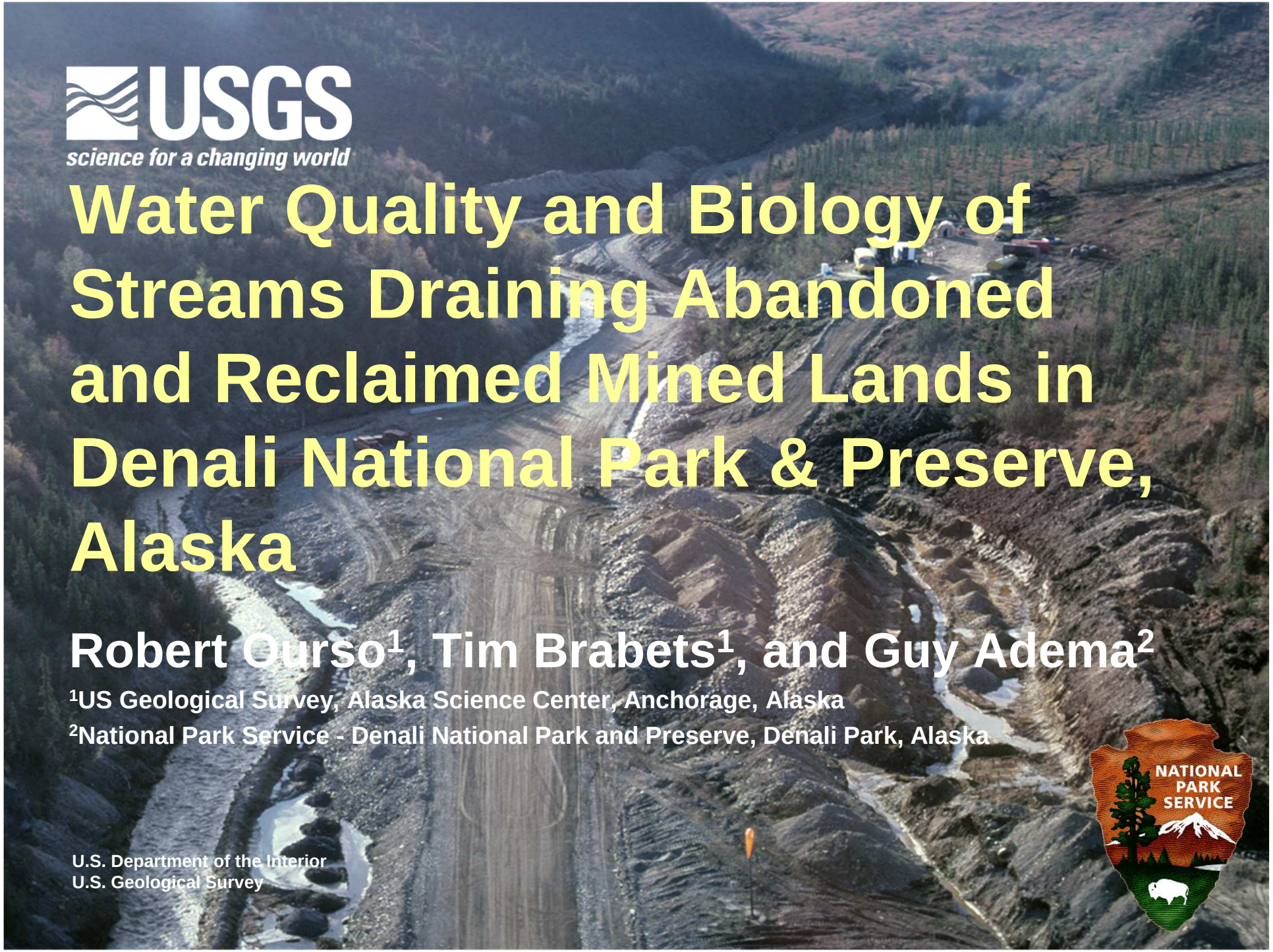

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Water Quality and Biology of Streams Draining Abandoned and Reclaimed Mined Lands in Denali National Park & Preserve, Alaska

