An Ecological Function and Services Approach to Nonpoint Source TMDL Prioritization

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Introduction

- Total Maximum Daily Load (TMDL) Process
  - Determination of a Problem
  - NPS Priority Ranking and Targeting
  - NPS Load Allocation
- Implementation of NPS BMP
  - Functions (Physical, Ecological)
    - Natural Riparian Resources – vegetation, hydrology, soil and landform
  - Monitoring
- Stakeholder Participation
  - Perception (Point Source, Nonpoint Source)
  - Creeks & Community

TMDL Process

- TMDL - It's The Law. It's required.
- TMDL planning process :
  1. Identification of water quality limited waters requiring a TMDL - Determination of a problem
  2. Priority ranking and targeting
  3. TMDL development - Allocation of point and nonpoint source discharges
  4. Implementation Plan of control actions (i.e., depends on which state doing the TMDL)
  5. Assessment of water quality based control actions

Determination of a Problem

- Water Quality
  - Criteria
  - Standards
- Toxicity testing
- Biological community
  - Benthic invertebrates
  - Fish
- Question - Leading and lagging indicators?

Determination of a Problem

Non-point Source Stressors

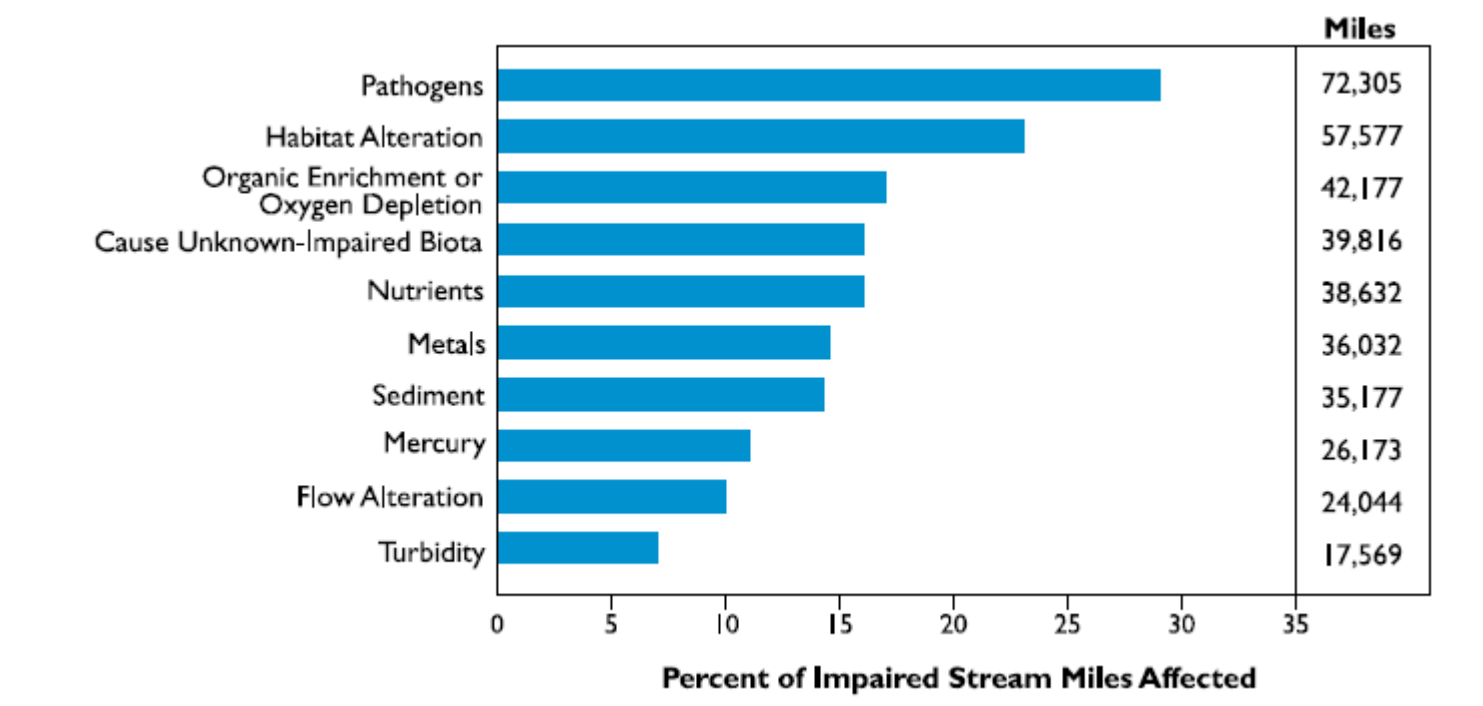


Figure from the National Water Quality Inventory: Report to Congress, August, 2009

Determination of a Problem

- Assimilative Capacity
  - The ability of a body of water (i.e., surface water (lentic = wetlands, lakes, ponds, etc.; lotic = streams), groundwater) to cleanse itself. Its capacity to receive waste waters, or toxic materials, without deleterious effects and without damage to aquatic life or humans who consume the water.

- How does a water body cleanse its self?
  - ▲Veg -> ▲Functions -> ▲Assimilative Capacity = ▲Water Quality

Q = How many programs monitor upland and riparian vegetation? Why do you want to?

Priority Ranking and Targeting

- State priority ranking process
  - Risk to human health
  - Degree of public interest
  - Recreational, economic, aesthetics
  - Vulnerability or fragility as an aquatic habitat
  - Immediate needs (i.e., permits)
  - Pollution problems

- Leading and lagging indicators
  - Q = Are we being proactive?

Ecological Function

- Proper Functioning Condition (PFC)
  - How well the physical processes reflect a state of resiliency
- Physical Processes:
  - Energy dissipation,
  - Sediment entrapment,
  - Floodplain development,
  - Ground-water recharge,
  - Stabilizing stream banks, and
  - Maintaining channel characteristics.
- Resiliency - The functional condition that holds a riparian wetland system together in 25 to 30 year flow events.

Resiliency = ↑ Functions -> ↑ Assimilative Capacity -> ↓ Riparian sources = ↑ Water Quality

- Thus, sustaining values from physical and biological attributes.

