harvested floodplains had water barriers removed to allow species access.
- Vegetation restoration was generally passive, but
- Trees were frequently planted on prior-agriculture sites.

Field surveys suggested that most projects had positive indicators of wetland hydrology, vegetation, and faunal use.

## Ruiz-Jaen et al. review 2005: Attributes recover at different rates

- Rapid recovery:
  - increased height, decreased herbaceous cover.
  - Species diversity: colonization of woody seedlings, ants, reptiles, and amphibians.
  - Ecosystem processes, particularly litter production and turnover, enhanced soil nutrients and organic matter.
- Slow recovery: litter cover, number of litter layers, DBH, but they increase vegetation heterogeneity in the reforested site.
- Conclusion: Including vegetation structure, species diversity, and ecosystem process provides → "better information to determine success"

# Varied outcomes in reviews of 9 states & 1 region (Pruitt 2013)

**Number of criteria** met

- PA: ~60% of 23 met "success criteria"
- WA: 71% failing to meet criteria, 63% partially compensating
- OH: 3 mit'n banks "mostly successful", 5 "successful in some areas…", 4 "mostly failed"
- MA: 54.4% did not comply (21.9% not attempted)
- New England: 40 projects complied; only 10 were "adequate functional replacements"

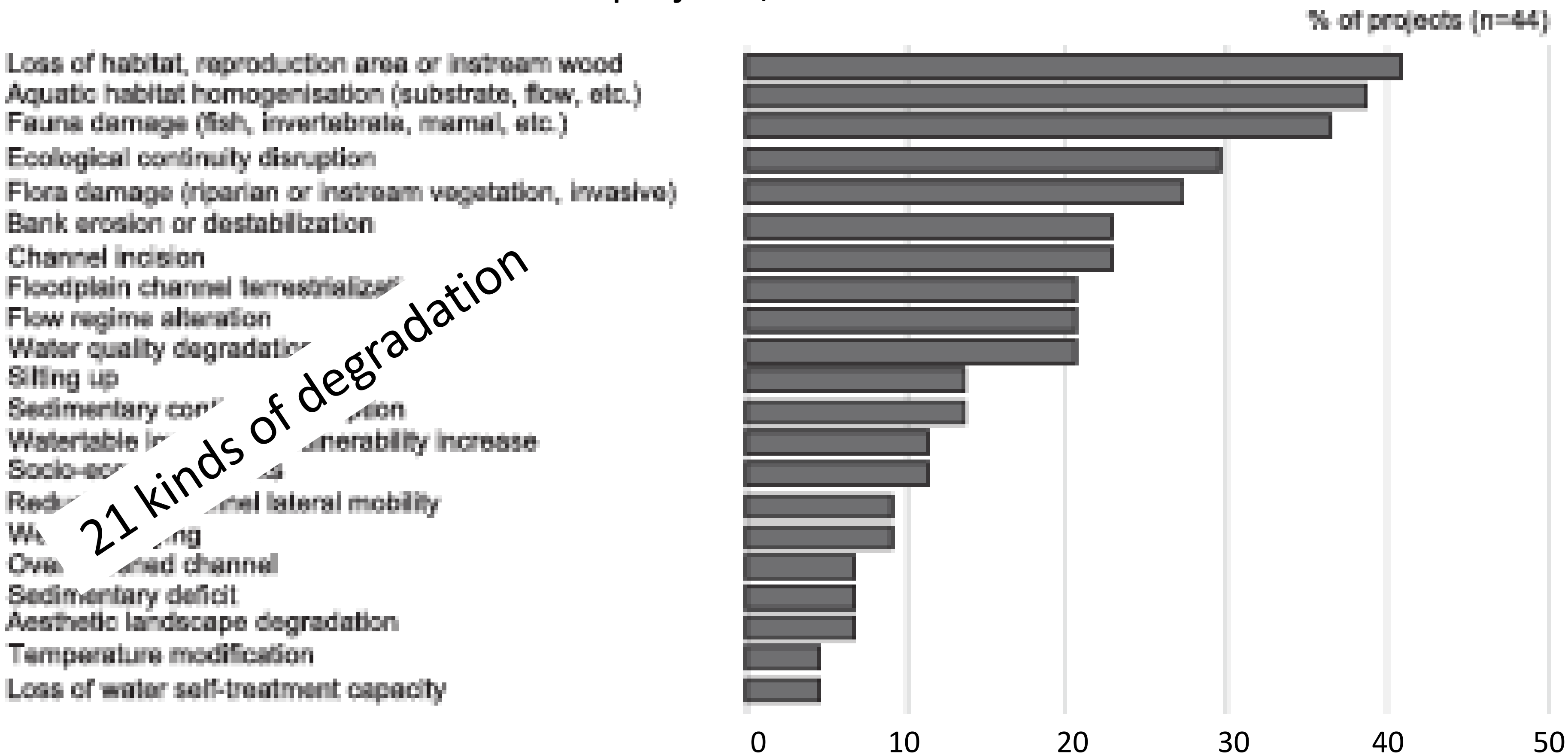
**Jurisdictional criteria not met** (wetl hydrol, hyric soil, hydrophytes)

