Response of Stream Biological Communities to Agricultural Disturbances in Kansas

Presented by
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GREAT PLAINS ECOREGION OF NORTH AMERICA
Class A: Historical (natural) reference condition

Class B: Contemporary (best remaining) 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
With permission: Kansas State Historical Society

Ernie McFarland at Great Bend, 1872

With permission: Kansas State Historical Society
SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS A STREAMS

- Biological community lacks exotic plant and animal species.

- Many peripheral fish species (e.g., American eel, chestnut lamprey) and invertebrate species (e.g., hickorynut mussel, sharp hornsnail) are represented in biological community.

- Regionally endemic or quasi-endemic fish species (e.g., Arkansas River shiner, plains killifish) and invertebrate species (e.g., ringed crayfish, “sand dwelling” mayfly) rank among dominant taxa.
CLASS B:

CONTEMPORARY REFERENCE CONDITION
DECLINE IN GEOGRAPHICAL DISTRIBUTION OF THE BLACK SANDSHELL IN KANSAS

- HISTORICAL POPULATIONS
- KNOWN EXTANT POPULATION
DOCUMENTED OCCURRENCE OF ASIAN CLAM AT KDHE
STREAM BIOLOGICAL MONITORING SITES

YEAR OF OBSERVATION

PERCENTAGE OF SURVEYED SITES WITH ASIAN CLAM

YEAR OF OBSERVATION


PERCENTAGE OF SURVEYED SITES WITH ASIAN CLAM
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, carp, Asian clam).
- Some peripheral species (e.g., black sandshell mussel) and regionally endemic species (e.g., Arkansas River shiner) 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- Dominant taxa, major trophic pathways, and nutrient cycling (spiraling) relationships are little changed from historical reference condition.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

- Exotic plant and/or animal species constitute a significant component of biological community.
- Most regionally endemic taxa and many peripheral species are missing from community.
- Stonefly taxa are few in number or entirely absent, but EPT percent count approaches or exceeds 50%. Pennate diatoms dominate epilithic and episammic algal communities.
- Natural trophic structure/function and nutrient cycling relationships are largely maintained.
CLASS D:
PARTIALLY SUPPORTIVE OF
AQUATIC LIFE USE
Asian Clam (*Corbicula fluminea* Müller, 1774)
Walnut River, Butler County, September 19, 2000
SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS D STREAMS

- Exotic species may dominate stream biological community in terms of biomass and number of individuals.

- Few if any regionally endemic taxa and peripheral species are represented in community.

- EPT percent count ranges from 30-50%. Midge larvae, oligochaete worms, and other tolerant forms rank among dominant invertebrate taxa. Pennate diatoms absent or nearly so.

- Nutrient cycling interactions and major trophic pathways differ from those of class C streams.
CLASSES E AND F:

(GROSSLY) NON-SUPPORTIVE OF

AQUATIC LIFE USE
SUMMARY OF EXPECTED BIOLOGICAL CONDITIONS IN CLASS E STREAMS

- Virtually all peripheral and regionally endemic species are absent from biological community.
- Macrofauna are often limited to a few hardy exotic species (e.g., carp) and highly tolerant native taxa (e.g., Chironomus larvae, physid snails). Nuisance algal growths may develop seasonally unless precluded by high turbidity.
- EPT percent count does not exceed 30%.
- Biological nutrient cycling interactions and trophic relationships are less complex than those occurring in higher quality 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 will occur seasonally unless precluded by high turbidity.

Nutrient cycling interactions and trophic relationships within biological community are highly simplified and generally inefficient.
UTILITY OF MACROINVERTEBRATE DATA IN
DELINEATION OF AGRICULTURAL
IMPACTS AND 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

Streams potentially included on 303(d) list

NON-SUPPORT (CLASSES E AND F)

PARTIAL SUPPORT (CLASS D)

FULL SUPPORT (CLASSES B AND C)

Streams potentially subjected to antidegradation provisions

CUMULATIVE FREQUENCY (%) vs. 25TH PERCENTILE EPT SCORE
DECLINE IN NATIVE MUSSEL ASSEMBLAGES

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

EXTIRPATED MUSSEL SPECIES (%)

CUMULATIVE FREQUENCY (%)

FULL SUPPORT (CLASSES B AND C)

PARTIAL SUPPORT (CLASS D)

NON-SUPPORT (CLASSES E AND F)
Generalizations made during this presentation may not apply well to all areas of the Great Plains.

Biological monitoring efforts in this ecoregion must account for natural temporal fluctuations in community-based metrics (i.e., weather and stream flow effects).

Non-agricultural factors also contribute to stream biological use impairments in many watersheds in this ecoregion.
Historical accounts and photographs, early biological survey records, and ongoing archeological studies afford an interesting and potentially useful perspective on the original condition of many streams in the Great Plains.

MBI, EPT and other classical biological indices may not be sensitive enough, by themselves, to reliably identify ecoregional reference streams. Surviving populations of historically occurring key species and indicator taxa may be useful in verifying the reference condition under such circumstances.
Although reference streams should retain historically dominant taxa and species deemed integral to function and identity of community as a whole, absence of a few historically occurring peripheral species does not necessarily preclude a reference designation.

Non-indigenous species in low numbers and densities may be acceptable for reference purposes provided other measured attributes of biological community are representative of wider body of reference systems.

Large areas within Great Plains probably no longer retain true reference streams.