Texas Riparian and Stream Ecosystems

Nikki Dictson

Texas Water Resources Institute

http://texasriparian.org and
http://www.facebook.com/TexasRiparianAssociation

Why should we be concerned about the health of the stream and riparian areas?

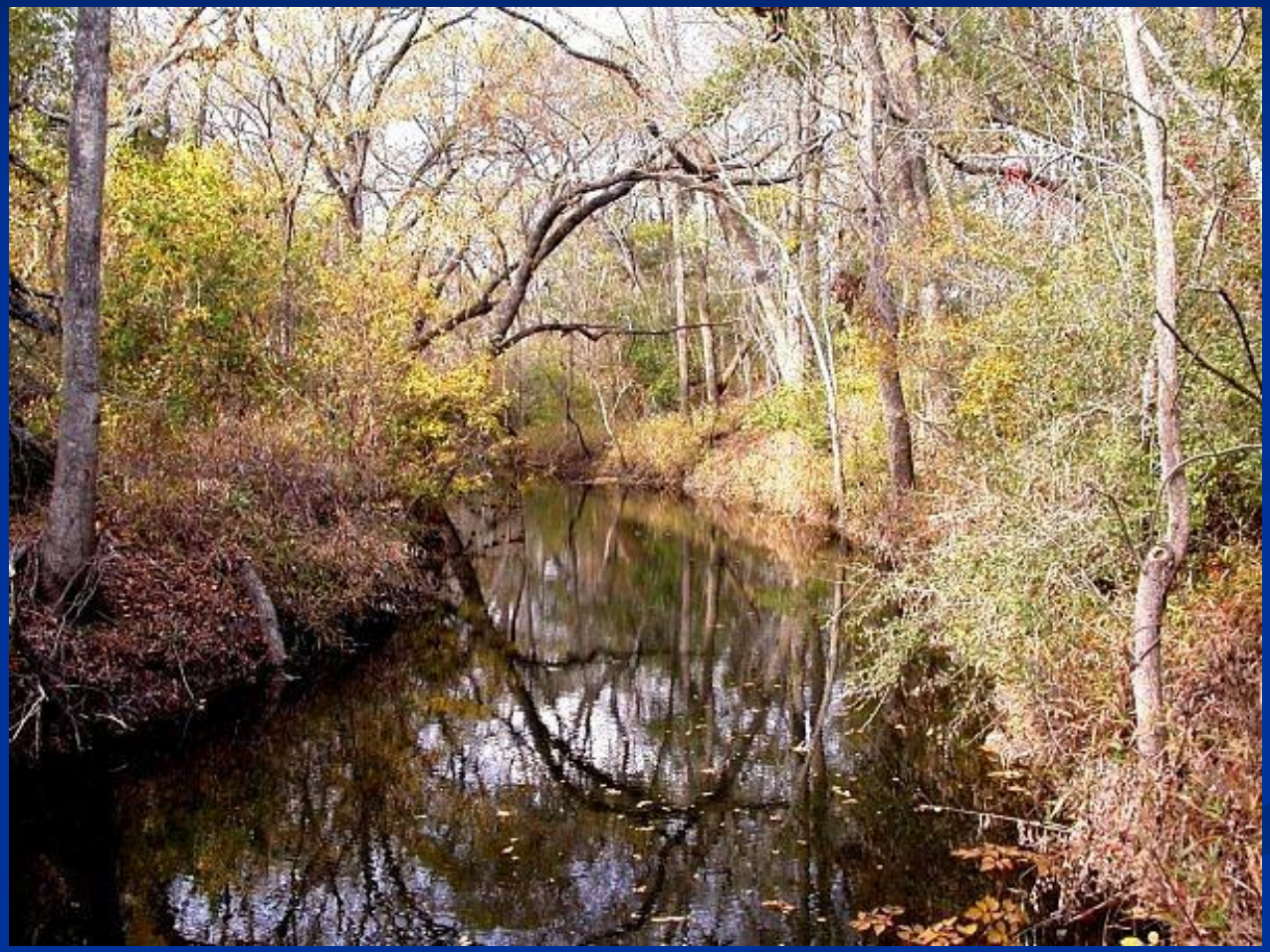
- **Cumulative impacts of natural and man induced disturbances in the drainage area.**
- **Management not only affects the individual landowner but everyone else downstream.**
- **Stream and riparian systems are the water pipeline.**
- **They are one of the most important resources found on private and public lands in Texas.**

Creeks and Riparian Areas are Important

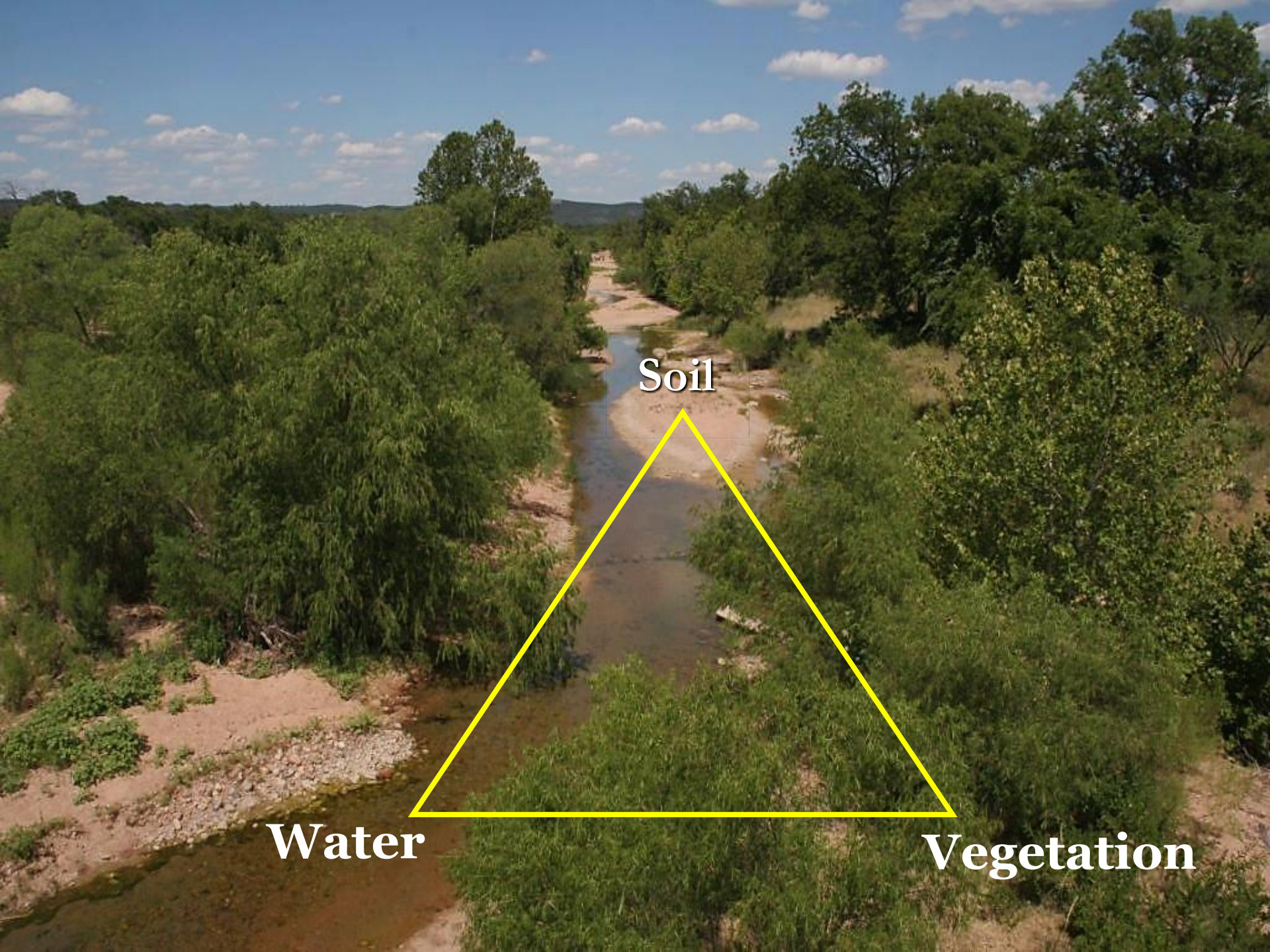
- Texas has more than 191,000 miles of rivers and streams with riparian zones and floodplains that comprise corridors of great economic, social, cultural, and environmental value.
- The 2014 Texas Integrated report assessed 1,409 water bodies of those 1,065 had sufficient data for evaluations with 7-10 yrs.
- 2014 303d List has **589** impaired water bodies on it (+21).
- Many WPP and TMDL Implementation projects are ongoing across the state to improve WQ in watersheds.
- Bacteria is the cause for over 43% of impairments followed by and low dissolved oxygen (nutrients) for 16% and organics in fish tissue at 19%.

Functions of a Stream

- Transport water
- Transport & deposit sediment
- Transport & replenish nutrients
- Biological functions (food, shelter, shading, movement, etc.)



What is a Riparian Area?


Soil
Water
Vegetation

Properly Functioning Riparian Area

Adequate vegetation, landform or large woody material to:

- Dissipate stream energy
- Stabilize banks
- Reduce erosion
- Trap sediment
- Build / enlarge floodplain
- Store water
- Floodwater retention
- Groundwater recharge
- Sustain baseflow

- Water quality
- Water quantity
- Forage
- Aquatic habitat
- Wildlife habitat
- Recreational value
- Aesthetic beauty

