Proper function and conditioning (PFC) and Traditional Knowledge - Working Together for Tribal Sustainability -

Dan Heggem and Tammy Jones-Lepp
US EPA, Office of Research and Development
National Exposure Research Laboratory
Las Vegas NV

2016 EPA STAR Tribal Research Progress Review meeting, Sept 20-21, 2016 RTP, NC

Working Together for Community Sustainability – 2.63.4 – Understanding the Interrelationships between Ecological and Human Health for Tribal Sustainability

- Bring affected interests together
- Create learning environments, build relationships/trust
- Build community information base
- Empower people

Research to Inform Tribal Sustainability Focus Areas

Tribal Communities: Influence of cultural factors and beliefs on environmental quality, risk, health outcomes and sustainability

- The P(roper) F(unctioning) C(ondition) train the trainers workshops
- Forecasting Toxic releases from Harmful Algal Blooms (HABs)
- Technical transfer to and research requests from Tribes

Riparian Proper Functioning Condition

- Traditional Ecological Knowledge (TEK) is key to understanding and implementing adaptive management for sustainability

- Sustainability is built into Tribal Values

- P(roper) F(unctioning) C(ondition) process is about building resilience and managing ecosystems for sustainability. PFC is the western science connector to TEK - how we all can work to make a difference.

Riparian Proper Functioning Condition

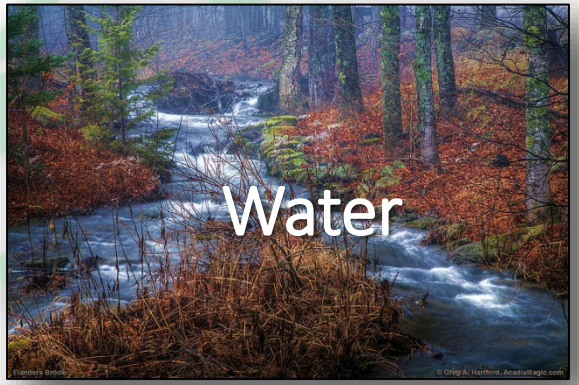
- A process for assessment
- A defined condition
- A starting point
- A common language
- An interdisciplinary team approach

