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Historical Reconstruction of Reference Condition

Presented by

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The time has come for science to busy itself with the earth itself.

The first step is to reconstruct a sample of what we had to start with.

- Aldo Leopold, 1938

Historical Reconstruction

Goal: To provide a benchmark for gauging the deviation of sample sites from a minimally disturbed condition

Approach: Describe a range of stream-riparian conditions that existed historically using a variety of available data, information, and approaches

Rationale: Needed as ancillary information in conjunction with least-disturbed sites or as an alternative to using reference sites in areas where site selection criteria cannot be met

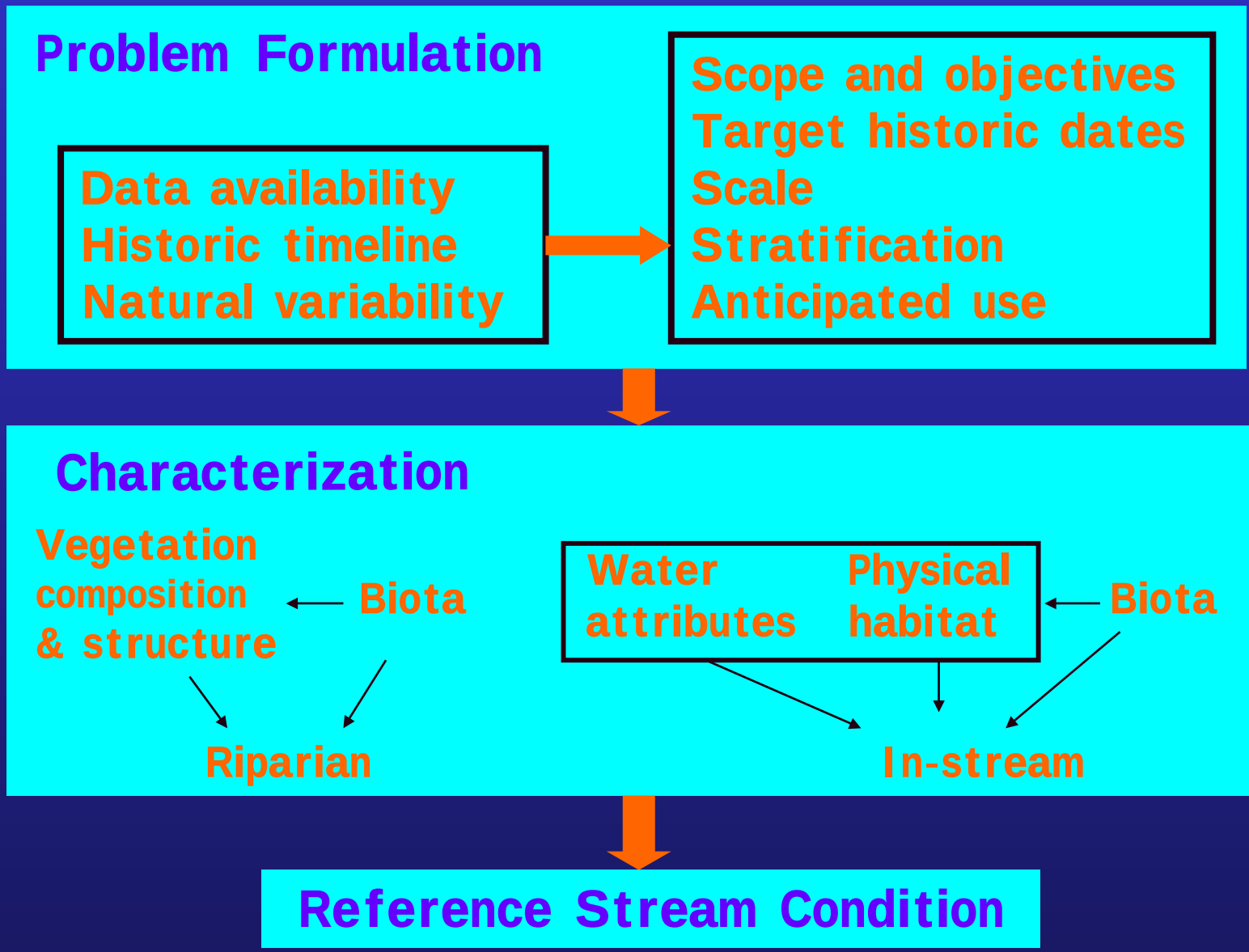
Advantages of Historical Reconstruction

- Estimates a minimally-disturbed condition rather than least-disturbed
- Can complement information collected at reference sites
- Reduces the potential for inconsistent definition of "least-disturbed" over time and from place to place
- Historical profile needs to be generated only once
- Historical record lasts forever; reference sites may be short-lived
- Regional coverage with a good source of data can be more thorough than sampling at reference sites

Why has Historical Reconstruction been Avoided?

- The process is time intensive and piecemeal, and historical data are often limited and inconsistent
