Whiskey is for drinking, water is for fighting over

Attributed to Mark Twain
Viewing ecological flows as one use of a shared public water resource rather than as a competing use

Paul Blanchard, Ph.D.
Stream Program Coordinator
Missouri Department of Conservation
Missouri Department of Conservation
Our Mission

- To protect and manage the fish, forest and wildlife resources of the state;
- to serve the public and facilitate their participation in resource management activities;
- and to provide opportunity for all citizens to use, enjoy and learn about fish, forest and wildlife resources.
Shared use of a public water resource

- The Missouri Department of Conservation wants to ensure that water quality and quantity are sufficient to sustain healthy and diverse aquatic life.

- Integrated water management options exist that meet the needs of both the human enterprise and the conservation of Missouri stream and floodplain resources.
Roles for MDC

- Evaluate proposed water management options and provide the best information about the potential impacts on stream and floodplain ecosystems

- As one stakeholder, advocate for options which minimize the impacts on the stream and floodplain ecosystems
Five Ecosystem Elements To Be Addressed

- **Hydrology** – The flow characteristics of magnitude, frequency, duration, timing, and rate of change, which support a natural flow regime.

- **Geomorphology** – The channel forming process including sediment transport.

- **Biology** – The habitat and population relationships which sustain and perpetuate a diverse fauna.

- **Water Quality** – The quality of the water based on its temperature, dissolved oxygen, contaminants, etc.

- **Connectivity** – The watershed pathways which provide for the movement of water, organisms and energy.

It is not sufficient to just avoid this.
Critical ecological processes for sustaining stream systems occur during:

- “Normal” base flows – Note that normal in April is not the same as in August
- Infrequent very low flows
- High flow pulses
- Overbank flows

Examples will be shown very quickly in the following slides
Ecological Roles of Base Flows

- Provide adequate habitat space for aquatic organisms
- Maintain suitable water temperatures, dissolved oxygen, and water chemistry
- Maintain water table levels in floodplain, soil moisture for plants
- Provide drinking water for terrestrial animals
- Keep fish and amphibian eggs suspended
- Enable fish to move to feeding and spawning areas
- Support hyporheic organisms (living in saturated sediments)
Ecological Roles of Extreme Low Flows

- Enable recruitment of certain floodplain plants
- Purge invasive, introduced species from aquatic and riparian communities
- Concentrate prey into limited areas to benefit predators
Ecological Roles of High Flow Pulses

- Shape **physical character** of river channel including pools, riffles
- Determine size of **stream bed substrates** (sand, gravel, cobble)
- Prevent **riparian vegetation** from encroaching into channel
- Restore normal **water quality** conditions after prolonged low flows, flushing away waste products and pollutants
- Aerate eggs in **spawning** gravels, **prevents siltation**

*Nature Conservancy*
Ecological Roles of Overbank Flows

- Provide migration and spawning cues for fish
- Trigger new phase in life cycle (e.g., insects)
- Enable fish to spawn on floodplain, provide nursery area for juvenile fish
- Provide new feeding opportunities for fish, waterfowl
- Recharge floodplain water table
- Maintain diversity in floodplain forest types
- Control distribution and abundance of plants on floodplain
- Deposit nutrients on floodplain
- Maintain balance of species in aquatic and riparian communities
Ecological Roles of Overbank Flows

- Create sites for recruitment of colonizing plants
- Shape physical habitats of floodplain
- Deposit gravel and cobbles in spawning areas
- Flush organic materials (food) and woody debris (habitat structures) into channel
- Purge invasive, introduced species from aquatic and riparian communities
- Disperse seeds and fruits of riparian plants
- Drive lateral movement of river channel, forming new habitats (secondary channels, oxbow lakes)
- Provide plant seedlings with prolonged access to soil moisture
Alterations that can change the Flow Regime:

Dams
- Hydroelectric, Flood Control, Water Supply
- Small Impoundments/Cumulative Effect

Withdrawal (groundwater and surface water)
- Irrigation
- Municipal
- Industrial

Diversions
Discharges
- Municipal
- Industrial

Land Use Changes
- Runoff and Infiltration changes
- Floodplain encroachment and restrictions

Climate Change

- Magnitude
- Frequency
- Duration
- Timing
- Rate of Change
Ecological streamflows are NOT

- A little water all the time
- All the water all the time
Ecological Flows are

Stream flows that *mimic* the natural flow regime by providing the short- and long-term *variability of flow characteristics* needed to maintain the *ecological processes and functions* that sustain the physical, chemical, and biological health of *stream systems*.

Possible within an integrated water management plan that meets the needs of both the human enterprise and the conservation of Missouri stream and floodplain resources.
For the Tri-State area, when list of possible water supply options is reduced, we will determine our level of involvement.