Physical Function

Values

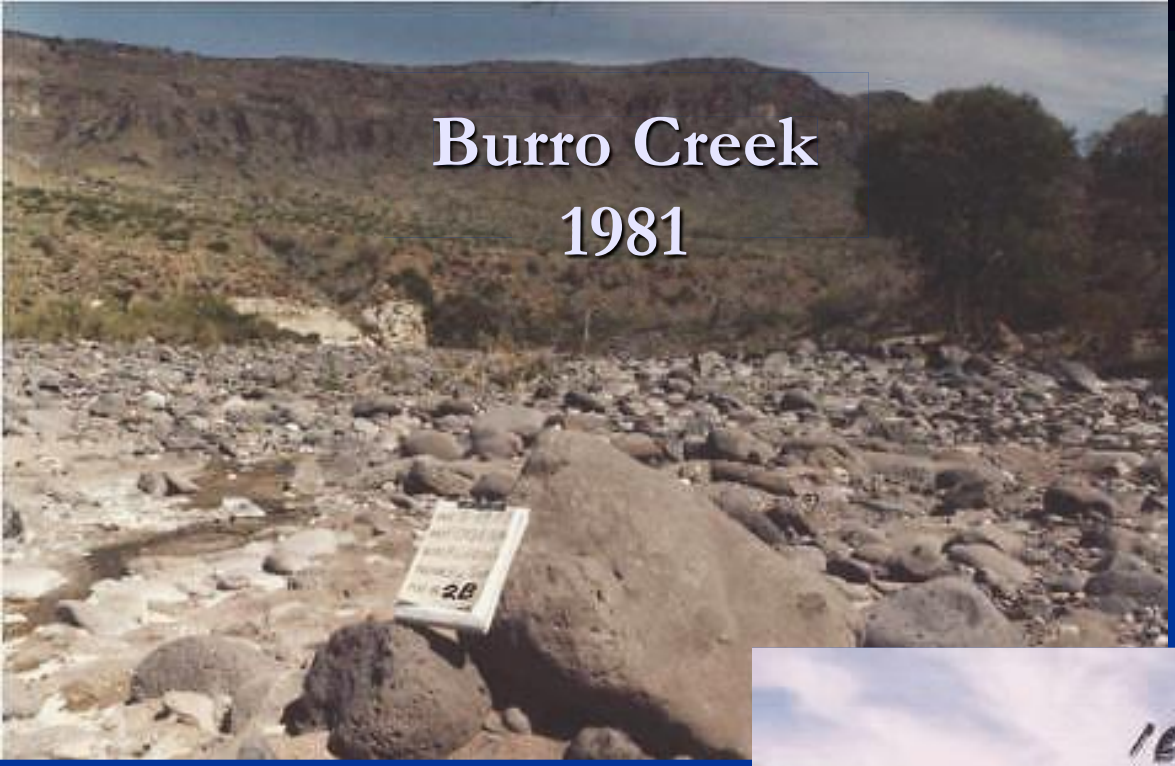
An Overlooked Opportunity

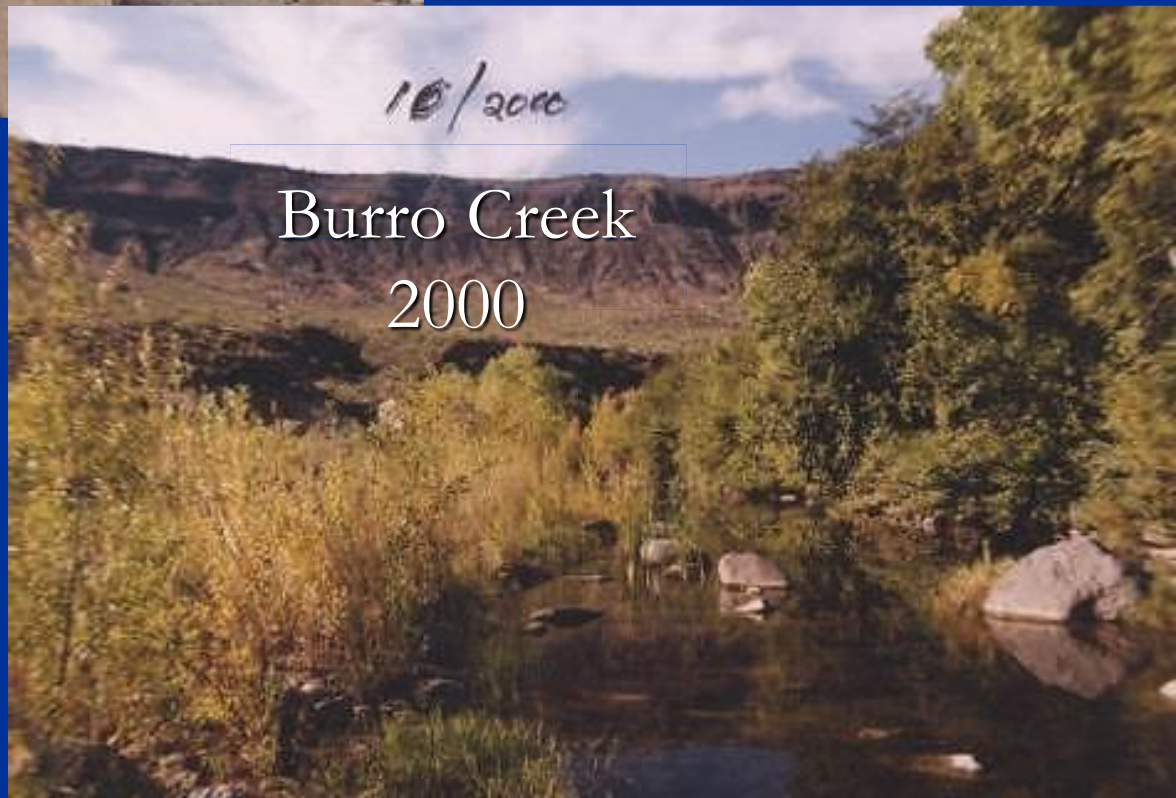
Catching the water

Storing the water in the land

Keeping Water on the Land Longer

“Riparian Sponge”

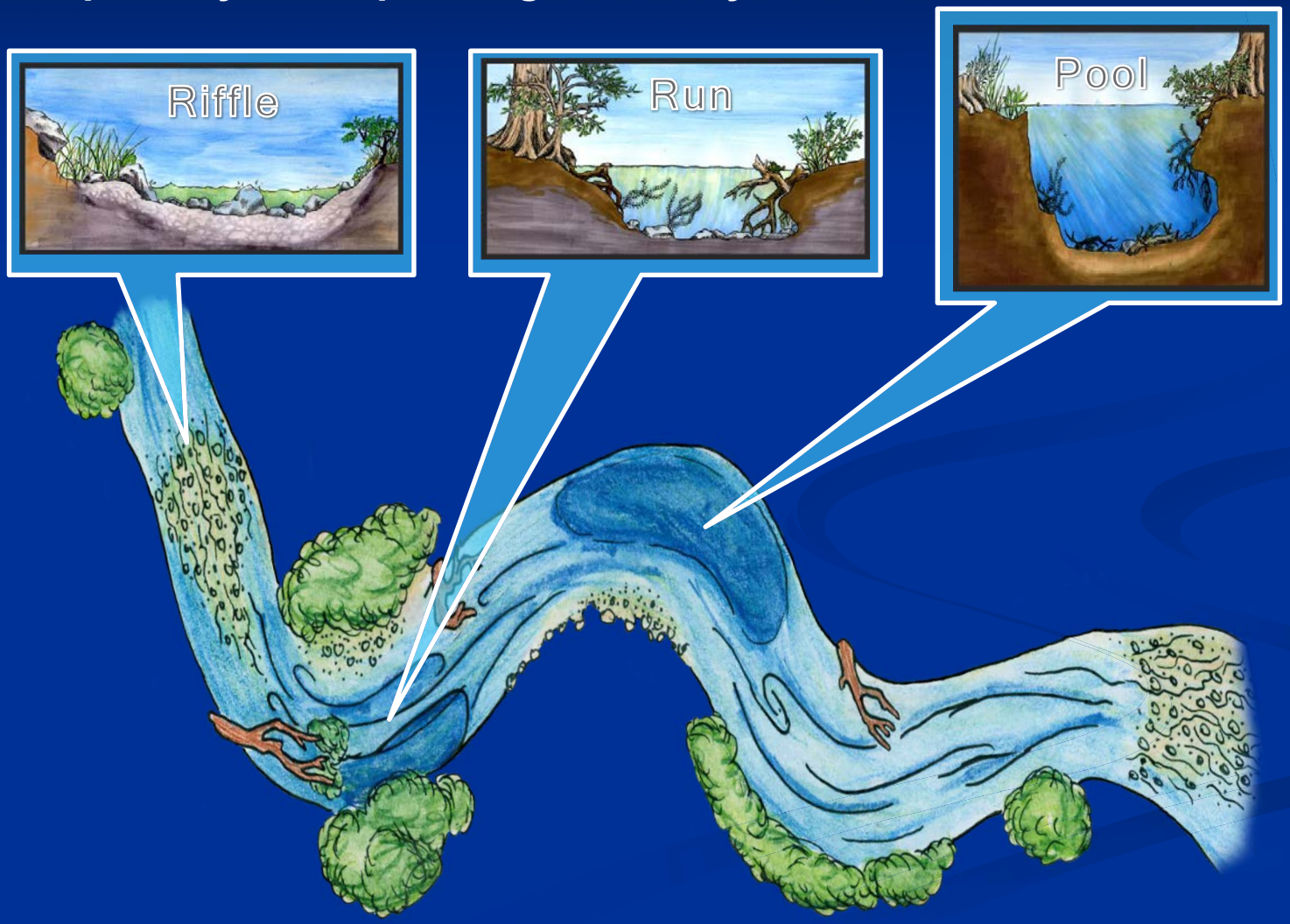

Burro Creek
1981


Burro Creek
2000

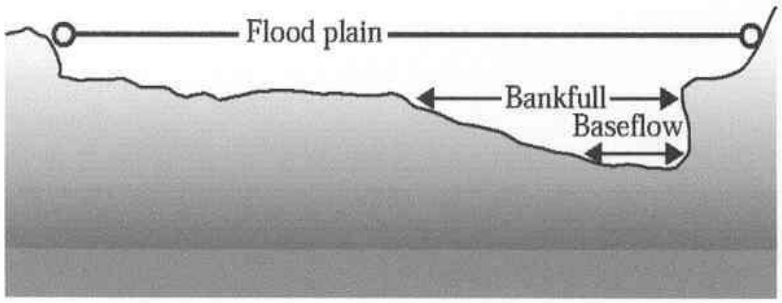
Dissecting a Creek

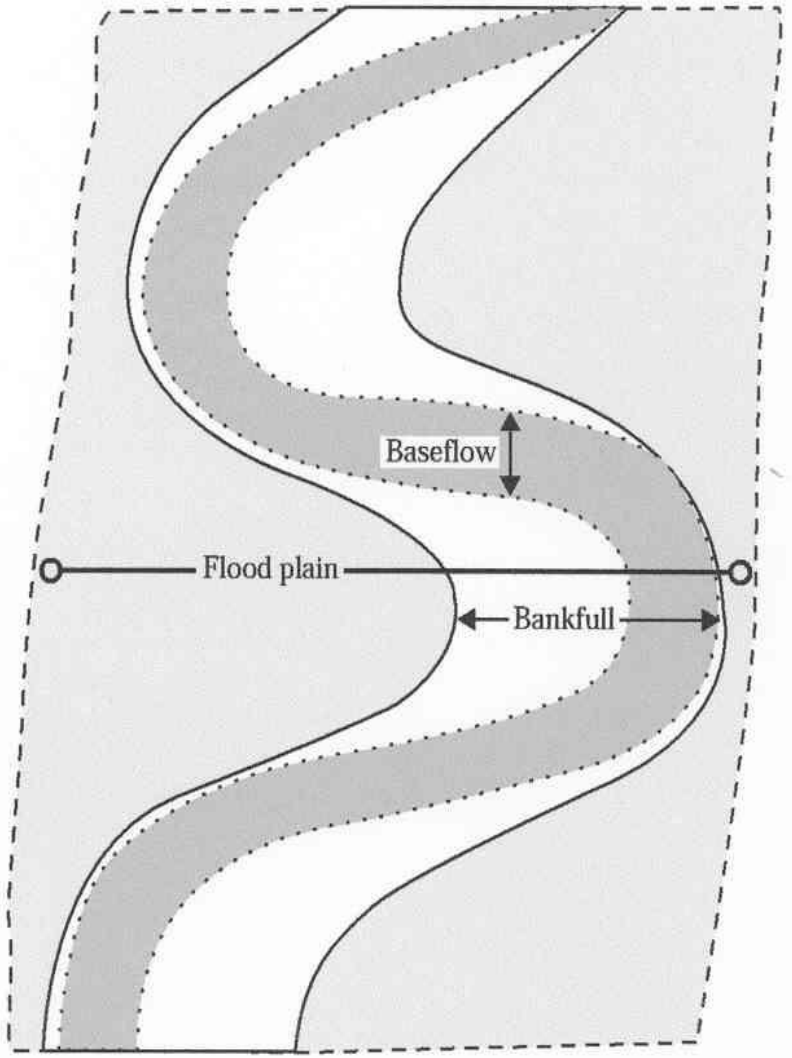
How and why does a creek operate and function the way it does?

The patterns of rivers are naturally developed to dissipate the energy of the moving water and to transport sediment. The meander geometry and associated riffles and pools adjust to keep the system operating efficiently.



Baseflow, bankfull, and flood plain locations.





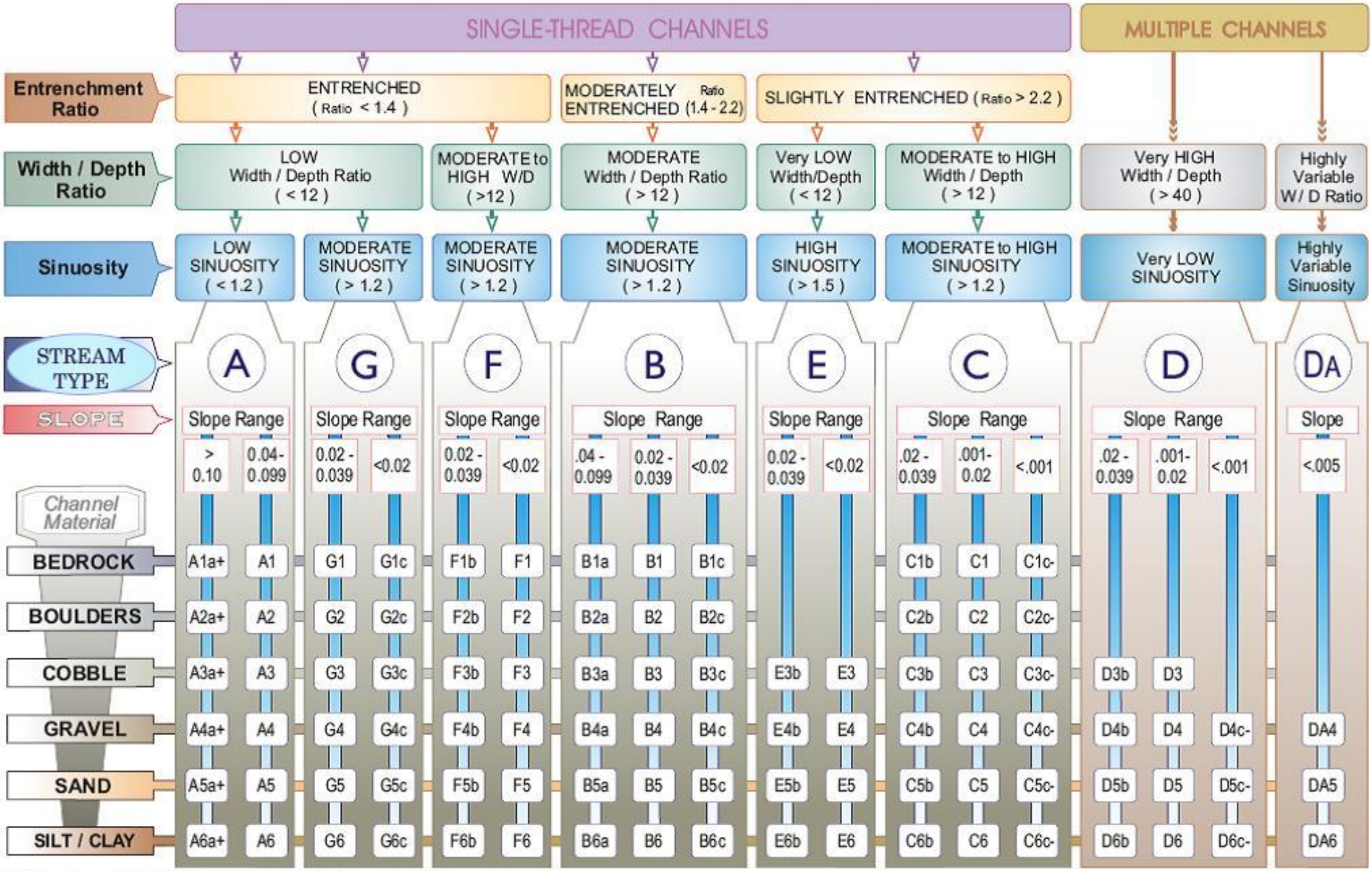
Identify the Components of a Creek

- Channel / Banks
- Floodplain
- Sediment
- Base flow
- Flood flow
- Water table
- Vegetation
- Large wood
- Organic debris

The Processes that occur

- Erosion / Deposition
- Bankfull discharge
- Sinuosity
- Width : Depth Ratio
- Gradient / Velocity
- Recruitment
- Root density
- Channel stability
- Channel evolution
- Plant succession

The Key to the Rosgen Classification of Natural Rivers



KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS.