- RI: 23 of 26 had wetland hydrology & hydrophytes but composition changed (invaders)
- UT: 15% "did not meet minimum wetland criteria"

Provided < **1:1 wetland area**

- NJ: "success" range = 1-140%; average = 45%
  - (acres restored/acres lost?)
- TN: 0.88 acres replaced/acre lost
- NH: many factors considered; results not listed

Review of 44 stream restoration projects,




Insight of Morandi et al. 2014: "…the projects with the **poorest evaluation strategies** generally **have the most positive conclusions** about the effects of restoration."

# Lockwood & Pimm (1999)

Natural wetland, MN

Reviewed 87 published studies with

**data on structure** and **indicators of functions**

The reviewers judged

- 17 “successful” = persistent, all goals met
- 53 “partly successful”
  - 11 all goals met but management continues
  - 42 persistent but not all goals met, mgt ended
- 17 “unsuccessful” = management ended, not all goals met

1. How is the term "success" used/misused?
2. Which criteria are used to assess restoration?
3. How do reviewers judge outcomes?
4. How are outcomes explained? Robin Lewis


Pruitt (2010) explained problems in compensatory mitigation as:

Inadequate baseline & target for hydrology

Inadequate tracking system

Lack of consideration of wetland processes

Inadequate assessment of adjacent land use

Inadequate assessment of ecosystem integrity

Inadequate adaptive management and monitoring plan

Inadequate water quality investigation

Invasion by undesirable or exotic species and use of cultivars

# Generalized hydrographs (Mitsch & Gosselink 2000. *Wetlands* 3rd Ed.)

**Design the target hydrology**: Obtain data from water wells and staff gauges for ≥1 year, covering all seasons for both a reference site and the proposed restoration site. Correlate water-level data with precipitation.

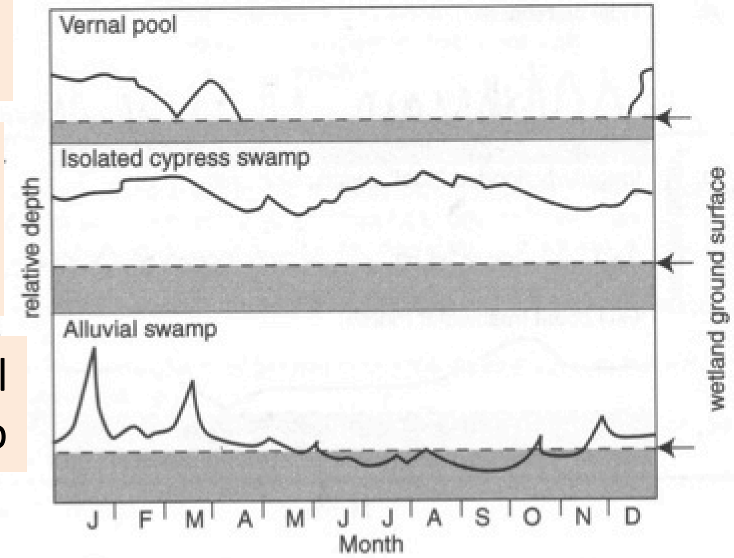
**Assess the outcome**: Monitor hydrology at the restoration site.