Degradation Rates

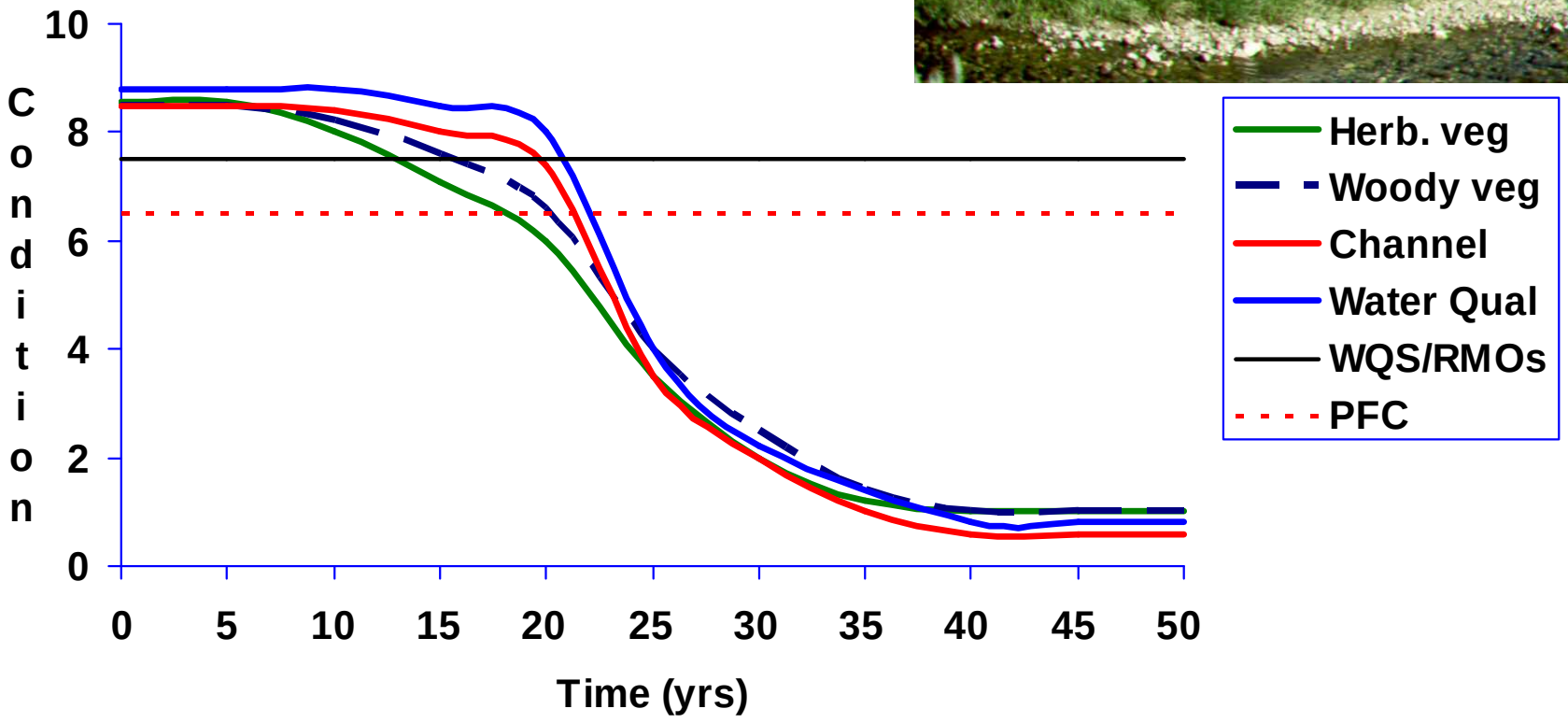


Figure from Cowley, 1997.