As a function of the "*continuum of physical variables*" within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

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Stream Facts

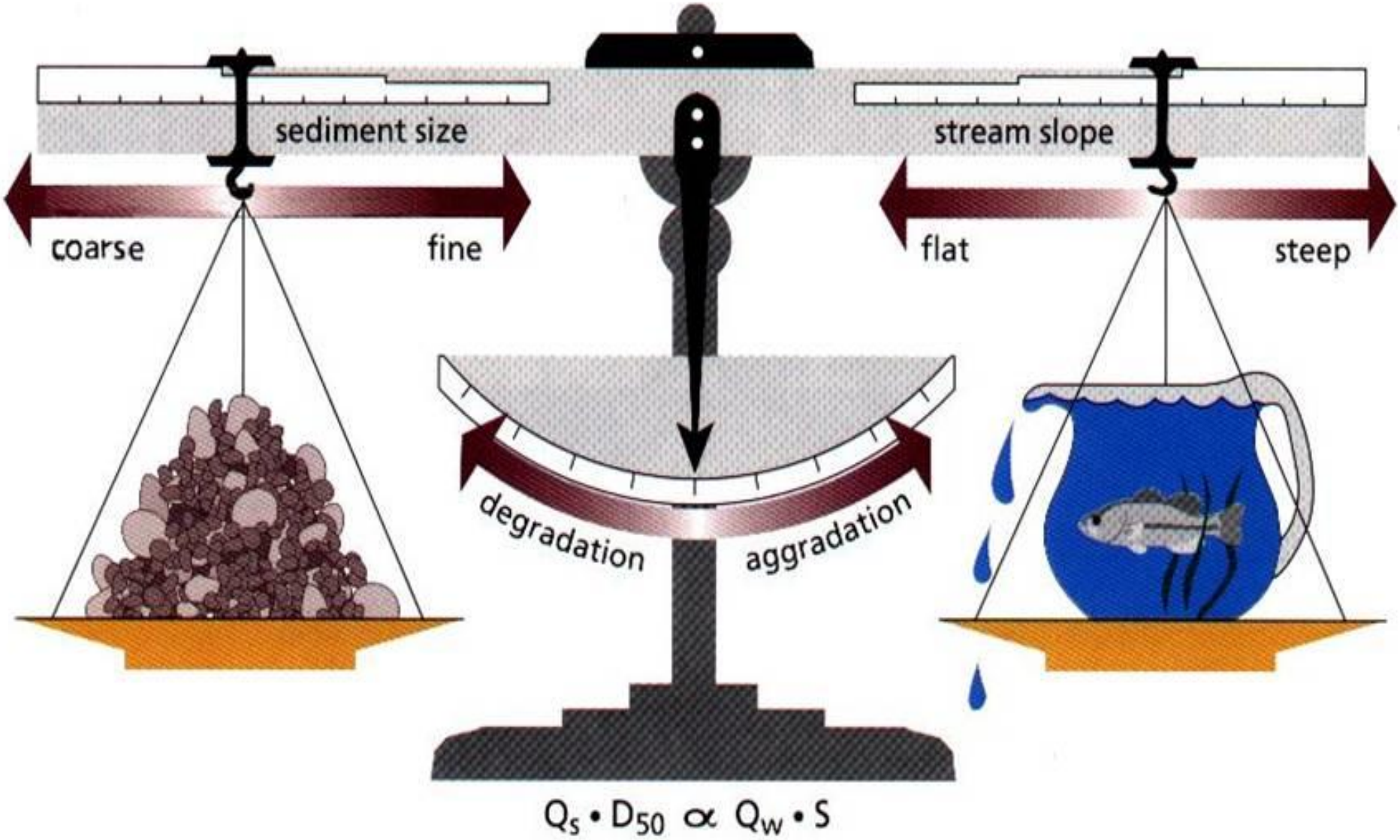
- Streambank and watershed erosion are natural processes
- A dynamic equilibrium exists in stable stream channels
- Floods have beneficial functions
- When changes are made in the watershed or stream, the stream will adjust to fix itself

Stable Stream

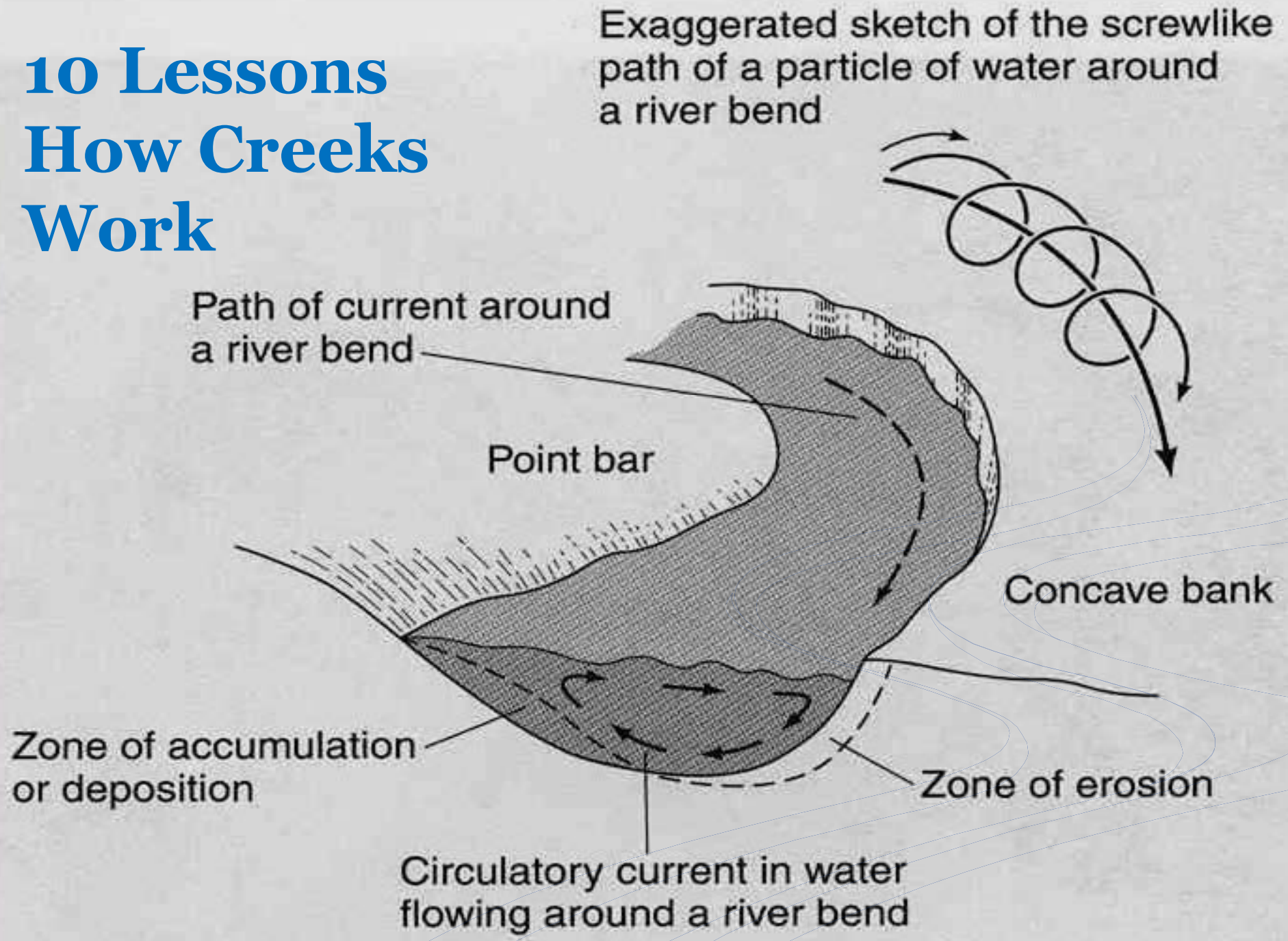
- A stable stream is one that has a stable dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades (deposits excess sediment) nor degrades (erodes excess sediment).

- Lateral migration and erosion do not necessarily indicate instability. Stable streams are also dynamic.

Lane's Relationship, 1950



10 Lessons How Creeks Work



2.7 | HIGH FLOW VELCITIES | dysart run, ohio

PREVIOUS NEXT

adequate floodplain at the bankfull stage and having geometry consistent with channel-forming discharge concepts. Therefore, it is critical that these concepts are understood and correctly identified.

FLOW PROCESSES fig2.6

- The velocity distribution in a channel is complex. Typically, at any cross-section in a channel there will be a portion of the flow along the deepest part of the channel called the **thalweg** that is moving the fastest. Think of the thalweg as a roller coaster that speeds up in riffles, slows down in pools, moves from side to side, up and down with depth, and rotates counter-clockwise as it moves around bends.
- The velocity of the flow will vary as we move from one bank to another at any point in a river. For example the velocity near the outer bank of a meander will be higher than near the inner bank because water near the outer bank has to travel further. The rotation of the flow on the outer bend might also create undercut concave banks. As we near the bottom or sides of the channel the velocity will decrease because of the surface roughness of the channel. Water in contact with the bottom and sides will be stationary. vid2.7
- As the roller coaster plunges from a riffle into a pool it will cause a

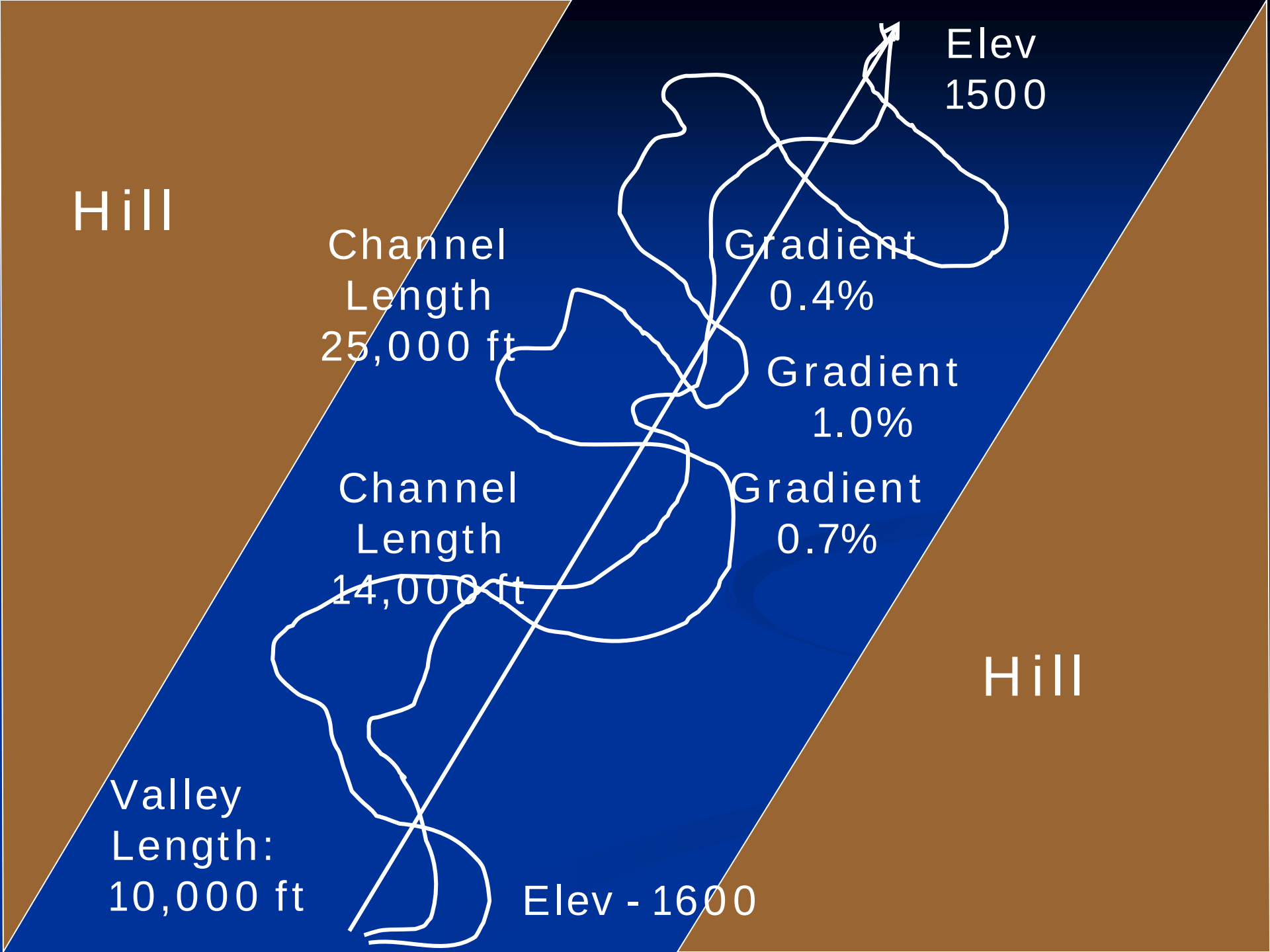
streams STREAM RESTORATION, ECOLOGY & AQUATIC MANAGEMENT SOLUTIONS

