

**National Biological Assessment
and Criteria Workshop**

Advancing State and Tribal Programs



Coeur d'Alene, Idaho
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TALU 101

Response of Stream Biological Communities to Agricultural Disturbances in the Great Plains

Presented by

**Bob Angelo,
Kansas Department of Health and Environment**

**GREAT PLAINS
ECOREGION
OF
NORTH
AMERICA**



BIOLOGICAL INTEGRITY CATEGORIES

SHALLOW, SANDY BOTTOMED PLAINS STREAMS

Class A: Historical (natural) reference condition

Class B: Contemporary (quasi-natural) reference condition

Class C: Fully supportive of designated aquatic life use

Class D: Partially supportive of designated aquatic life use

Class E: Non-supportive of designated aquatic life use

Class F: Grossly non-supportive of designated aquatic life use



CLASS A:
HISTORICAL REFERENCE CONDITION



With permission: Kansas State Historical Society



With permission: Kansas State Historical Society

Anderson at Great Bend 1892



SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS A STREAMS

- By definition, biological community lacks nonnative plant and animal species.
- Many peripheral fish and invertebrate species (e.g., American eel, chestnut lamprey, hickorynut mussel, sharp hornsnail) are represented in biological community.
- Dominant taxa include regionally endemic or quasi-endemic fish and invertebrate species (e.g., Arkansas River shiner, plains killifish, ringed crayfish, “sand dwelling” oligoneuriid mayfly).



CLASS B:

