



US Army Corps  
of Engineers



ERDC  
Environmental Research  
Development Center

# Streamflow Duration Assessment Methods: Introduction



*Video Training*

2024



# Introduction to SDAMs

- Streamflow characteristics
- What are Streamflow Duration Assessment Methods (SDAMs)?
- Uses of SDAMs
- Streamflow duration classes
- Regional Boundaries of SDAMs

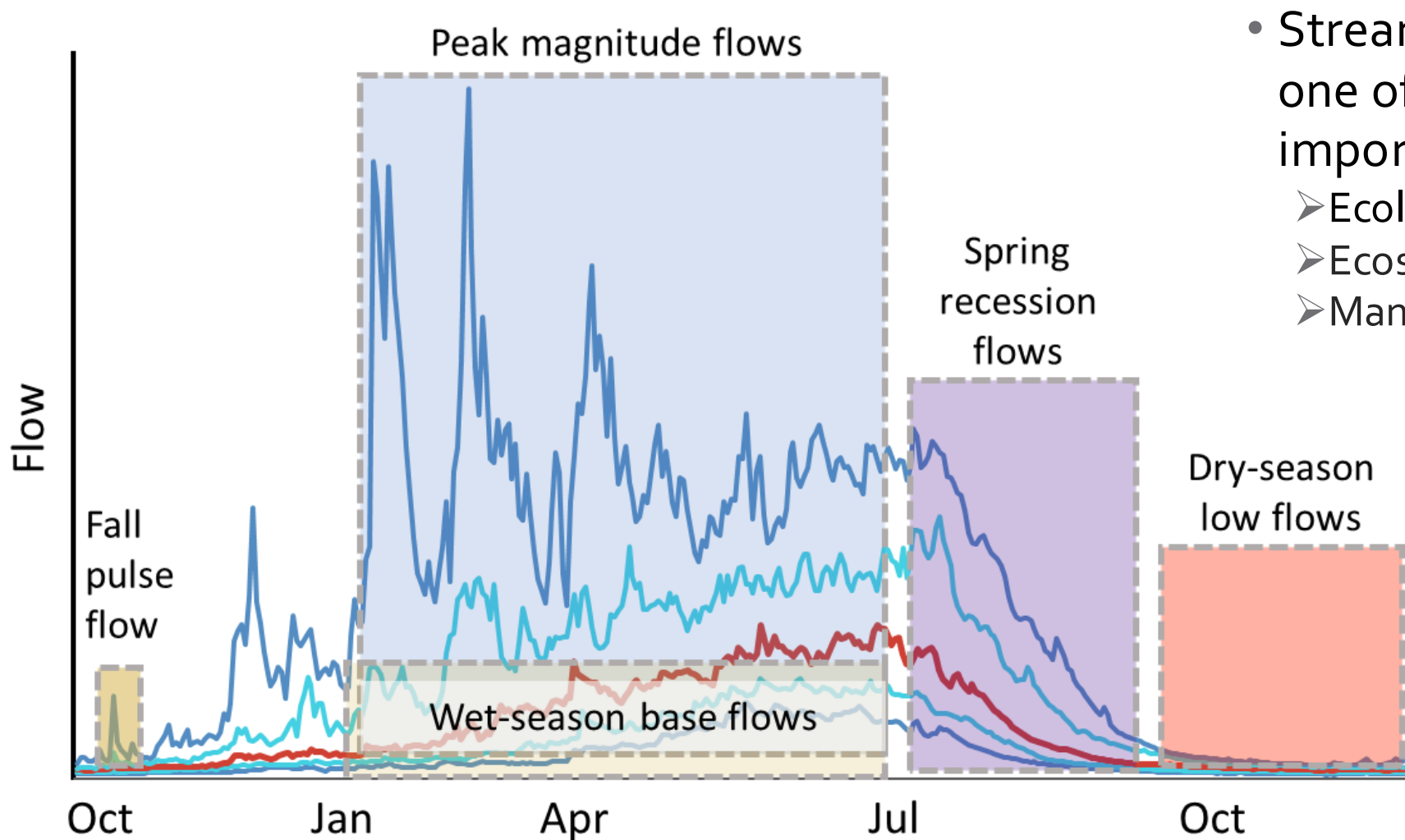




# What is streamflow?

- Streamflow is movement of water in a confined channel.
- Streamflow is different from:
  - Standing surface water
  - Subsurface flow
  - Seepage

