Streams in Forests

Small stream ecosystems are strongly influenced by the landscape around them. Stream ***integrate*** the habitat around them, and *propagate* materials downstream. Because of these connections, human activities on land can influence the stream.

Quick vocab lesson:

Stream habitats

- Main channel—main watercourse of stream
- Side channel—not the main
- Riffle—area of fast-flowing water, often over coarse substrate
- Hyporheic—Area in substrate that has contact with stream through water exchange
- Pool—area of stream that are relatively deep and low flow
- Riparian—land area along the banks of the stream
- Gradient (m/km or %)--drop in elevation over a distance
- Discharge (m^3/s)--rate of water movement

Connectivity

- *Longitudinal connectivity*—connections between upstream and downstream habitats.
    - Floods have great power and increase longitudinal connectivity. For example, they move large woody debris and sediments from the headwaters to lower down in the river.

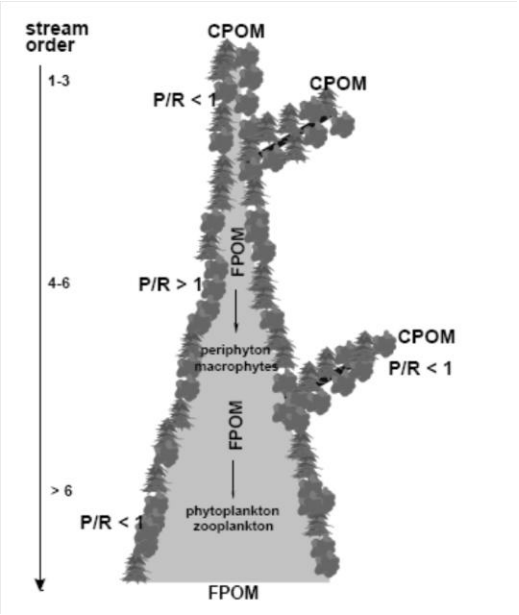
- *Lateral connectivity*—connections between a stream and its floodplain.
    - Through periodically inundating floodplains, floods connect rivers with the landscape around them. This is important for both aquatic and riparian habitats.

Stream characteristics change in a relatively predictive fashion as you go from headwaters to the ocean.

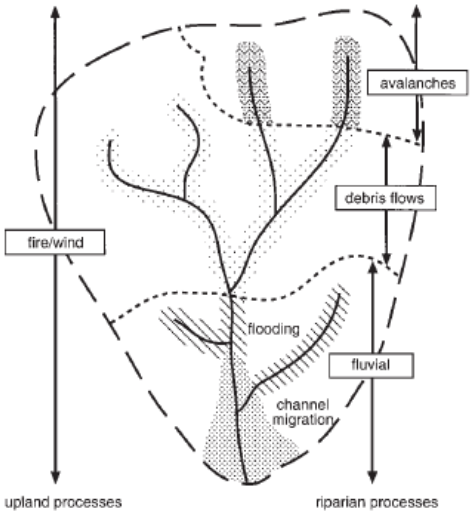
River continuum concept. A framework that describes how streams systematically change as they get bigger and how energy flow and invertebrate community structure changes. Streams change in:

- Physical structure
- Disturbance regime
- Where the energy (carbon) comes from
    - CPOM—coarse particulate organic matter
    - FPOM—fine POM
- The types of organisms that live them in them
    - Benthic invertebrate communities shift to track the dominant source of energy

River continuum concept



Across stream watersheds, different processes will control the community dynamics. From: Naiman



Streams in Forests

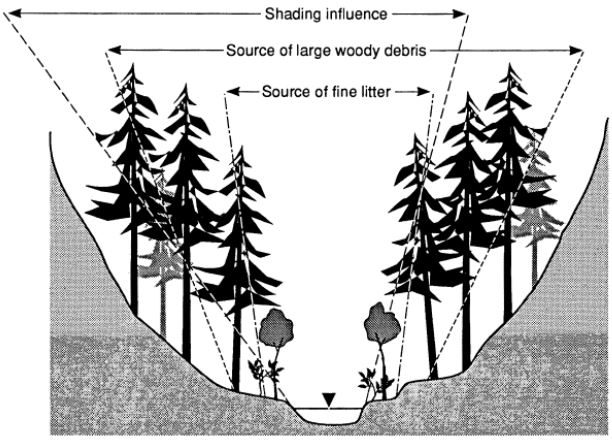
Small headwater streams

Streams systems usually have a *dendrite* (branch-like) structure

Therefore, the majority of stream length is often in small headwater streams

- *Allochthonous*—energy produced outside of ecosystem (e.g., leaf litter fall).
- *Autochthonous*—energy produced within the ecosystem (e.g., phytoplankton, periphyton).