- Some common techniques are not applicable in streams
- We have no control over the data and are limited in our use of traditional scientific analyses
- Most information is descriptive and not directly comparable to data that we typically collect today
- Many historical data were collected after impacts from European settlement--some quite severe--had already occurred

Conceptual Framework



Sources of Historical Record

Human Record

- Narratives & journals
- Writings & reviews
- GLO survey notes
- Photographs and maps
- Early biological surveys
- Indigenous knowledge

Biological Record

- Tree ring analyses
- Fossil records, e.g.,
  - Pollen deposits
  - Packrat middens

Current resources

- Potential natural vegetation summaries
- Soil surveys

Modern Techniques

- Modeling
- Radiocarbon dating

Overview of Presentation

I. Case study: John Day/Deschutes Basins, Oregon

- Stratification
- General Land Office (GLO) Survey notes
- Historical literature and excerpts
- Historical photographs
- Tree ring data
- Summaries of potential plant associations
- Natural vegetation of Oregon

II. Early Surveys--applications

- Fish
- Birds

Riparian Reconstruction, Case study
John Day/Deschutes basins, eastern Oregon

Problem Formulation: Stratification

Level IV Omernik Ecoregions

Stream gradient: low (0-1.8)
moderate (1.9-4.5)
high (>4.5)

Valley form: broad
V-shaped
trough-shaped

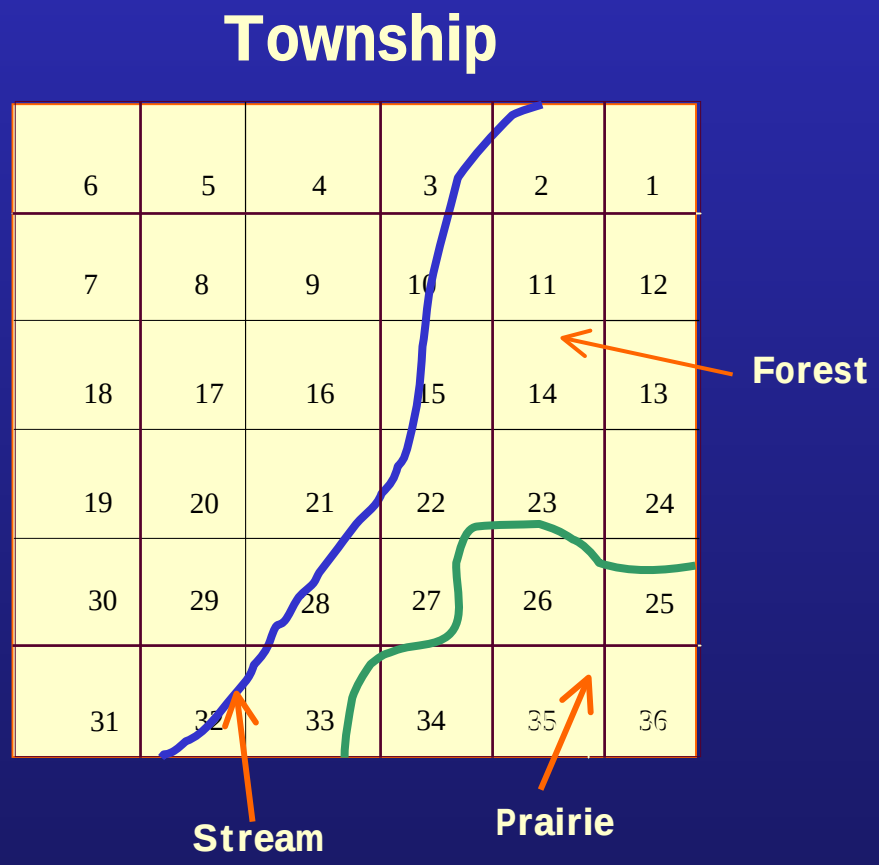
Example stratum:

