

NPS Monitoring- surface waters



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Forest Service Water
Monitoring Workshop
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NPS Lakes Monitoring Overview :

- 1. Communicating Importance of Aquatic Ecosystems**
- 2. NPS Water Monitoring – Clean Water Act and Water Resources Division driven (not Air Quality)**
- 3. How water monitoring data is used in NPS Air resource management (Planning, TMDL, Critical Loads)**

Explaining value of surface water data -why FLMs care....

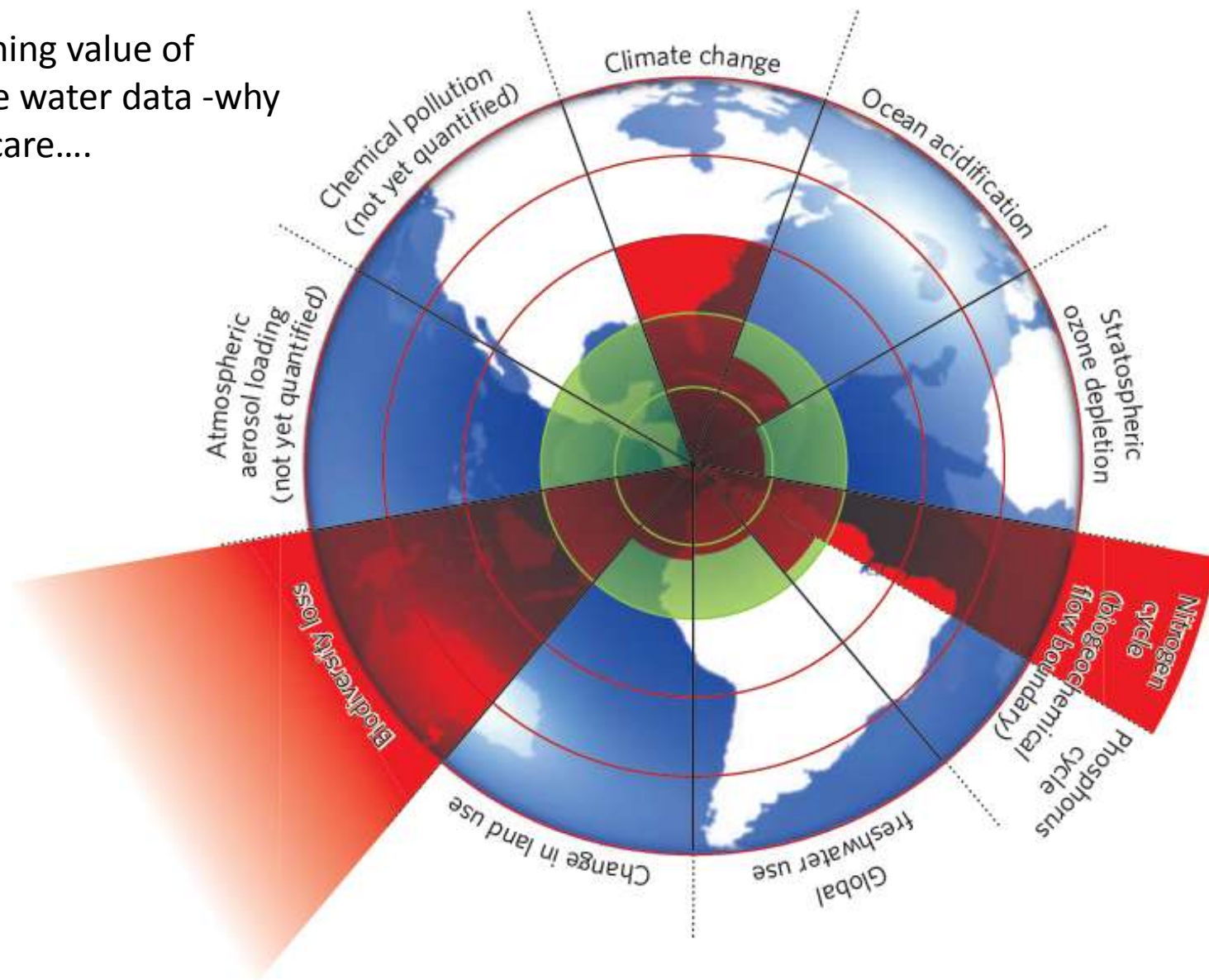


Figure 1 | Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded. Rockstrom et al 2009: Nature