**Determine**: If the designed hydrology is achieved. (Lewis)

Vernal pool

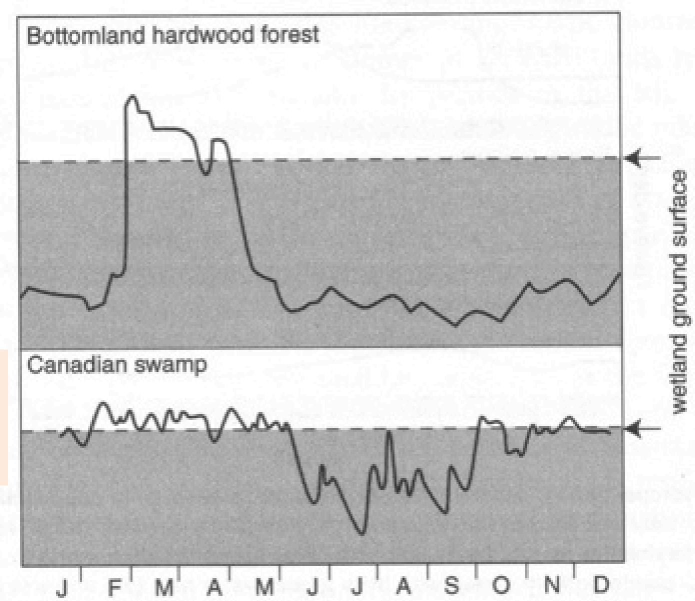
Isolated Cypress swamp

Alluvial swamp




Bottomland hardwood forest

Canadian Swamp



# R. R. Lewis: Failure is due to…

- Incorrect design specifications at the conceptual and final design stage and/or
- Incorrect construction of a project even if the specifications are correct
- Too little institutional learning (i.e., adaptive management)
- Inadequate monitoring, reporting and documentation.

Many projects require on-site **changes** to plans … best done by a combined team of the original design professionals and construction professionals.

Continued…

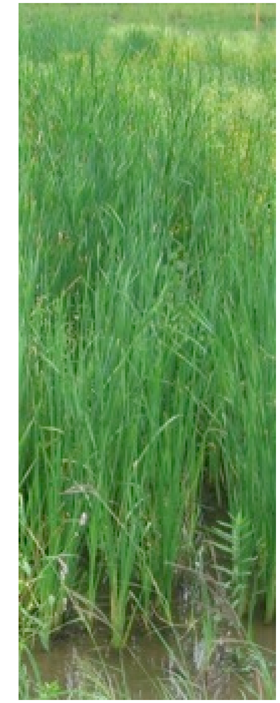
# R. R. Lewis explains….

- Compliance and enforcement personnel are typically underfunded and required to review a myriad of projects, often very old and with insufficient documentation ….
- There are no consequences for those who design bad projects. A poorly designed **project that fails** either partially or completely **can be cited as "successful"** by inexperienced designers or dubious "experts," and the cycle repeats itself.

# Katie Suding (2011) explains 3 kinds of outcomes

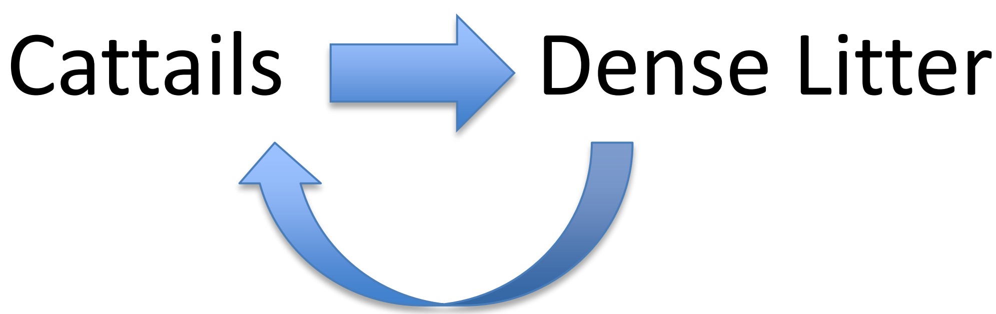
- Complete recovery occurs where species persist and abiotic processes permit natural regeneration.
- Incomplete recovery results from local and landscape constraints, including shifts in species distributions and land use.
- No recovery is due to strong species **feedbacks** and regional shifts in species pools and climate.