CONTEMPORARY REFERENCE CONDITION

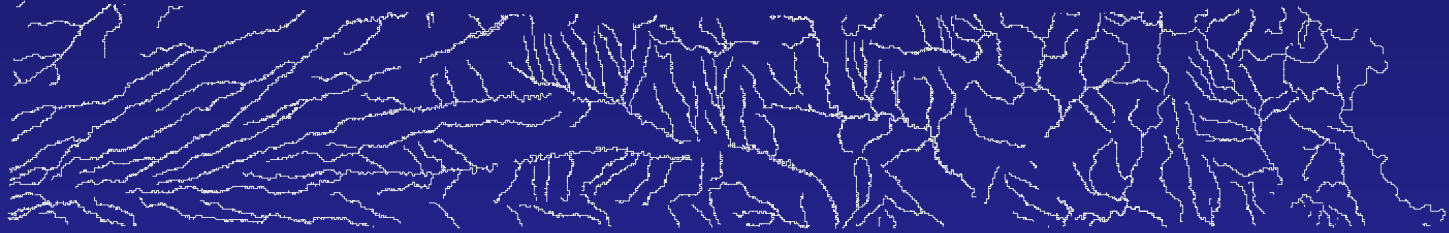






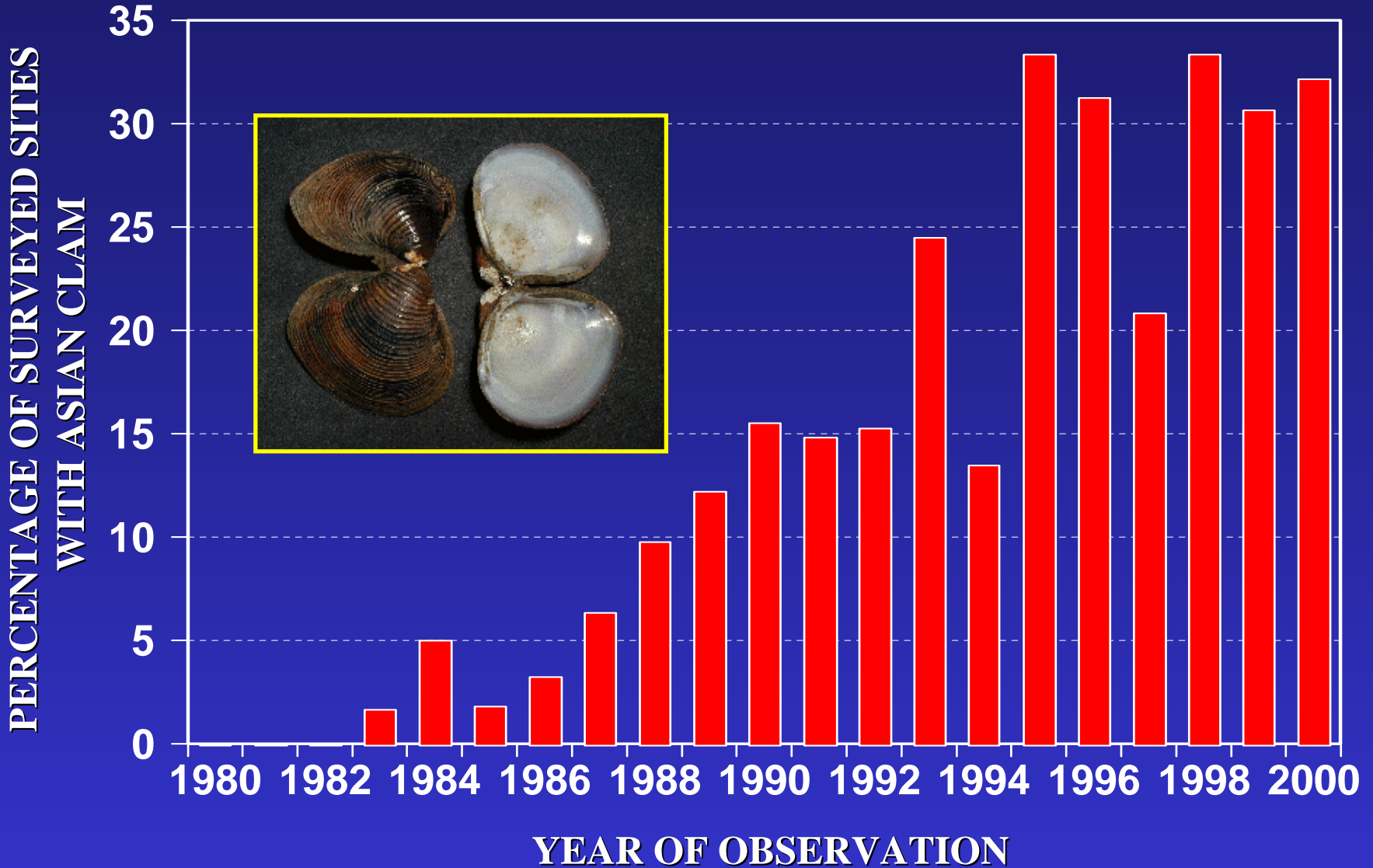


DECLINE IN GEOGRAPHICAL DISTRIBUTION OF BLACK SANDSHELL MUSSEL IN KANSAS



- HISTORICAL POPULATIONS
- KNOWN EXTANT POPULATION

DOCUMENTED OCCURRENCE OF ASIAN CLAM AT KDHE STREAM BIOLOGICAL MONITORING SITES



SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS B STREAMS

- Biological community may include populations of a few widely occurring exotic plants and animals (e.g., watercress, common carp, Asian clam).
- Some peripheral taxa (e.g., mooneye, western sand darter, black sandshell mussel, hickorynut mussel, ponderous campeloma snail) are no longer present.
- Dominant taxa, major trophic pathways, and nutrient cycling (spiraling) relationships are little changed from historical reference condition.



CLASS C:

