

National Biological Assessment
and Criteria Workshop

Advancing State and Tribal Programs



Coeur d'Alene, Idaho
31 March – 4 April, 2003

RFC 202

Challenges in Selecting Reference Streams in Plains Landscapes: Northeastern Montana

Presented by
Michael W. Suplee,
Montana Dept of Environmental Quality,
Water Quality Standards Section

Acknowledgements

Many thanks for their efforts in the field:

- Vicki Watson, U. of Montana
- Rosie Sada, MT DEQ
- Marianne Zugel, U. of Montana
- John Lhotak, U. of Montana

Study Objective

- To contrast the physical, biological, and chemical characteristics of impacted and minimally impacted stream sites in the Northwestern Glaciated Plains ecoregion in Montana.
- Use this information to help develop nutrient and algae standards within this basin.

Site selection Approaches

- A habitat index was built to describe anticipated condition of small basins in the area (11 digit HUCs).
- Index was based on satellite data of land uses: natural vegetation, agricultural, urban development, etc.
- Each land use was assigned a score; high scores applied to natural vegetation, low or negative scores to urban and agricultural. Composite scores ranged from -100 to +100.

Land Use Index Approach

- The index was too coarse to adequately locate reference sites
- Stream condition changed from fence line to fence line, depending upon specific stewardship practices of each land owner

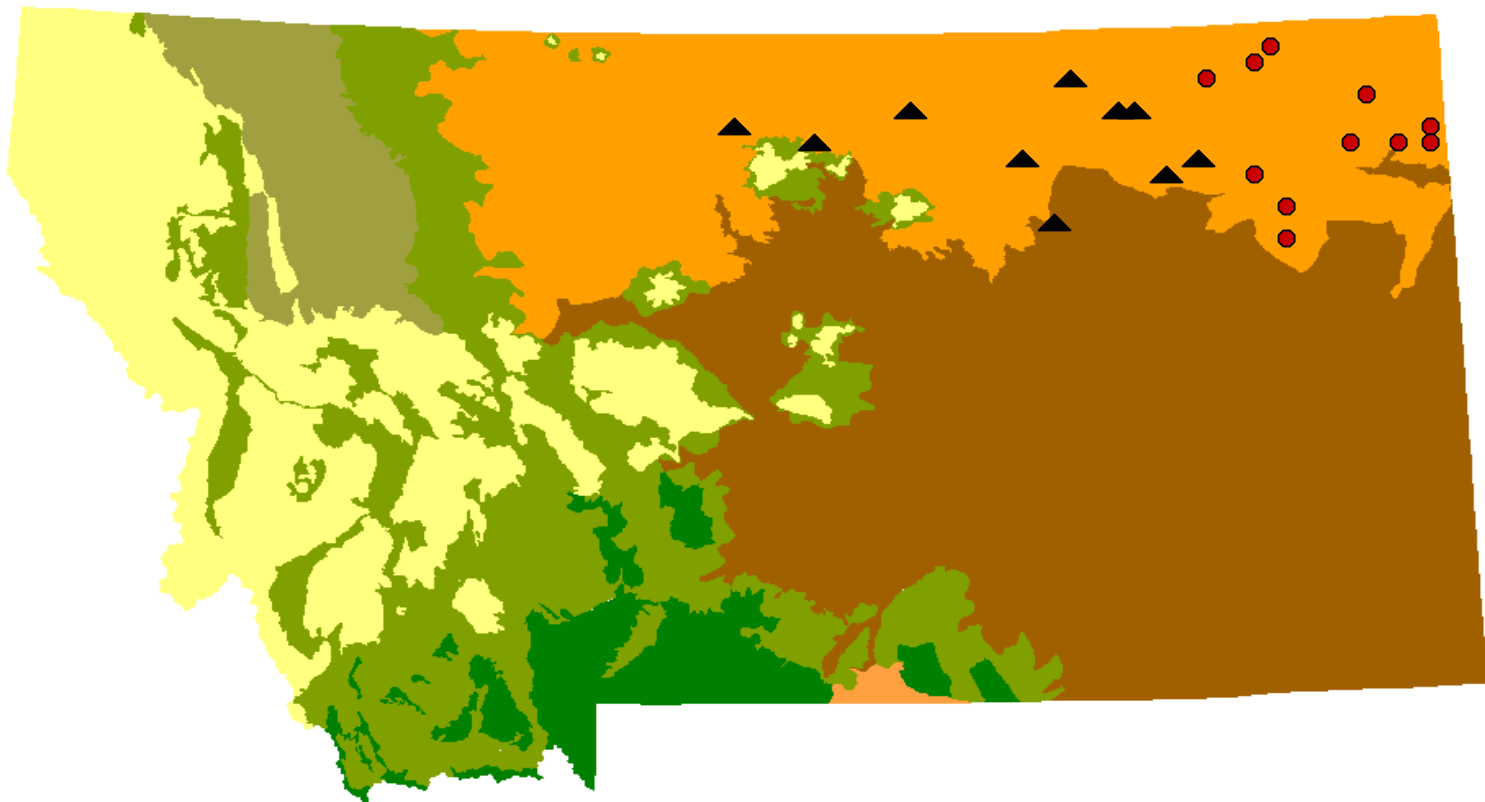
Site Selection Approach-Route B

- Relied upon best professional judgment (BPJ) to locate “impacted” and “reference” sites
- Scouted basin by car looking at sites, trying to locate those at each end of spectrum.
- Approach was fairly successful, however our ability to discern conditions along the spectrum was limited.

