Missouri Streams

The word “stream” is used here to represent all flowing natural surface water, from brooks to large rivers. In Missouri, many streams begin as outlets of springs where the groundwater table intersects the surface. In contrast, the Missouri River begins as snow melt in the mountains of Montana. Added to this flow is surface runoff and local snowmelt. Because precipitation amounts vary seasonally, the rate and volume of stream flow can also fluctuate widely, from flood conditions to a nearly dry streambed.

Physical Characteristics of a Stream

Current

A stream is a body of water with a measurable current. Current is the physical indicator of the continuously moving water that composes the body of the stream. Current shapes the stream channel and influences the types of organisms that inhabit the stream. The velocity of the current varies depending upon the topography of the land through which the stream flows, the gradient from a stream’s headwaters to mouth, and the average rainfall within the stream’s watershed.

The velocity of the current (how fast the water is moving) influences the character of the stream bottom and the types of aquatic organisms that can live there. A slow moving portion of a stream will deposit more silt while a faster moving part will wash everything downstream except for the heavier sediments like gravel and cobble stones. Higher water velocity will also scour and deepen the streambed by moving stones and sand along the bottom and it can even cut new stream banks and channels. Flowing water transports nutrients and minerals to aquatic organisms. In high water events, the current may even sweep away the organisms themselves. Balancing the depletion of stream bottom plants and animals, the current continuously reintroduces new life from areas upstream.

Water Temperature

The temperature of water in a stream is not constant. In general, small shallow streams exhibit temperatures that fluctuate with the warm and cool seasons. Large streams that are exposed to direct sunlight are warmer than those shaded by trees and other stream bank vegetation. These temperature changes are important because water temperature affects the types of plants and animals found in the stream.
Dissolved oxygen gets into the water by diffusion from the atmosphere, aeration of the water as it tumbles over falls and rapids, and as a byproduct of photosynthesis. The oxygen dissolved in streams is crucial for the organisms and creatures living in it. Just as we humans breathe oxygen from the air, aquatic organisms use oxygen that they obtain from the water through their gills. As the amount of dissolved oxygen drops below normal levels in streams, these animals will be negatively impacted and may even die if the oxygen levels do not rebound. Dissolved oxygen in surface water is used by all forms of aquatic life; therefore, dissolved oxygen is typically measured to assess the health of a stream.

Sediment Load

Sediment is inorganic and organic material that is transported by, suspended in, or deposited by streams. Sediment load is the quantity of sediment transported by a stream. Many things effect sediment load in a stream like stream discharge (the velocity and volume of water), soil type, plants and trees along the stream banks, weather conditions, and land-use activities. Sediment carried by streams and rivers can be composed either of fine materials, like silts and clays, or larger materials such as sand and gravel. Historically, poor farming and logging practices have greatly increased sedimentation in streams. Changes in those industries has slowed sedimentation down in the past few decades.

Substrate

The substrate of a stream is the stream bottom. The substrate is composed of materials that vary in size from very fine mud, made of silt and clay to sand and pebbles on up to large boulders. In some streams, the water flows over the native bedrock where no gravel or sand is present. Stream substrate can affect the life found within the stream habitat since organisms prefer different substrate types. In a stream with a lot of sediment, the water may appear murky or cloudy and the substrate may be embedded in a layer of silt. In a stream with low sediment, the water will be very clear and the substrate will not be embedded. When measuring stream health, these physical characteristics (embeddedness, substrate type, water clarity, etc.) can help indicate problems upstream.

Ecological Characteristics of a Stream

Stream Ecosystems

The ecosystem of a stream is viewed as a system operating in its natural environment, and includes biotic (living) interactions amongst plants, animals and micro-organisms, as well as abiotic (non-living) physical and chemical interactions. The organisms that inhabit stream environments are impacted by various abiotic factors, such as current, temperature, and substrate composition. Some organisms, like plants and algae, depend on abiotic factors for energy and growth. Sunlight and nutrients are important to these organisms. In turn, other organisms such as fish and
waterfowl depend on bottom-dwelling organisms as their food source. When the food source is decreased, the other organisms also will decrease. These interrelationships between the biotic and abiotic factors of the stream are what define the dynamics of a stream environment.

