Streamside Stabilization

Riparian Area Management

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Eastern Kansas has had drastically changed vegetation cover and hydrology

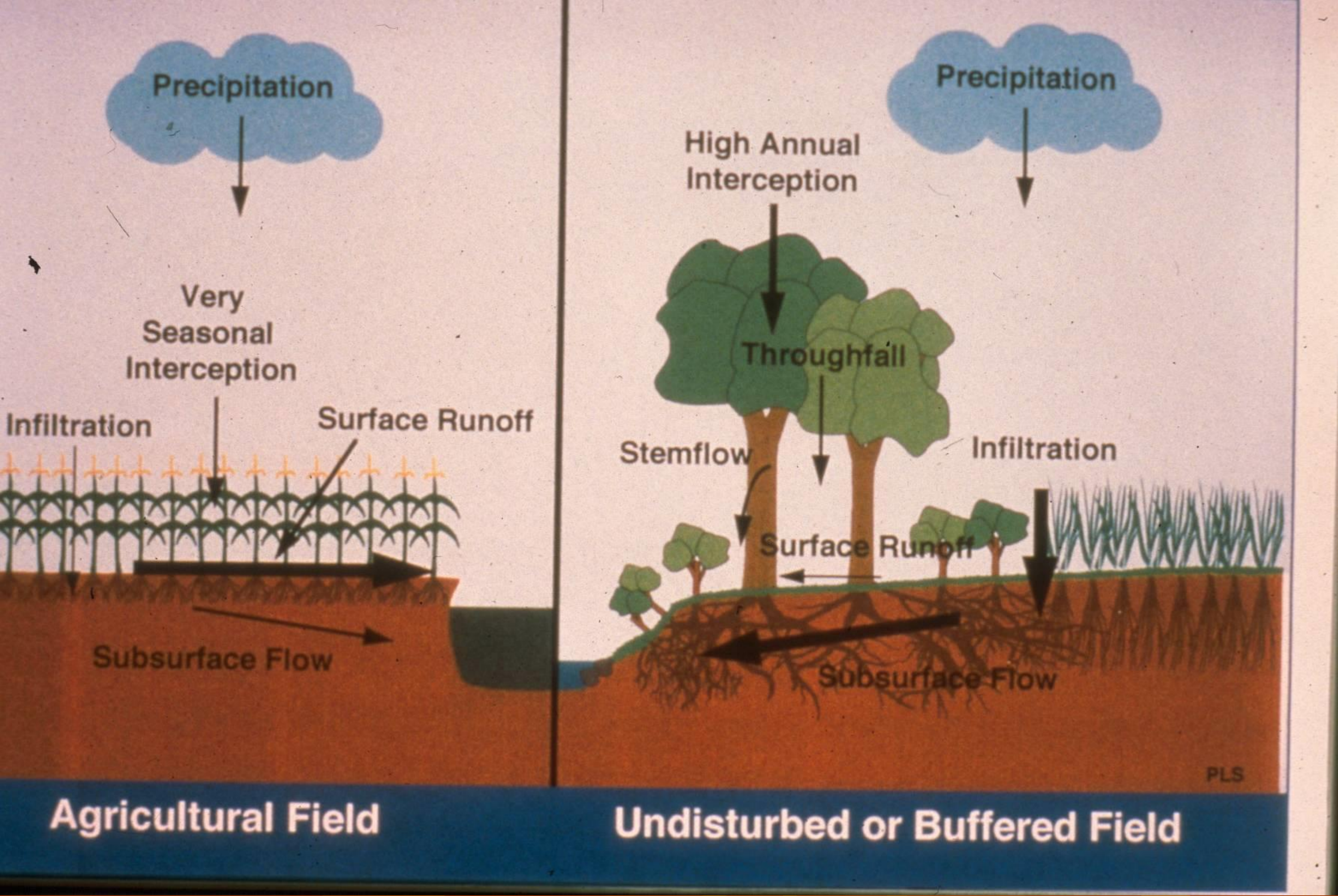
- Conversion of native prairie to cropland
  - Reduced infiltration rates from 4”/hr to <0.3”/hr
- Conversion of streamside forests to cropland
  - Reduced streambank stability and flood attenuation
- Heavy grazing over vast areas
- Urban development, impervious surfaces
- Channelization of streams
  - All lead to more rapid runoff, less infiltration

Stream Geomorphology

- Streams naturally meander across the landscape, moving water and sediment.
- Sinuous, curving streams dissipate energy, removing and depositing sediment.
- Streams react to the environment, integrating the condition of the entire watershed.