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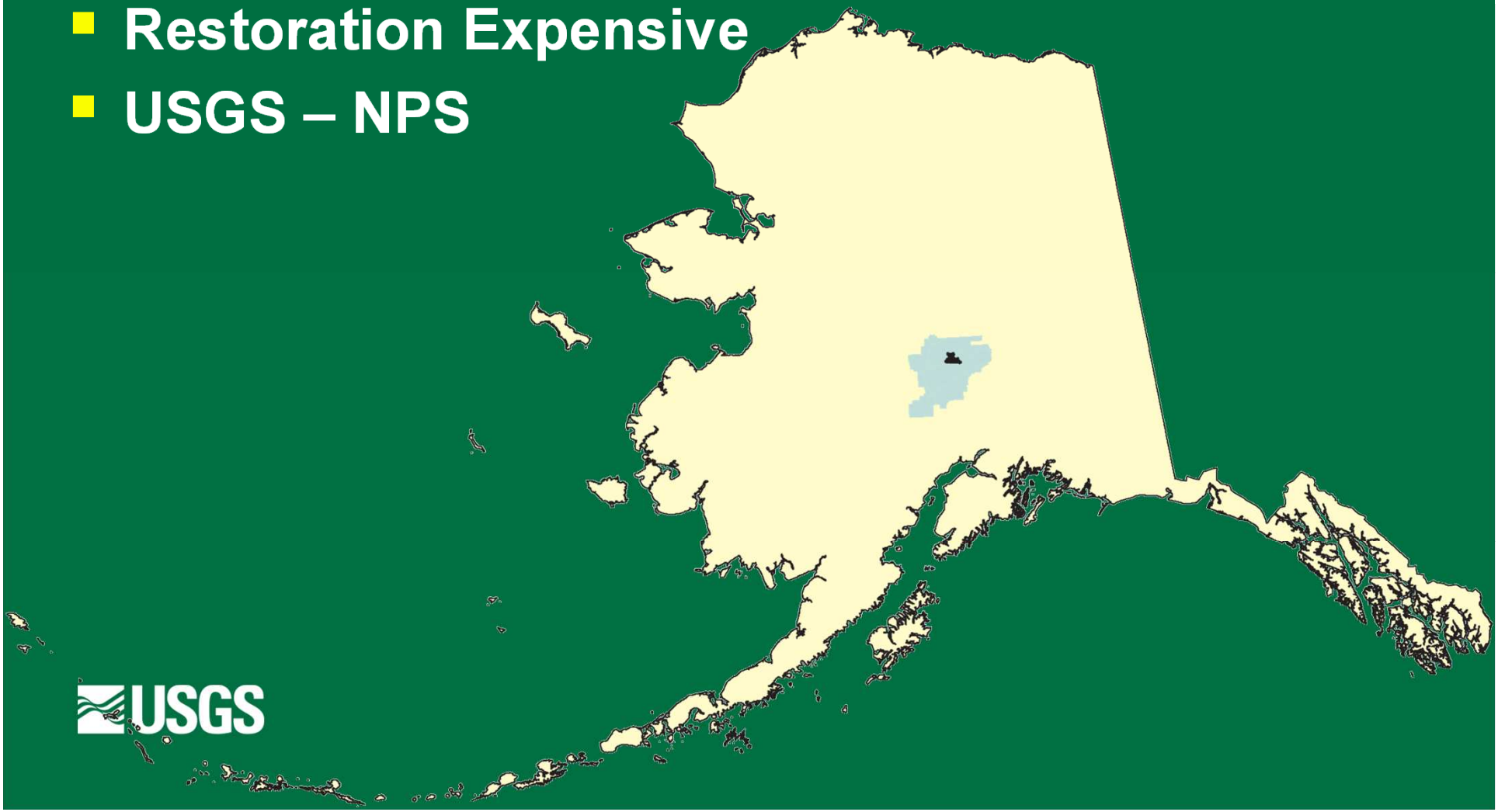
NATIONAL PARK SERVICE

U.S. Department of the Interior
U.S. Geological Survey

Kantishna Hills, Denali NPP, AK

- Degraded Water Quality
- Restoration Expensive
- USGS – NPS



Historical Overview - Continued

- Gold first discovered in 1903
- 1930's were the "golden era" for mining
- Stampede Mine became largest antimony mine in Alaska*
- Large-scale placer mining re-introduced
  - Caribou Mines used mechanical draglines
- In 1980, Kantishna mining district was incorporated into Denali National Park and Preserve (DENA) as part of ANILCA

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Historical Overview – Continued

- 1983 total mineral production in Kantishna
  - 85,000 ounces of gold
  - 265,000 ounces of silver
  - 504,000 pounds of lead
  - 4,400,000 pounds of antimony
  - Several million pounds of combined lead and zinc
- Mining in Parks Act of 1976 ended most mining activities by 1985
- In 1988 DENA began to study stream restoration techniques on several creeks

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Kantishna Hills

- 131,000 acres total
- 1,500 acres, 10 watersheds with visible effects of mining
  - Mine waste and tailings
- Little regard for potential effect on landscape
  - Tailing piles
  - Altered flood plains, increased turbidity
  - Heavy metal contamination
  - Degraded riparious