Assessing Ecological Functionality

Outwash Plain Pondshore, Maine

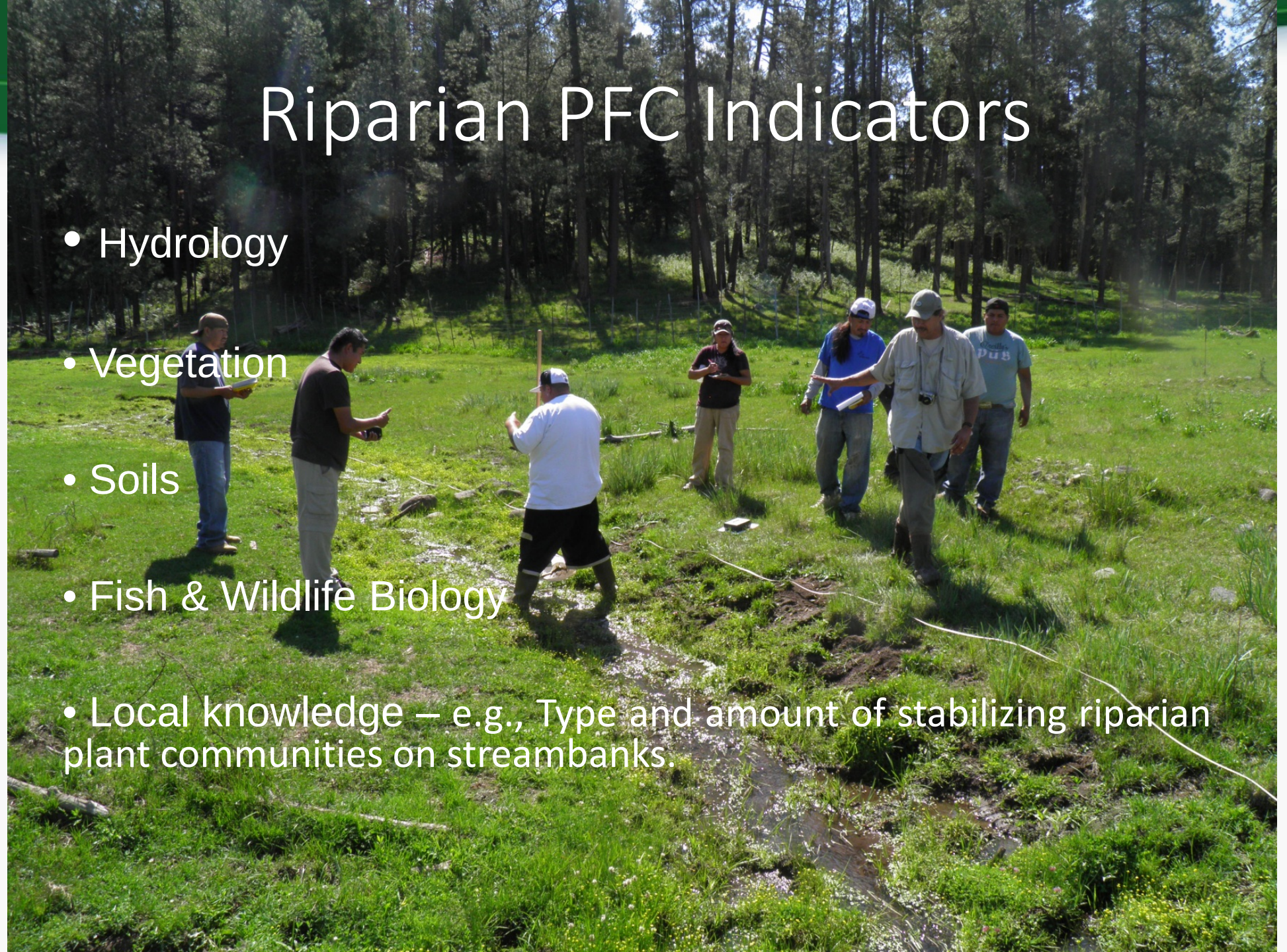
Goals & Values

Humboldt Basin, Nevada



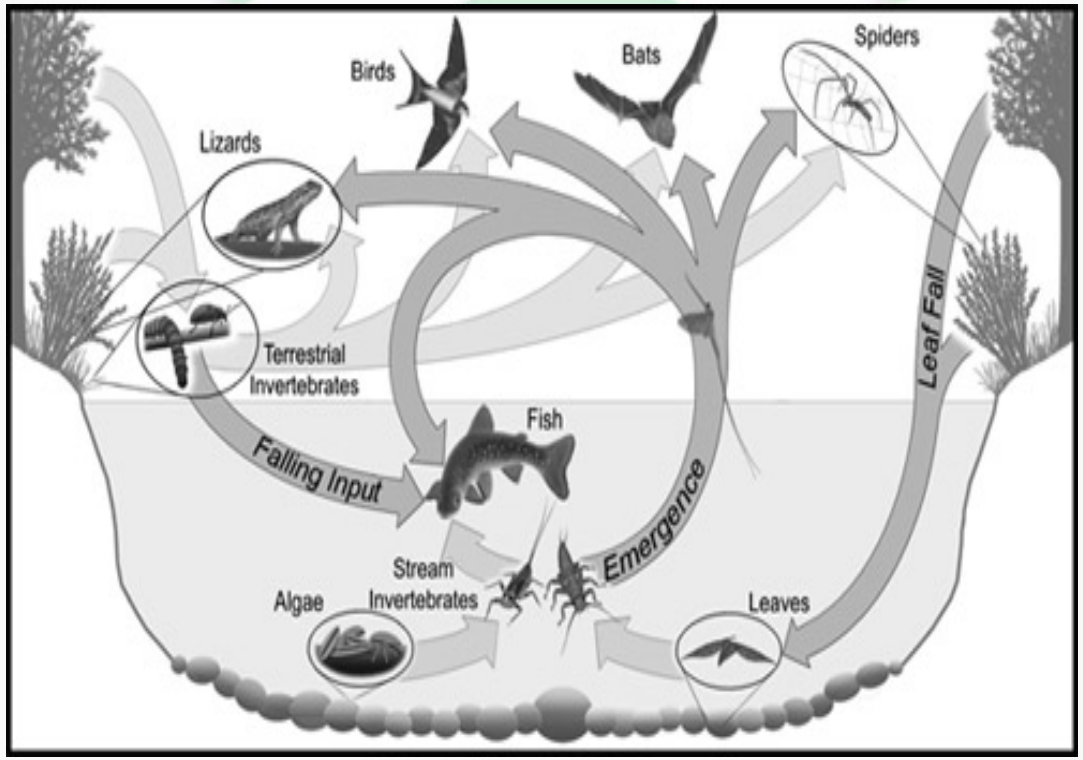
Flanders Brook, Central Maine

Riparian PFC Indicators



- Hydrology
- Vegetation
- Soils
- Fish & Wildlife Biology
- Local knowledge – e.g., Type and amount of stabilizing riparian plant communities on streambanks.