Streams almost act like a living creature

- We pinch one end by narrowing or straightening a channel, and the higher velocity water causes increased erosion for miles downstream.
- A similar effect occurs as a watershed is developed, with increased stormflow runoff, causing the stream to down cut and widen, to handle the increased flow.


Precipitation
Very
Seasonal
Interception
Infiltration
Surface Runoff
Subsurface Flow
Agricultural Field
Precipitation
High Annual
Interception
Throughfall
Stemflow
Infiltration
Surface Runoff
Subsurface Flow
PLS
Undisturbed or Buffered Field

ISU

Flood control practices

- Straightening and simplifying stream structure
  - Removing trees has several unintended effects
- Speed up water velocity, leading to increased erosion and worse flooding downstream
- The problem- we all live downstream from somewhere else.

Alternatives

- Reduce stormflow and runoff upstream, retain water across the landscape, increase infiltration to recharge aquifers.
- How?
  - Cropland BMP’s that increase infiltration
  - Detention basins
  - Buffer setbacks from streams

Why are buffers needed?

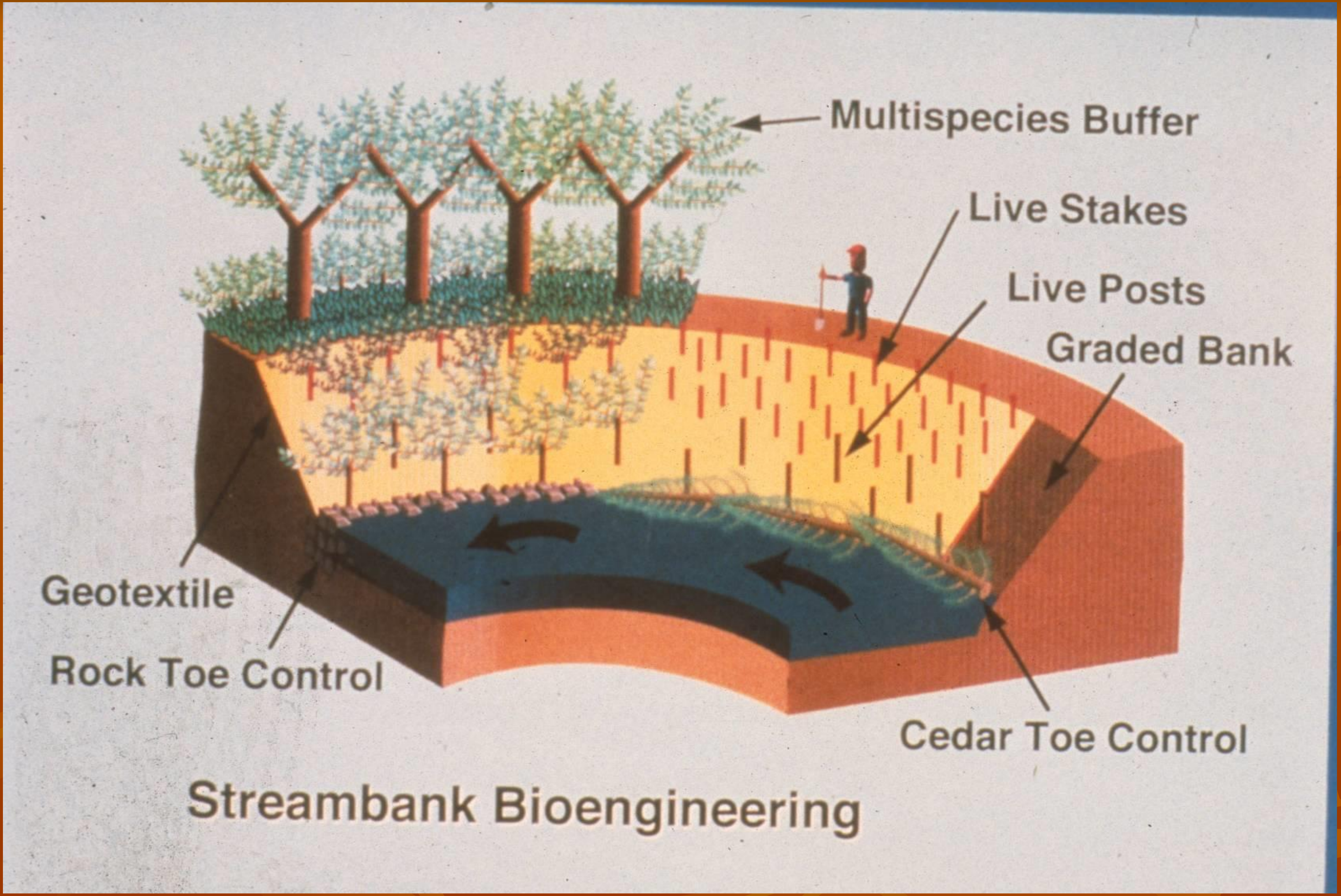
- If the region was still predominately prairie, with native woodlands along the rivers and creeks, then restoration of native riparian vegetation would not be needed.