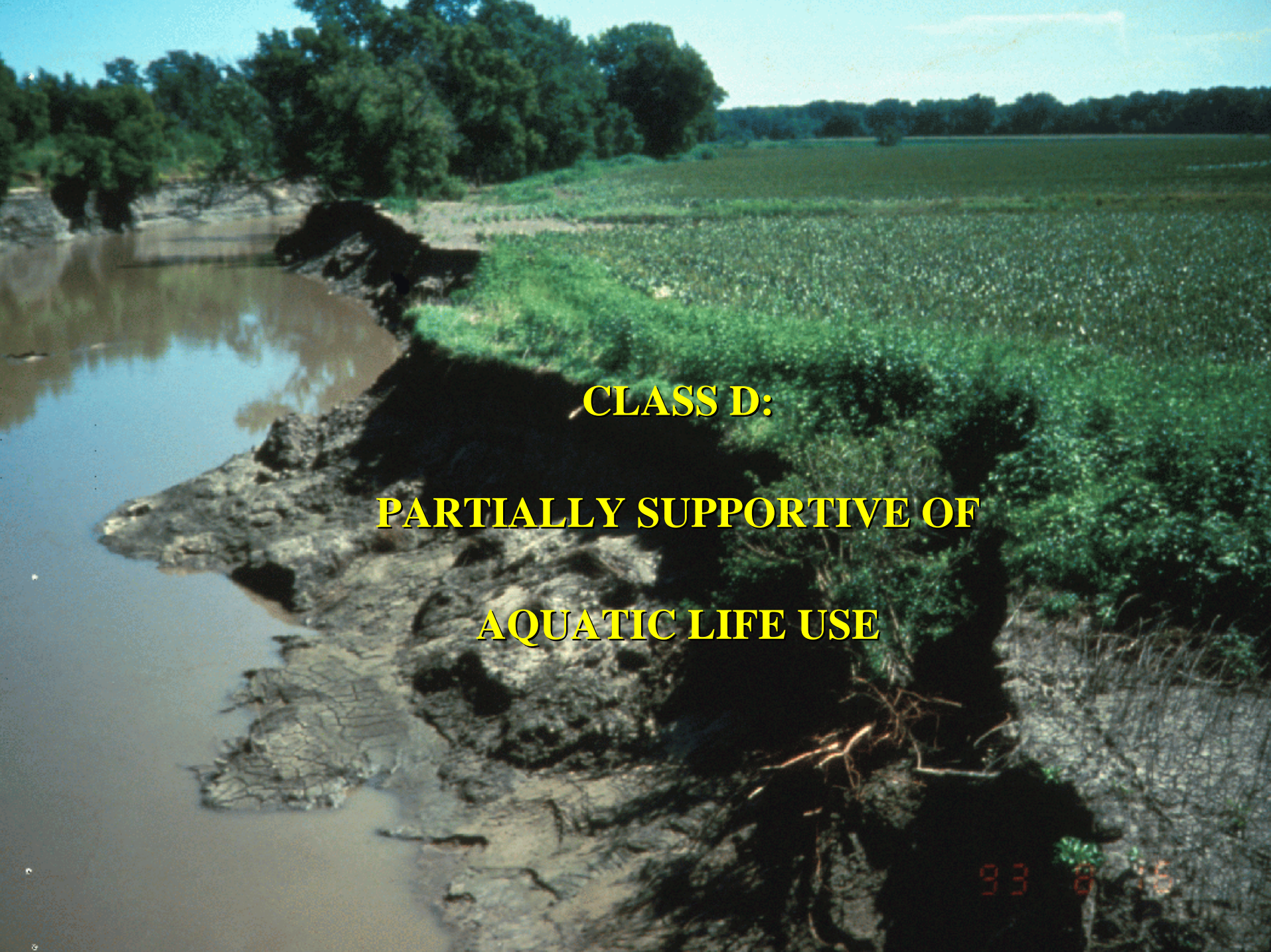
FULLY SUPPORTIVE OF

AQUATIC LIFE USE



SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS C STREAMS

- Nonnative plant and/or animal species constitute a significant component of biological community.
- Most native peripheral and regionally endemic species are missing from community.
- Stoneflies are absent or poorly represented in macro-invertebrate assemblage, but EPT percent count approaches or exceeds 50%. Pennate diatoms continue to dominate epilithic and episammic algal assemblages.
- Natural trophic structure/function and nutrient cycling relationships are largely maintained.