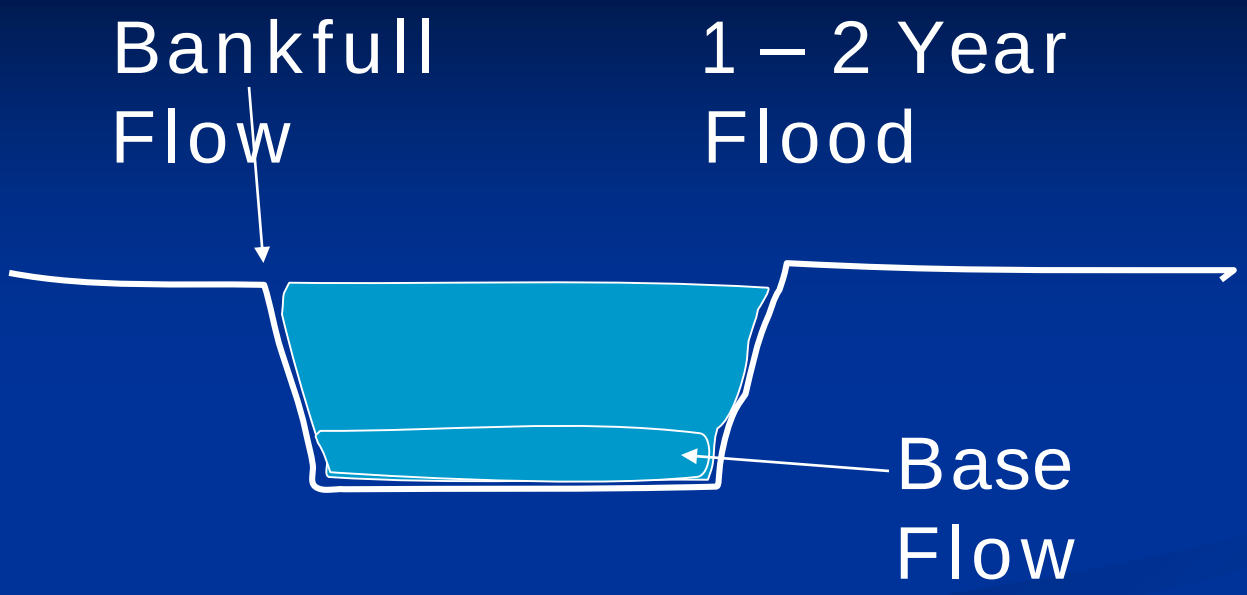
OEEF OHIO ENVIRONMENTAL EDUCATION FUND

THE OHIO STATE UNIVERSITY OSU EXTENSION | OHIO NEMO

Walla Walla River, 1964

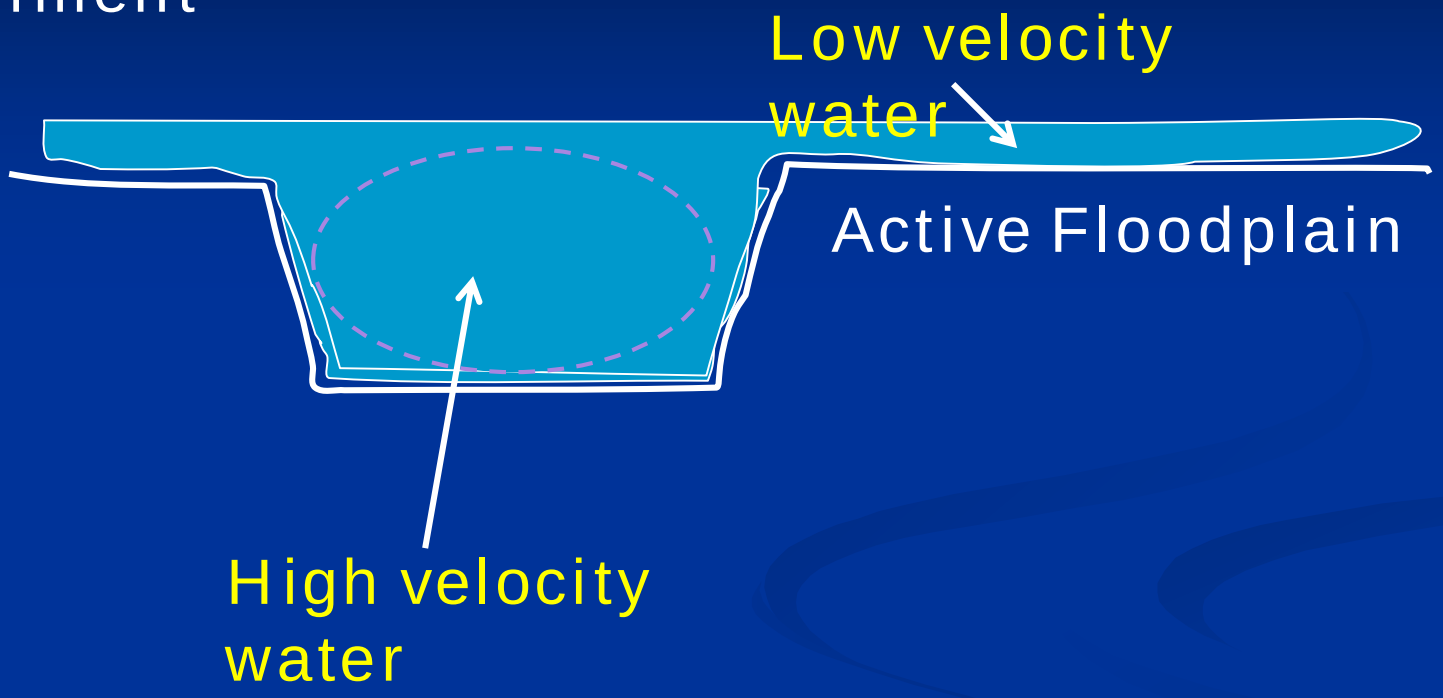

Lesson 1:
Creeks do not want to be wide and straight


Elev
1500
Hill
Channel
Length
25,000 ft
Gradient
0.4%
Gradient
1.0%
Channel
Length
14,000 ft
Gradient
0.7%
Hill
Valley
Length:
10,000 ft
Elev - 1600


Bankfull
Flow
1 – 2 Year
Flood
Base
Flow

Lesson 2:

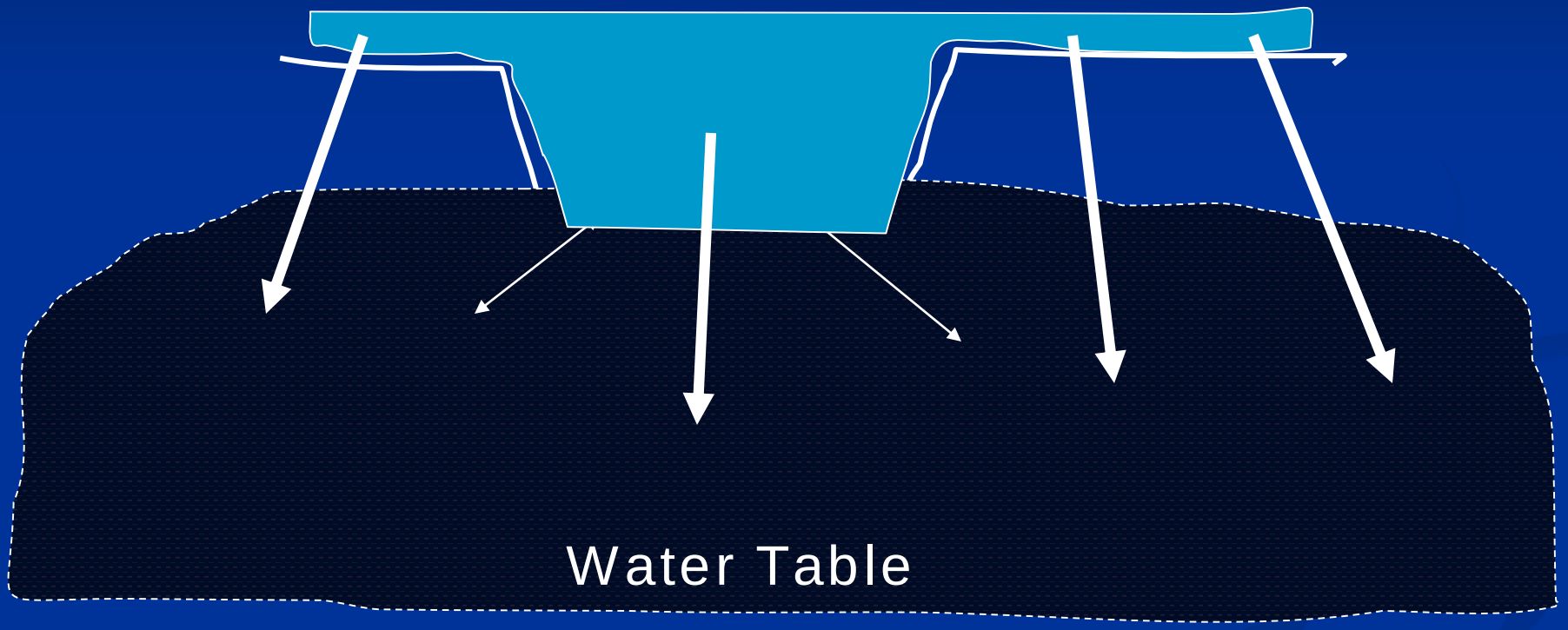
Floodplains Dissipate Energy and Trap Sediment




Floodplain

Lesson 3:

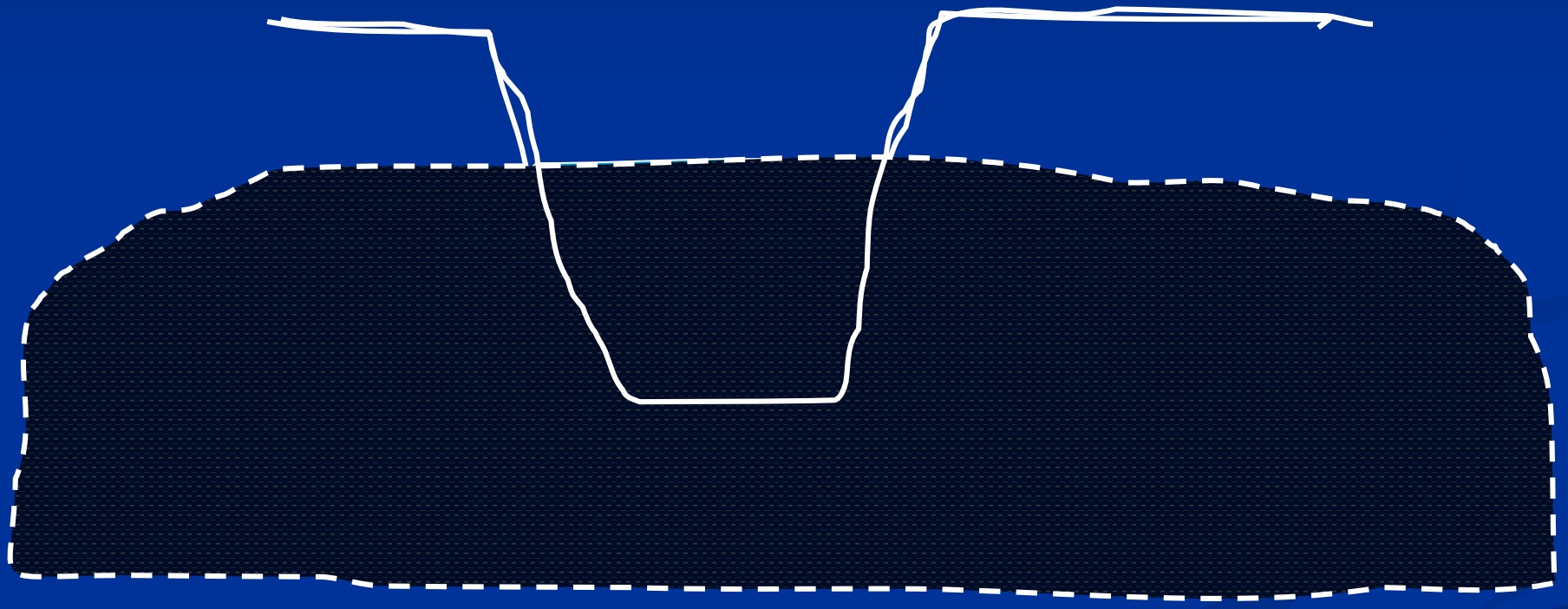
Flooding Recharges Water Tables



Lesson 4:

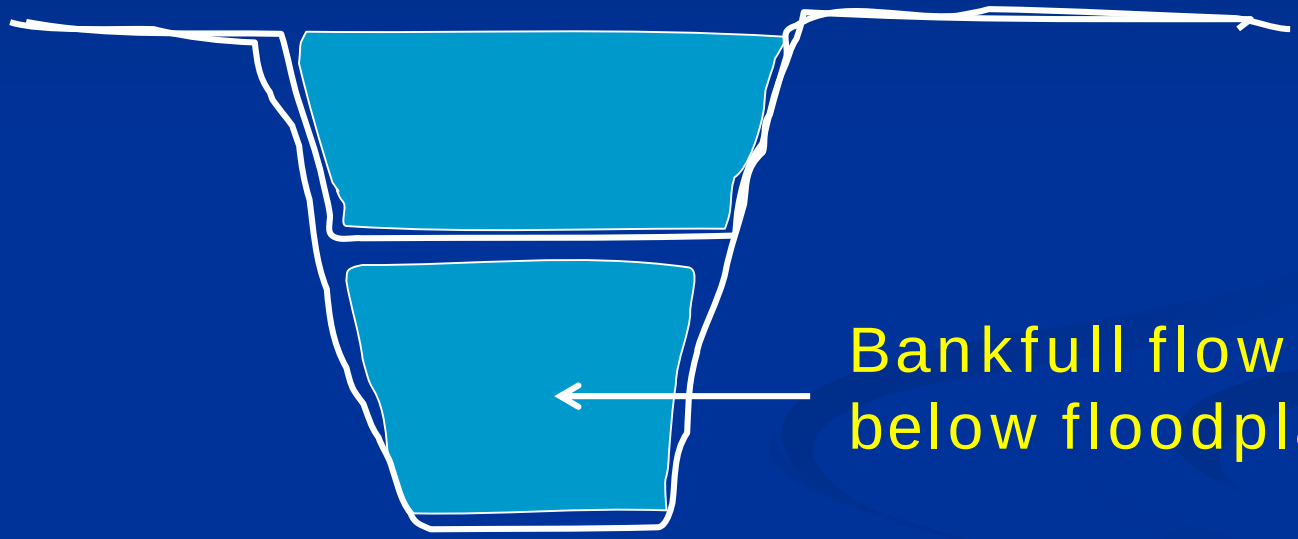
Excessive Erosion Enlarges the Channel

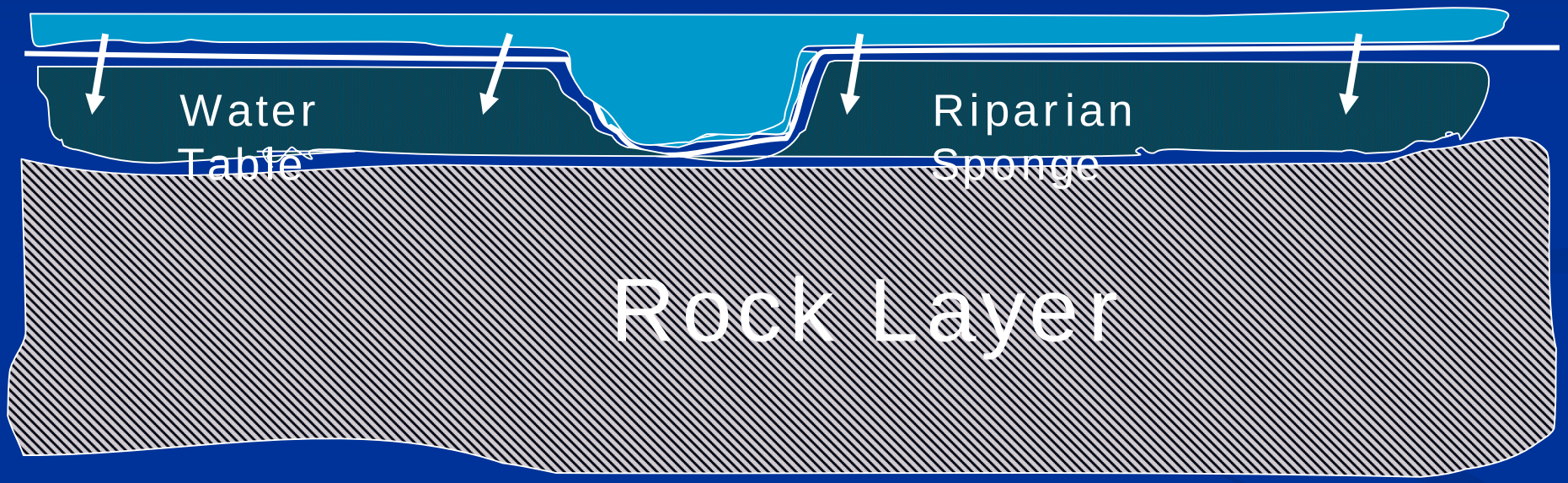
Lesson 5:
Down-cutting Drains the Water Table



Lesson 6:

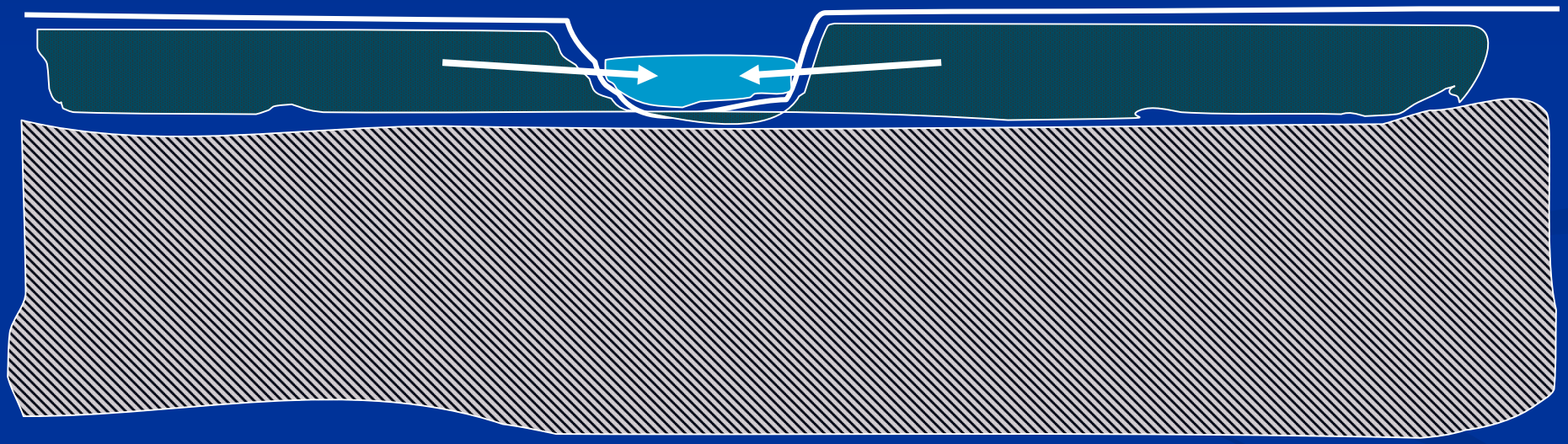
Down-cutting: Loose Access to Floodplain




Water
Table
Riparian
Sponge
Rock Layer

Lesson 7:

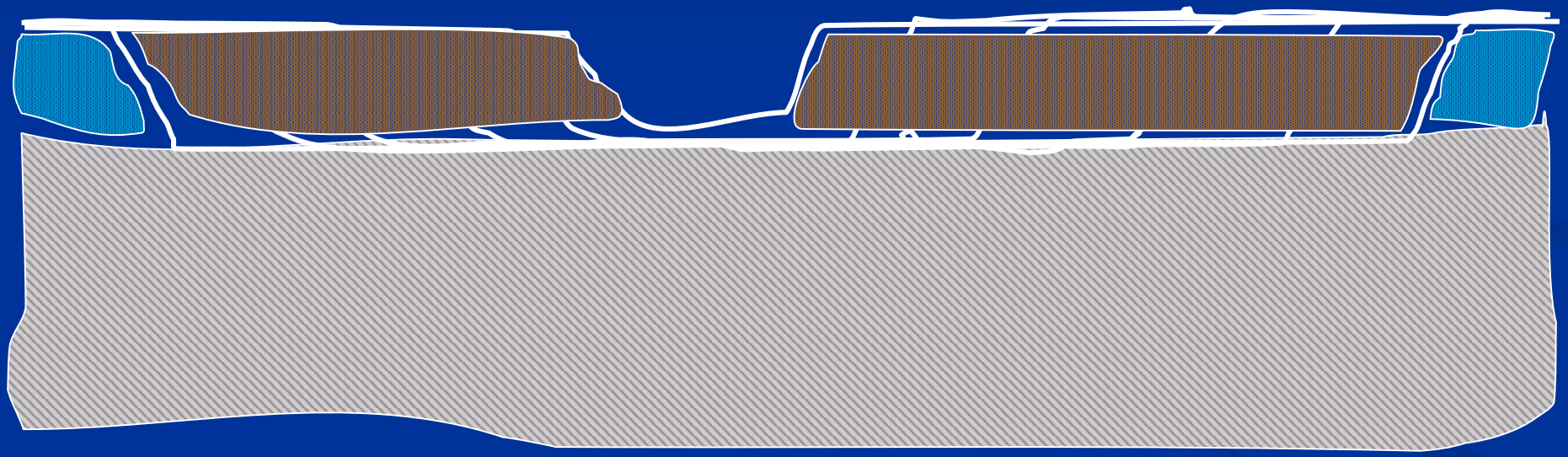
The Water Table Sustains Base Flow




Riparian Sponge

Lesson 8:

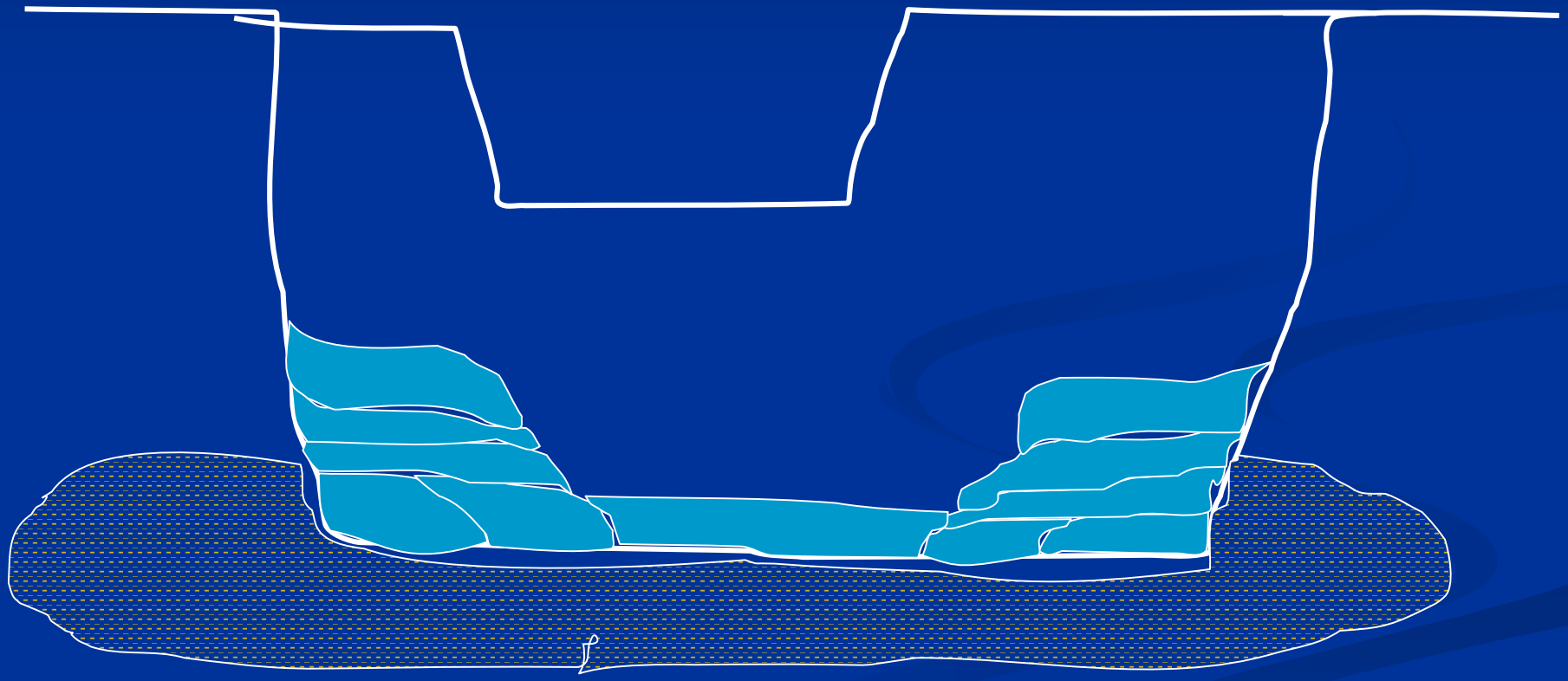
Channel Widening Reduces the Riparian Sponge