Stabilizing streambanks

- Rock works well, but it has shortcomings
  - Ugly
  - Zero wildlife value
  - Speeds up high water flows
  - Expensive, when you armor the whole shoreline
- Alternative is to install rock veins and weirs that project out into the river
  - Less expensive, makes great fishing access
  - Slows flood waters
  - Sediment deposits between weirs.

Cedar revetment

- A good alternative on small creeks and tributaries, especially if they carry a lot of sediment.
- Bushy pasture cedars are anchored to base of streambank.
- Can be done without heavy equipment.
- Blends nicely into a natural environment.


Multispecies Buffer
Live Stakes
Live Posts
Graded Bank
Geotextile
Rock Toe Control
Cedar Toe Control
Streambank Bioengineering

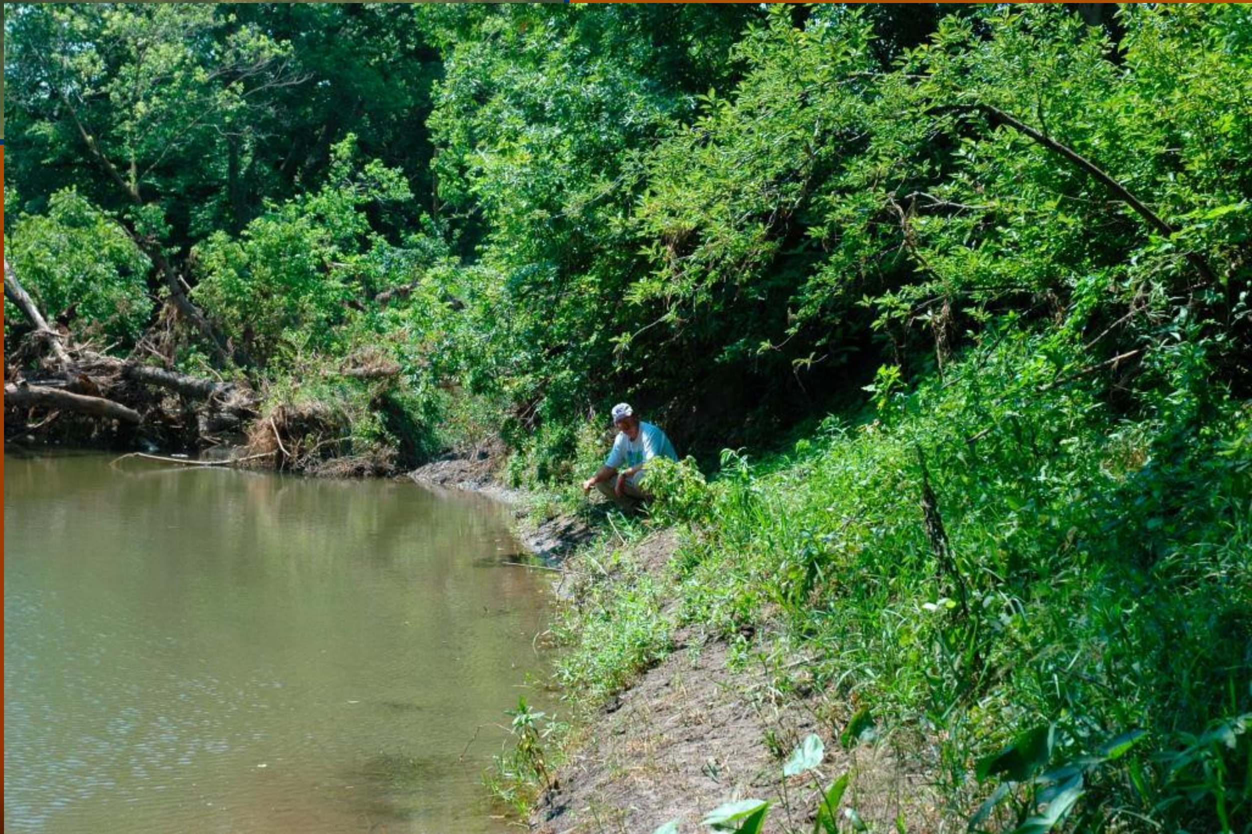
Stabilizing Streambanks Case Study

- Jackson County
  - Crow Creek
  - Little Soldier Creek
  - Big Soldier Creek

Crow Creek Revetment

Before

Feb. 1999



June 2005

How did we achieve that?

- Installed a redcedar revetment
- Planted willow cuttings and posts, sycamore, and red twig dogwood seedlings.