Two examples follow



A litter **feedback** sustains invasive cattails, thus challenging freshwater marsh restoration

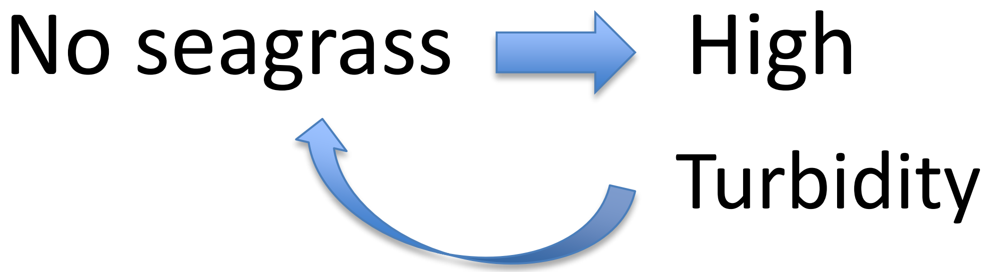
- Cattails grow tall, dense and shade competitors
- The leaves die and create thick litter, which cattails can penetrate better than competing species—Cattails perpetuate themselves.




(Larkin et al. 2011)

# A turbidity feedback challenges eelgrass restoration in the Dutch Wadden Sea

- Turbidity (suspended sediment) is high if seagrass is missing.
- Seagrass is needed to reduce sediment




Seagrass in clear water

.waddensea-worldheritage.org

- Feedbacks may explain global collapses and inability to restore seagrass.

(Van der Heide et al. 2007)

1. How is the term “success” used/misused? Joy Zedler

   Rarely defined, usually adds confusion.

2. Which criteria are used to assess restoration? Larry Urban

   Many criteria; no standard set.

3. How do reviewers judge outcomes? Bruce Pruitt

   A variety of outcomes, described in various ways.

4. How are outcomes explained? Robin Lewis

   Many reasons, basic need is to achieve the hydrological target.

   [Also contributing: Richard Weber]

5. Recommendations:

   For wetland restoration to improve, changes need to go far beyond revisions to monitoring requirements.

A natural wetland in MN

# Zedler's recommendations

Use clear terminology; use terms consistently

Base assessments on multiple indicators (of structure and function) that relate to the specific project objectives

Report assessment data

- *e.g., clapper rail habitat mitigation: 8 attributes, each with quantitative standards*

Describe *progress* made toward objectives giving

- the list of objectives and standards,
  - *e.g., nesting habitat with tall cordgrass (max. extended leaf ≥60 cm on average*
- the degree to which each objective was met
- overall outcome: Compliance or not, explaining irregularities/shortcomings

Limit using "success" to a specific definition in a specific context—say who is making the judgment and for what purpose.

## Pruitt and Weber recommendations

| Cause of Failure | Recommendation | Selected Measures |
|---|---|---|
| Wetland not accurately classified | Use a classification system that is consistent across wetland types and reproducible among wetland scientists | Provide training for wetland restorationists |
| Inadequate baseline and target restored hydrology | Establish current hydrography and conceptual target hydrography by using an analog, historic or constructed reference condition | Monitor surface and ground water hydrology during normal rainfall, tidal, etc. conditions; Establish current frequency and duration of flooding, ponding, and/or soil saturation; Predict post-construction or restoration conditions and set as an attainable performance standard |
| Lack of consideration of wetland processes | Establish current and targeted nutrient cycling, pollutant sequestration or transformation, carbon export | Conduct import/export studies and/or establish correspondence with proxies or indicators of processes; Measure increase in biomass or NPP of woody, rooted vegetation, soil organic matter in O and A horizons |
| Inadequate assessment of current & future adjacent land use practices | Establish current and future land use practices at multiple scales (e.g., watershed, stream segment, wetland area) within the catchment of the restoration site | In consultation with state and regional planning centers, forecast future development and land use changes within the catchment of the restoration site; Implement a restoration plan that includes an adaptive management program which accounts for future land use changes |
| Inadequate water quality investigation ("build it and they will come "misconception) | Document current and future water quality conditions at both the watershed and stream segment scales | Conduct current physiochemical and biological water quality and sediment quality and quantity conditions; Establish ecological integrity based on baseline conditions with and without project; Set predicted conditions as an attainable performance standard |