John Day-Clarno uplands/Deschutes River Valley
Low gradient streams at low elevation
Broad or V-shaped valleys

General Land Office (GLO) Survey Technique

Features recorded at section corners, quarter-section corners, and along the section lines:

- Bearing trees - species, diameter, bearing, distance
- topography
- Water features
- Plant community description
- Cultural features
- Soil



GLO Survey Notes-1880s Summary for example stratum

- Willow and cottonwood were scattered along the streams
- Other riparian timber included alder, aspen, birch, and mahogany
- Thick riparian understory included willow, alder, currant,serviceberry, rose, thimbleberry, dogwood, myrtle
- Sparse junipers and heavy growth of prairie bunchgrasses in upland
- Fine bottomlands; first rate soils

North Fork Beaver Creek East of Paulina, OR, 1900

Photo: Steve Lent collection

"We have investigated this drainage and all the tributaries there too and find them to all be well lined with willow and aspin…a greater place for beaver did not exist in this world" (Ogden, 1825).

"Indians set fire to plain; willows on [Beaver] creek stopped fire" (Ogden, 1826).

Ochoco Creek, OR, 1913

Photo: Steve Lent collection

…many stream banks apparently lined with woody vegetation such as willow, aspen, alder, and cottonwood. "Ochoco" means "streams lined with willows". Willows, sedges, and rushes were typical riparian plants, possessing strong root systems (early 1800s) (Elmore & Beschta, 2000).

"…came to a stream [Ochoco] affording an abundance of water, grass, and timber" (1845).