Traditional ecological knowledge (TEK) plays a significant role in a Tribe's approach to natural resource management. Stream and wetland riparian functions integrate the relationships between species, their habitats and fostering ecosystem resilience, which is critical to ensuring long-term sustainability.

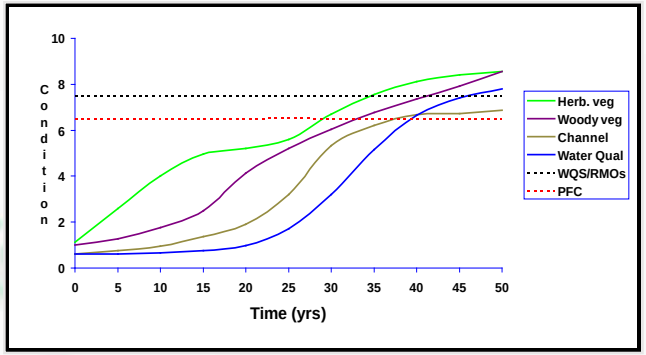


Stream food web from Nakano, et al., 1999.

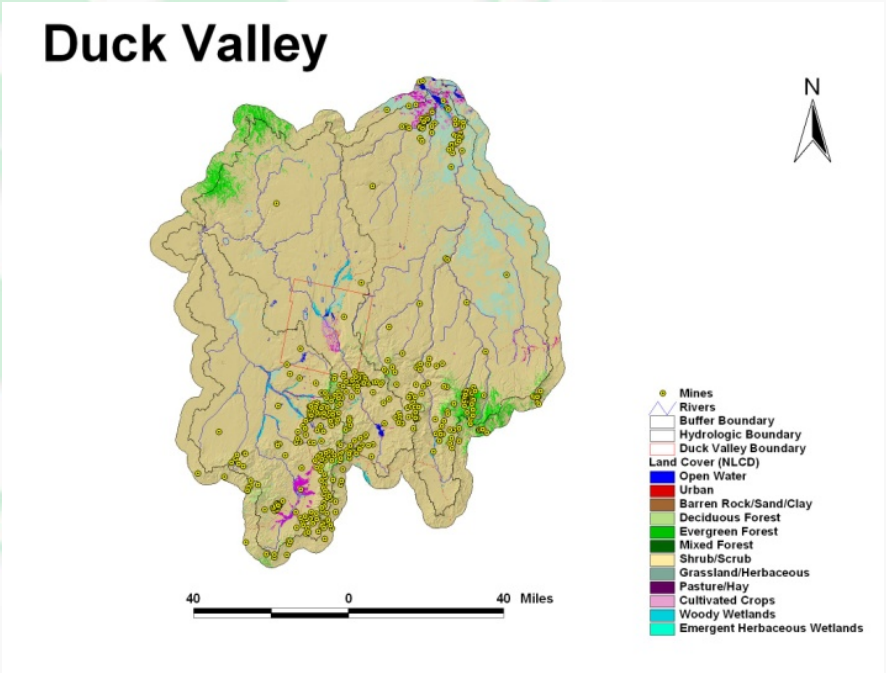
Slide provided by Dan Mosley, Walker River Paiute Tribe

Supporting Tribal Decision-Making with SHC Research and Tools

- How has tribal land changed over time?
- How can vegetation patterns and water use be optimized, considering TEK?
- Remote Sensing and GIS
- T-FERST
- EnviroAtlas



Working Together for Community Sustainability - Tribes



Harmful Algal Bloom research objectives

- Not all algal blooms are equal.

- Disturbances occurring within watersheds (anthropogenic, climatic) may temporarily and/or permanently alter environmental and ecological risk factors (i.e., sediment, N and P input, riparia habitat disturbances).

- These disturbances have led to increases in harmful algal blooms (HABs)

- Focus on cycles of HABs within pilot study area:
  - This focus will include both prokaryote (i.e., cyanobacteria) and eukaryote (i.e., Golden algae dinoflagellate) HABs.

HAB research Implementation

- Step 1:
  - Gather PFC information from pilot study areas with State and Tribal partners.