Crow Creek Revetment Installation

Crow Creek Revetment

After 1 Month

Crow Creek Revetment

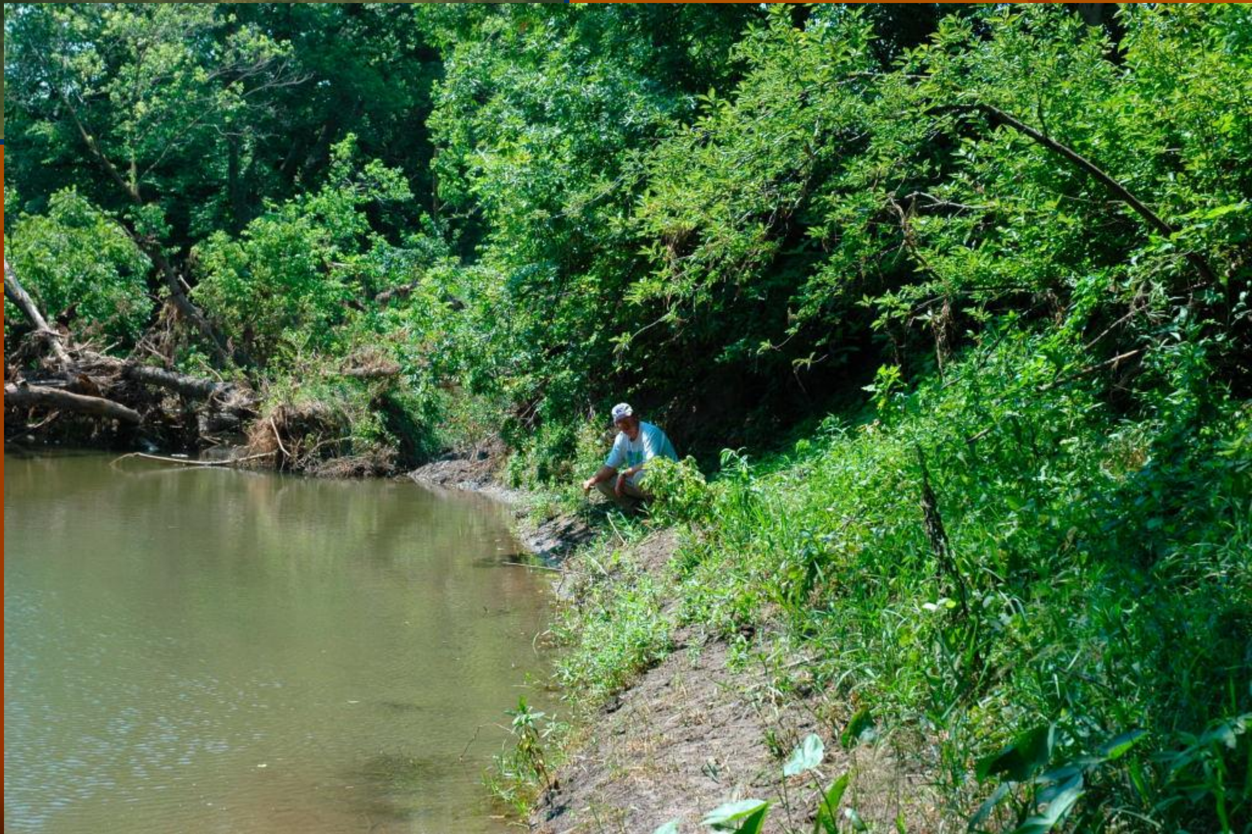
After 1 ½ Months

Crow Creek Revetment
After 2 Months—Willows