Ochoco River 1918

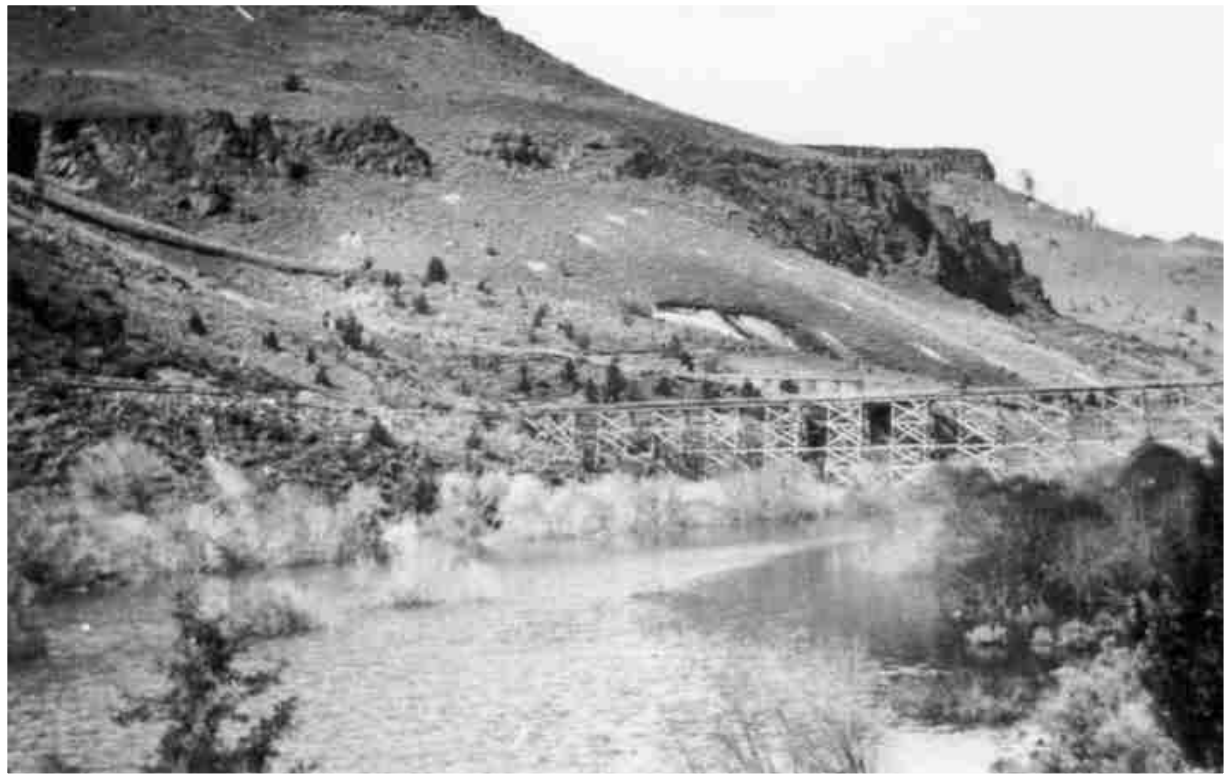


Photo: Steve Lent collection

"Watershed covered with low junipers and sagebrush; willows fairly dense along stream" (1942)

"Banks of river well-lined with willow, none of great size. Only a few junipers seen on hills" (1825).

Irrigation flume off the Ochoco River east of Prineville, OR, 1911

Photo: Steve Lent collection

"….river spreads out into a well-watered valley". Wild ryegrass undoubtedly grew in abundance (author's note) (1826).

"[Ochoco] flows through broad valley continuous with that of the Crooked River…. Hay is raised extensively in whole area except in canyonous section" (1942).