BPJ Approach to Site Selection

- Sites that were clearly “reference” were rare, as the region is completely utilized for agriculture or livestock grazing.
- Roadside visual surveys limit one’s ability to locate potentially better sites away from roads
- Land owners occasionally denied access to sites on their property.

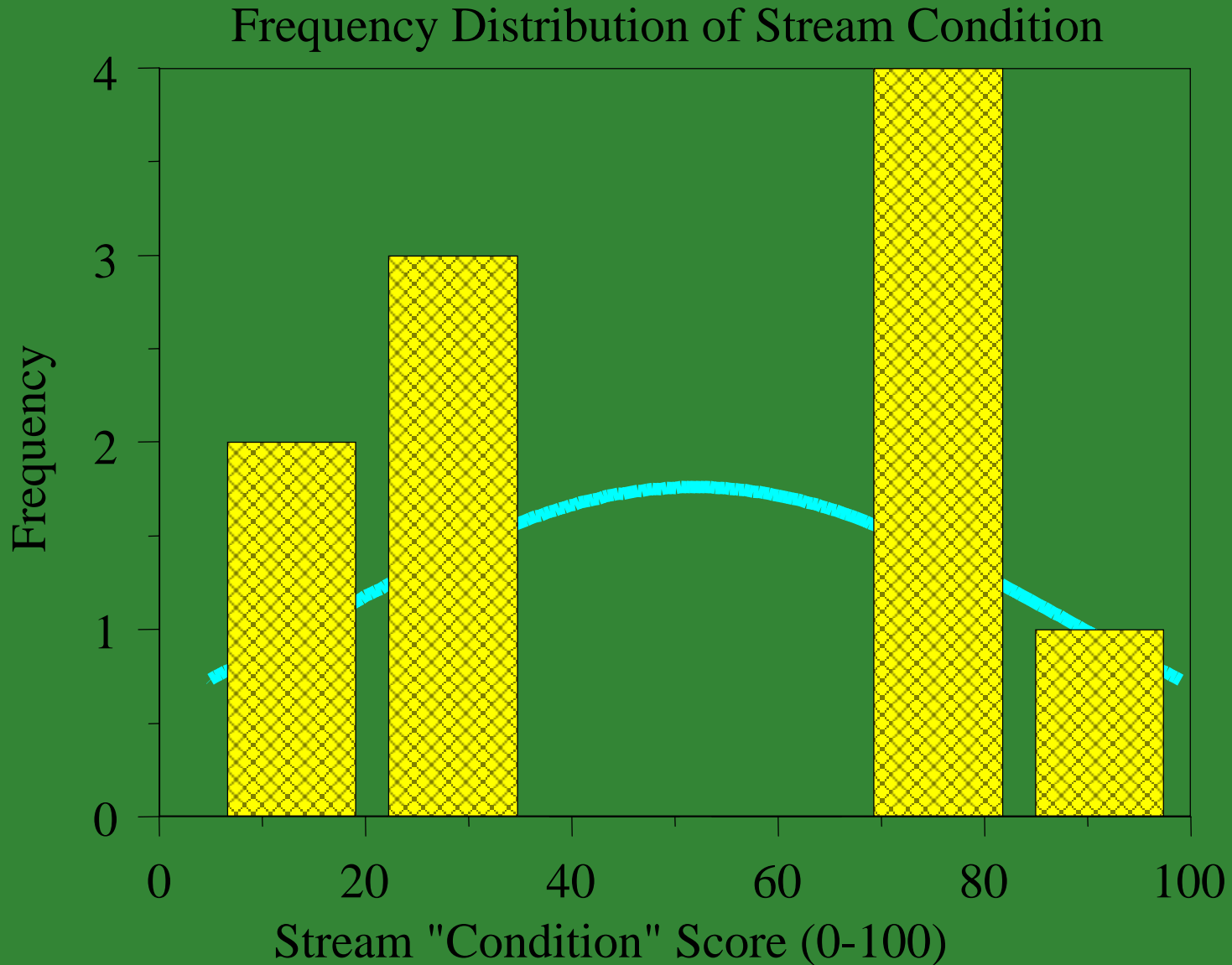
Site Locations



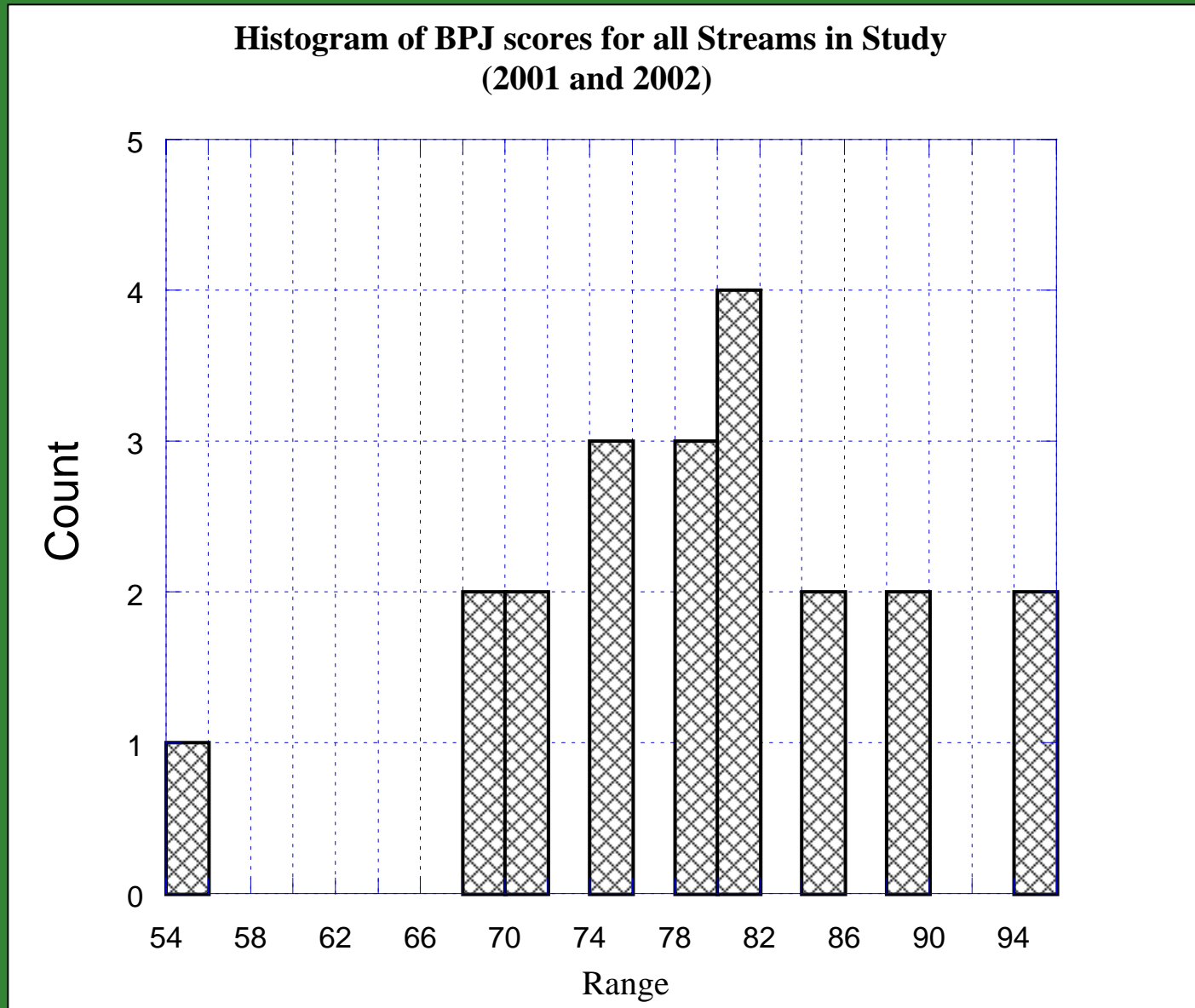
▲ 2001 (3 sites also sampled in 2002)