**CLASS D:
PARTIALLY SUPPORTIVE OF
AQUATIC LIFE USE**

93 8 15





Asian Clam (*Corbicula fluminea* Müller, 1774)
Walnut River, Butler County, September 19, 2000

SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS D STREAMS

- Nonnative species may dominate stream biological community in terms of biomass and number of individuals.
- Few if any native peripheral or regionally endemic species are represented in biological community.
- EPT percent count ranges from 30-50%. Midge larvae, oligochaete worms, and other tolerant forms rank among dominant invertebrate taxa. Pennate diatoms are absent or nearly so.
- Major trophic pathways, nutrient cycling relationships, and other functional and structural attributes of biological community differ from those of class C streams.

An aerial photograph showing a river or stream flowing through a rural landscape. The river is the central focus, winding through a patchwork of agricultural fields. A road or path crosses the river. The surrounding area is mostly flat, with some trees and structures visible in the distance under a clear sky.

**CLASSES E AND F:
(GROSSLY) NON-SUPPORTIVE OF
AQUATIC LIFE USE**



SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS E STREAMS

- Virtually all native peripheral and regionally endemic species are missing from biological community.
- Macrofauna are limited to a few hardy exotic species (e.g., common carp) and highly tolerant native taxa (e.g., bloodworms, physid snails). Nuisance algal growths may develop seasonally unless precluded by high turbidity.
- EPT percent count generally does not exceed 30%.
- Biological nutrient cycling interactions and energy transfers among trophic levels are less efficient than those occurring in higher quality streams.



SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS F STREAMS

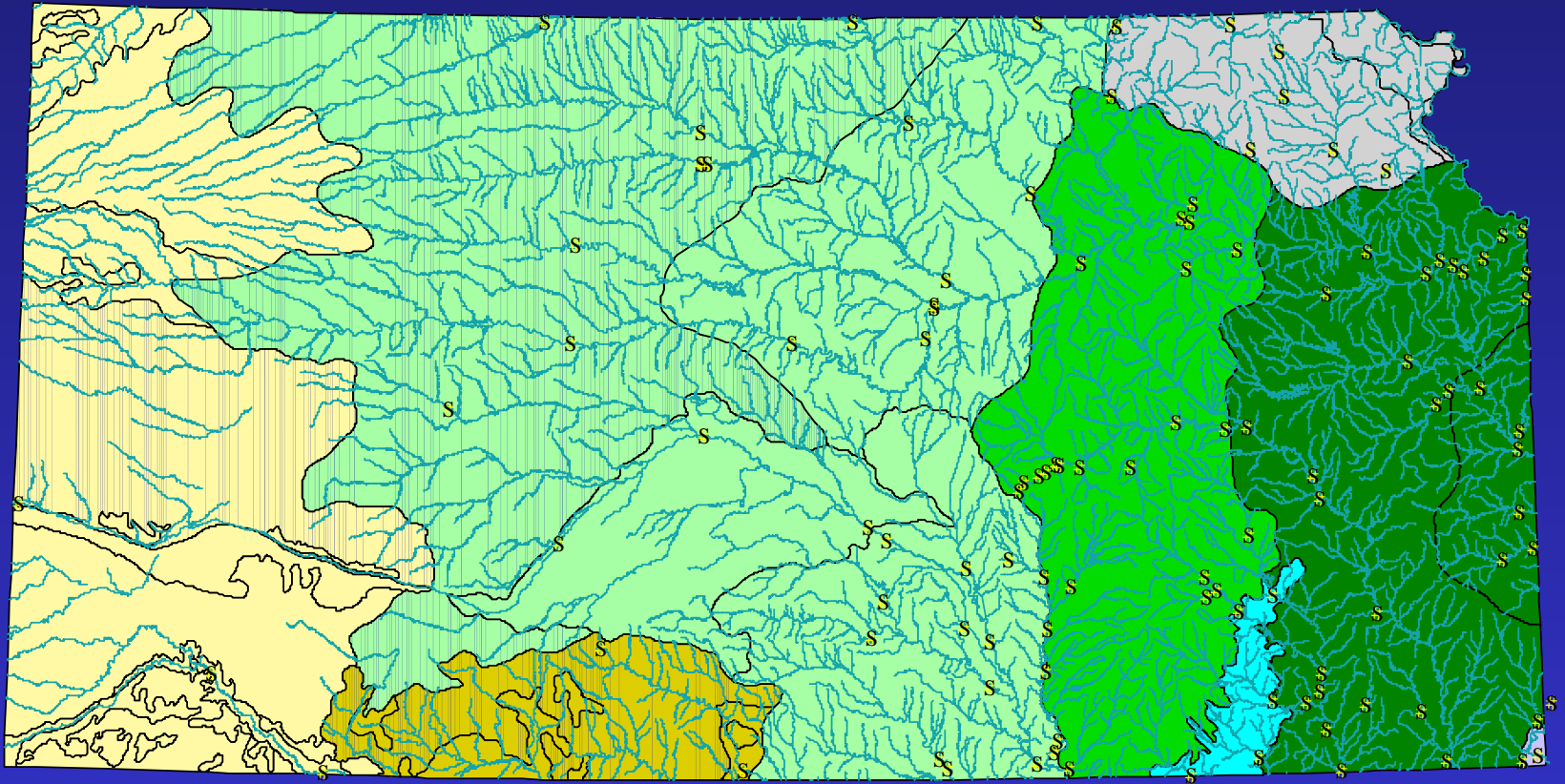
- Fish no longer comprise permanent component of biological community.
- Surviving invertebrate life (e.g., mosquito larvae) may attain very high population densities.
- Nuisance algal growths are likely to occur seasonally unless precluded by high turbidity.
- Nutrient cycling interactions and energy transfers among trophic levels are much less efficient than those occurring in higher quality streams.