John Day River Valley, 1911

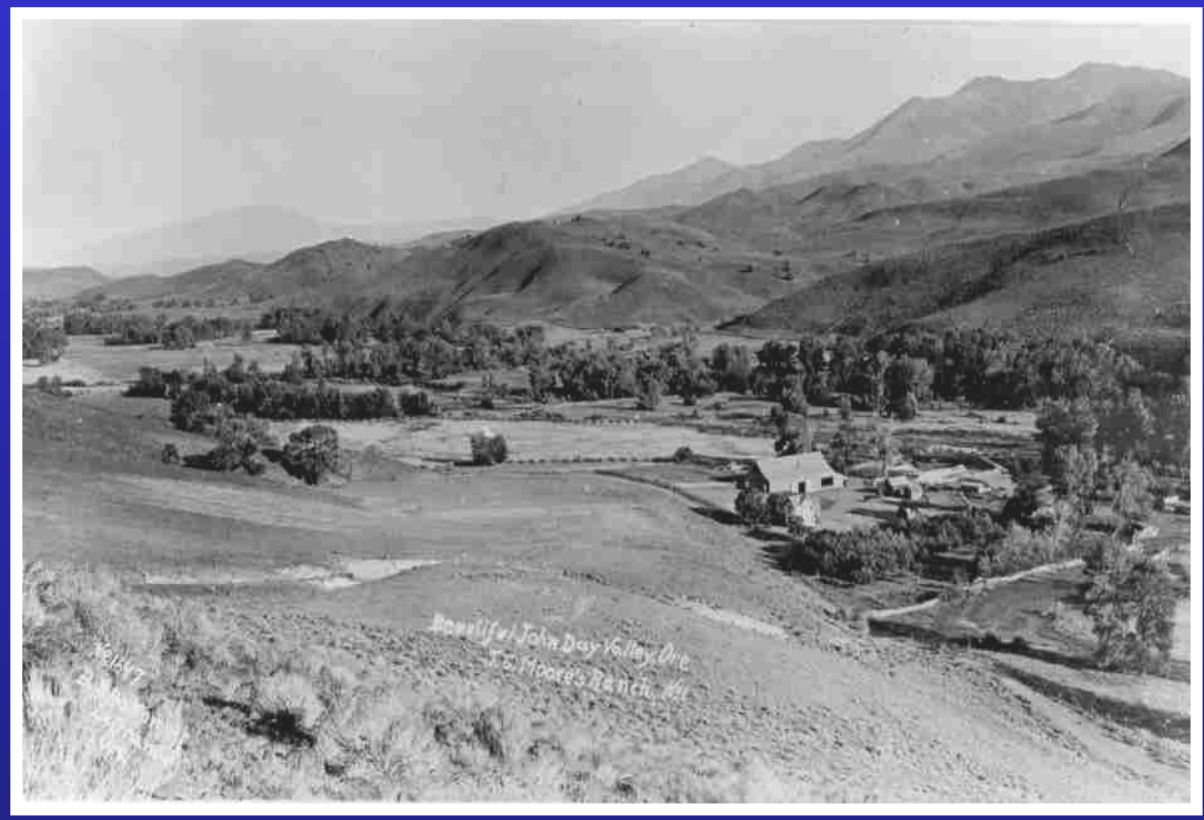


Photo: Steve Lent collection

"[John Day] River has a broad bed, and valley supports a number of giant cottonwoods, willow copses, a small marsh and hay fields" (1899)

"All forks and streams off N. Fork and main stem of John Day River well-wooded with aspen, poplar, and willows" (1828)

Crooked River south of Prineville, OR, 1910

Photo: Steve Lent collection

"…a delightful stream running to the southwest, affording an abundance of fine grass; no wood" (1845).

Crooked River runs through "a fine plain, well-lined with willows"; "Soil remarkably rich…In some places the grass is 7 feet high" (1825).

"The Crooked River was as clear as a mountain stream. There were lots of beaver and beaver dams. All kinds of berries grew along the banks…" (1881).

Photo courtesy of BLM

Photo: Mike Bollman, Dynamac Corp.

Photo: Sandra Bryce, Dynamac Corp.

Photo courtesy of NRCS

Photo courtesy of BLM

Overview of Presentation

Case study: John Day/Deschutes Basins, Oregon

- **Stratification**
- **General Land Office Survey notes**
- **Historical literature and excerpts**
- **Historical photographs**
- **Tree ring data**
- **Summaries of potential plant associations**
- **Natural vegetation of Oregon**