Macroinvertebrates

Macroinvertebrates living among the stones, logs, sediment and aquatic plants on the bottom of streams and rivers are essential in the overall aquatic food chain. Although many species feed upon plant matter in various forms, some are predatory and eat small fish and tadpoles, as well as each other. In turn, macroinvertebrates are eaten by both large and small species of fish and often are the primary food source for certain fish species. Because they are confined to well-defined areas at the bottom of a stream, macroinvertebrates are often the first to decrease during a pollution event. This die-off of macroinvertebrates ultimately impacts the rest of the aquatic food chain and serves as an indicator of poor stream health.

Fish

The distribution and abundance of fish in a stream can be influenced by a number of factors, including oxygen concentration, temperature, current speed, availability of food sources and suitable substrate for spawning. Often, the type of habitat sought for spawning is very different than what they might normally search out to find food and to grow.

Stream Habitats

Natural streams are composed of a series of three major types of habitats, the turbulent riffle, the fast flowing run and the quiet pool. Each habitat has unique characteristics yet all are interrelated and necessary to maintain the health of the stream.

Riffles

Riffles are shallow, turbulent areas with fast moving water. This is where the water and air are mixed and the dissolved oxygen of the riffle will be measurably higher than average for the whole stream. In riffles where mixing is vigorous the dissolved oxygen may be near the saturation point. In deep pools or in polluted or stagnant water, the dissolved oxygen content will lower.

In addition to enhancing the dissolved oxygen content of the water, the speed of the current in the riffle allows only bedrock, rubble and gravel to remain on the bottom. This provides a large surface area for colonization by bottom dwelling flora and fauna. The riffles serve as the substrate for substantial growth of filamentous algae and most species of aquatic invertebrates. The riffle typically has the largest biomass production in the stream.
Runs

Runs are areas where the water is flowing rapidly, generally located downstream from riffles and many times lead into pools. They are deeper than riffles and the water surface is smooth. The smooth surface allows for light to penetrate. Although their current may be somewhat swift, the speed of the water tends to be less than a riffle. This is the result of the greater depth and a smoother bottom. Runs support aquatic insect life but usually less so than a riffle. In general, runs are preferred by smaller fish such as minnows.

Pools

Located above and below riffles, pools are relatively deep, quiet areas with slow moving water. The pools serve as sites for organic decomposition acting as catch basins for the organic matter produced in the riffles. More sediment characterizes the bottom of the pool since the water has slowed enough to allow gravity to act upon the sediment load. Because of the decomposition that takes place, the biological oxygen demand (also referred to as BOD) is higher because the microorganisms in the water need more oxygen. As a result, the dissolved oxygen level of pools is usually lower than that of riffles. Many aquatic organisms can be found in both pools and riffles. Some animals and plants may be swept into the pools by the current, others move back and forth between the two at will. For the larger predators, like fish, the riffles may provide food while the pools provide shelter.

Land Connections

Riparian Corridor

As a part of the floodplain, riparian corridors play an important role in the stream system. Riparian corridors are the area of vegetation that extends from the stream channel up the stream banks and into the surrounding landscape. A good riparian corridor extends 100 feet on either side of the stream creating a wall of vegetation between the water and the surrounding land. The riparian corridor provides a sort of cushion between the land and water, and it performs many critical functions. A healthy riparian corridor will provide nutrients, shade, organic material, soil stability, and habitat. The vegetation acts as a buffer, trapping and filtering sediment, nutrients, and chemicals that are carried in runoff and shallow groundwater. Tree roots stabilize stream banks while branches shade the stream, cooling the water. Cooler water temperatures allow water to hold more oxygen and therefore support more life. Leaf litter provides food for bottom-feeding organisms that make up the bottom of the food chain. Plant stems and roots slow water velocity and keep the soil porous so that it can absorb more water. When riparian buffers are forested they add variety to the instream habitat of the waterway by the shedding of large long-lasting woody debris from trees. Fallen trees and branches slow the flow of water and provide habitat for aquatic species. This debris tends to accumulate which beneficially influences the depth, flow, and texture of the stream; increases the physical surface area of the stream bed, which helps to support aquatic life; and prevents stream channel degradation and substrate loss by retaining organic matter and inorganic sediments. Riparian corridors also offer wide swaths of land, allowing various land animals to
move more safely between developed areas. Perhaps the most important benefit of riparian corridors is in their ability to hold water, thereby reducing flooding and aiding in deep percolation of water to replenish groundwater supplies.