An aerial photograph of a wide, winding river flowing through a flat, grassy landscape. The river is light blue and has several meanders. There are patches of green vegetation and small islands in the water. The sky is clear and blue.

**UTILITY OF MACROINVERTEBRATE DATA IN
DETERMINATION OF AGRICULTURAL
IMPACTS AND ASSIGNMENT OF
BIOLOGICAL INTEGRITY
CATEGORIES**

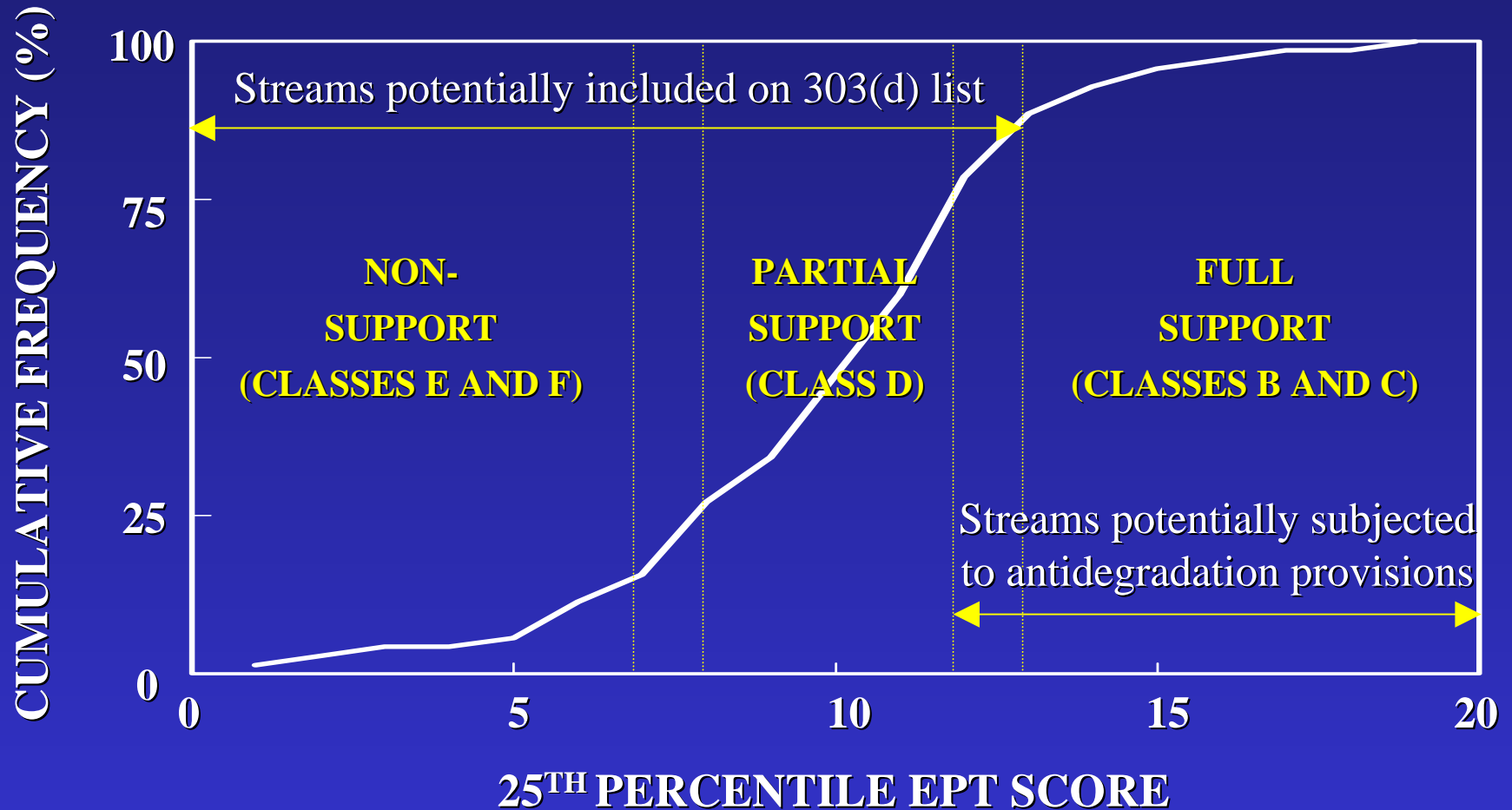
KDHE STREAM BIOLOGICAL MONITORING NETWORK