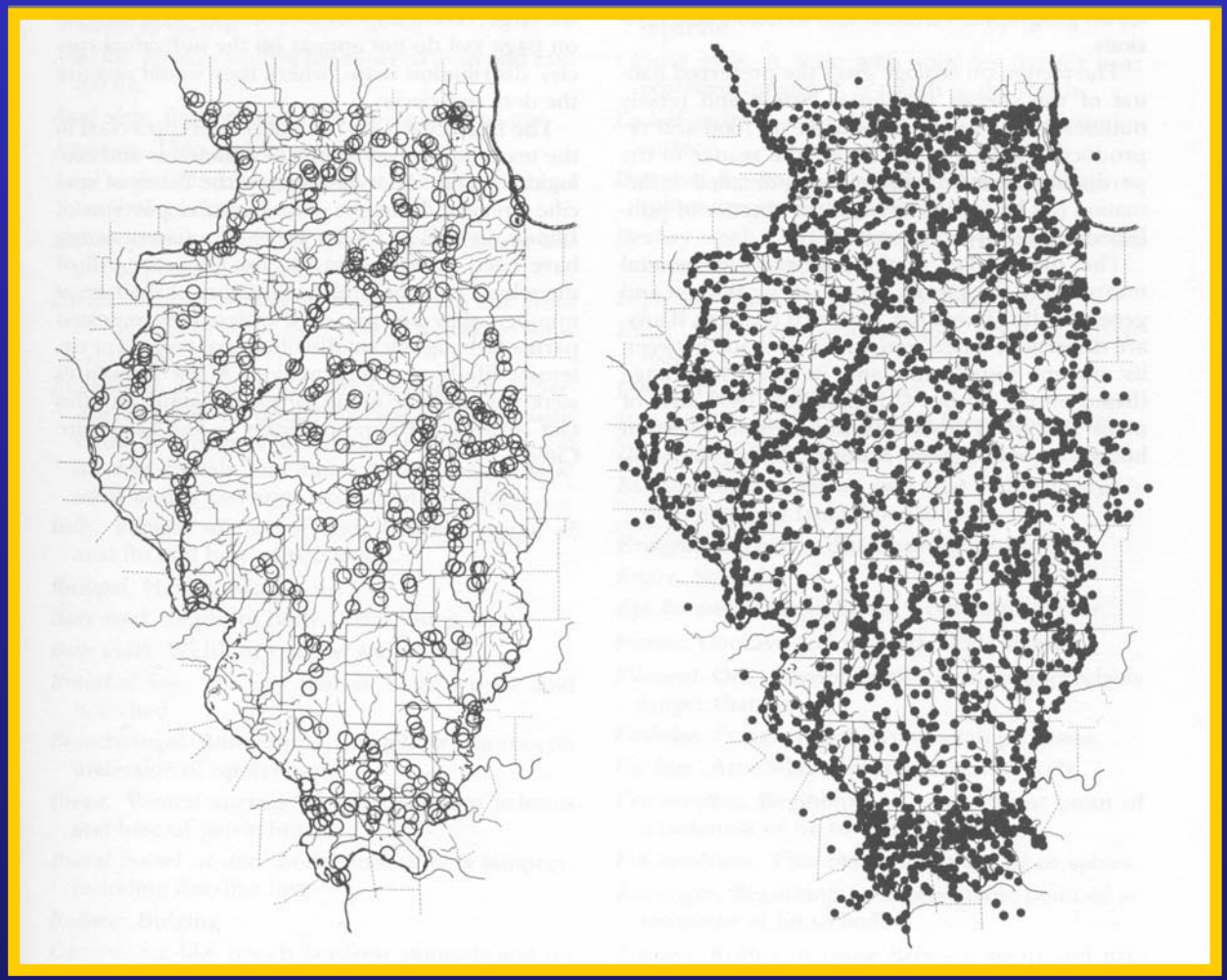
Early Surveys--applications

Fish: Carp, Bigeye Chub

Birds: Yellow Warbler, Willow Flycatcher

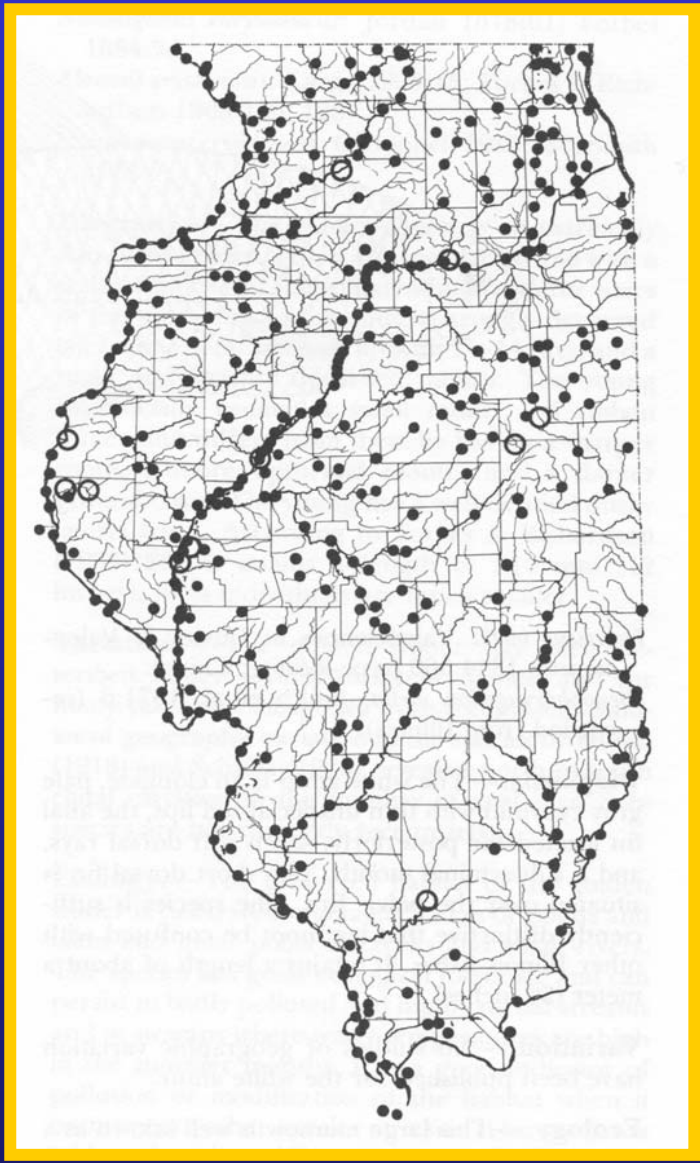
Early Surveys--Fish