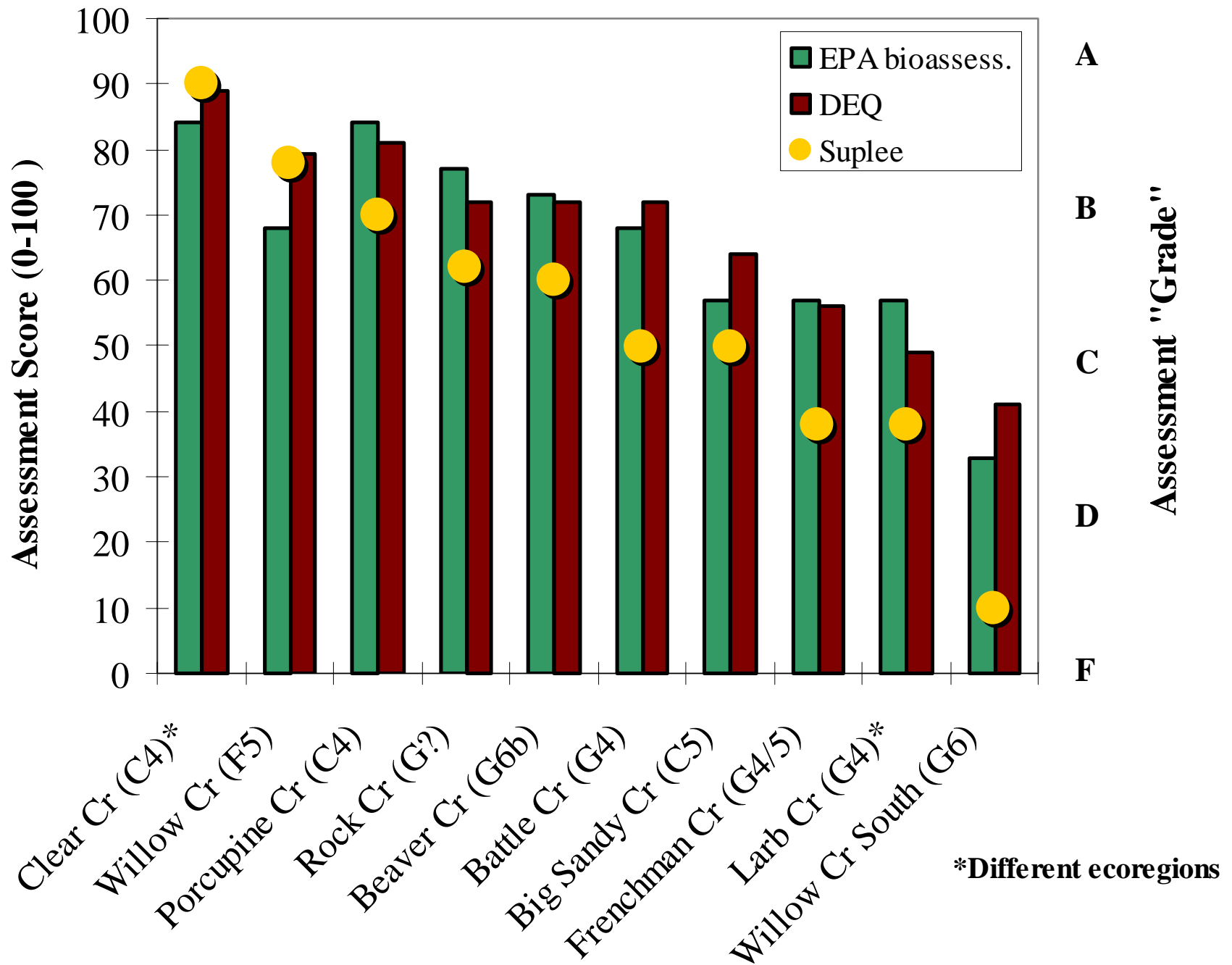
● 2002

Comparative Data Approach-Theoretical



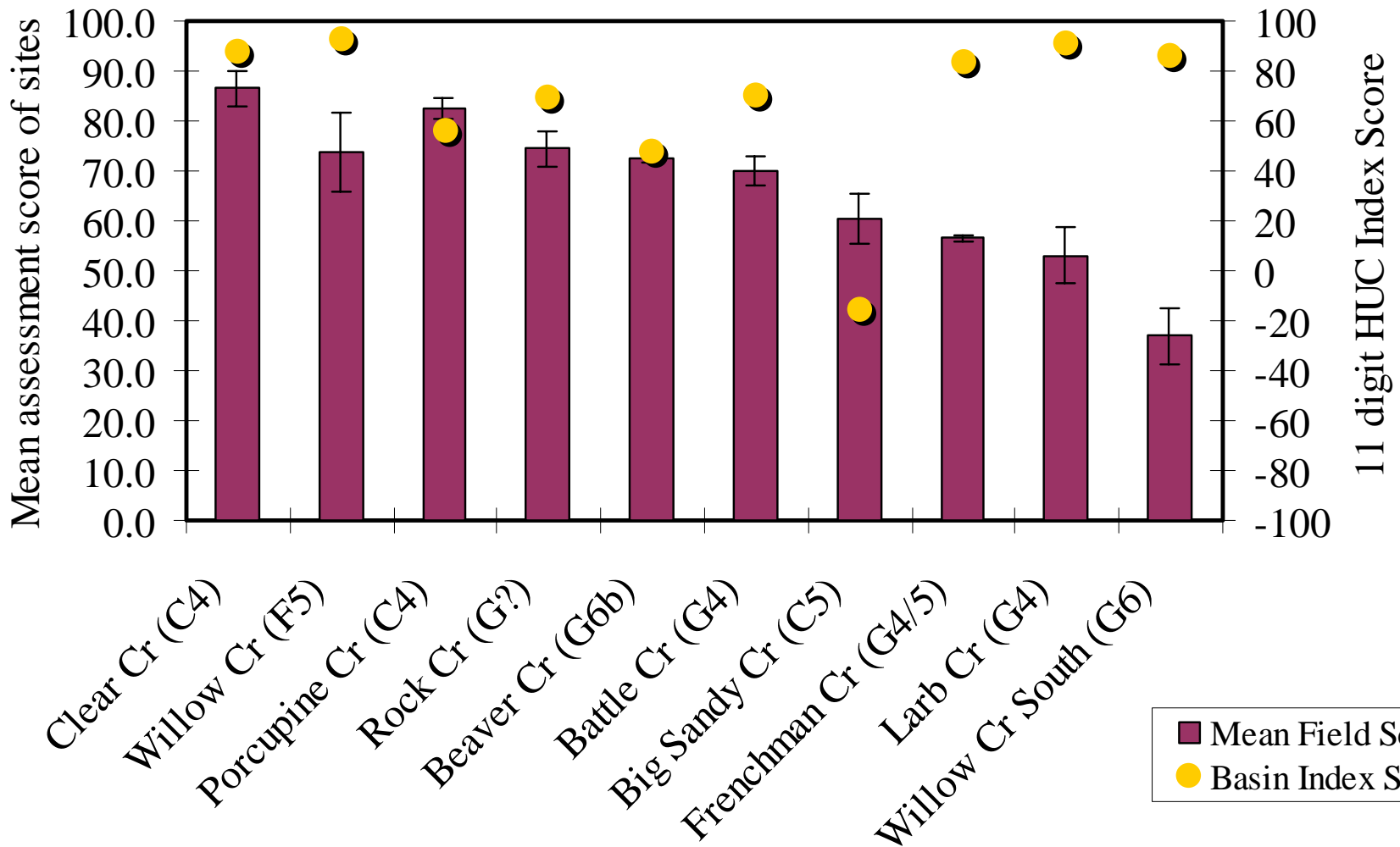
Histogram of Stream Habitat Conditions





Field Assessments vs. Basin Index Values

(error bars are 1SD of the mean)



Should there be Woody Vegetation?



Rock Creek. Valley
County, MT

Sheep Creek. McCone
County, MT



What kind of algae and macrophyte community should we expect?

Plains streams generally had two well defined communities, with little overlap:

1. Phytoplankton community (green pools)
2. Robust, mixed population of macrophytes and filamentous algae, with little or no phytoplankton (clear water pools).