## Lewis' Top Five Recommendations to Improve Wetland Restoration and Creation

| Cause of Failure | Recommendation | Details |
|---|---|---|
| 1.Wetland restoration designed incorrectly | Better training | Provide training for wetland professionals including consultants, regulators and monitoring and enforcement personnel |
| 2. Inadequate baseline and target restored hydrology | Establish current hydrology and conceptual target hydrology by using an analog, historic or constructed reference condition | Monitor surface and ground water hydrology at a proposed restoration site during normal seasonal rainfall, tidal, etc. conditions; Establish current frequency and duration of flooding, ponding, and/or soil saturation; Predict post-construction or restoration conditions using reference conditions, and set as an attainable performance standard. See above. Training needed. |
| 3. Lack of consideration of the historical context and previously published work on success. | Republish Kusler and Kentula (1989) (the USEPA version) with added notes from the authors or substitutes to bring them up to date. Make freely available. | Simply providing a bibliography is not enough. Wetland professionals and regulators are busy people. It is often difficult or impossible for them to access good free science. This would start to overcome that impediment. |
| 4.Inadequate respect for the experience of current professionals with proven track records. | Provide a method for precertification by regulatory agencies and requirements for applicants to use trained professionals in wetland design. | In consultation with federal, state and local wetland planning, and design and permitting agencies, develop approved lists of wetland design and construction professionals who have proven track records of successful restoration and monitoring, and recommend their use. |
| 5. Beef up compliance monitoring and enforcement activities to stop repeated errors in design with distribution of "lessons learned." | Document current wetland restoration and creation efforts on the regional level to keep professionals apprised or progress in more successful wetland restoration and creation efforts. | Current progress towards improving the practice of successful wetland restoration and creation is hampered by the lack of freely availability documentation on who, what and where are the successful projects being done, and what monitoring and reporting is available for professionals to review and learn about these efforts and improve their practices. |

# Urban's Recommendations to Improve Wetland Restoration and Creation

| Problems Encountered | Recommendations | Details |
|---|---|---|
| 1. Aquatic restoration not constructed properly | Hire construction contractors with experience & qualifications in restoring aquatic resources (e.g., streams & wetlands. Require As-Built Plans of the completed project for purpose of monitoring performance objectives & to determine if adaptive mgt is necessary. | Montana Dept. Of Transportation has developed a list of pre-qualified construction contractors for aquatic resource restoration projects. This may be prudent for other areas of the country, as it is specialized work in every aspect. Contractors who have experience in such work will be more efficient and provide inputs during construction that result in a better product on the ground. |
| 2. Lack of experienced oversight professionals | Insure that an experienced restoration professional is on site during stream / wetland construction. | Ensures that a project is correctly constructed and provides direction to the contractor. When problems with designs are encountered in the field; corrections can be made at the direction of the restoration professional. |
| 3. Poor site selection | Focus on restoring areas that were once wetlands, and channelized stream reaches, instead of creating wetlands in uplands. | Millions of acres of wetlands and miles of streams have been degraded for various reasons (mining, industry, flood control, etc.). Restoration of former ecosystem functions will benefit the landscape and watershed, as well as the public. |
| 4. Scientific studies versus regulatory monitoring | Both communities need to agree on what constitutes monitoring requirements and assess the costs of implementation of regulatory requirements to monitor restored areas. | In the world of mitigation restoration, few have the funds or dollars to conduct detailed bio-geochemical analyses, and import/export studies of nutrients. Funds are drying up in many avenues; agencies are short on staff and funding to conduct annual inspections, etc. Work together to provide better projects. |
| 5.Regional performance standard templates | The majority of regulatory performance standards have been developed for the wetter areas of the US and do not equate to the drier arid regions of the country. | There need to be regional performance standards developed similar to the Regional Delineation supplements. As well as the development of performance standards for stream restoration. |
| 6. Drowned woody vegetation plantings | Plant woody plants after water regimes have established over a period of 3 to 5 years. | Many resource agencies want woody vegetation planted immediately, but experience is that even with good hydrologic data site, actual hydrology will throw a curveball. Suggestion: plant woody plants as water regimes establish after 2- 3 years, to prevent drowning and avoid costs of replanting. |


Learning from our mistakes - Camp Creek, fall 2001. Stream reconstruction cannot be done with graders.