Reconstruction of Fish Communities & habitat based on presence



From Smith, 1979

Pre-1908 collecting sites **Post-1950 collecting sites**



From Smith, 1979

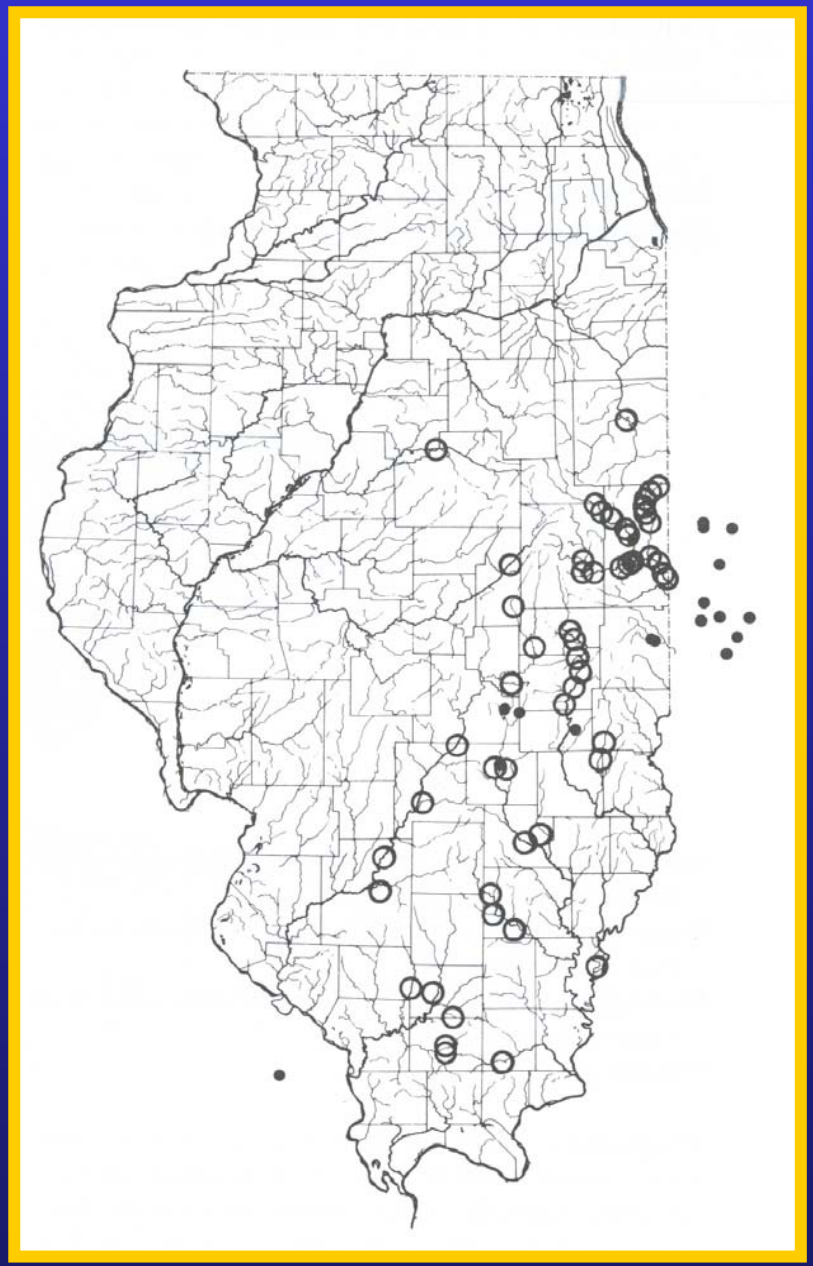
Carp (Cyprinus carpio)