Beaver Creek. Phillips County, MT

March 31 - April 4, 2003

National Biological Assessment and Criteria Workshop, RFC 202_06

15

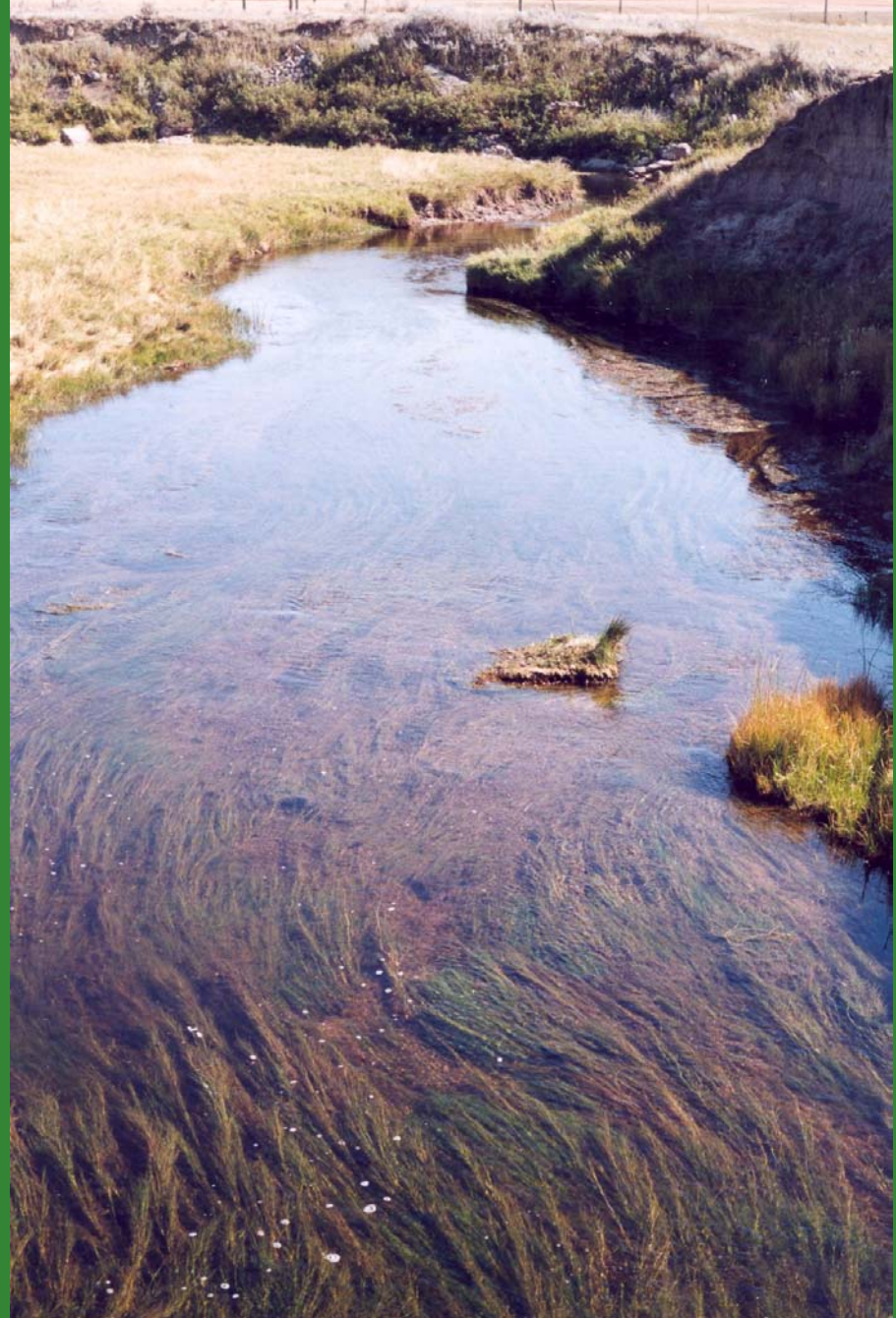


Willow Creek. Valley County, MT

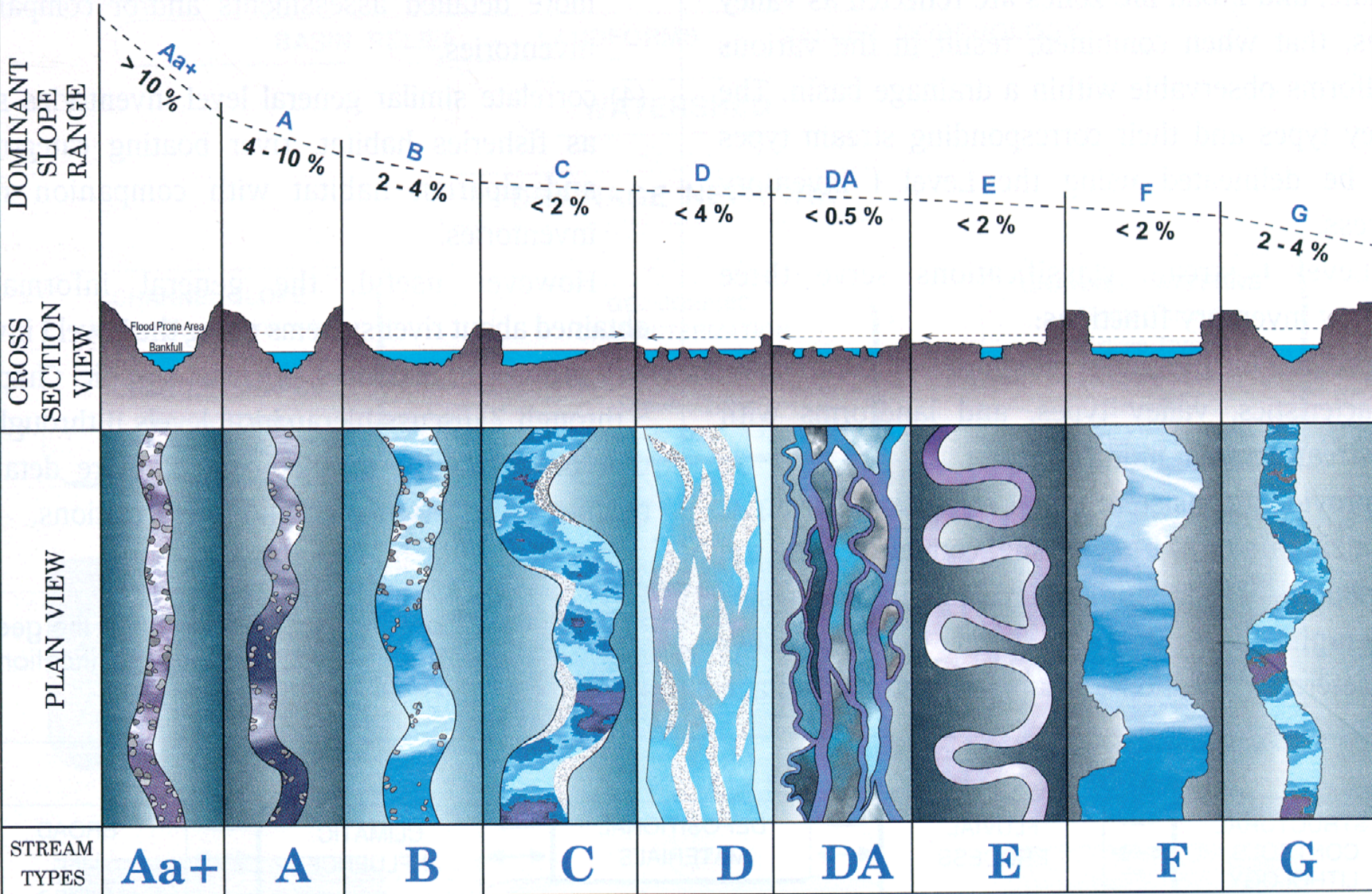