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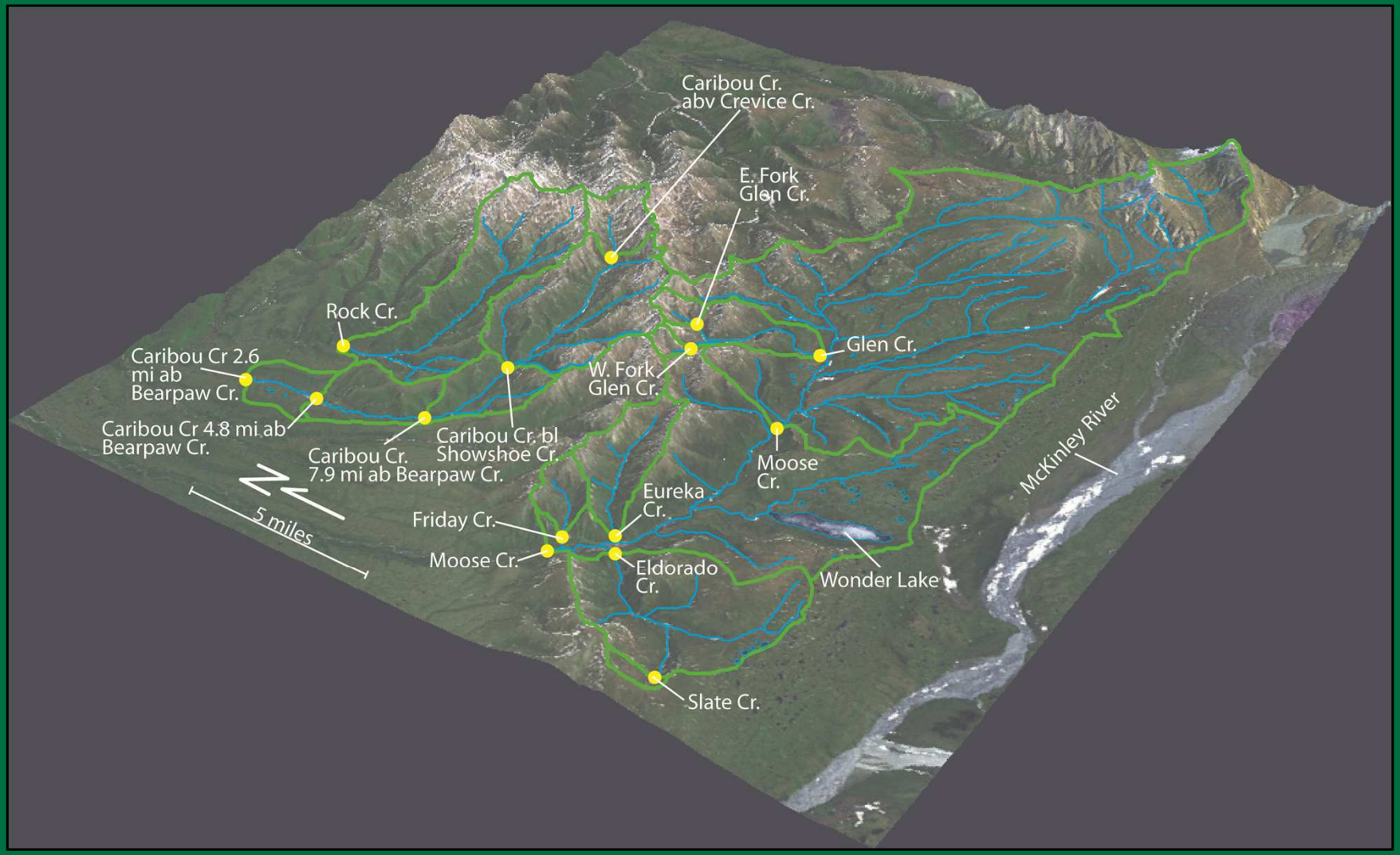
Kantishna Hills, Denali NPP, Alaska