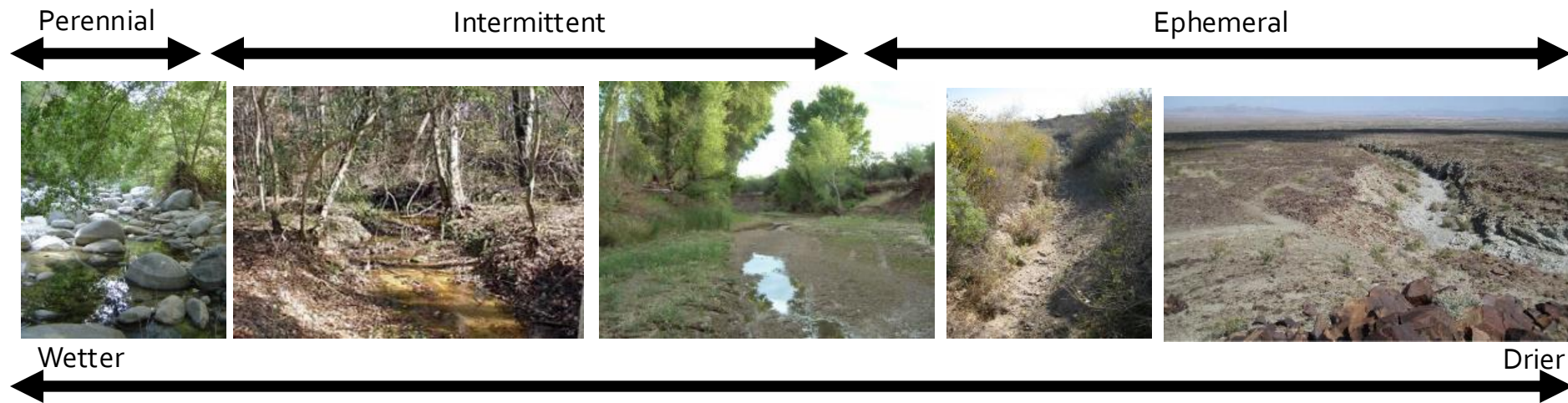
# There are many ways to characterize streamflow



- Streamflow duration is one of the most important!
  - Ecology
  - Ecosystem functions
  - Management