## ASWM recommendations

- Provide better evaluations of baseline conditions to develop restoration plan
- Adapt the wetland restoration plan to the watershed's current (not historic) conditions
- Identify criteria for measuring progress;
  - tailor them to the site;
  - focus on measures that address the objectives
- Support interdisciplinary teamwork:
  - from design through implementation
- Ensure that the project described in the restoration plan is actually established on site

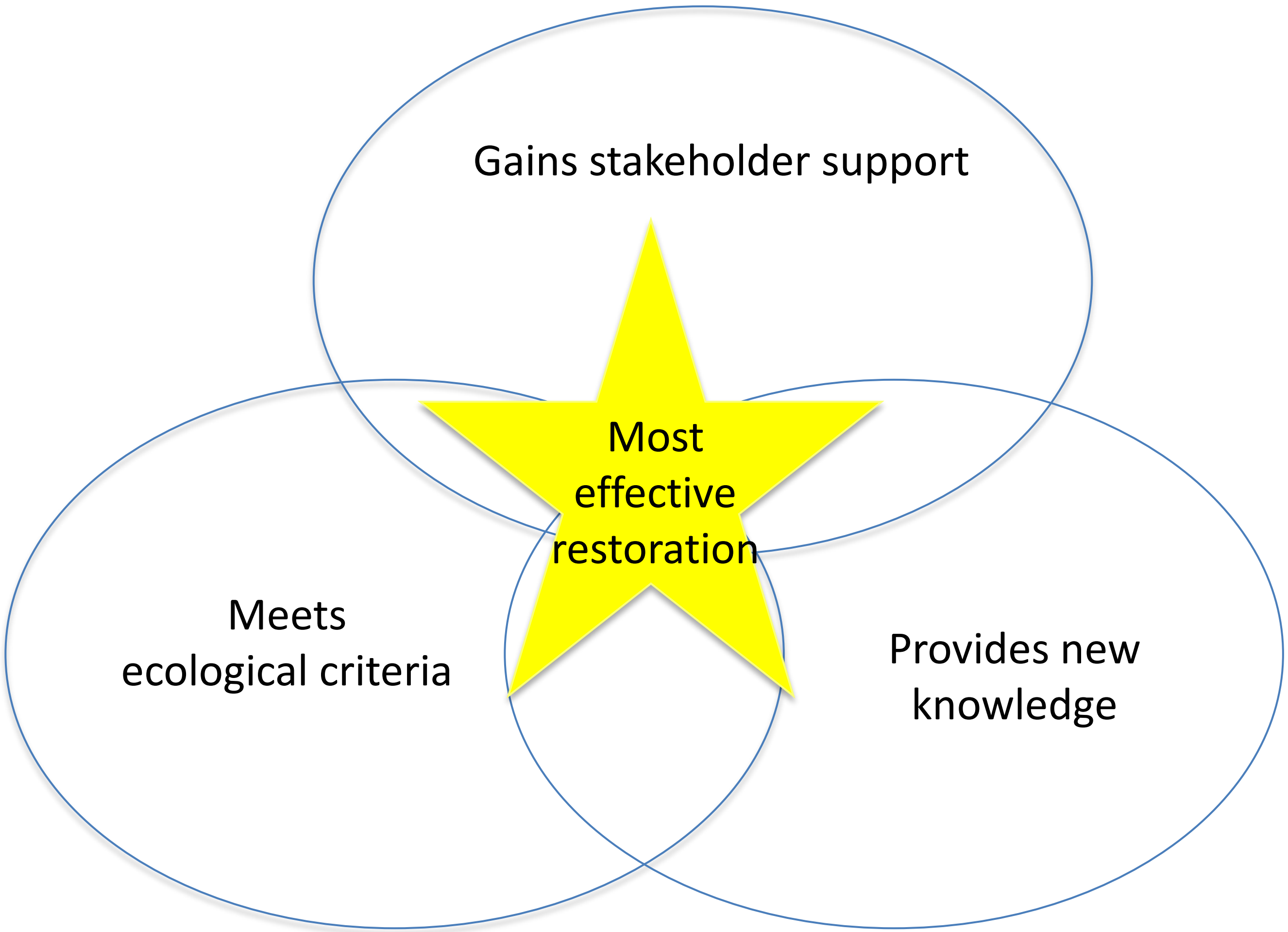
## ASWM recommendations

- Provide a framework for improvement
  - training,
  - repository of information on how to design wetland restoration projects that achieve objectives
  - etc.

- Establish accountability and consequences

- Revise permitting standards and requirements to include current science and technology

# Beyond ecology:



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# Please Send Us Your Recommendations to Improve Wetland Restoration and Creation When You Receive an E-mail from Go To Webinar Following this presentation.

# We Welcome Your Ideas!

| Problems Encountered | Recommendations | Details on Recommendations |
| --- | --- | --- |
| Your Ideas Here. | Your Ideas Here. | Your Ideas Here. |


Questions?


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