Recovery Rates

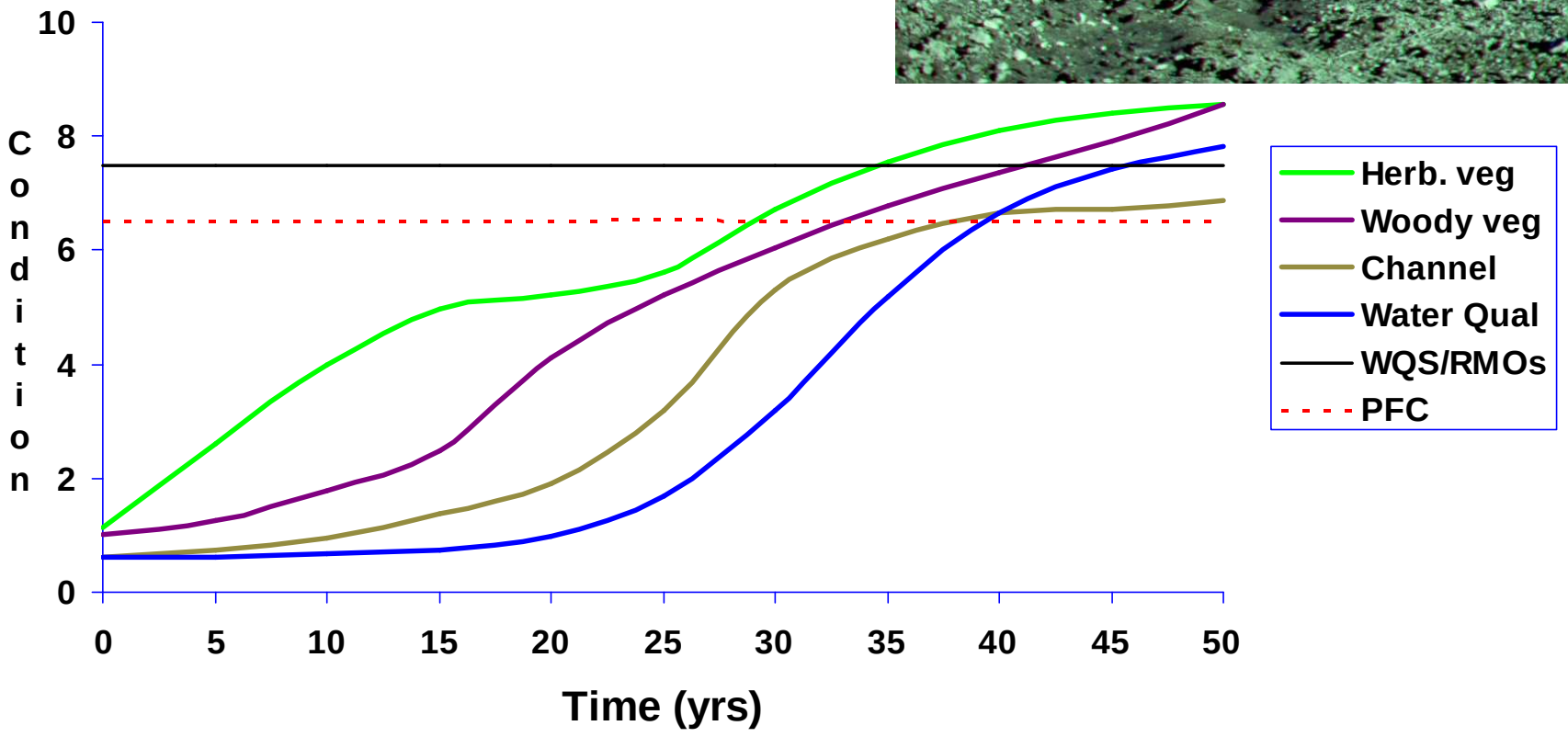