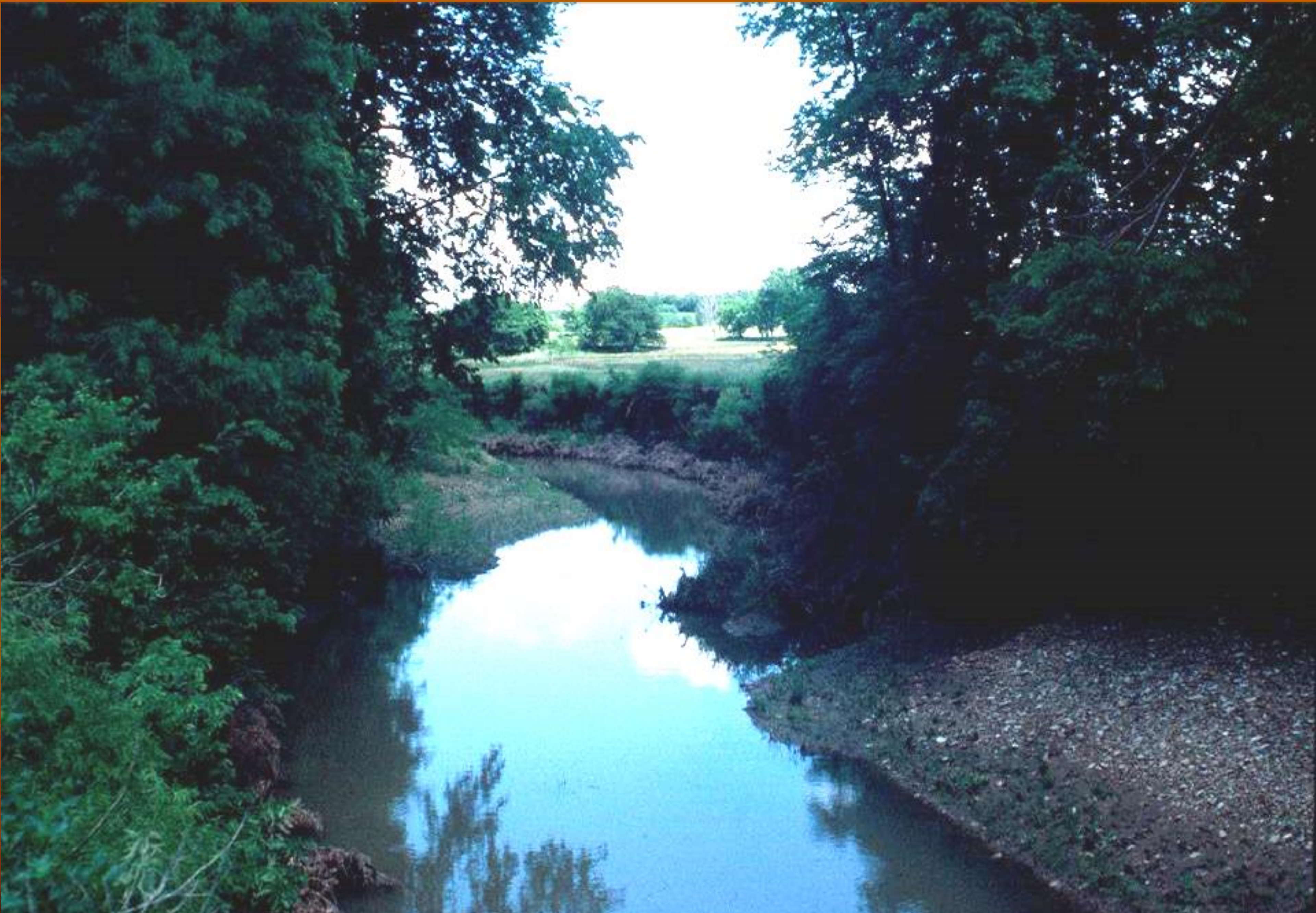
Crow Creek Revetment
After 3 Months

Crow Creek February 1999, before cedar revetment was installed.

Crow Creek June 2005 at the same location, 6 years after cedar revetment was installed.