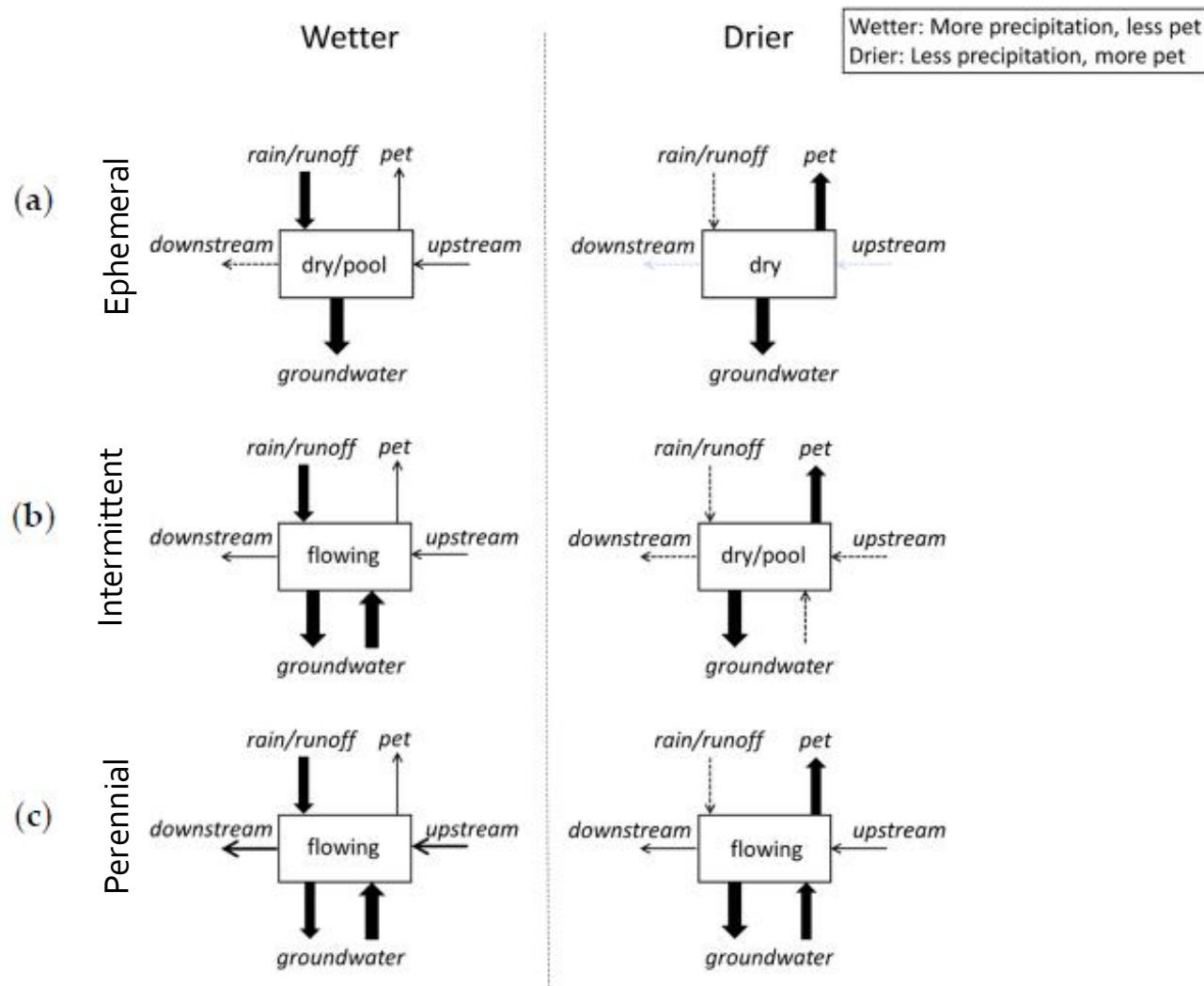
# Streamflow duration exists on a continuum



- There are many terms to describe and classify this continuum
  - Three classes (perennial, intermittent, ephemeral) widely used in the US for academic and management purposes.
  - There are no universally accepted definitions for these classes, but they are generally assumed to reflect typical regimes at a reach over many years under present-day conditions.
- Multiple dimensions characterize the continuum
  - Length of flow
  - Timing of flow
  - Predictability
  - Etc.

# Streamflow duration is dictated by changes in a reach's water inputs and outputs

Fritz et al. (2020)



- **Inputs:**

- Discharge from upstream
- Discharge from groundwater
- Rainfall/runoff

- **Outputs:**

- Discharge to downstream
- Groundwater percolation
- Potential evapotranspiration (pet)

# What is a Streamflow Duration Assessment Method (SDAM)?

A rapid, field-based method of classifying the flow duration of a stream reach.

- Field-based: Based on observations of *indicators*, not on hydrological models.
- Rapid: Can be completed in a single site-visit. No long-term data collection required.