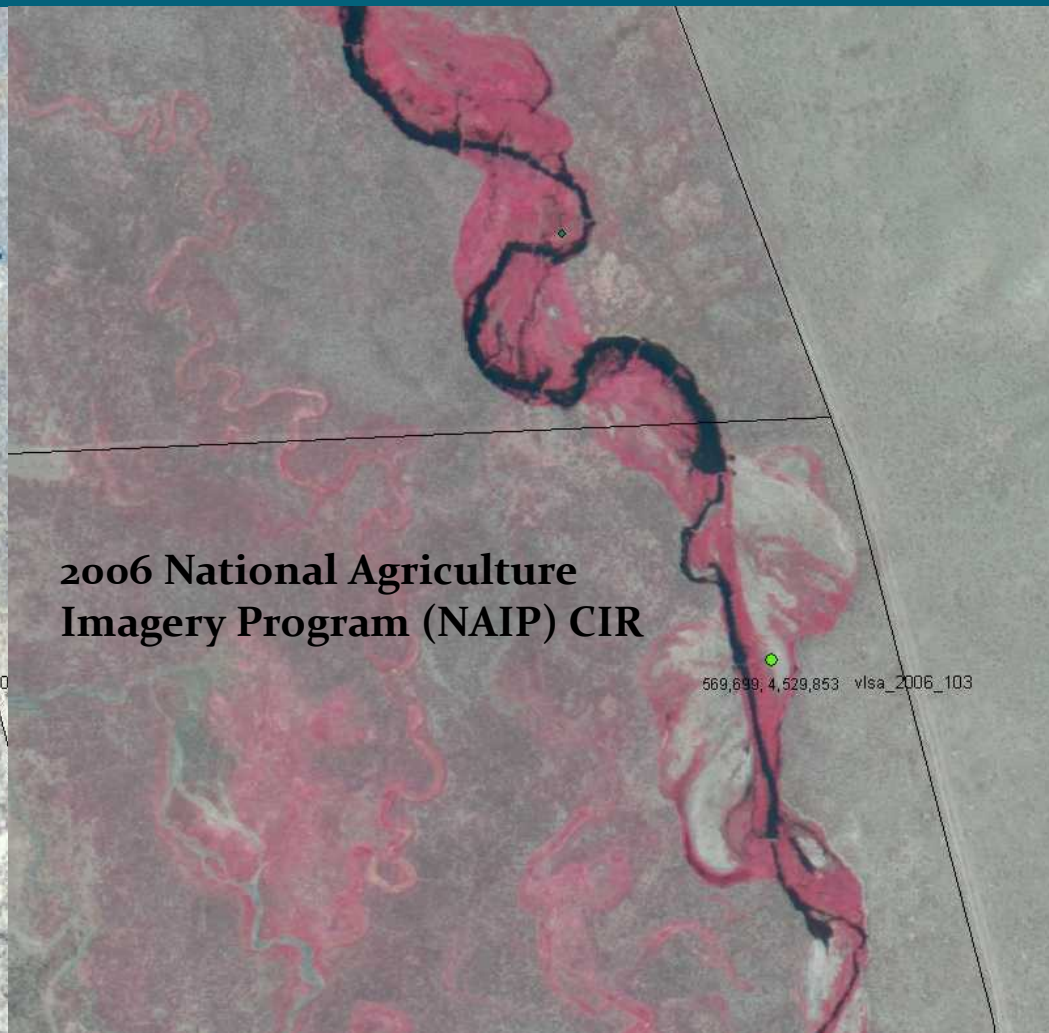