Porcupine Creek. Valley County, MT

Poplar River, Middle
Fork. Daniels County,
MT

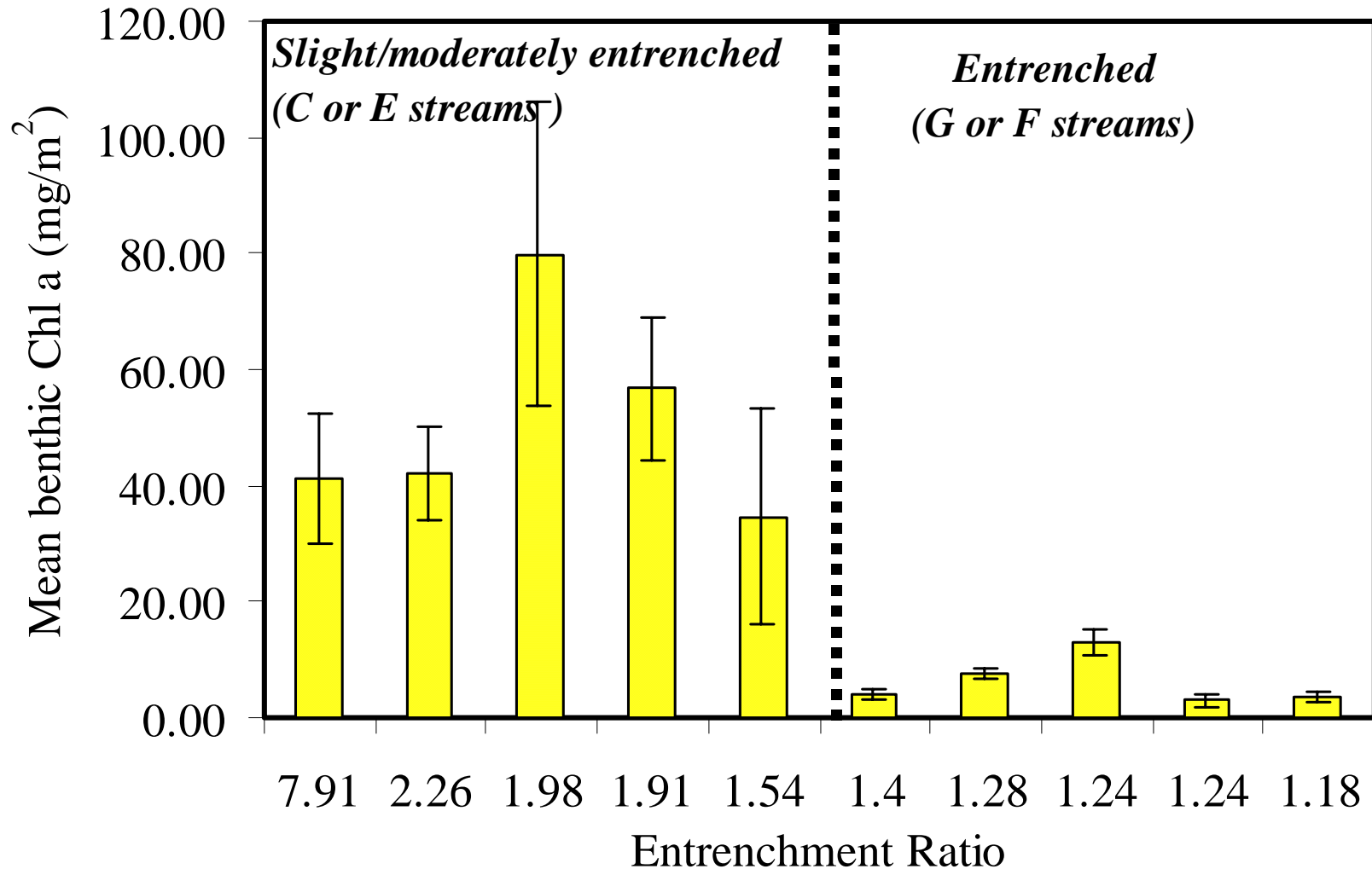


LONGITUDINAL, CROSS-SECTIONAL and PLAN VIEWS of MAJOR STREAM TYPES



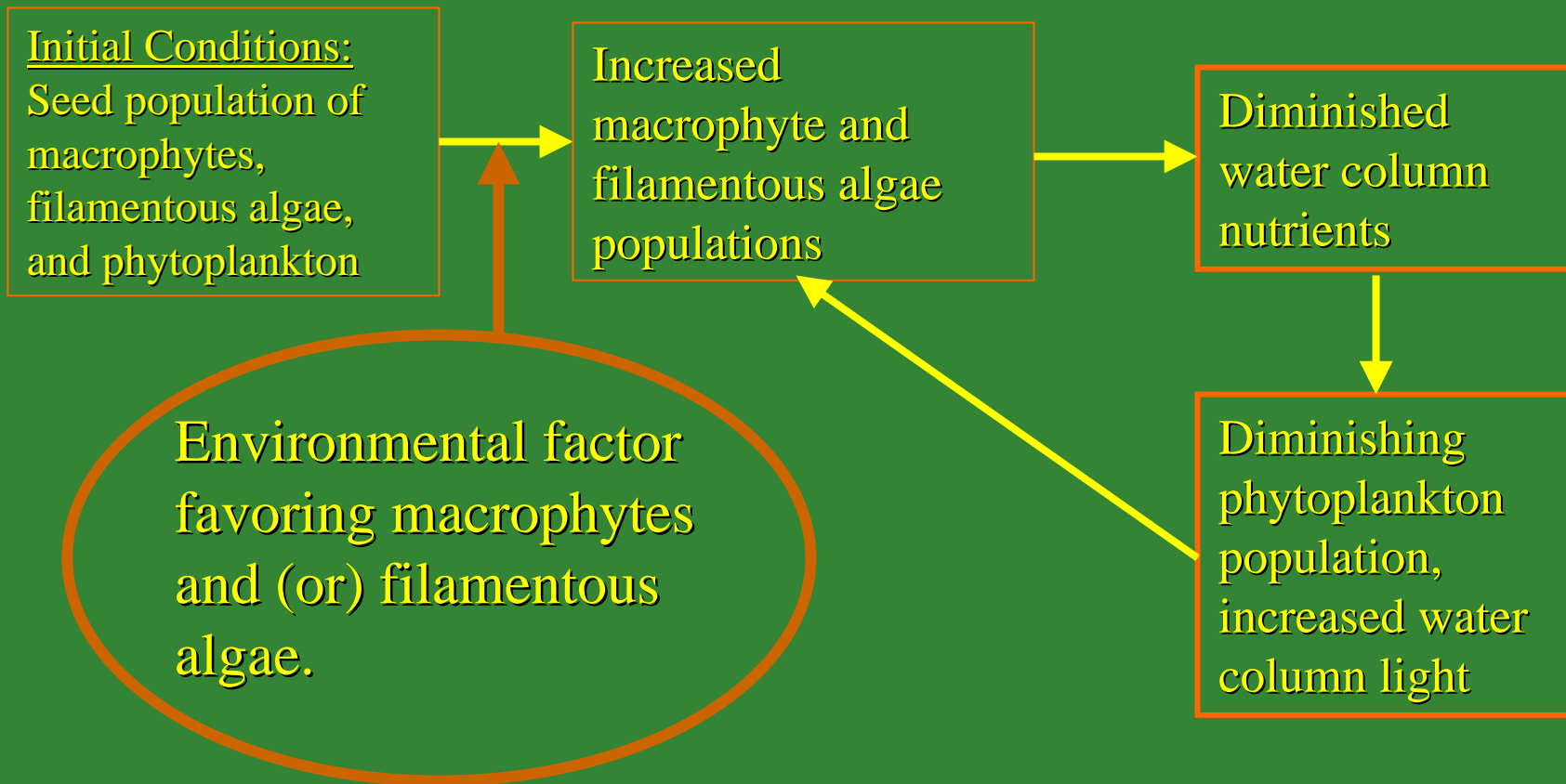
Benthic Chl *a* and Entrenchment Ratio-August 2001

(error bars are 1 SE of the mean, n=11)



Why do the aquatic plant communities diverge?

- Ultimate cause unclear, proximate cause probably a positive feedback loop.