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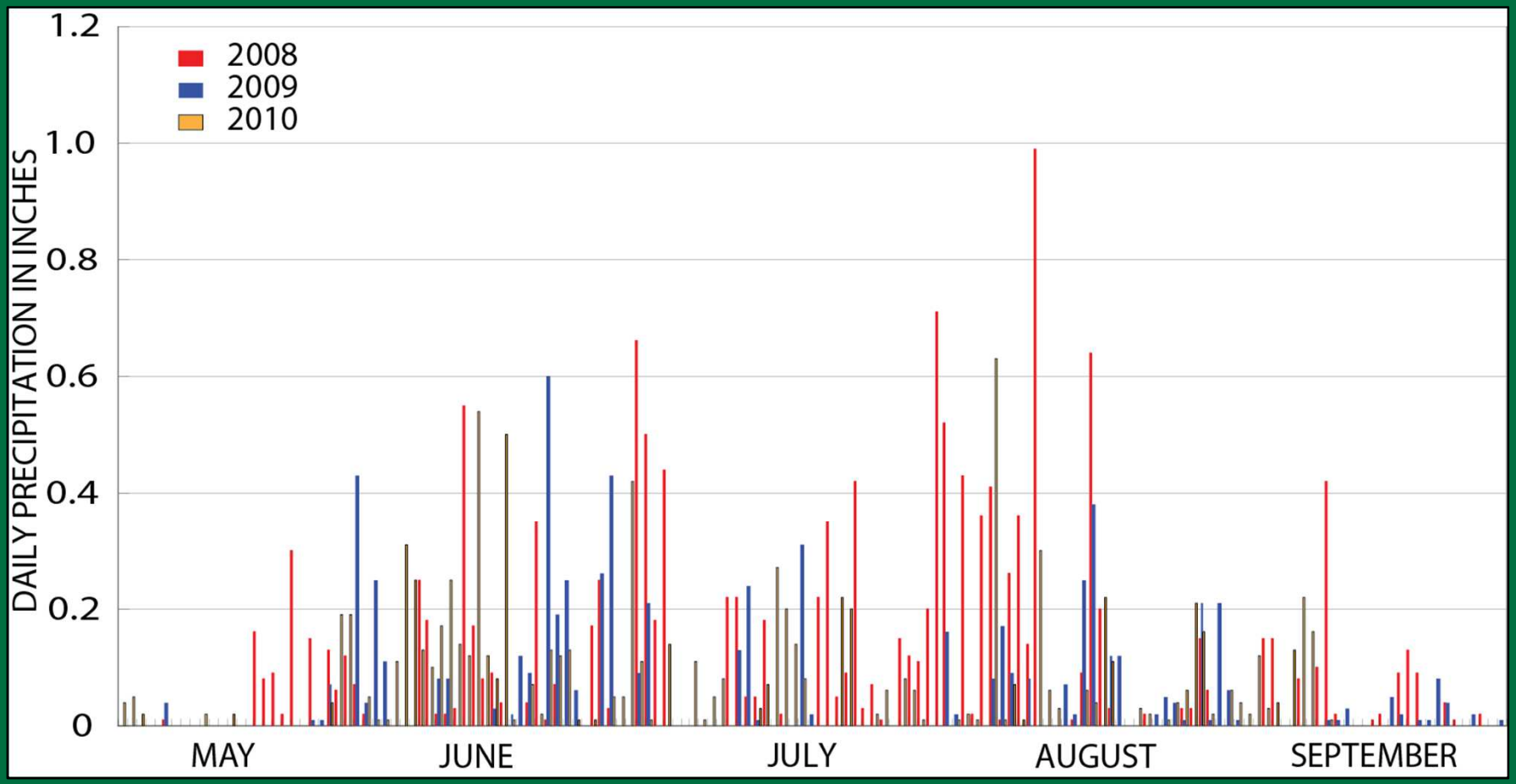
Daily Precipitation



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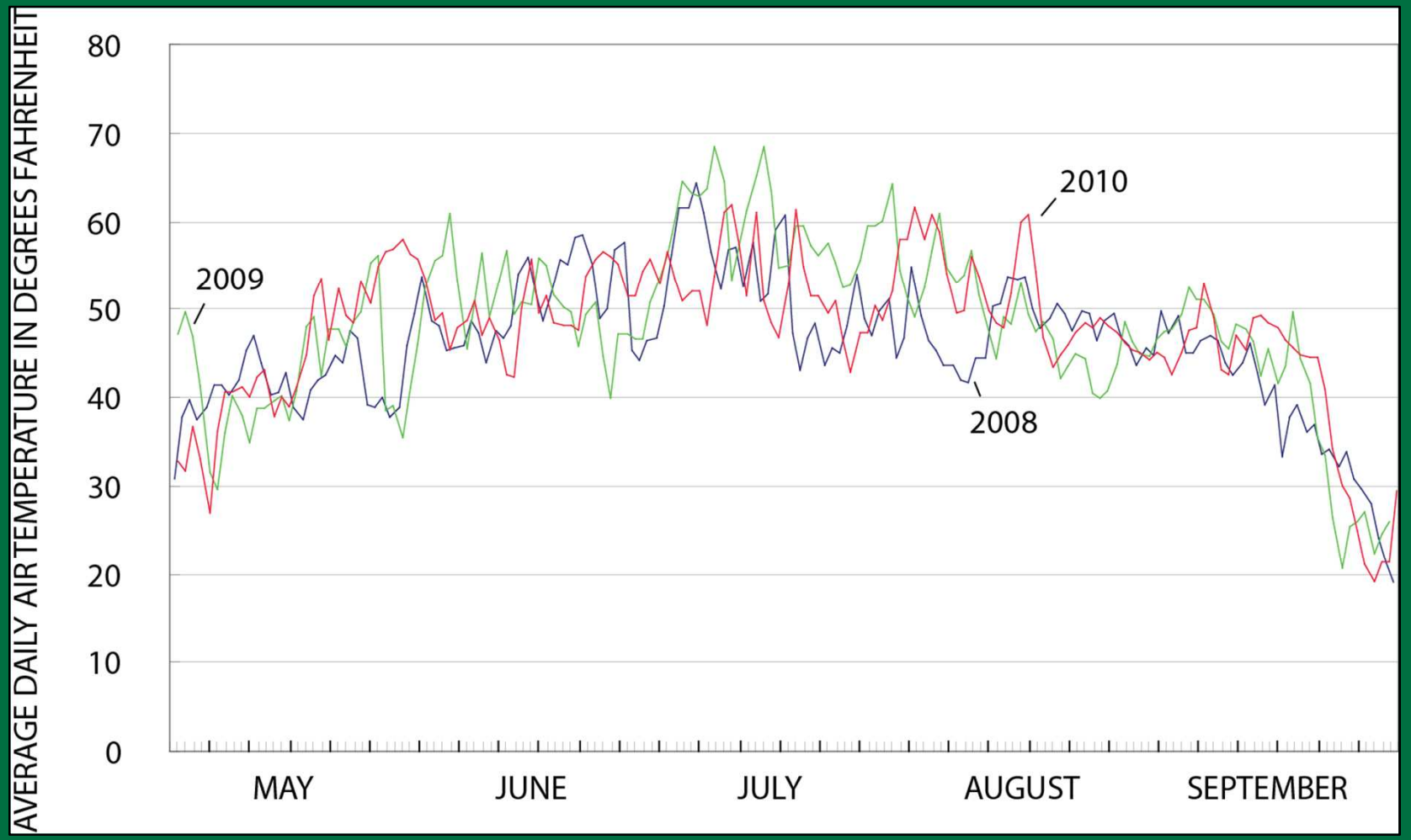
Mean Daily Air Temperature