Figure from Cowley, 1997.

Load Allocation (LA)

Maggie Creek, NV (Donald Kozlowski, UNR)



Implementation

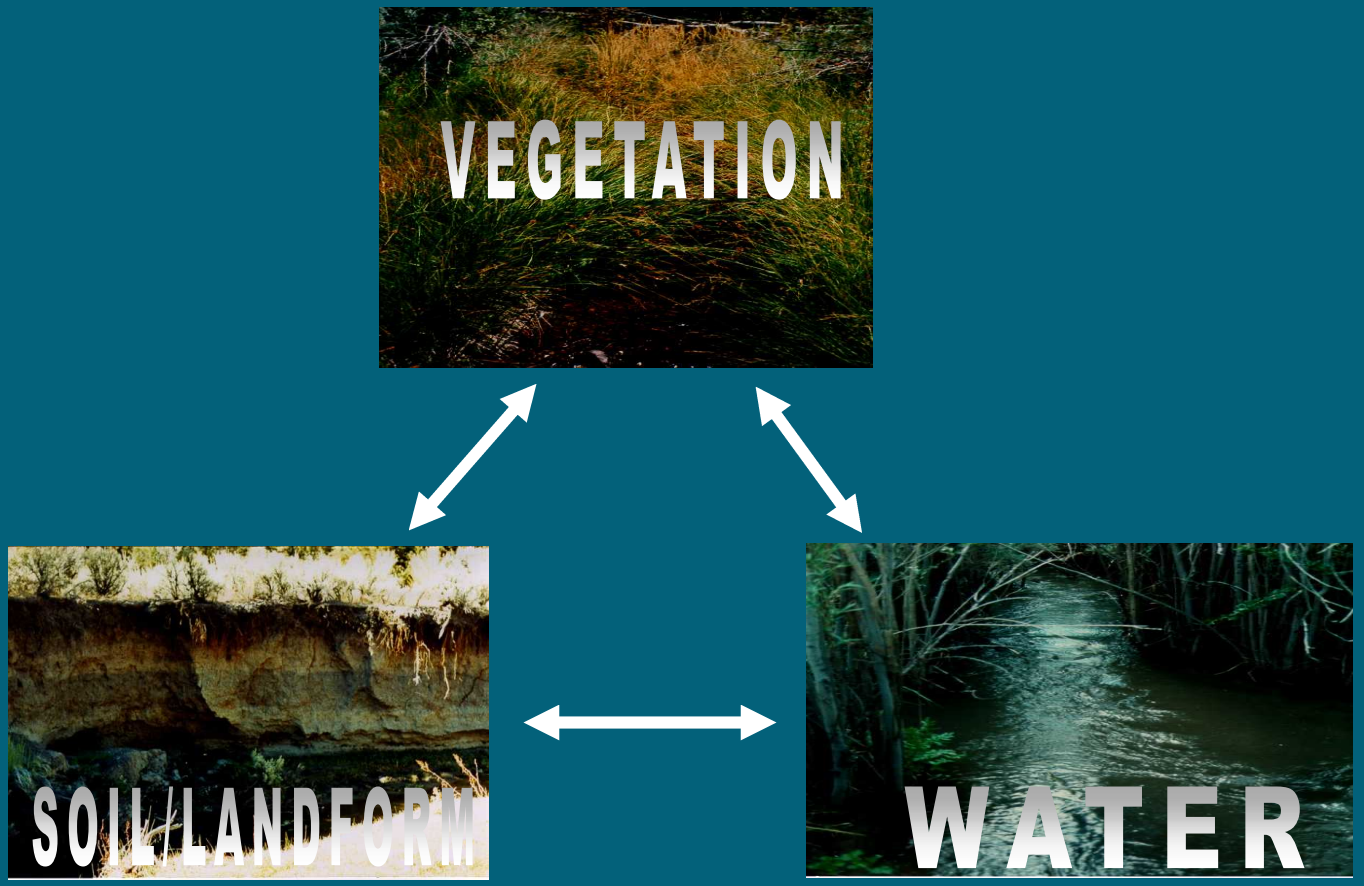
- Best Management Practices
  - Modeling = Build a fence around it!
    - Biggest complaint process is to prescriptive.