Some Observations Concerning Eastern Montana's Prairie Streams

- Frequently see two general groups:
 - Streams with well-developed floodplains showing minimal recent geomorphic change
 - Streams that have recently changed and are now entrenched “gullies”
- Modern gully erosion occurred 1880-1920 from climate changes and heavy grazing (Leopold 1993)
- Gully streams have refilled in the geologic past, but process is slow and may take hundreds of years (Leopold 1993)

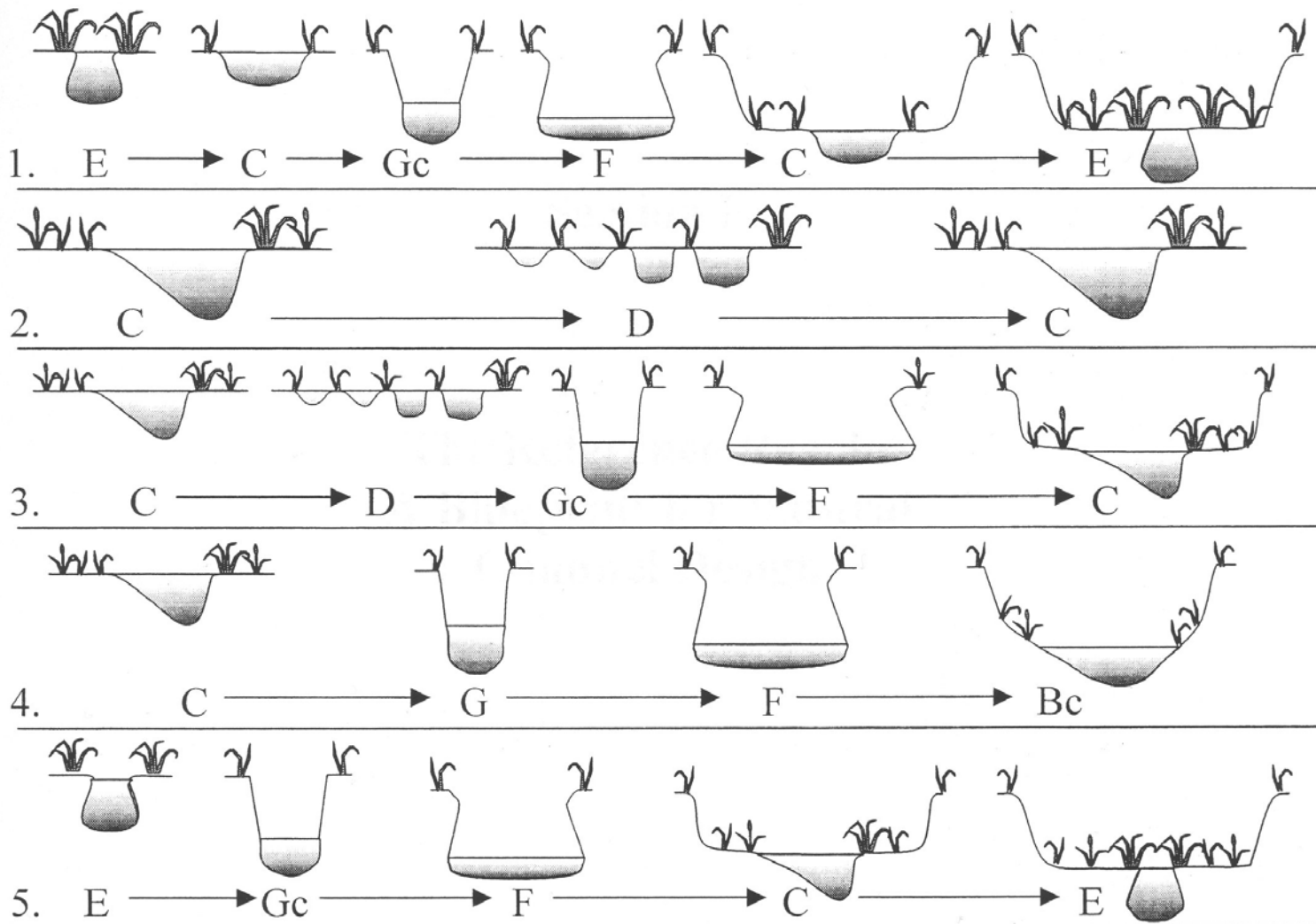


Milk River
abandoned oxbow

Milk River
at present



Various Stream Type Succession Scenarios



Stream type evolution. From Rosgen 2002



Big Sandy Creek (C6)



Porcupine Creek (C4)



Willow Creek
North (F5)



Larb Creek (G4)





Willow Creek South (G6)

Can entrenched streams (Rosgen G and F types) be used as reference sites?

- Entrenched streams are considered unstable, erosive, and in a dynamic state evolving towards more stable stream types.
- 50% of the streams in this study were of this type. They appear to be very common in the Plains of Eastern Montana



Example range
of conditions for
two entrenched
streams



Observations and Conclusions

- In spite of efforts to the contrary, the study ended up with most sites in the middle range of habitat condition
- Various BPJ approaches to rating individual stream sites provided similar results, however a simple basin-index approach could not predict *a priori* the location of impacted vs. un-impacted sites.

Observations and Conclusions

- Not all Prairie streams have extensive woody vegetation; careful observation of the old floodplain, stubble, and grazing practices will help elucidate whether this is “natural” or not.
- Divergent aquatic plant populations are likely a result of positive feedback in the aquatic ecosystem; ultimate cause unknown

Observations and Conclusions

- Want to compare apples to apples
- Prairie streams with well-developed floodplains should probably not be used as “references” for entrenched streams
- Among entrenched streams, there will be streams that will make reasonable reference sites for comparison against impacted, unstable sites.