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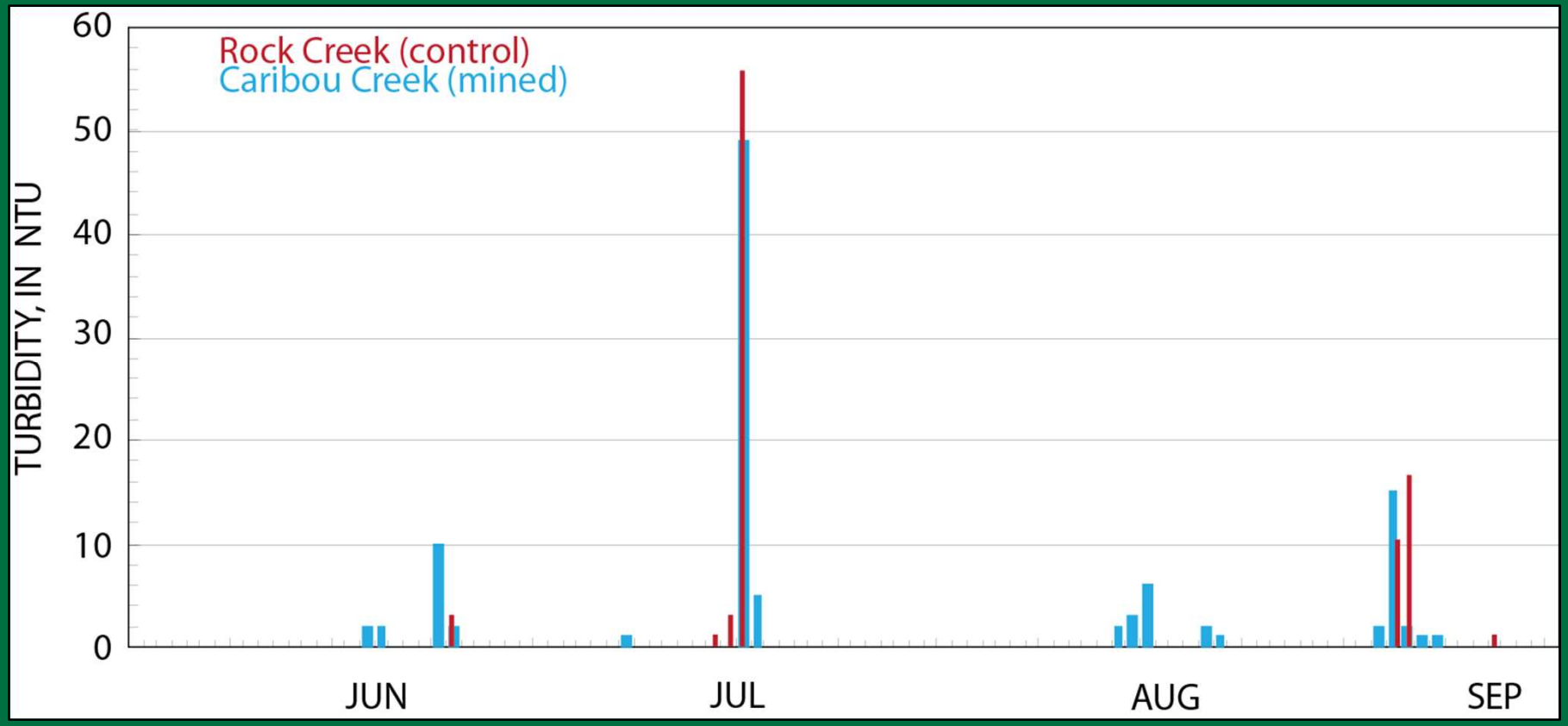
Turbidity