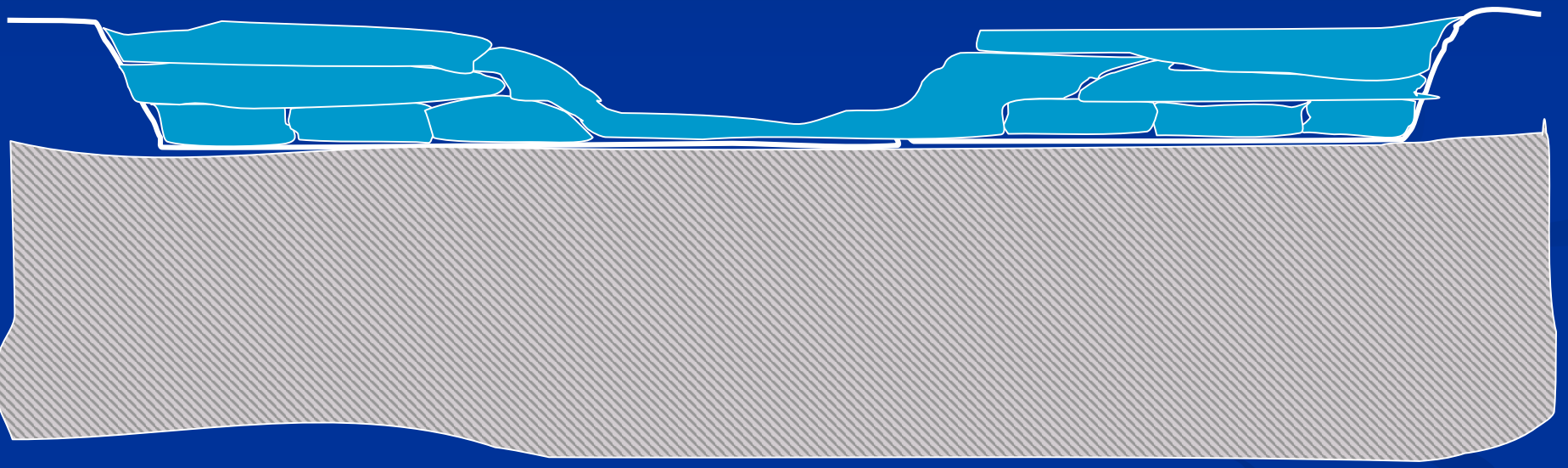
Lesson 9:

Overly Wide Channels Reduce Sediment Transport Ability

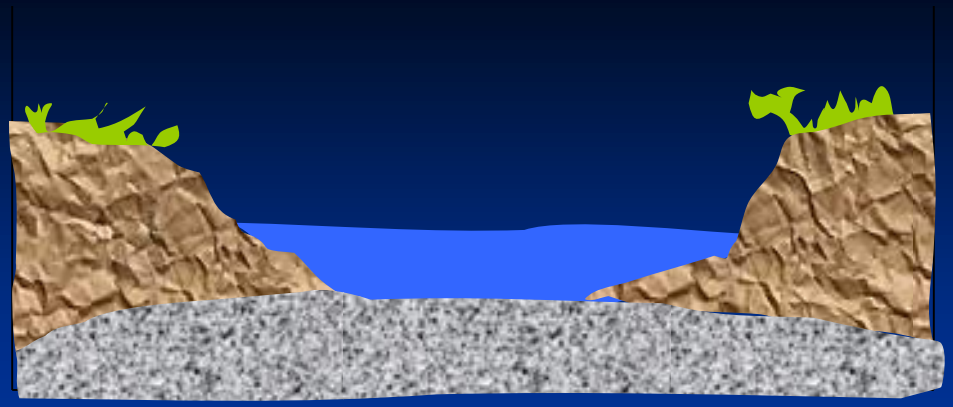
Lesson 10:
Degraded and eroded channels can be restored



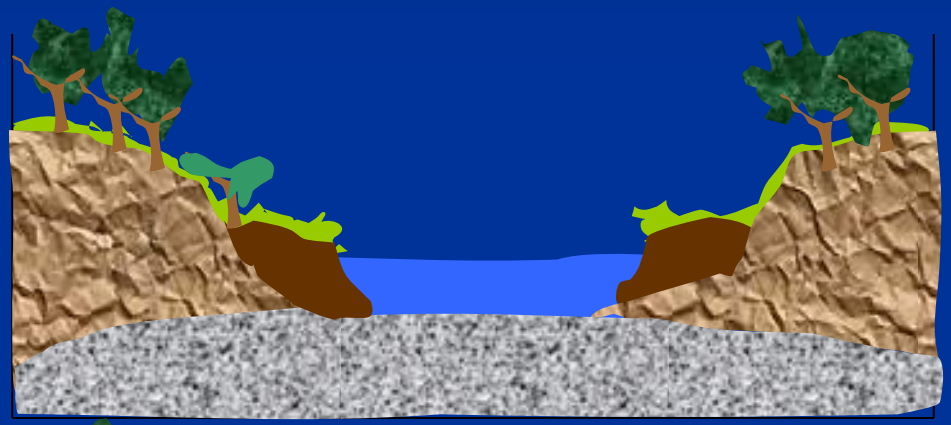
Natural Channel Restoration



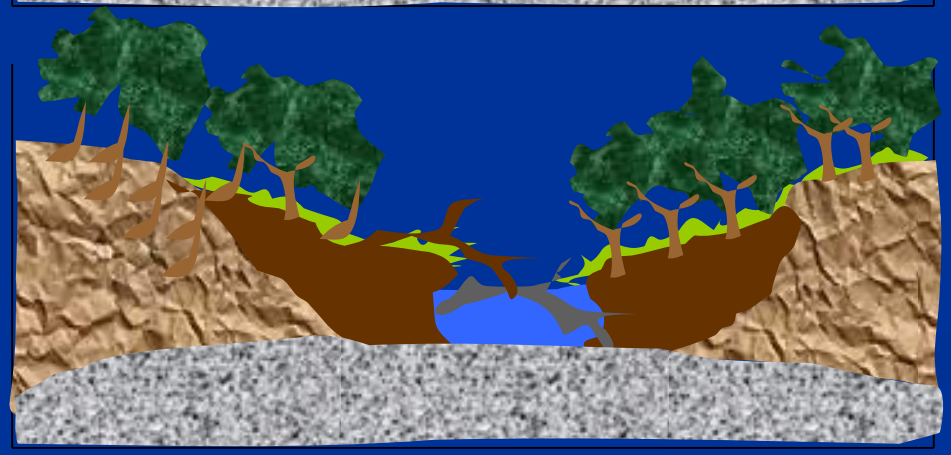
Successional Stages



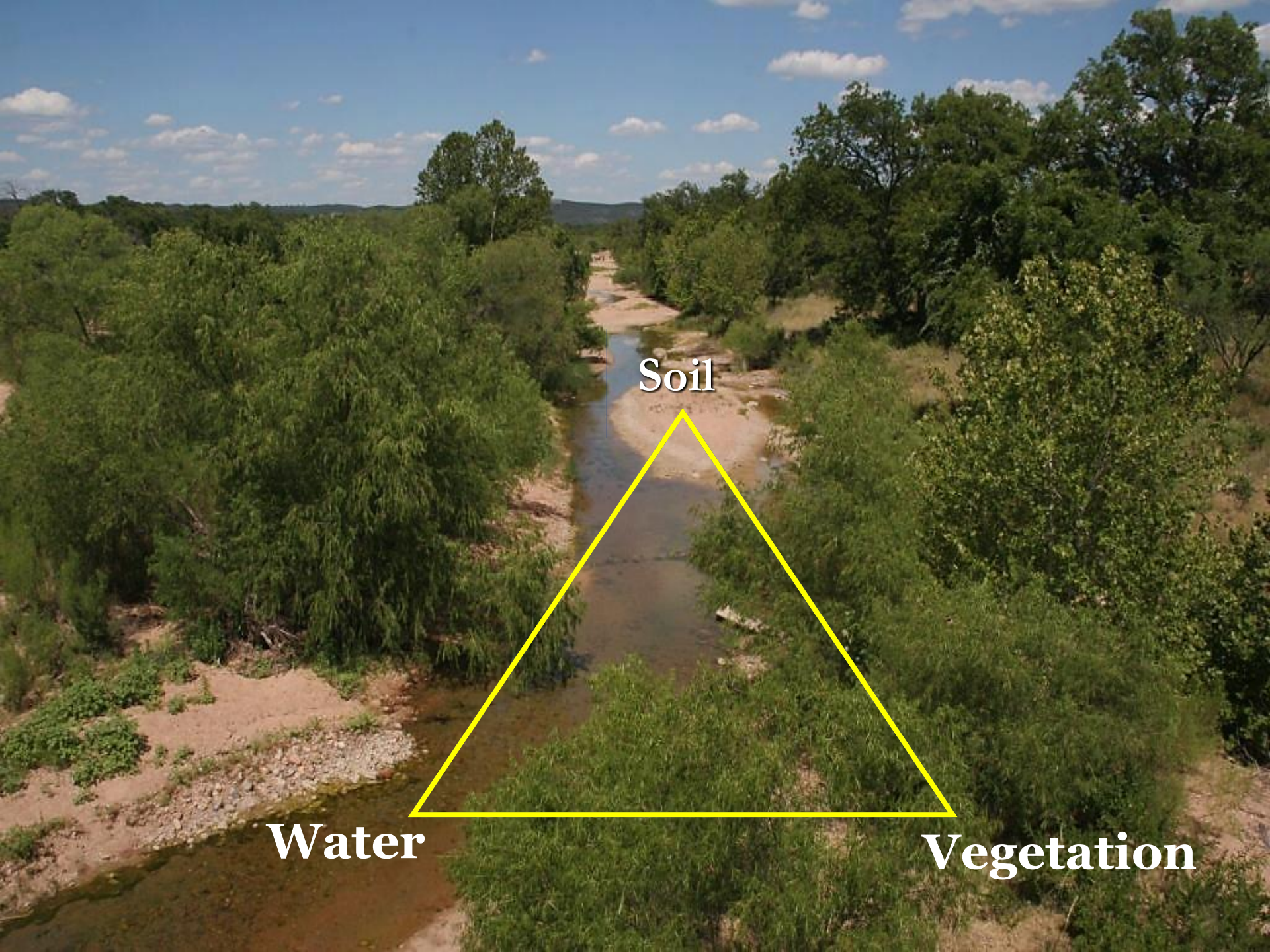
Early successional stage showing bare stream banks with little vegetative cover. Stream flow unrestricted.



Mid successional stage showing deposition along stream bank with herbaceous and woody cover developing.



Late successional stage showing deposition of sediment along stream banks, good woody and herbaceous cover, woody debris in floodplain and stream.


Soil
Water
Vegetation

Riparian Chain Reaction

Adequate Vegetation:

Protects banks from excess erosion

Dissipates energy and slows the velocity of floodwater

Sediment dropped

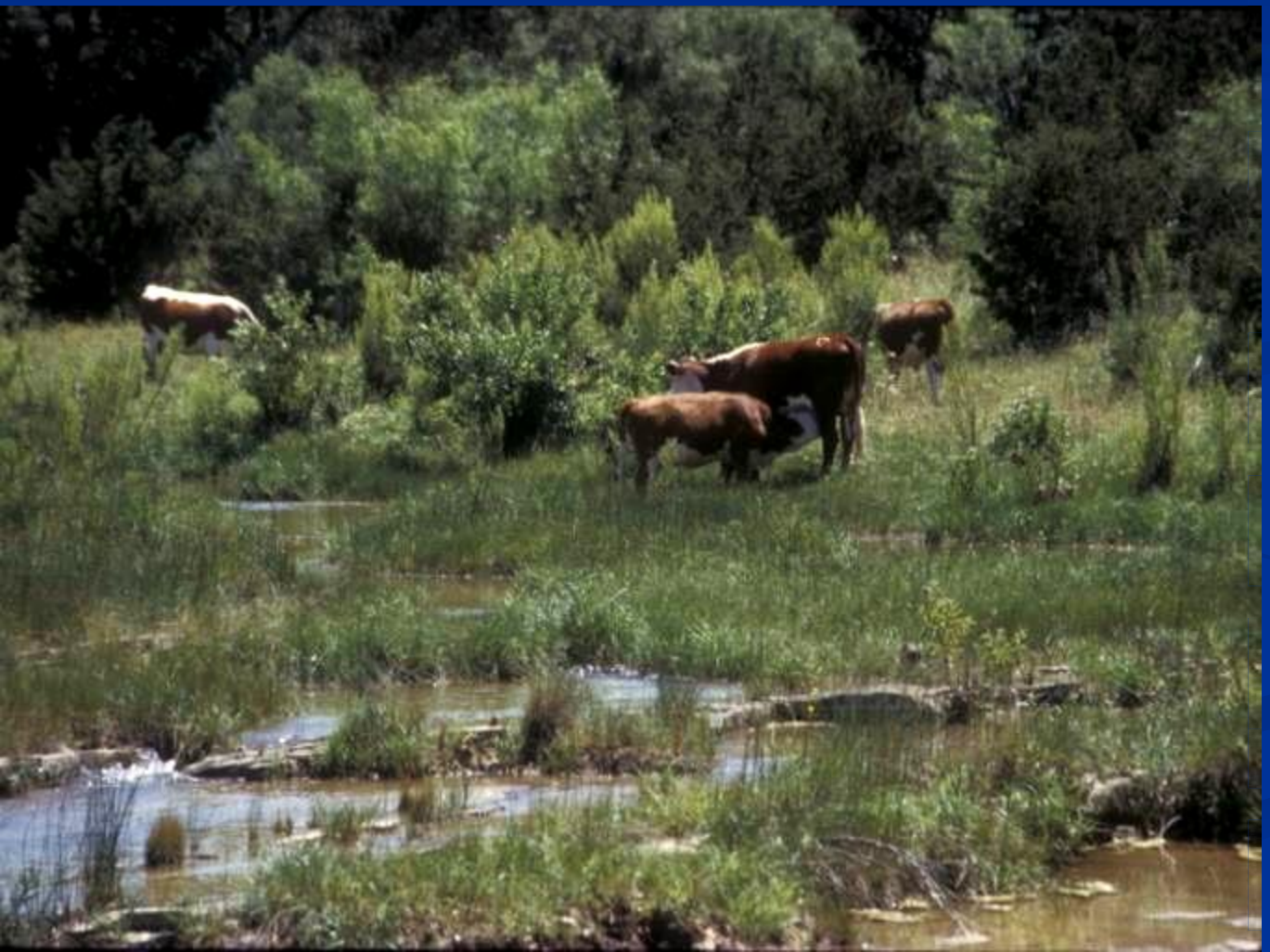
Sediment trapped and stabilized

Floodplain / riparian sponge is enlarged

Increased groundwater recharge

Base-flow is sustained over time

Vegetation Indicators:



Multiple age classes?