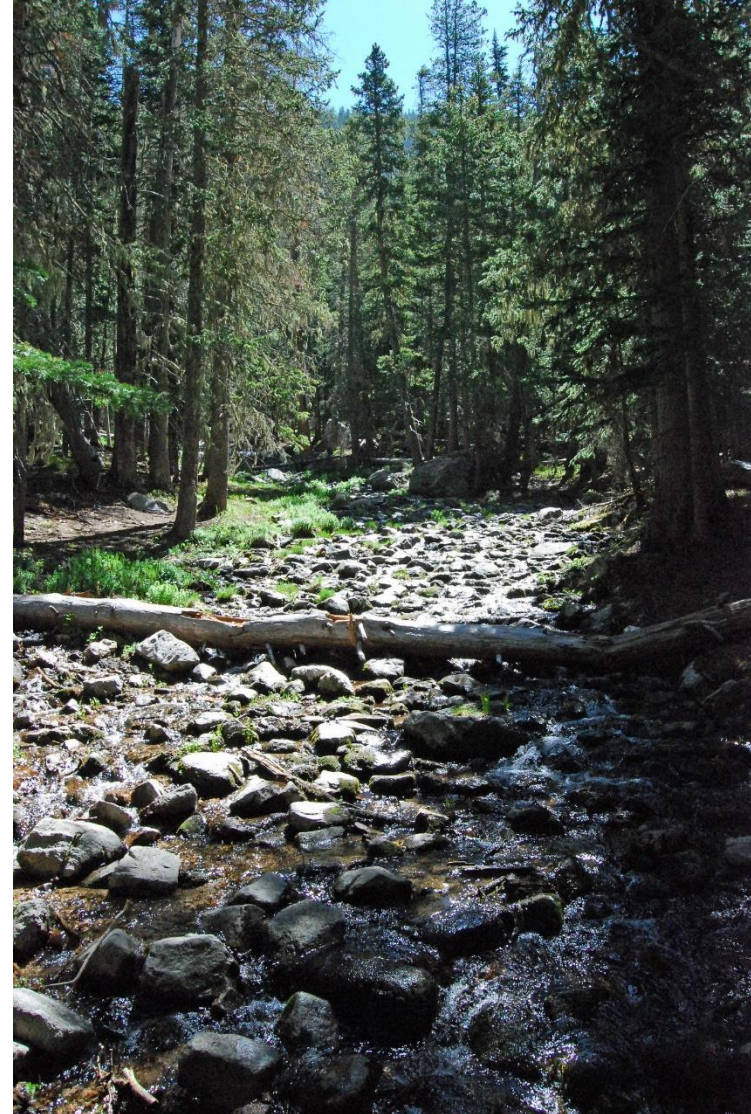
# What are indicators?

- Easy to measure properties of an ecosystem that let us infer hard-to-measure properties.
- Streamflow duration indicators:
  - May include geomorphological, hydrological, biological and geospatial measures.
  - May reflect:
    - **Controls** on streamflow duration (e.g., streambed substrate composition)
    - **Responses** to streamflow duration (e.g., hydrophytic plants)
    - **Associations** with streamflow duration (e.g., sinuosity)
  - Indicators that reflect long-term conditions are favored (e.g., long-lived plants) over those that are more transient or reflect only recent conditions (e.g., presence of water).



# Why do we need SDAMs?

- Underpins several regulatory and management decisions (e.g., determining jurisdiction of the Clean Water Act, applying Water Quality Standards).
- Classification usually requires long-term hydrologic data that is only collected at a small number of sites (e.g., USGS stream gages).
- Rapid field-based streamflow duration assessment methods (SDAMs) can classify streams where the necessary hydrologic data are lacking.



# An SDAM is *not* a jurisdictional determination under the Clean Water Act

- Jurisdictional determinations are based on current regulatory guidance, policy and caselaw.
- SDAMs can inform jurisdictional determinations for some aquatic resources by providing timely streamflow duration information.
- SDAMs do not constitute jurisdictional determinations by themselves.
- SDAMs have other management and research applications (e.g., setting restoration goals, assessing water quality, etc.).