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Trace Elements

- Streambed sediments sampled for 34 trace elements
- Arsenic and Lead
  - Harmful to aquatic life
  - Probable Effect Level (PEL) - for comparison
  - As - 17.0 mg/kg, dry weight
  - Pb - 91.3 mg/kg, dry weight
- Water sampled for 23 trace elements
  - Antimony – exceeded 6 mg/L at 3 sites
  - Pb and As high, but not above EPA standards

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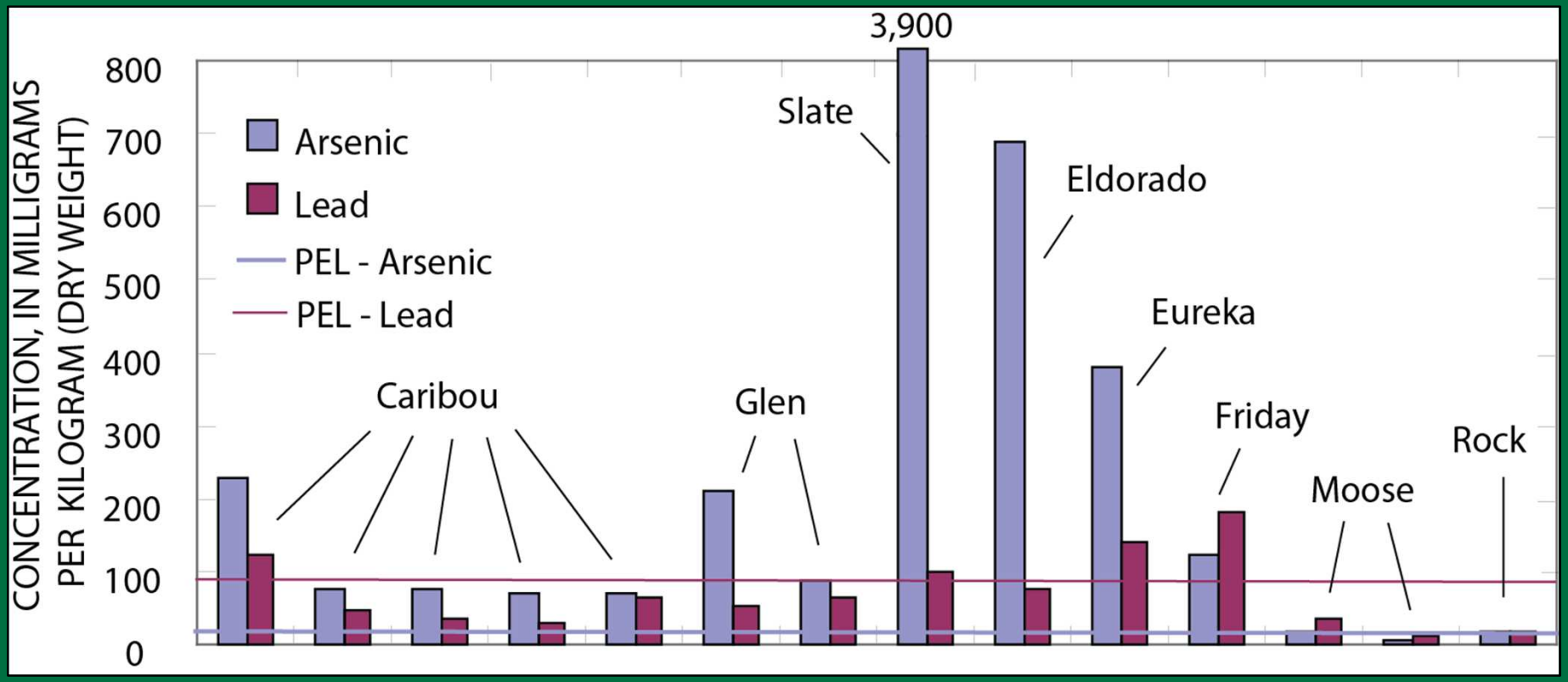
Arsenic and Lead



