STREAMBANK REHABILITATION & HABITAT PROTECTION WORKSHOP
WORKSHOP OUTLINE

1. Hydrology & Fluvial Geomorphology
2. Fish and Riparian Habitat
3. Fish Biology
4. Anthropogenic Cause of Erosion
5. Vegetation and Invasive Species
6. Techniques
7. Project Site Considerations
8. Examples of Past Projects
AN INTRODUCTION TO STREAMS: WHAT ARE STREAMS?

• Rivers and streams are drainage networks that transport water and sediment transport from mountains to lakes, ponds, and oceans.

• The size, shape and movement of a stream or river are dependent from the water and sediment delivered to it from its watersheds and therefore a reflection of the characteristics of that watershed.

• Fluvial process can be broken down into three main categories: Erosion, Transportation, and Deposition

• Streams are dynamites systems that are constantly changing laterally, vertically, longitudinally, and temporally
Rivers Systems in Dynamic Equilibrium

River Overview Video

0 - 2:20

https://www.youtube.com/watch?v=8a3r-cG8Wic

https://www.youtube.com/watch?v=8a3r-cG8Wic
Figure 1.27: Three longitudinal profile zones. Channel and floodplain characteristics change as rivers travel from headwaters to mouth.

GEOMORPHIC PROCESS & CHANNEL FORMATION

Inherent Landscape Factors
- Physiography (slope, valley width, etc.)
- Geology
- Hydrology

Key Geomorphic Process
- Flooding
- Ice Processes
- Coarse Sediment Transport
- Fine Sediment Transport
- Large Wood Recruitment
- Vegetation Succession

Channel and floodplain formation

Landforms & Habitats
BANK EROSION PROCESS

1) Sediment entrainment from bank surface
2) Weakening and weathering of bank materials
Erosion produces stream load, which is the combination of bed load, and dissolved load.
As Stream slows down it drops some of its load. Havier particles drop out first.

When stream has heavy load, sediment is often deposited in the stream channel itself to form bars and islands.

These deposits split the channel into smaller channels forming a braided channel.
Braided Streams

- More suspended load
- More stable
- Fine sediments
- Low variability
- Gentle slopes

Sediment load
Stability of banks
Sediment grain size
Discharge (flow) variability
Channel slope

More bedload
Less stable
Coarser grained
Highly variable
Steeper

River splits into individual channels
River Islands or bars built by deposition
Abandoned channel due to sedimentation

By Rob Gamesby
RIVERS MOVE!
2012 LiDAR Map

- **Landowner Parcels**
- **MSB Cadastral Parcels**
- **2012 Channel**

Map By: Franklin Dekker, USFWS
Date Generated: 8/15/2018
Flooding is bad for humans, but it is important for streams.

- More water increases water velocity and increases erosion.
- Flooding moves and deposits both small sediment, butlarges coarse sediment.
- Flooding deposits new sediment, nutrients, and seeds onto floodplain surfaces.
ICE PROCESSES

• Sheets of ice flowing down a river not only change the river channel but also changes the surrounding riparian area
• Ice jamming can cause massive flooding to communities by the “lakes” that form behind the ice jams and the outburst of these jams
• Ice supplies woody debris for fish to utilize and promotes complex habitat in the riparian corridor
VEGETATION
SUCCESSION
Erosion is not a Dirty Word

Channel Migration

Channel Form

Riparian Vegetation, Large Wood, Sediment

Aquatic and Floodplain Habitat
Rivers: Systems in Dynamic Equilibrium

- Need room to move
- Preserving the Riparian
- Corridor for River Function

Biology

Hydrology

Geology

SET with the planform patterns defined by Schumm (1985).
Castro and Thorne, 2019 in review.
Let’s Deep Dive Into Riparian Areas

**Riparian (n):** relating to area adjacent to rivers and lakes.

A type of habitat occurring along the bank of, and is influenced by, a stream or lake, typically consisting of water tolerant trees and shrubs such as alder, cottonwood and willow.
What is “Habitat”?  

Definition – “a place where a plant or animal can get the food, water, shelter and space it needs to live.”

What are functions of riparian to streams.
  o Clean water
  o Bank Stabilization
  o Shading of waterways
  o Food for both terrestrial and aquatic organisms
  o Refuge during flood events
  o Woody debris inputs into waterways – which in tern creates more habitat for aquatic organisms
**Streambank Revegetation Zones**

**Zone 1**
Hydric soils - relatively slow flowing open water along stream or lakes - emergent vegetation: Water sedge

**Zone 2**
Hydric-mesic soils - fluctuating water levels subject to boat or wind driven waves: Bluejoint Reedgrass, Sedges - Carex sp., Feltleaf Willow, Thinleaf Alder

**Zone 3**
Hydric-mesic soils - floodway terrace, in addition to Zone 2 plants Diamond-leaf Willow, Undergreen Willow

**Zone 4**
Mesic soils - seasonally variable moisture regimes: Prickly Rose, Raspberry, Poplar/Cottonwood

**Zone 5**
Mesic - xeric soils - upland benches: Paper Birch, White Spruce, Black Spruce
WHY IS HEALTHY WELL VEGETATED RIPARIAN HABITAT IMPORTANT?