Increasing population

Habitat:

- Soft-bottomed pools of rivers
- Warm water, slow-moving or stagnant
- Brush piles, weedy overflow areas
- Sewage discharge points

O = Pre-1908 occurrences
● = Post-1950 occurrences



From Smith, 1979

Bigeye chub (*Hybopsis amblops*)

Decreasing population

Habitat:

- extremely clear water
- some current
- high dissolved oxygen content
- bottom of sand and fine gravel
- well-vegetated pools

O = Pre-1908 occurrences
● = Post-1950 occurrences

Early Surveys--Birds

Reconstruction based on known presence and habitat needs

Example for the Yellow Warbler
--Obligate riparian species in the West--

Nesting Habitat: Wet, deciduous, riparian thickets with various species of willows. Early successional habitats--cottonwood and aspen groves.

Nest site: Low elevation. Follows riparian thickets upward to mid-elevations in mountains. Nests placed low (0.9-2.4 m above ground) in shrub or small tree.

Threats: Grazing. Loss of riparian habitat.

Example for the Willow Flycatcher
--Obligate riparian species in the West--

Nesting Habitat: Moist, shrubby areas, willow thickets, beaver meadows, woodland edges, brushy lowlands, low gallery forests with shrub understory; usually near running or standing water

Nest site: Low (0.5-1.5 m) in a small tree or shrub, usually willow; near water; outer edges of shrubs or in clumps of shrubs;

Threats: Habitat destruction and livestock overgrazing: soil compaction and gullying, changes in willow height and volume, physical disturbance to nests

Examples of Other Approaches:

1. Using historical mussel composition and habitat information to reconstruct stream habitat attributes (Angelo et al.)

3. Using pollen records to assess historical vegetation changes in a mountain meadow subject to grazing (Dull 1999)

4. Analyzing sediment cores for diatoms, pollen, seeds, charcoal, and chemicals to describe the environmental history of estuaries and lakes (Brush, Dixit)

4. Describing French Mediterranean landscape changes based on old postcard photos (DeBussche et al., 1999)

5. Analyzing tree rings and fire scars, paired with GLO notes, to reconstruct vegetation and disturbance regimes in the Missouri Ozarks (Batek et al. 1999)

Historical Reconstruction….

- is more visual than numerical
- is time-consuming and piecemeal
- requires us to challenge our boundaries as scientists
- requires innovation in its application
- will be a valuable contribution to our concept of reference
- will be increasingly necessary as land development occurs