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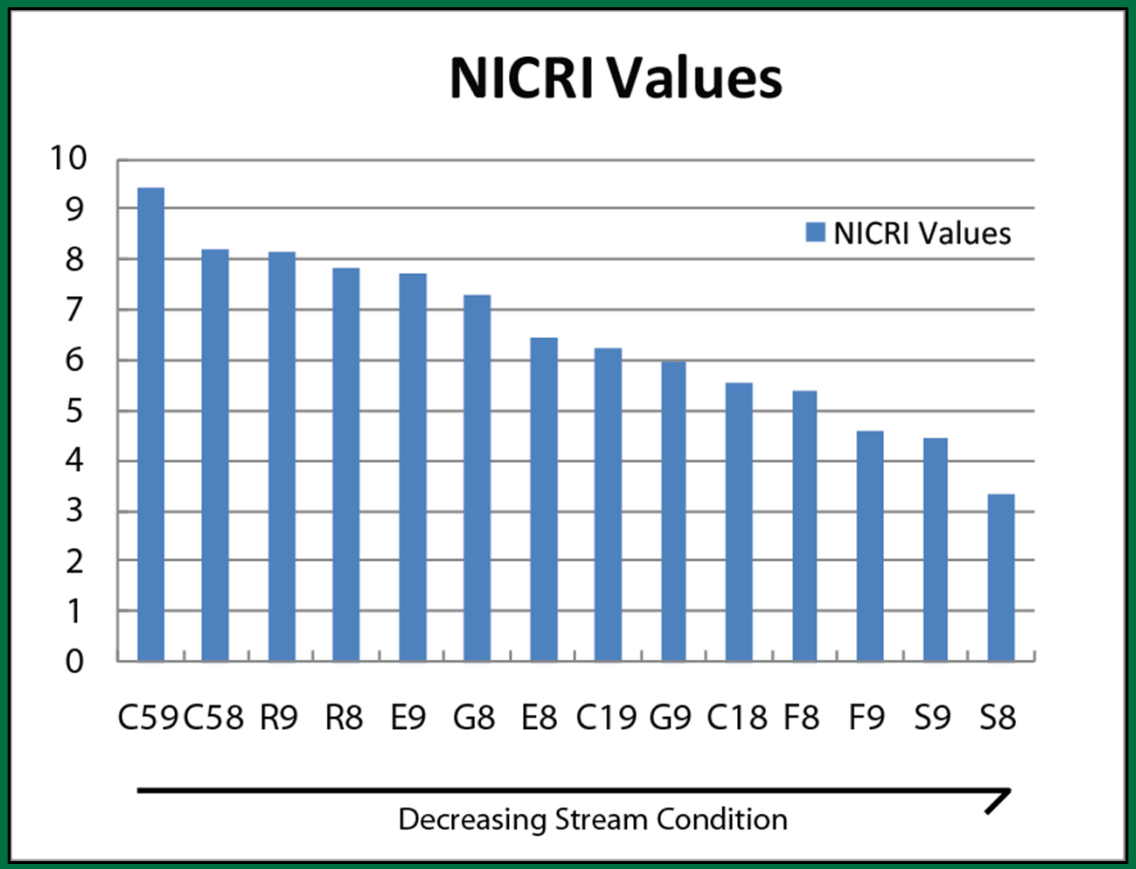
Site Ranking Using Macroinvertebrates



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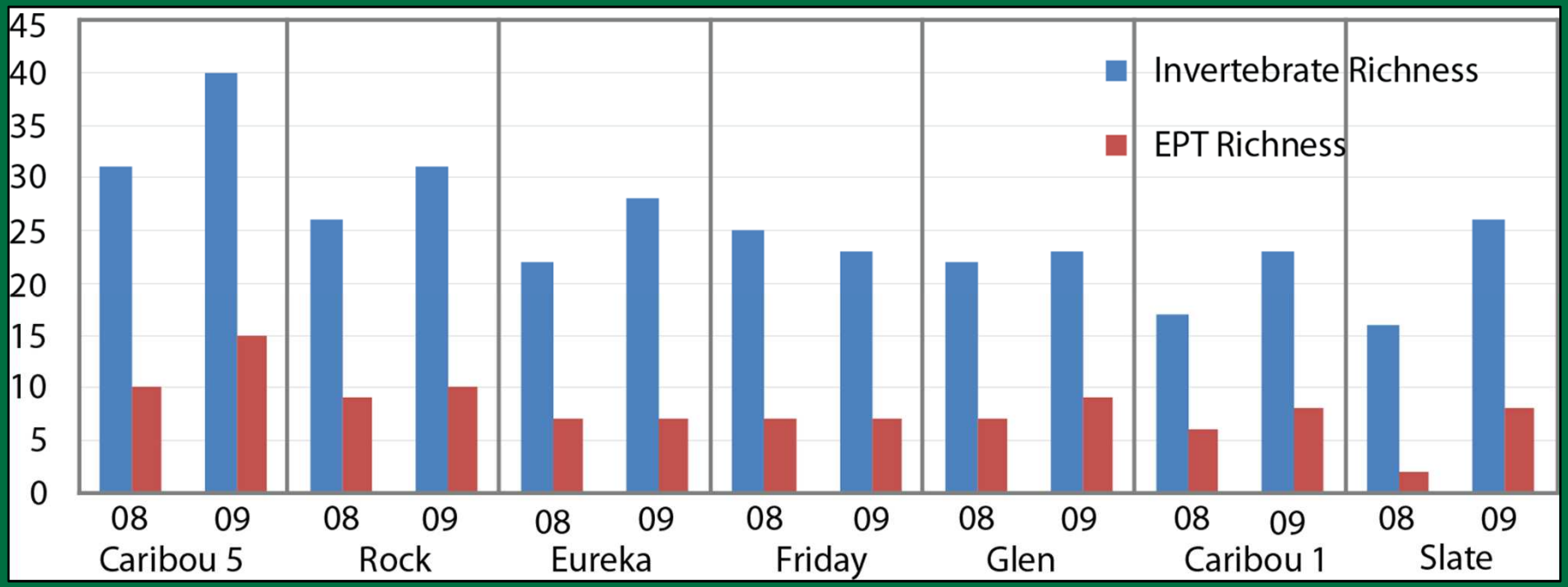
Macroinvertebrate Taxa & EPT Richness