The majority of the carbon in headwater streams comes from *allochthonous* inputs—*why?*



Geology, sediment, and streams

- The structure of the stream is controlled by the landscape around it.
- Streams erode sediment and transport it downstream through time.
    - Sediment gets deposited into streams via erosion as well as landslides.
    - Small sediment—easy to move—accumulates in slow water
    - Large sediment—large to move—found in fast water
    - Sediment strongly influences the types of animals found in places. For example, salmon spawn successfully in sediment that is approximately apple- to cherry-sized.

Streams in Forests

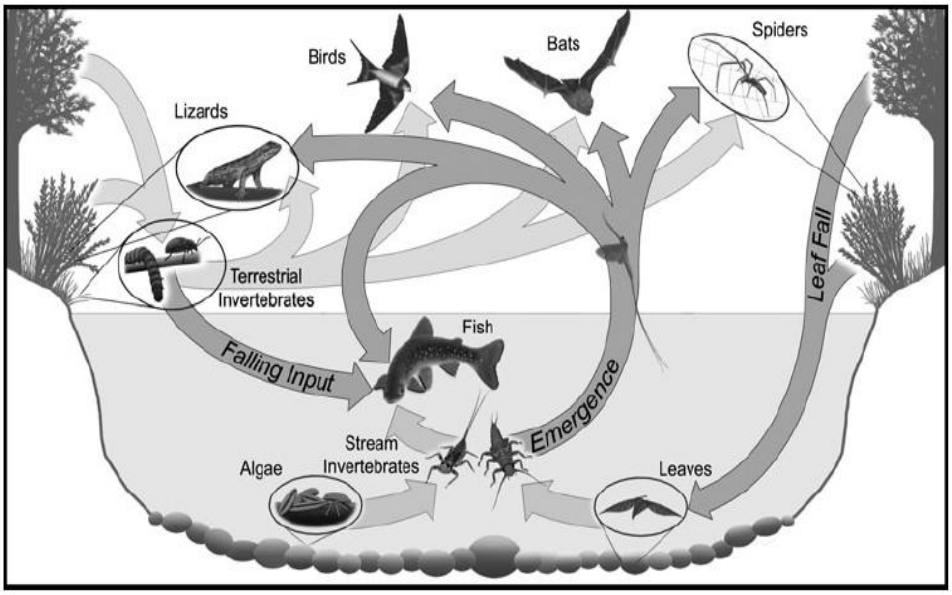
Large woody debris in streams

a.k.a. –logs

- Flow refuges—places with low velocity water
- Traps sediment and organic matter
- Provides critical habitat for a variety of organisms
- Large woody debris is deposited by in-fall, and then buried or transported over time (decadal scales).
- Forested headwater streams, in their natural state, are often very jumbled and “messy”.
    - Historically, people would “clean” streams to try to improve fish habitat.
    - This had the exact opposite consequences as intended.
- Conifer species—don’t degrade very rapidly
- Deciduous species—tend to degrade very quickly

Habitat coupling

The connection between two adjacent habitats, for example, aquatic insects connect freshwater and riparian ecosystems. Aquatic insect hatches are often important for riparian consumers such as spiders and birds. Cartoon below from: Baxter et al.



This habitat coupling means that terrestrial land-use decisions will impact aquatic species.

For example, logging:

- Can reduce large woody debris (may be long time lags and slow recovery)
- Can dramatically increase rates of erosion leading to excess fine (small) sediment
- Reduces prey for stream fish
    - Stream salmonids often derive most of their energy from terrestrial invertebrates that have fallen into the stream
- Fishless reaches produce food for downstream fish-bearing areas

This information has been used to manage logging. For example, buffer strips are mandated for fish-bearing streams.