- Helps keep excessive sediment from being washed into the stream or lake from runoff or erosion
- Helps stabilize shorelines and streambanks from excessive erosion
- It provides shade to help limit temperature change
- Provides food for fish and other aquatic animals
- Provides shelter habitat for fish
- Slows near shore water velocity

Meuse River from Durot et al. 2020
FISH AND FISH HABITAT
FISH HABITAT & NEEDS
RESIDENT FISH
Salmon Lifecycle in the Watershed

Eggs and alevin rely on cool, clean, oxygen-rich water flowing through the gravel for survival.

Spawning Season:
- Coho: Late Summer/Fall
- Sockeye: Mid Summer
- Chinook: Mid Summer
- Pink: Late Summer
- Chum: Mid-Late Summer

Spawning:

Egg

Eyed Egg

Alevin

Salmon Fry Habitat:
- Coho: Slow areas, Streams, Wetlands
- Sockeye: Lakes, Streams
- Chinook: Slow areas, Streams, Wetlands
- Pink: Estuary
- Chum: Estuary

Fry (overwinter)

Fry

Typical Ocean Feeding:
- Coho: 1 year
- Sockeye: 2 years
- Chinook: 3 years
- Pink: 1 year
- Chum: 3 years

Smolt

Typical Age at Out-Migration:
- Coho: 1-3 years
- Sockeye: 1-3 years
- Chinook: 1 year
- Pink: 0 years
- Chum: 0 years

Most juvenile salmon overwinter in deep pools or lakes.
Crone and Bond 1976 LIFE HISTORY OF COHO SALMON, ONCORHYNCHUS KISUTCH, IN SASHIN CREEK, SOUTHEAST ALASKA

Freshwater Juvenile Salmon Survival

- 21% Survive Egg to Emergence
- 7.1% Survive to July
- 2% Survive to September
- 0.7% Survive to 2nd July
- 0.4% Survive to 2nd September

Figure 11.—Estimated populations of juvenile coho salmon of three brood years, Sashin Creek, from potential egg deposition to late summer of second year. (Semilogarithmic plot to indicate mortality rate.)
CLEAN, OXYGENATED GRAVEL
SPAWNING SEDIMENT
COMPLEX IRREGULAR SHORELINES
UNDERCUT BANKS AND OVERHANGING VEGETATION
WOODY DEBRIS
SLOW MOVING WATER
Complex natural structures provide:
• Optimal juvenile salmon rearing habitat
• Shelter for juvenile salmon
  • High water velocity
  • Predation
• Substrate for macroinvertebrate food sources
• Optimal temperatures
Figure 5. Mean catch of juvenile chinook salmon per cell by velocity and depth intervals (bars) in low turbidity waters, Chilkat River to Skilak Canyon reach of the Susitna River. Suitability indices (lines) fitted by hand.
HABITAT SUITABILITY INDEX FOR CHINOOK SALMON

Figure 17. Category two SI curves for chinook salmon juvenile velocity, depth, percent cover, and cover type utilization (from Suchanek et al. 1984).

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<th>x Code</th>
<th>Cover type description</th>
<th>y SI</th>
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<tr>
<td>2</td>
<td>Undercut bank</td>
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<tr>
<td>3</td>
<td>Rubble/cobble/boulder</td>
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<td>4</td>
<td>Aquatic vegetation</td>
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<tr>
<td>5</td>
<td>Large gravel</td>
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<td>6</td>
<td>Overhanging vegetation</td>
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<tr>
<td>8</td>
<td>No cover</td>
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FIGURE 3. Mean (A) number of juvenile Chinook Salmon per sampling point and (B) proportion of occupied points along different shoreline categories based on a cumulative 2,450 samples collected during 11 repeated visits to Sacramento River sites characterized by rock revetment (n = 3), mitigated (n = 9), and natural (n = 4) shorelines in spring 2013 and 2014. Vertical bars indicate 95% confidence intervals.
Predation

C.C. Woods- 1987 Study written for the Canadian Journal of Fisheries and Aquatic Sciences

“... merganser broods consume about 82,000 to 131,000 juvenile coho salmon between June and August... equivalent to 24-65% of the wild smolt productions from the river”
FOOD

Mosquito

Midges

Zooplankton

Stonefly

Mayfly

Caddisfly
**FISH**
- Natural Banks
- Undercut banks
- Overhanging vegetation
- Irregular shoreline
- Spawning gravel

**RIVERS**
- Rivers move!
- Erosion is not a dirty word
- Riparian corridors give rivers room to function