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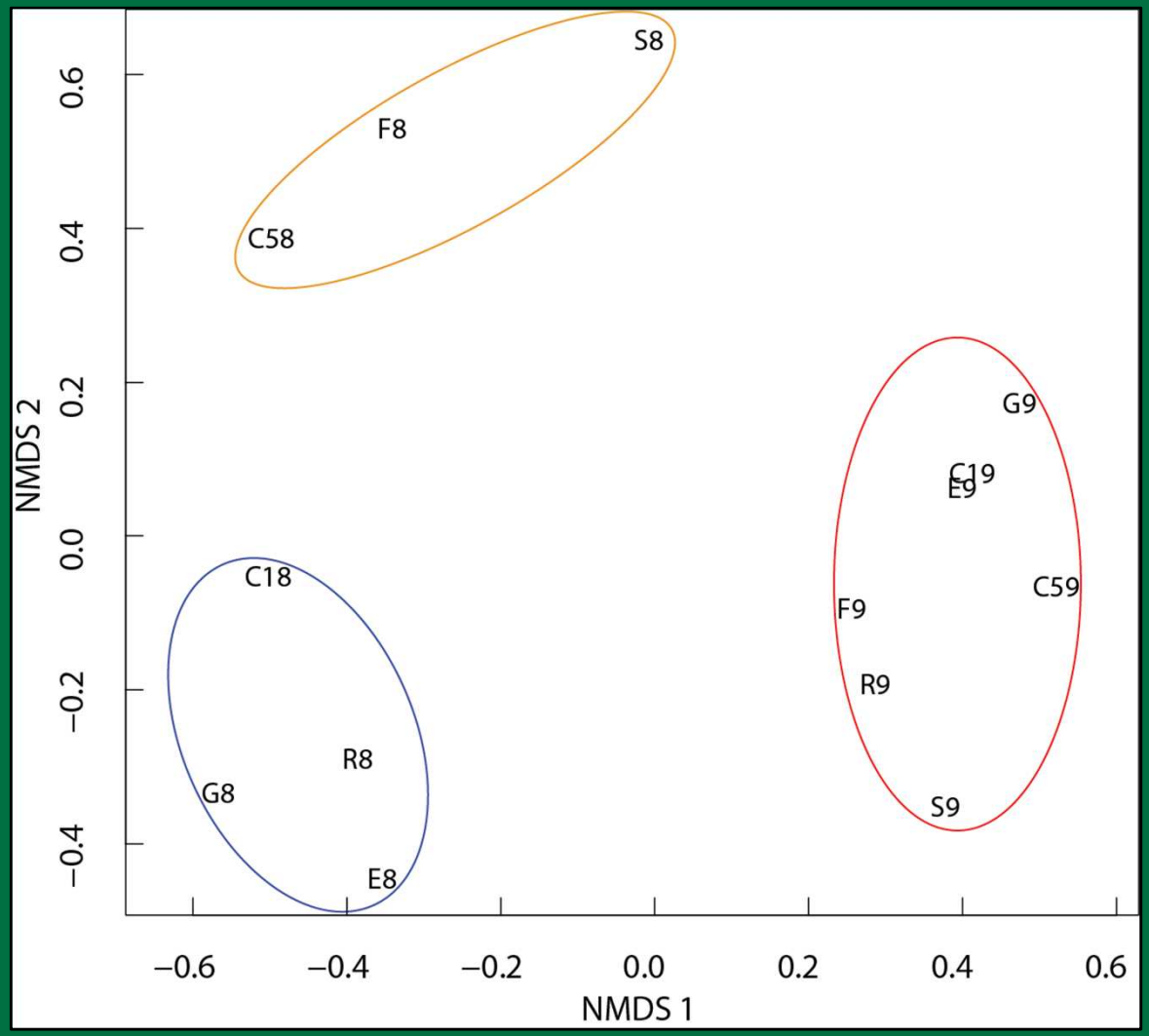
Periphyton NMDS



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Summary

- Restoration and re-vegetation are working
- Turbidity and suspended sediments low
- Caribou Creek delisted from CWA 303(d) in 2010
- Trace elements in water are generally below guidelines, except for antimony
- Trace elements in streambed sediments
  - Arsenic concentrations could adversely effect aquatic life

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Summary - Continued

- Macroinvertebrates and algae indicate Caribou Creek is rebounding from mining
- Slate Creek is still very disturbed, but new efforts in 2010 to add structure and complexity to mined area are promising
- Continued monitoring will aid in determining which methods are most beneficial and cost effective

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- Guy Adema
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