# What SDAMs cannot do:

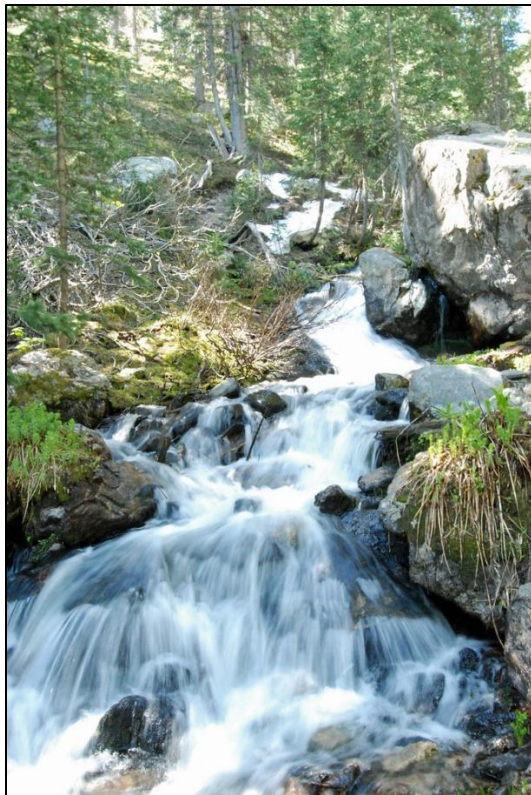
- Determine historic streamflow conditions
  - They reflect present-day (or recent) conditions
- Determine what streamflow conditions should be at a reach

*Treated effluent sustains intermittent flows for environmental and recreational benefits.  
Credit: Michael Bogan.*

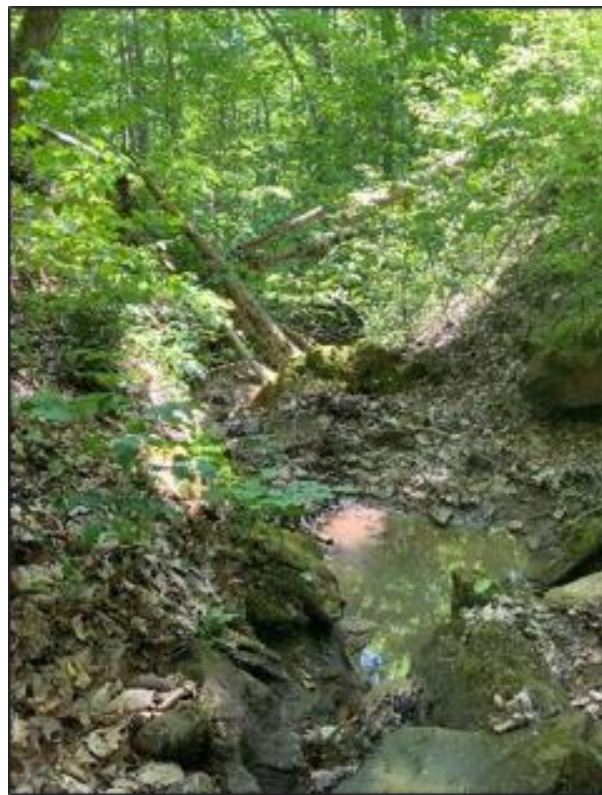


# Regional SDAMs were calibrated to classify stream-reaches into 3 categories

Perennial



Intermittent



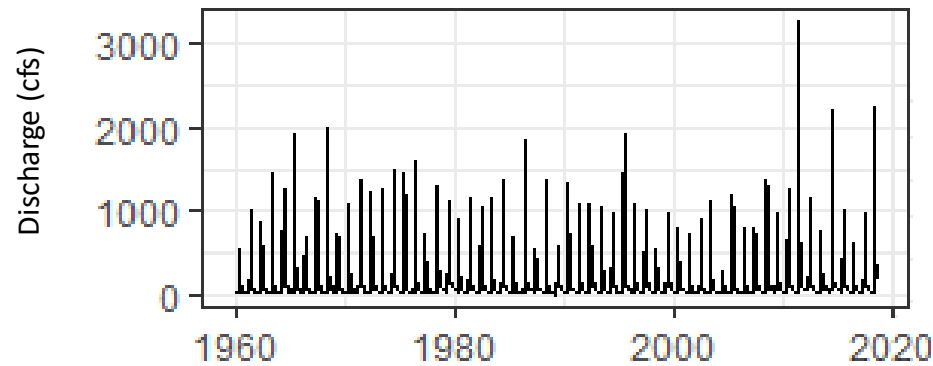
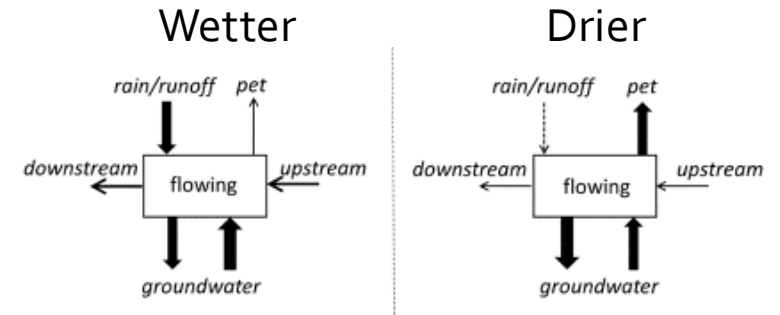
Ephemeral