Resource Inventories

Natural Resource Inventories in National Parks

The Inventory and Monitoring Program provides guidance, funding, and technical assistance for parks to complete a set of 12 "basic" natural resource inventories. These basic inventories are common to all parks with significant natural resources, and are intended to provide park managers with the minimum information needed to effectively manage the natural resources of their park. See the *Inventory Strategic Plan* for a description and status for each of the inventories. *[Click on the name of the inventory for more information]*

- Natural Resource Bibliography
- Base Cartography Data
- Air Quality Data
- Air Quality Related Values
- Climate Inventory
- Geologic Resources Inventory
- Soil Resources Inventory
- Water Body Location and Classification
- Baseline Water Quality Data
- Vegetation Inventory
- Species Lists
- Species Occurrence and Distribution

32 NPS Inventory and Monitoring Networks



National Park Service
U.S. Department of the Interior

Natural Resource Program Center
Inventory and Monitoring Division



Park vital signs monitoring

Taking the pulse of the national parks



Park vital signs are selected physical, chemical, and biological elements and processes of park ecosystems that represent the overall health or condition of the park

NPS Vital Signs Monitoring for Surface Waters:

Required Parameters:

*pH, Specific Conductance, Dissolved Oxygen, Temperature, Flow Discharge

*These parameters are relatively easily obtained with multiparameter probes (called "datasondes")

Optional Parameters --Added Dependent on Local Needs:

Category 1 Sites: Water Quality Act enforcement

Category 2 Sites: established threats (e.g. air pollution); or subject to some ecological impairment; or have no established baseline condition



NPS Data in EPA STORET

National Park Service
U.S. Department of the Interior



Water Resources Division
Fort Collins, CO



45,571 Sites



> 6 Million Results



3,122 Parameters



1,071 Projects



256 NPS Units

- All NPS water data and metadata is loaded into “modernized” STORET (v2.02)
- All Labs processing water samples are under National Environmental Lab Accreditation Program (NELAP)