MONITORING SITE DISTRIBUTION AMONG LEVEL III ECOREGIONS



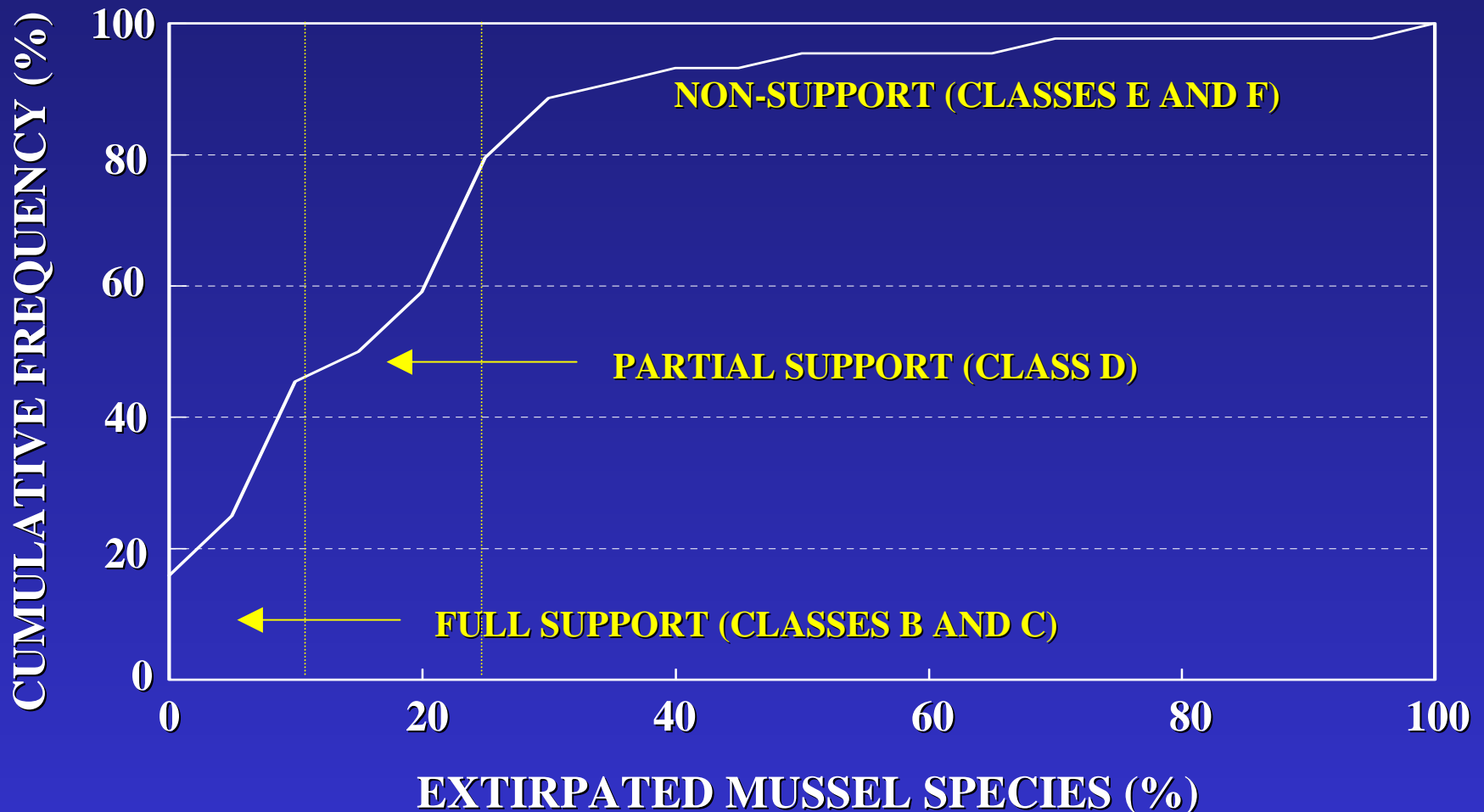
EPHEMEROPTERA-PLECOPTERA-TRICHOPTERA INDEX