Crow Creek July 1999, 5 months after installation



Crow Creek- 6 years later, 2005

Little Soldier Creek

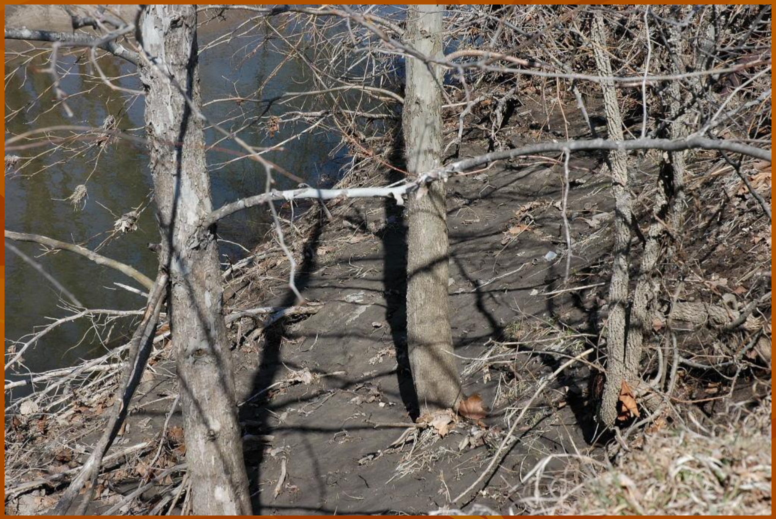
Before

Little Soldier Creek, March 2000, immediately after cedar revetment was installed.

Little Soldier Creek, June 2005, at the same site.

Little Soldier Creek-
August 2008.

Cedars trapped sediment, and vegetation got well-established



Nov. 2007

Aug. 2008

Measured sediment deposited within the 200’ long cedar revetment

=86 cubic yards

Smaller #68 are OK for hand driving with rebar and sledge

Larger #88 are required to fit shank of Pionjar (jackhammer available from KFS)

Little Soldier Creek Rock revetment

May
2008

Installation- May 2008

Little Soldier Creek Rock revetment, vegetation recovery August 2008

Flood debris in a field with no buffer

Soldier Creek, 12-1998

Big Soldier Creek June 1999.

Big Soldier Creek July 1999, immediately after installing rock veins and weirs.

Big Soldier Creek, June 2005. Note the flood debris caught within the riparian zone. Before the project, this debris would be spread across the cropfield.

Benefits of streamside trees

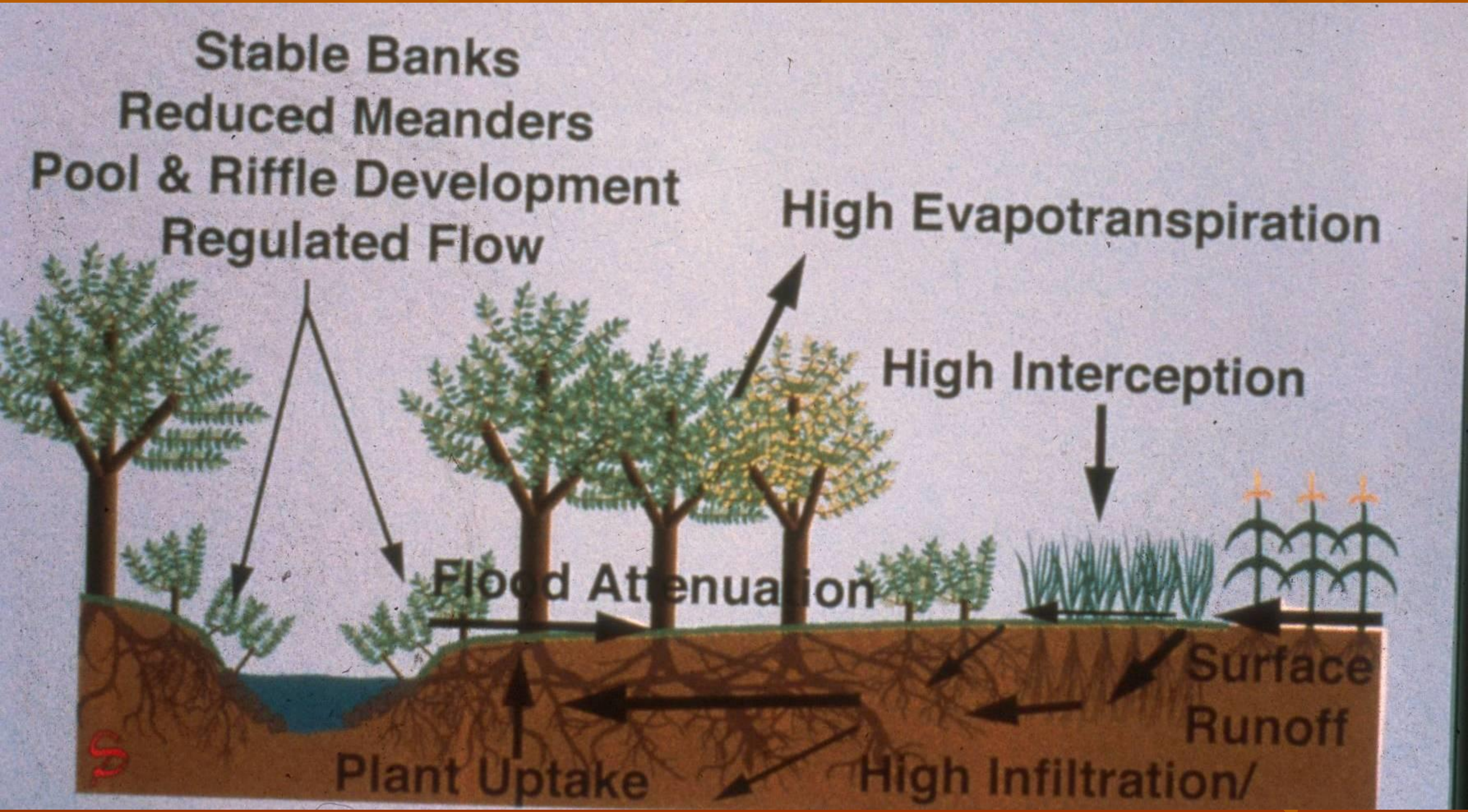
- Streambank stability, roots provide tensile strength to soil (rebar in concrete).
- Flood attenuation.
- Filters surface runoff, removing sediment, nutrients, pesticides, bacteria.
- Nitrate removal from shallow groundwater.