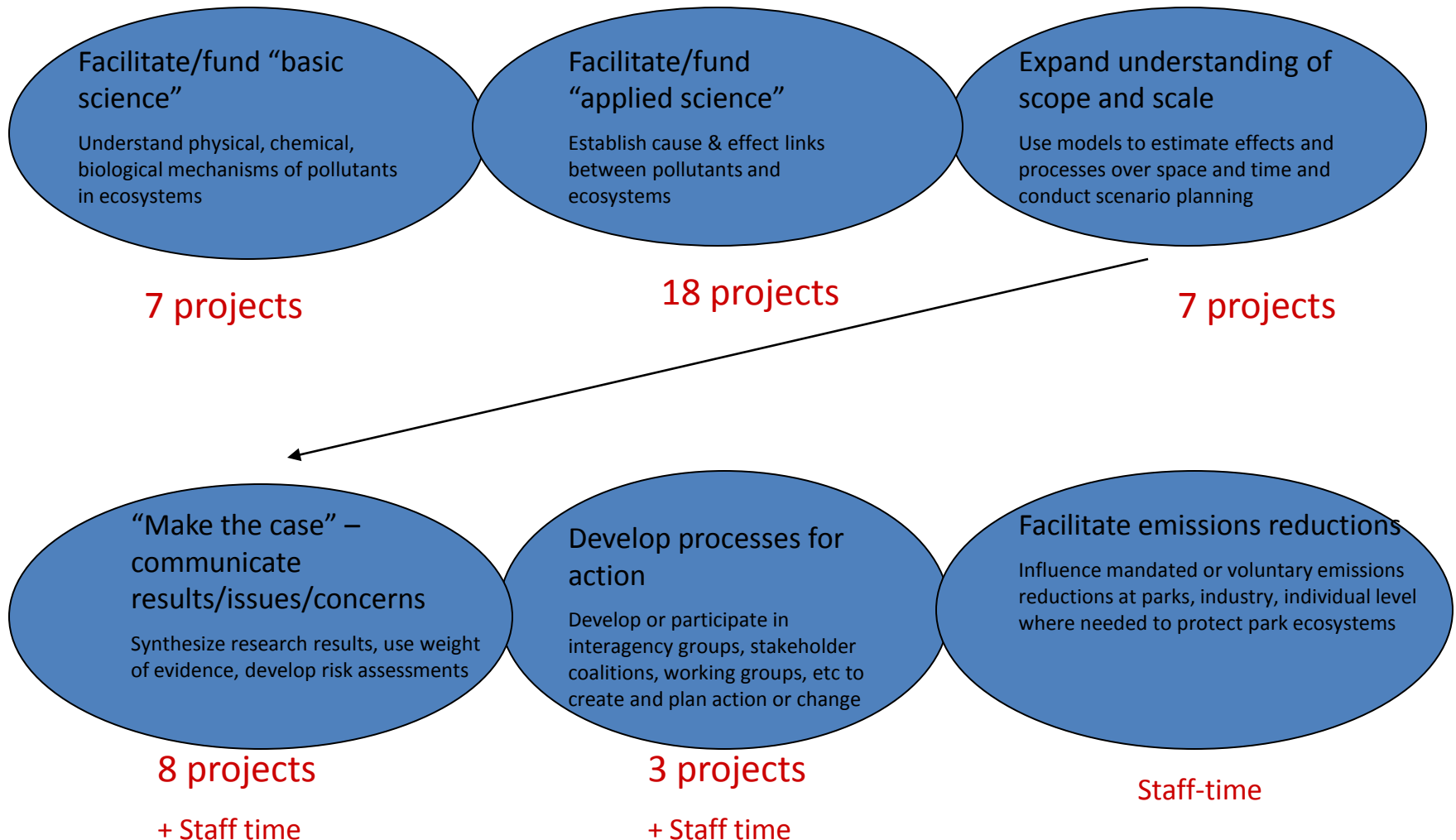
Olympic National Park, WA

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ARD Eco Effects Strategy – filling links in the chain from science to policy (emissions reductions that reduce impacts on park ecosystems)

43 ARD funded/sponsored projects:



NPS water data (ANC or NO₃ trends) to selected western parks:

For Air deposition-lake water studies: rely on other agency partners (USGS, U.C. Riverside, Colorado State University)



Stage 2 nitrogen saturation in soils/streams:

The significance? Nitrate above zero consistently indicating “stage 2+ nitrogen saturation” (describes progression of nitrogen effects to ecosystems between stage 0-3). This shows stream health is declining and may worsen as deposition continues.

Loch Vale Watershed compared to healthy/unhealthy stream profiles

The Science: Compare Loch Vale data to stages of N saturation progression observed in the eastern US...