CUMULATIVE FREQUENCY DISTRIBUTION FOR SITES WITH MINIMUM FIVE-YEAR PERIOD-OF-RECORD



DECLINE IN NATIVE MUSSEL ASSEMBLAGES

**CUMULATIVE FREQUENCY DISTRIBUTION FOR SITES
WITH MINIMUM THREE-YEAR PERIOD-OF-RECORD
AND FIVE OR MORE SPECIES HISTORICALLY**



CLOSING COMMENTS AND CONSIDERATIONS

- Most generalizations made during this presentation were based on monitoring data obtained from Kansas streams and may not apply well to all areas of the Great Plains.
- Biological monitoring efforts in this ecoregion must account for temporal fluctuations in community-based metrics resulting from natural (seasonal, interannual) changes in weather and stream flow conditions.
- Non-agricultural stressors (e.g., urban runoff, WWTP discharges, surface water impoundments and diversions unrelated to agriculture) also contribute to stream biological use impairments in this ecoregion.

CLOSING COMMENTS AND CONSIDERATIONS

(continued)

- Historical accounts and photographs, early biological survey records, and many archeological studies provide interesting and useful sources of information on the original characteristics of streams in the Great Plains.
- MBI, EPT, IBI and other classical biological indices may not be sensitive enough, by themselves, to reliably identify reference streams in this ecoregion. Surviving populations of historically occurring key species and indicator taxa, along with supporting physicochemical (water quality, habitat) data, may be useful in verifying the reference condition under such circumstances.

CLOSING COMMENTS AND CONSIDERATIONS

(continued)

- Reference streams should retain historically dominant taxa and those species deemed integral to the function and identity of the pre-settlement stream communities.
- The absence of a few historically occurring peripheral species should not automatically preclude the designation of a stream as a reference ecosystem.
- Nonnative species, in low numbers and densities, may be acceptable for reference purposes provided other measured attributes of the biological community are representative of the wider body of reference systems.

A person wearing a red and black plaid shirt, dark waders, and a yellow cap is standing in a shallow stream. They are using a long-handled net to catch something in the water. The stream is surrounded by large logs and branches, and the water is clear. The text "THE END" is overlaid in yellow on the image.

THE END