- Managing for Physical Functions
  - Improved riparian vegetation
  - Channel form
  - Dissipate stream energy
  - Reduce bank erosion
  - Aid floodplain development
  - Improve floodwater retention & groundwater recharge
  - Trap sediment and nutrients

Photograph provided by Robert Pearce, NRCS, Bishop, CA

Monitoring

- Drivers of physical and ecological function



Monitoring

- Physically, ecosystems are always in motion reacting to natural climatic changes and anthropogenic conditions.
- Properly functioning ecosystems are resilient to disturbance and maintain the capacity to capture, hold and slowly release water and sediment to the benefit and protection of streams, lakes, wetlands and coastal areas.
- In contrast, nonfunctional ecosystems fail to process the surges in flow that can result in extreme flooding as well as increased soil and bank erosion, which discharge excess sediment into the coastal zone.
- Understanding how riparian and upland ecosystems work and how to use assessments of ecological functionality will assist decision makers to identify the connections between form, function, management, and monitoring so they can better address the underlying causative factors behind ecological degradation.

Conclusion

- **Assessing Ecological Functionality**
  - Ecosystems are dynamic and resilient
    - Prioritize nonpoint source (NPS) implementation based on Function
  - Vegetation drives many functions.
    - Monitor the drivers of function (vegetation, hydrology, soil/landform)
  - Proactive in Managing Lands to:
    - Reduce nonpoint land-based sources (e.g., bank erosion causing flow = excess sediment) to increase water quality
    - Sustainability and effectiveness of ecological restoration
  -

- **Building Capacity**
  - Individuals, communities and institutions
  - Assessments as communication tool for common vocabulary
  - Understanding of how ecological function supports sustainable use.

"Riparian functions keep water on the land longer, reduce flood and drought effects, improve water quality, enhance forage and habitats, and focus monitoring for management." (Sherman Swanson, 2009)