Plant diversity?

Plants indicative of wet conditions?

Stabilizing root mass?

Plant vigor?

Amount of plant cover?

Source of large wood?

Two Functional Groups of Riparian Plants:

1. Colonizers
2. Stabilizers

Colonizers

First plants to establish in freshly deposited sediment

Often spread rapidly by stolons or rhizomes or rooting at the nodes

Roots generally shallow and weak

Critical to recovery

Stabilizers

Strong, robust plants

Able to withstand high energy flows

Strong, deep, reinforcing root systems

Provide bank protection and energy dissipation

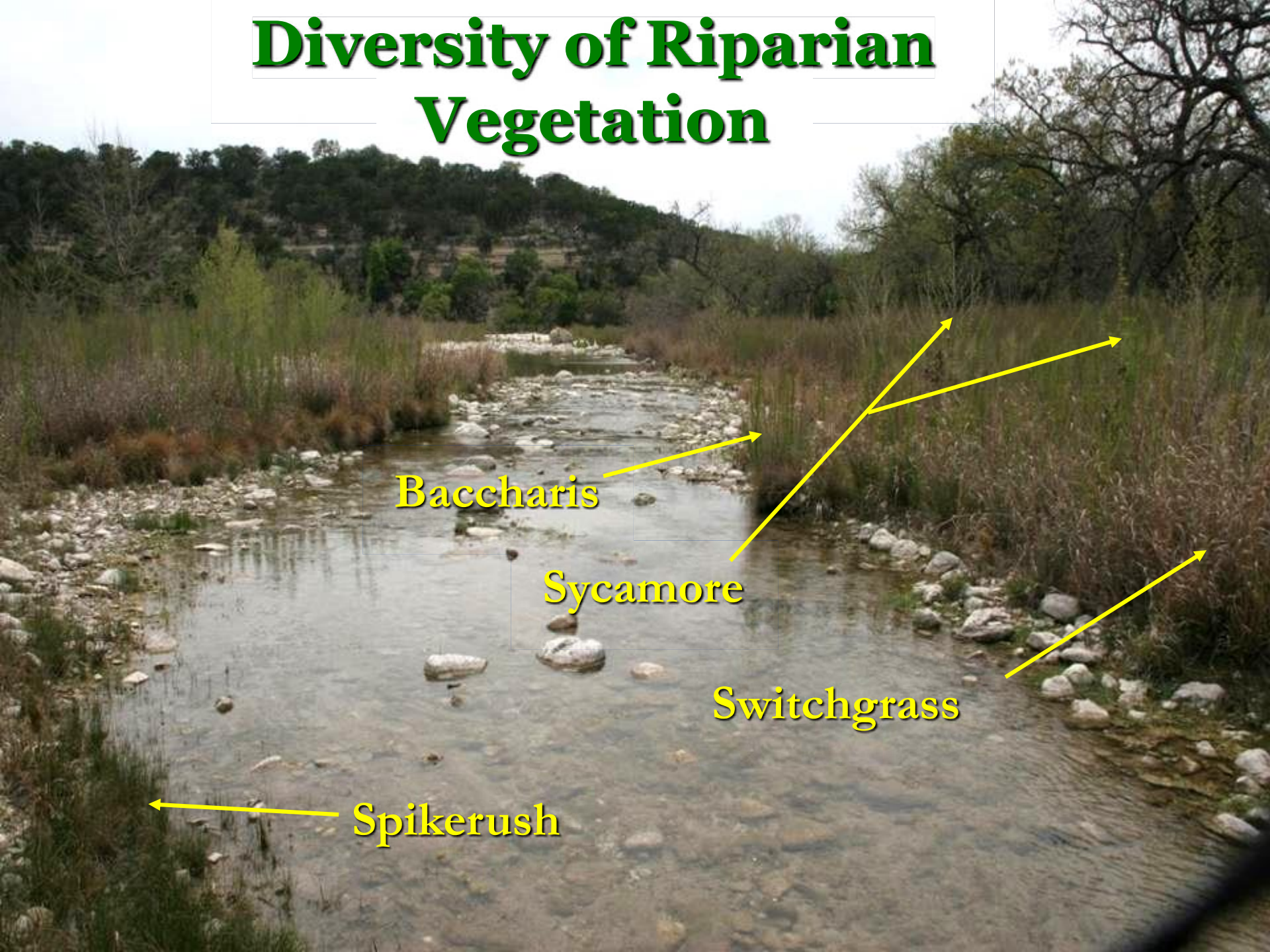
Stability Ratings of Riparian Plants Scale of 1 - 10