Andrews Creek, Loch Vale, RMNP

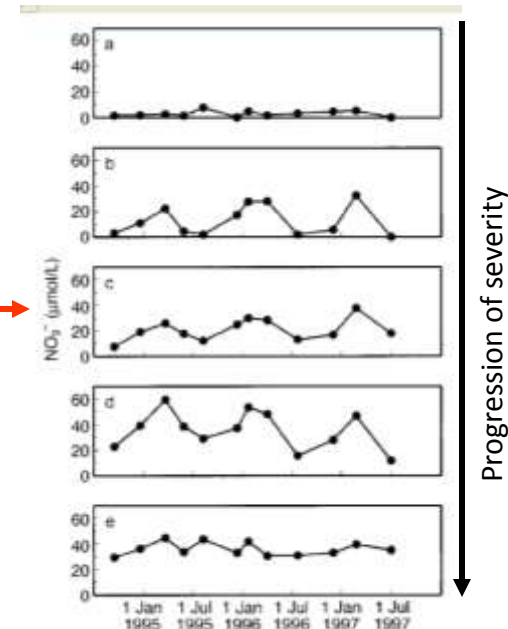
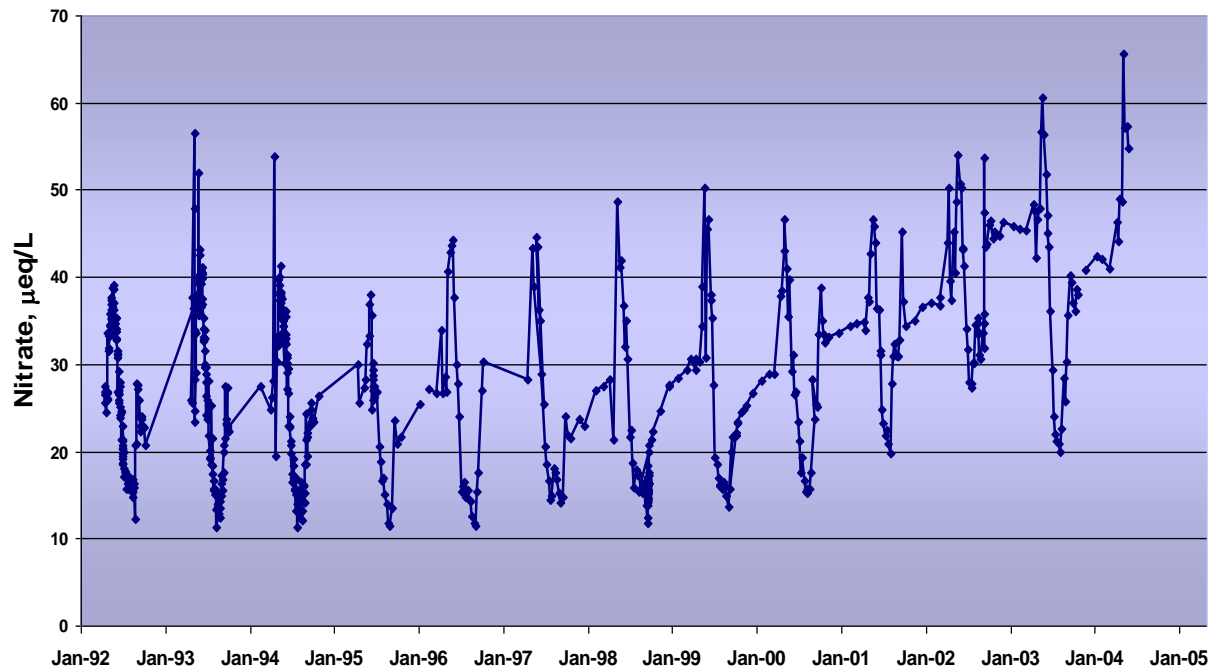


FIG. 4. Temporal patterns of NO_3^- concentration in five streams representing the five groups identified in the cluster

Lovett and others 2000, Ecological Applications

USGS water sampling data: 1992-1998 published in (Campbell, 2000). 2000-2005 data not yet published)

Surface Water Chemical and Biota INDICATORS commonly Used for Air Quality impact purposes in western US: (NO₃ and ANC Thresholds can link to Critical Loads)

1. Nitrate (NO₃) –

- * nitrogen saturation status
- * Indicator for aquatic biota responses (diatoms)- biodiversity changes

2. Acidic neutralizing (buffering) capacity (ANC)

- * Evidence of episodic acidification (with very frequent monitoring)
 - Sensitivity for future acidification potential (if we think deposition increases are likely)
 - Tracking of acidification trends (if we think deposition has increased enough to use up ANC buffering ability)

3. Mercury (Hg)

- Hg conc in water may be threshold for fish (pike) response
- * Hg in fish is good direct measure of impact to humans and wildlife reproduction, behavior, etc.

TMDL- The Place Where Air and Water Regulations Collide:

TMDL Process (related to AQ) :

- (1) Water body exceeds state water quality “standard” and declared “impaired” (e.g. Hg, NO₃, pH)
- (2) Once on 303d (impaired) list someone (usually state) determines pollution source contributions. If contributors are “point source” then mandatory regulatory process. If “non point source” (air deposition), then “voluntary” process to reduce emissions.
- (3) Long process (often 10-15 yrs).
- (4) No success stories yet ... (related to air quality) but a few have explored this option:
 - Everglades (air modeling done to assess **Hg** source contrib to water impairment)
 - Chesapeake Bay (ongoing TMDL assessment process for **N** (air and land))
 - Rocky Mountain NP (explored **N** TMDL options with WQ control commission)
 - Great Smoky Mountain NP (TMDL for **pH** exceeded- 10 streams listed “impaired”, Critical loads modeling beginning)

NPS Impaired Waters

National Park Service
U.S. Department of the Interior

Water Resources Division
Fort Collins, CO



- **4,395,124 acres of lakes, reservoirs, estuaries and marine areas**

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- **936,105 acres of CWA 303(d) impaired lakes, reservoirs, estuaries, and marine areas**