Tree roots holding a streambank

Benefits to the stream

- Shading- reduces summer peak temperatures, cooler water has higher oxygen content.
- Provides OM input, leaf and twig detritus forms base of a stream's aquatic food chain.

Streamside Vegetation Functions



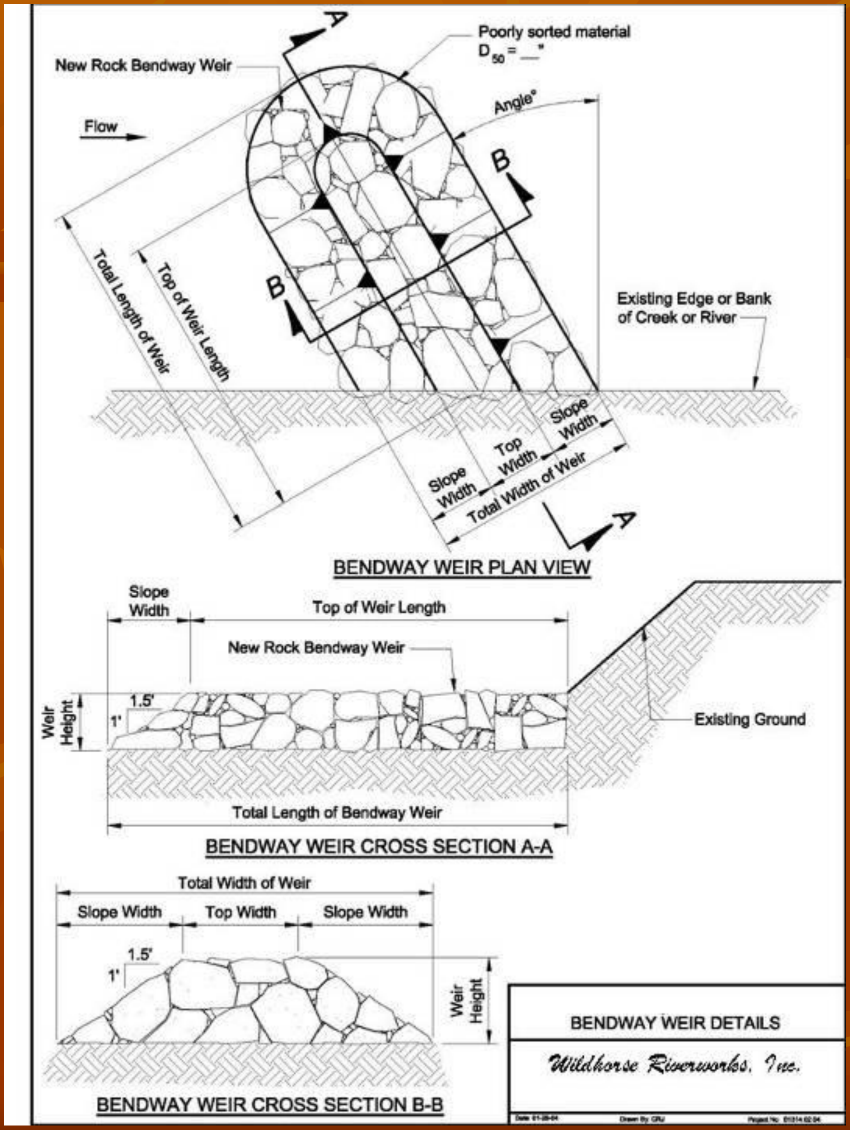
What About Rivers?