- Step 2:
  - Temporal trends of various physico-chemical properties - i.e., temperature, DO, conductivity, pH, N&P, via *in situ* sensors (OK DEQ)
  - Water samples will also be subjected to whole effluent toxicity testing (Reg 6)
  - Water/sediment samples will be chemically fingerprinted (environmental forensics) for known and unknown HAB toxins.
  - Data analysis (i.e., PCA) to determine which chemical classes of precursors to, as well as, produced natural toxins are present/absent during the temporal cycles of sampling.

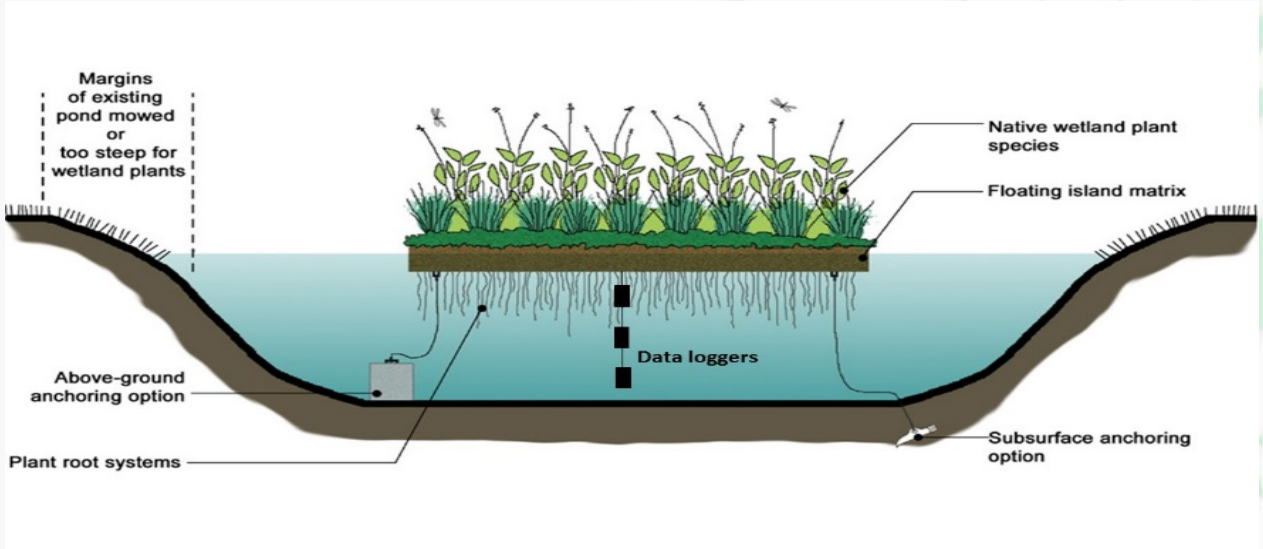
HAB research Outcomes

- Improve the ability to forecast HABs on Tribal lands.
- Devise real-time sensors to monitor identified stressors such that adverse impacts upon susceptible communities can be reduced.
- Research will improve understanding and develop management options between causal PFC relationships and adverse outcomes of HABs.
- This research will cross-over to SSWR under Topic 2 Nutrients Project 4.01, Reducing Impacts of Harmful Algal Blooms.

Floating Vegetation Island Project Colorado River Indian Tribes – Chemehuevi – Hopi - Mojave - Navajo

No Name lake is an area on tribal lands where EPA and the CRIT (The Colorado River Indian River Tribes) have worked together in the past few years using PFC (proper functioning condition) analysis to re-establish shoreline vegetation.

CRIT and EPA will collect baseline water samples early Fall in No Name Lake. The purpose of this sampling effort will be to establish water quality baseline criteria before the floating islands are placed. Investigating simple water quality parameters, as well as screening for a variety of algal toxins.



Stylized diagram of a floating vegetation island. Diagram is from the Texas Coastal Watershed Program where they used a dense mesh of polyethylene terephthalate (PET) fibers which have been recycled from plastic waste such as soda bottles (http://tcwp.tamu.edu/floating-wetland-islands/). Data loggers will be placed down column, and up and down flow of the island.

No Name Lake – CRIT – Chemehuevi – Lower Colorado River

Floating islands will improve the shoreline habitats that are degraded by extreme flow regime.

All pictures are courtesy of Terry Dock, CRIT, Lake Havasu, Lower Colorado

Final Thoughts

- Chronic/acute exposure to natural toxins will become increasingly important in a water commodity-based future.
- Scarce clean source water, water reuse, and recycling, will play an ever-increasing role, along with the probability of increasing natural toxins.
- Managing our ecosystems for function is paramount and just plain common sense.