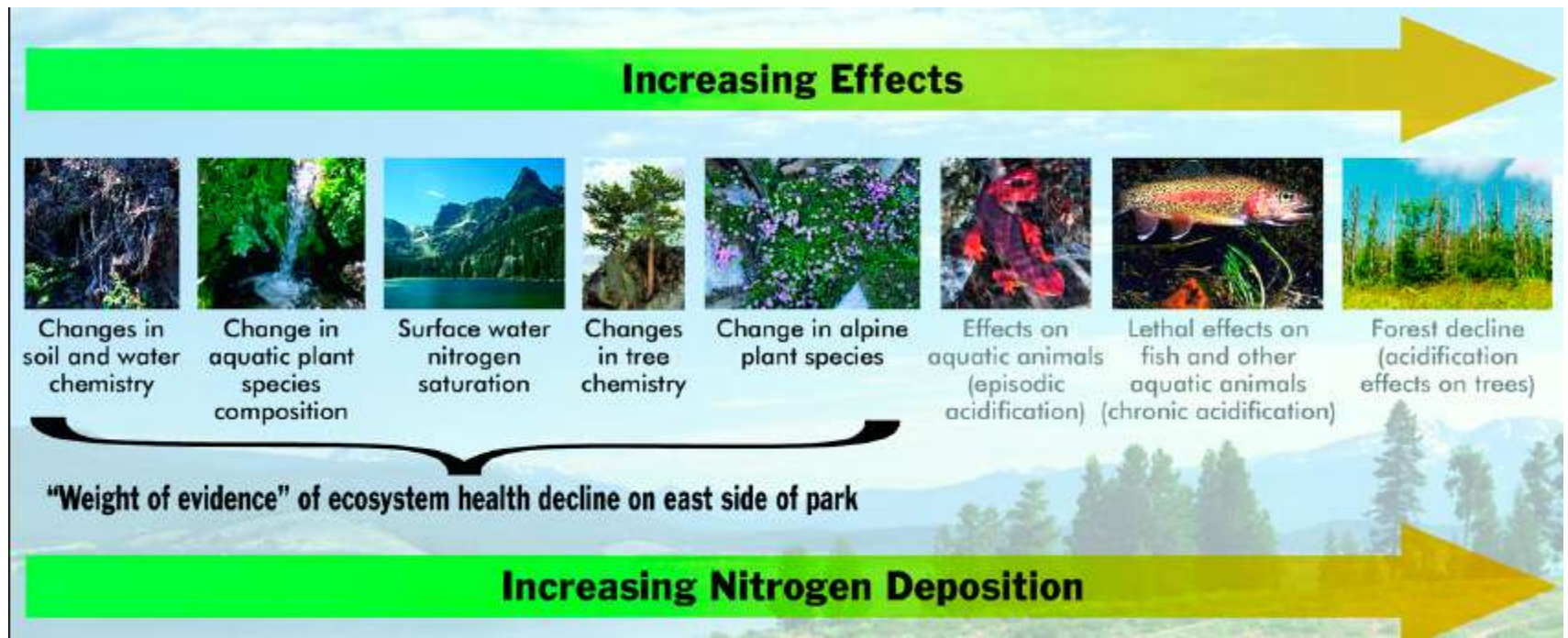
~21%
Impaired

Critical Loads- A very strong potential for future linkages between air and water quality.....

“The deposition loading below which ecosystems are not significantly affected by air pollution”

Critical load:

“The quantitative estimate of an exposure to one or more pollutants below which **significant harmful effects** on **specified sensitive elements** of the environment do not occur according to present knowledge.” (Nilsson and Grennfelt 1988)



- **“Specified sensitive elements”**: ecosystems sensitive to nitrogen and/or sulfur deposition, e.g.,
 - Poorly buffered lakes, streams, soils
 - Ecosystems that evolved under low nutrient conditions and/or with short growing season (e.g. deserts or alpine areas)
- **“Harmful effects”**: changes in the natural functioning of an ecosystem, e.g.,
 - Loss of acid-neutralizing capacity affecting biota (growth, viability, condition, etc)
 - Unwanted enrichment by nitrogen resulting in changes in natural vegetative community

**Ecosystems... just the sound of it,
gives me the willies.**



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More on Critical Loads on Thursday (1/2 overview, 1/2 discussion)