Redirective

Resistive

Note the unstable, vertical banks where the riparian vegetation is gone, and the stable, gently sloping banks, where there is woody riparian vegetation.

Bendway Weirs



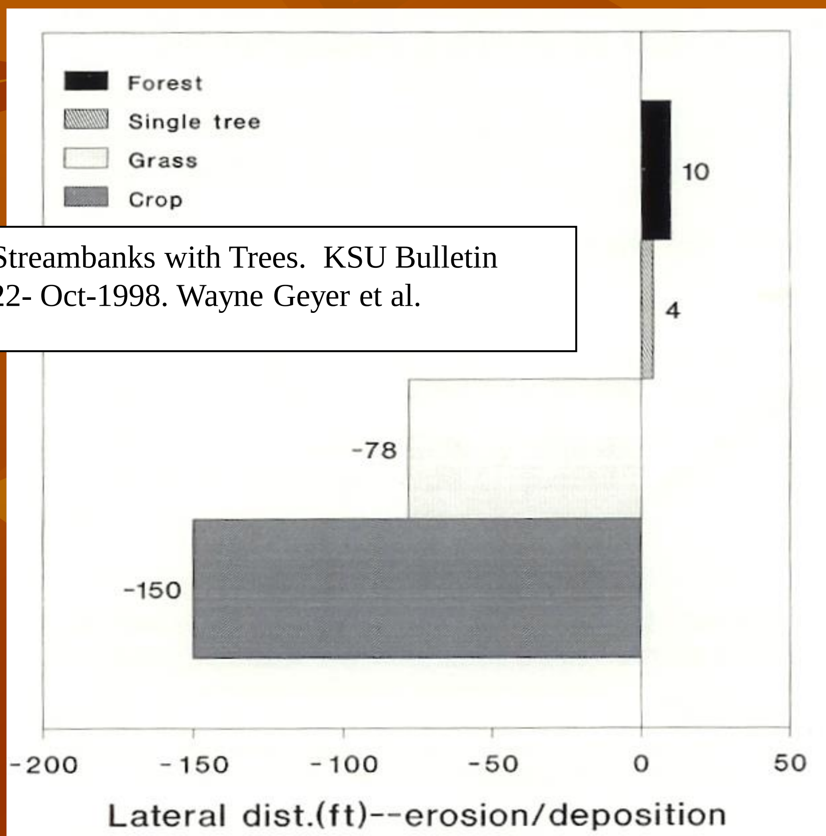
- Used in streams with a high width to depth ratios.
- Low, level-crested row of rocks.
- Slightly angled into streamflow.
- Re-directive stabilization method.
- Water passing over the weir turns perpendicular to the weir and away from the streambank.
- Reduce velocity in the near-bank region creating deposition along the bank and move the thalweg to the end of the weir.

High flow over top of wier

Trees save riverbanks

- Major river levies with trees suffered less damage than levies with only grass, following 1993 and 1995 floods.
- This goes against standard engineering recommendations!
- When flood waters flow through trees, it is slowed down, and deposits sediment.

Kansas River study, done after the 1993 flood.



Protect Streambanks with Trees. KSU Bulletin #SRL 122- Oct-1998. Wayne Geyer et al.

Streambanks covered with only grass **lost 78 feet,** while streambanks with multiple trees **gained 10** feet.

Similar results were found by Travis Robb, on the Verdigris River, after the 2007 flood.

Reference

- Conservation Buffers (Design Guidelines for Buffers, Corridors, and Greenways), USDA-FS, GTR SRS-109, Sept. 2008.
- Website www.bufferguidelines.net
- Schematic diagrams used with permission from the Leopold Center for Agroecology, Iowa State University