1 = Bare ground

10 = Anchored rock or large anchored logs

6/7 = Acceptable riparian stability *

Diversity of Riparian Vegetation



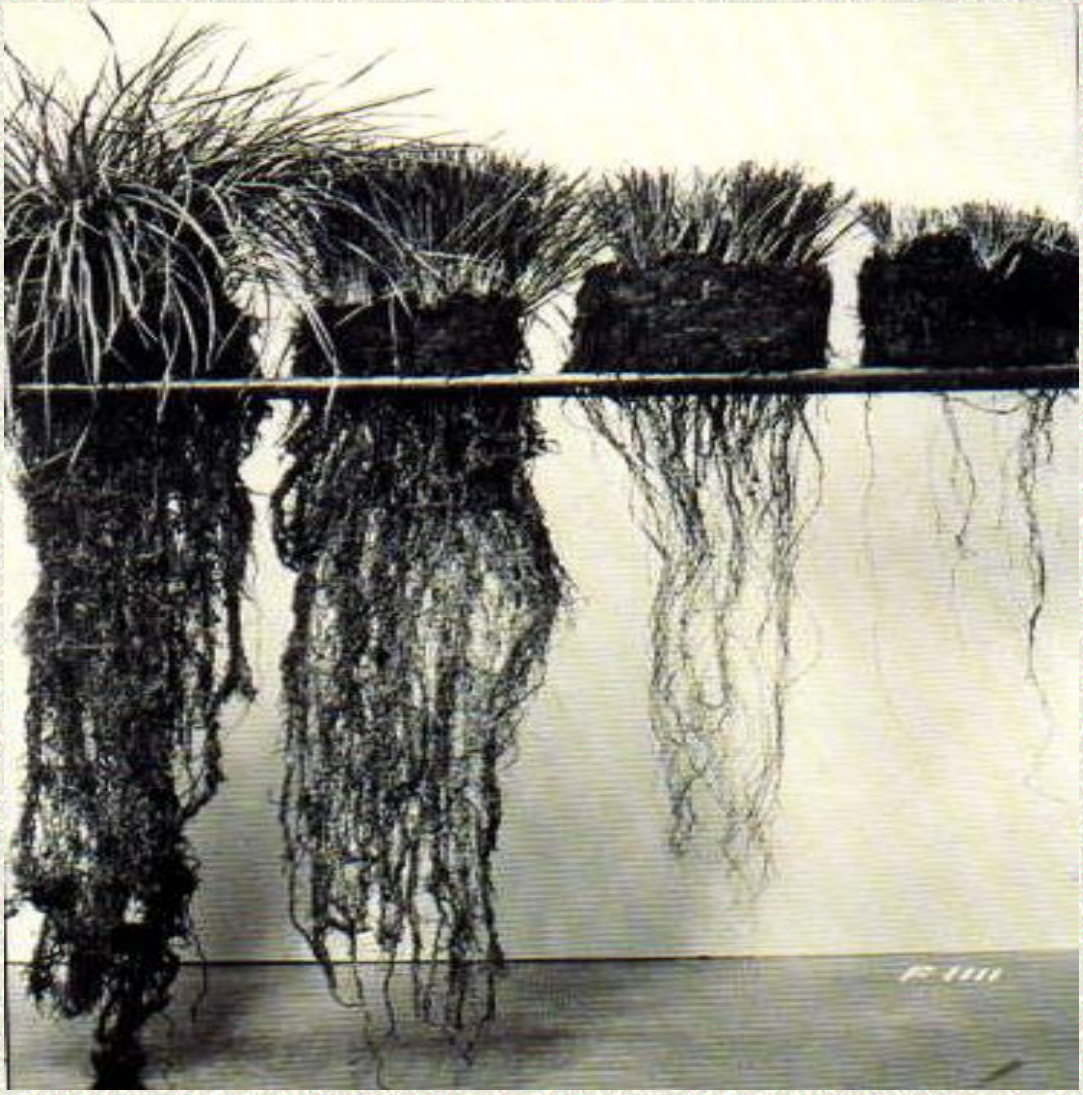

Plants indicate large water table
“Riparian Sponge

Plant Vigor

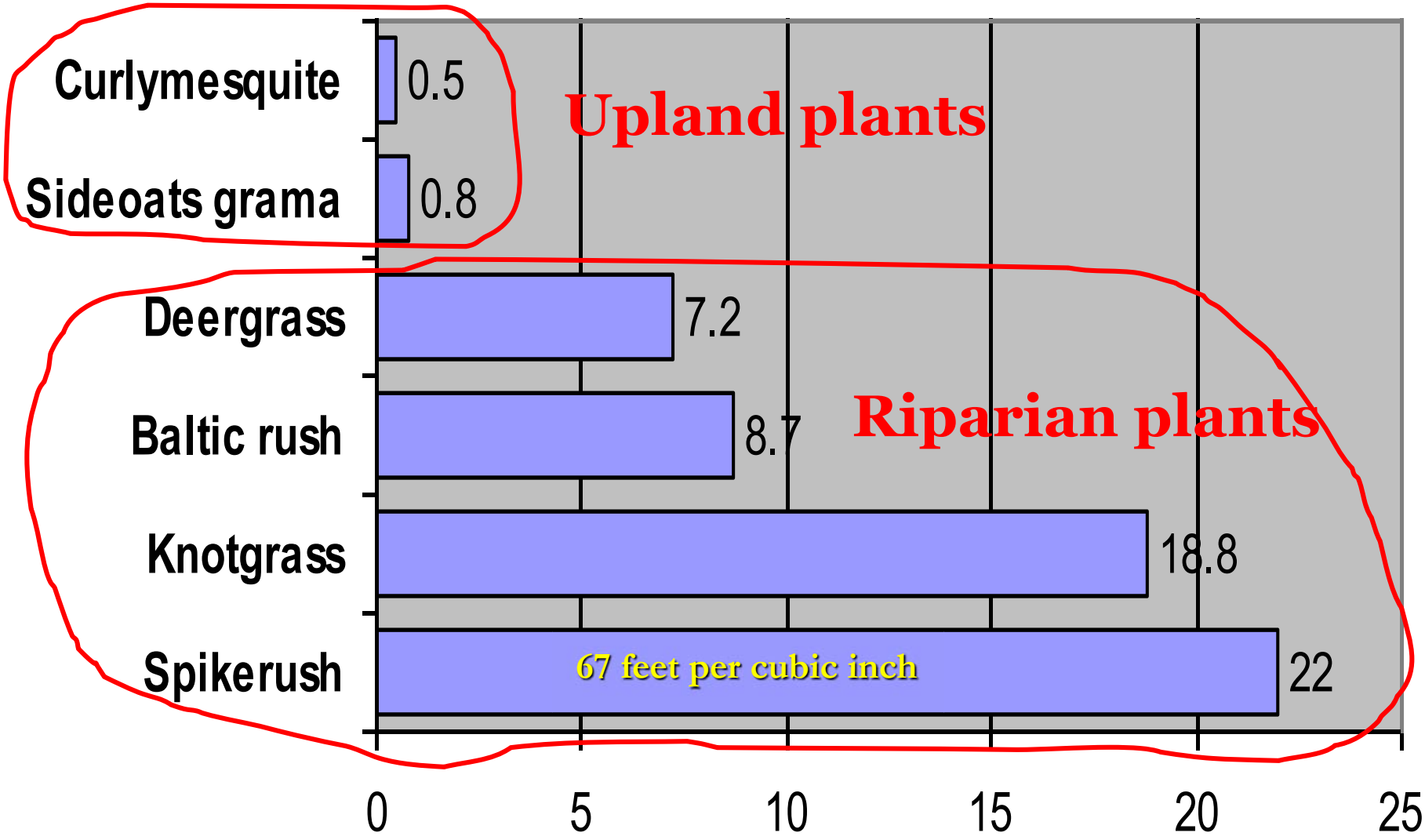
Plant Vigor-Leaves and Roots

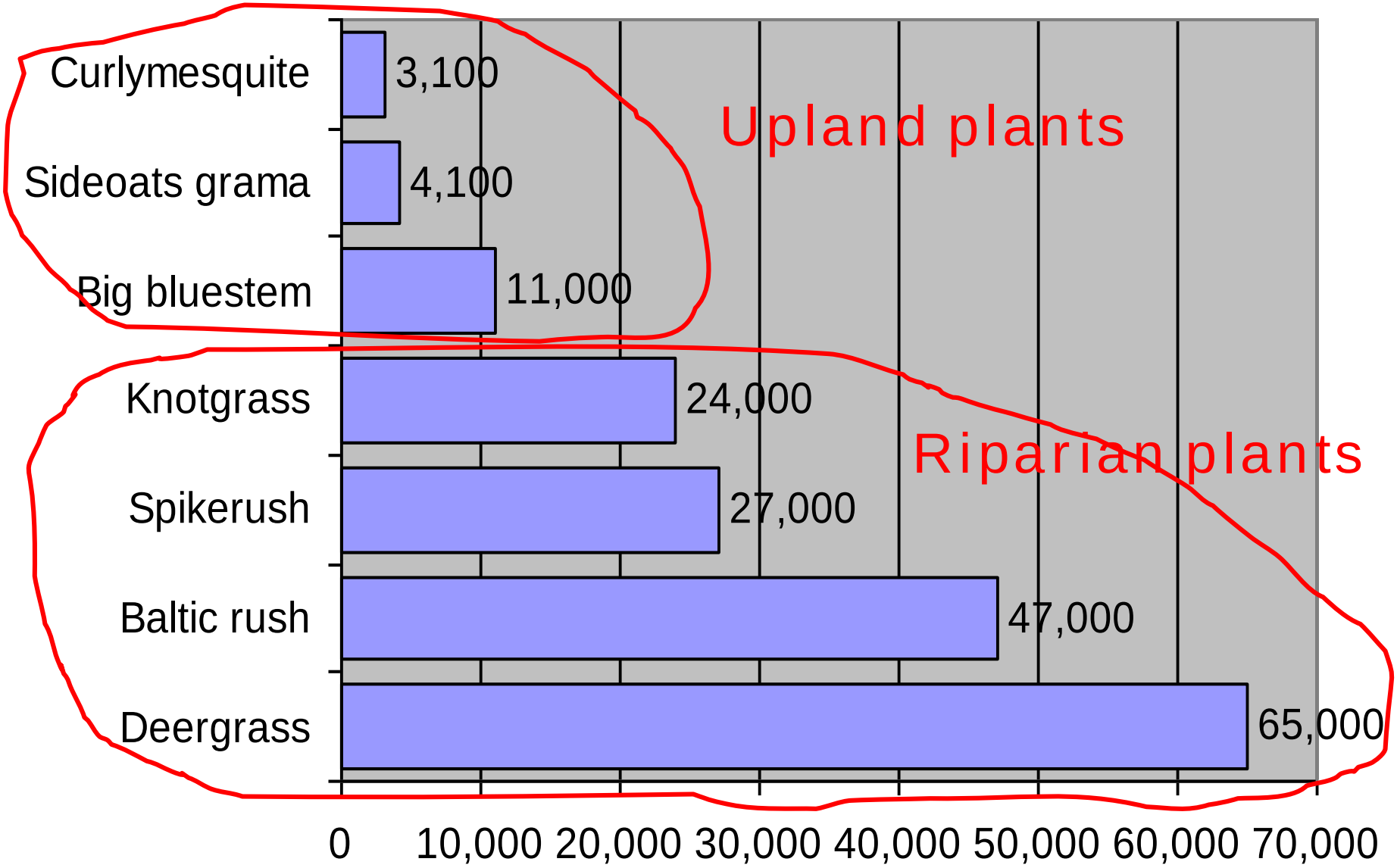
Caring for the Green Zone, Riparian Areas and Grazing Management

Alberta Riparian Habitat Management Project, "Cows and Fish Project"



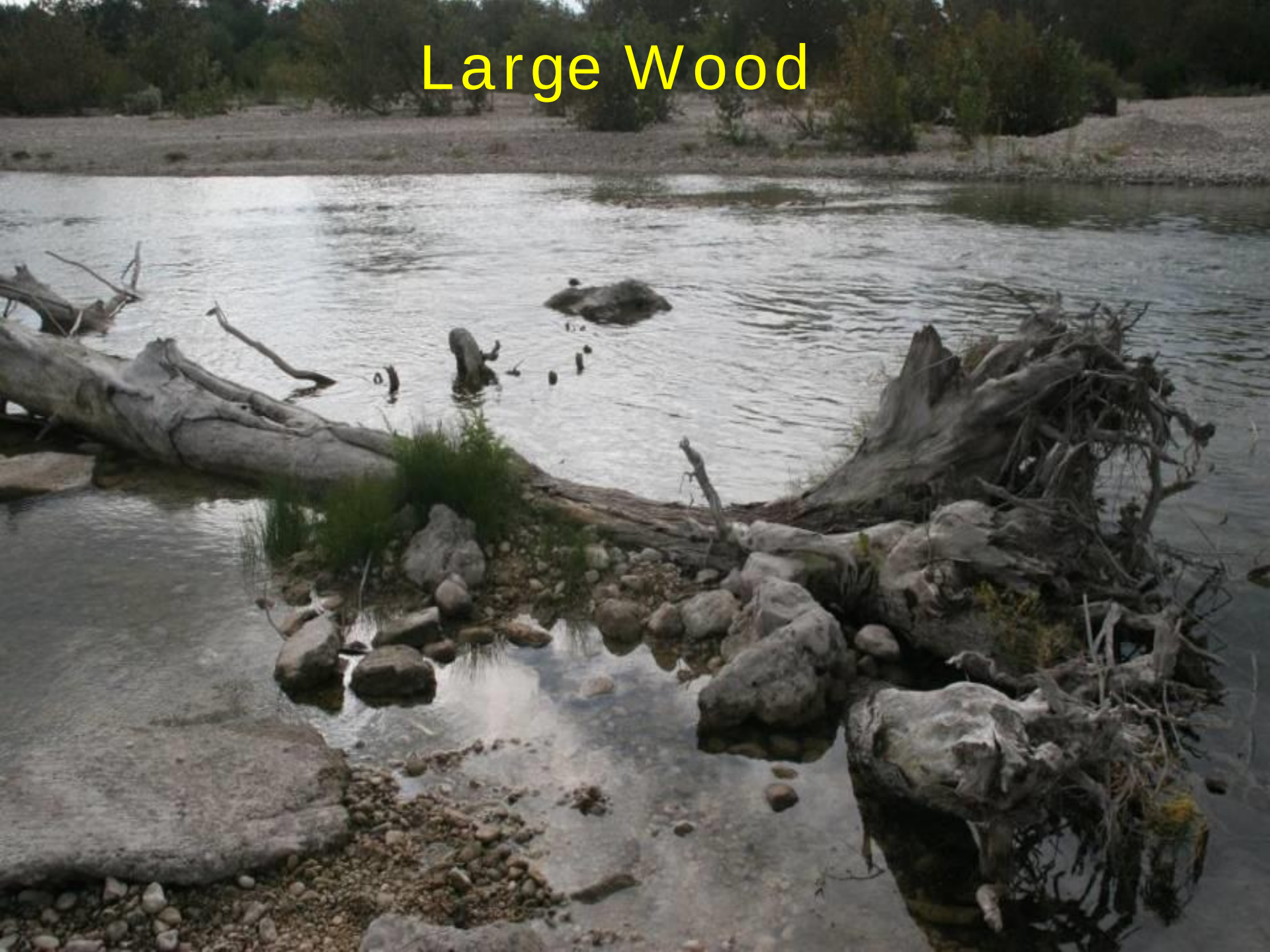
Root Length; Miles per Cubic Foot




Rootmass; Pounds per Acre
Curlymesquite
3,100
Sideoats grama
4,100
Big bluestem
11,000
Upland plants
Knotgrass
24,000
Spikerush
27,000
Baltic rush
47,000
Deergrass
65,000
Riparian plants
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000

Young cypress vs Axis deer

Large Wood



Key Functions of Riparian Vegetation:

Dissipate Energy
Reduce Erosion
Trap Sediment
Help Create / Enlarge Riparian Sponge

Slow Down the Water

Hindrances to Healthy / Functional Riparian Areas:

- Farming too close to the bank
- Mowing, spraying close to the creek
- Manicured landscapes next to the creek
- Chronic grazing concentrations in creek areas
- Excessive deer, exotics, hogs in creek
- Burning in riparian area
- Removal of large dead wood
- Artificial manipulation of banks / sediment
- Excessive vehicle traffic in creek area
- Poorly designed road crossings / bridges
- Excessive recreational foot traffic
- Excessive alluvial pumping or other withdrawals

Management and Stewardship

- The impacts of stream flow and water quality are cumulative as the water moves down the system.
- Management upstream can lead to positive or negative impacts downstream.
- As you assess the stream and riparian ecosystem think about what may be hindering it.
- Has something caused a change in the water, sediment or vegetation?
- Management activities should protect healthy systems or allow recovery to return to a healthy functioning system.

Photo Monitoring

- Repeating photographs at set locations will allow better assessment of current conditions and changes over time.
- Location selection: critical sites along the stream where the force of moving water has the potential for detrimental impacts
  - A tributary or high runoff location
  - Where the stream changes course – point bar or bend
  - Sites that are easily accessible and representative


12-2-07


10-2-08


5-2-09


9-2-12


-10-10

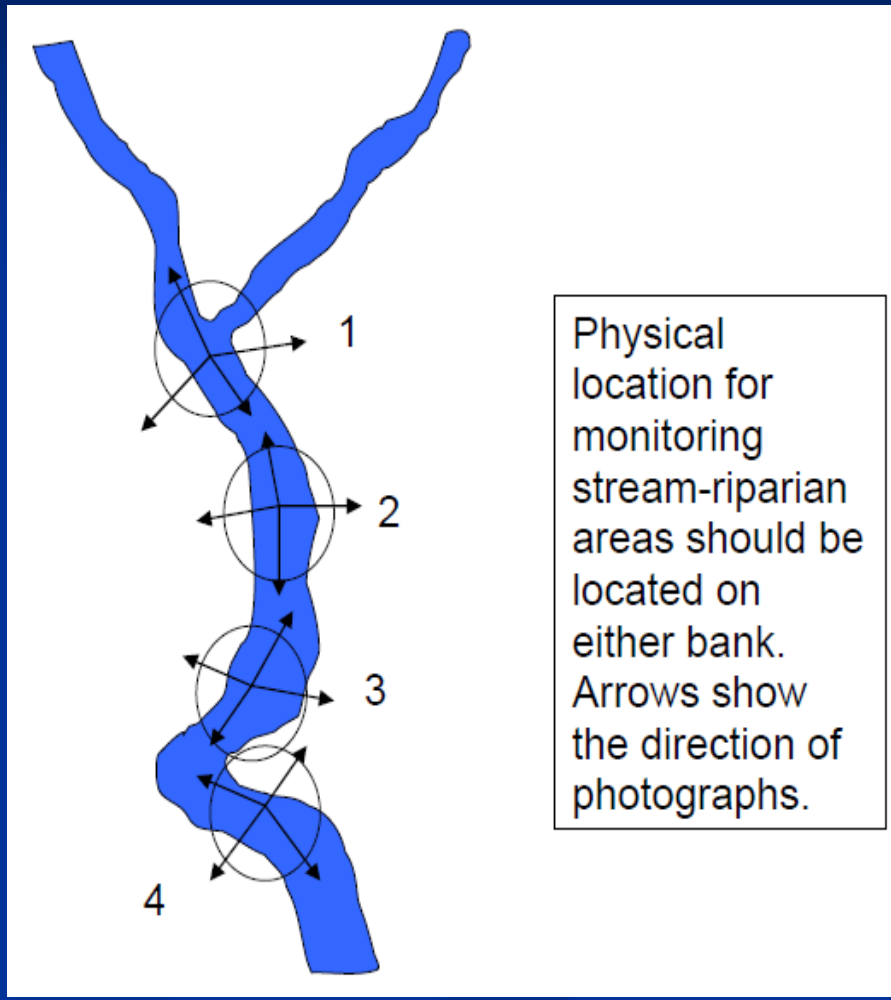

4-8-12
2012 04 08

Permanent Photo Point Method

- Four photographs should be taken at each observation site:
  - 1) upstream showing the nearest bank , stream channel and opposite bank if possible,
  - 2) perpendicular to the stream of the opposite bank,
  - 3) perpendicular to the stream away on the bank where the observer is standing, and
  - 4) downstream showing the channel and both banks if possible.
- With a felt pen and a yellow paper pad (white is too bright), make a sign to include in the photo scene.
- Include some identification (stream name, range site, etc.) concerning the specific scene being photographed and the date.

Key Locations to Monitor

- Each location should be permanently marked for future evaluations using a steel stake or on-the-ground reference plus GPS coordinates if possible.
- locate the permanent reference point a “safe” distance inland
- Make a map of the stream showing the location of each permanent marker and the monitoring point.



To improve the management of these sensitive and vital ecosystems, riparian education programs are needed regarding the nature and function of riparian zones, their benefits, and BMPs for protecting them. This will not only reduce NPS pollution, it will provide tremendous ecosystem service benefits and direct economic benefits to the community.