**Forested Floodplains**

Floodplain forests are a transitional habitat between the stream and upland and serve as a wildlife corridor between habitats. The canopy and underlying leaf litter of a forested floodplain protects soil from the force of rain and traps woody debris. The forest floor absorbs runoff and root systems help to reduce erosion and serve to protect surface water quality and aid in recharging groundwater. The forested areas act as a buffer for streams to reduce erosion and sedimentation downstream, and improve the overall health of the watershed. When forests are removed for levee development, agricultural expansion and human development, the buffering benefits of these uniquely adapted trees is diminished. Without bottomland forests, streams erode downward and develop a narrow, steeply sloped bed. This reduces available habitat, so the stream lacks diversity. What habitat does exist tends to have warmer temperatures, increased sunlight and drastic changes in stream flow which could result in a decline of plants and wildlife.

**Glossary of Terms**

**Abiotic:** Nonliving; not derived from living organisms; inorganic.

**Aeration:** The process by which air is circulated through, mixed with or dissolved in a liquid or substance.

**Aquatic invertebrates:** Aquatic invertebrates are small animals that live in water and have no backbone such as insects, crustaceans, mollusks, and worms.

**Aquatic organism:** Any living thing that lives in water for most or all of its life.

**Biological Oxygen Demand (BOD):** The amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

**Biomass:** The total amount of living material in a given habitat.

**Biotic:** Of or having to do with life or living organisms; organic.

**Colonization:** The occupation of a habitat by a community or population.
**Decomposition:** The process of decaying or rotting. Decomposition of dead organic matter is brought about by the activity of certain bacteria and fungi feeding on it.

**Diffusion:** The spreading of something more widely.

**Dissolved oxygen:** Oxygen gas absorbed by and mixed into water.

**Ecosystem:** The whole group of living and nonliving things together with their physical environment and the relationships between them.

**Fauna:** All the animals that live in a particular area, time, period, or environment.

**Filamentous algae:** Single algae cells that form long visible chains, threads, or filaments.

**Flood plain:** A relatively level area on both sides of the stream channel that carries excess water the channel cannot handle during a flood. Allowing excess water to spread out reduces the floodwater’s speed, reducing damage downstream.

**Flora:** All the plants that live in a particular area, time, period, or environment.

**Forested:** Land covered with trees.

**Gradient:** The degree to which something inclines; a slope.

**Inorganic:** Composed of matter that does not come from plants or animals dead or alive; abiotic.

**Macroinvertebrates:** Organisms without backbones, which are visible to the eye without the aid of a microscope. Aquatic macroinvertebrates live on, under, and around rocks and sediment on the bottoms of lakes, rivers, and streams.

**Organic:** Composed of matter that comes from plants or animals dead or alive; biotic.

**Percolation:** The process of a liquid slowly passing through a filter.

**Pool:** An area of deeper, slower-moving water in a stream channel.

**Riffle:** An area of shallow and fast-flowing water in the stream channel. Riffles mix oxygen into the water.

**Riparian zone/corridor:** The land bordering a stream channel that begins at the top of the stream banks. A riparian corridor at least 100 feet wide and full of plants helps protect the stream ecosystem.

**Runs:** Areas in a stream where water flows rapidly, the water surface is smooth and deeper than in riffles.

**Sediment:** Material such as silt, sand, stones, and other material that is carried and deposited by water, wind, or glaciers.

**Silt:** Sand, soil, mud, etc., carried by flowing water before settling to the bottom of a river, pond, lake or ocean.

**Spawning:** The process of laying eggs by an aquatic organism.

**Stream bank:** The shoulder-like sides of the stream channel from the water’s edge up to the adjacent higher ground. Stable stream banks have plants growing on them that help hold the soil in place and minimize erosion.

**Stream channel:** The channel of the stream is where water concentrates to flow downstream. It includes the bed, the gravel bars and the stream banks. Stream channels always follow a downhill path.
Stream: A body of water with a measurable current that flows in a channel or bed. This description applies to all flowing natural waters such as brooks, creeks, and rivers.

Substrate: The surface or material in the stream bed on or from which an organism lives, grows, or obtains its nourishment.

Topography: The shape of an area of land, including its hills, valleys and streams.

Velocity: The speed of something in a given direction.

Watershed: All the land from which water drains into a specific body of water.