# Perennial streams

- *Perennial reaches* contain flowing water continuously during a year of normal rainfall, often with the streambed located below the water table for most of the year. Groundwater supplies the baseflow for perennial reaches, but the flow is also supplemented by stormwater runoff or snowmelt.

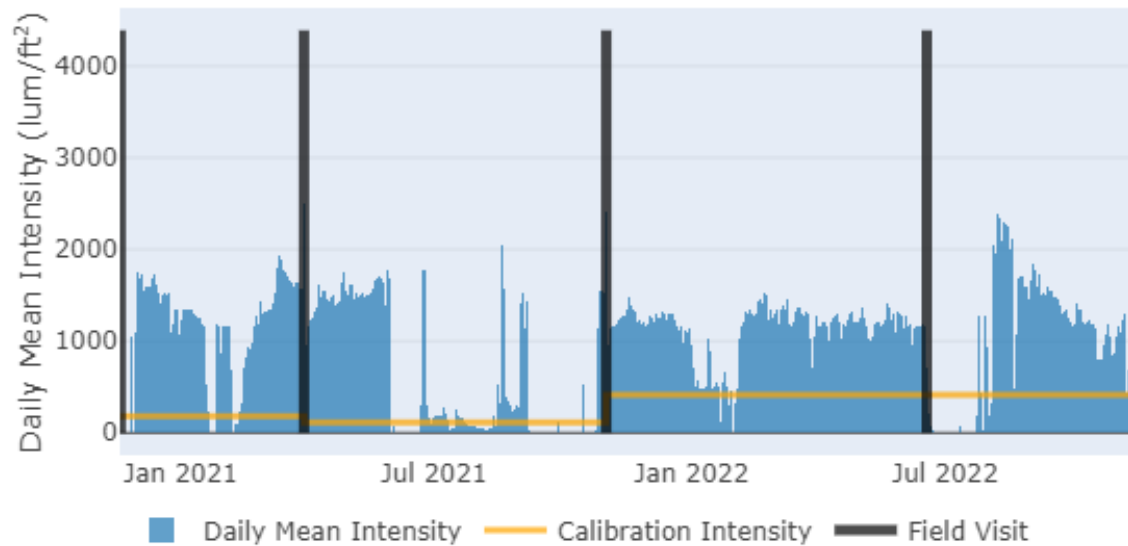
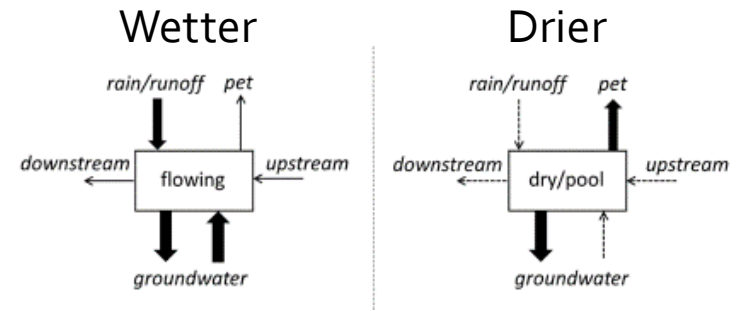


*Shell Creek near Shell, WY (USGS gage 06278500)  
No dry periods observed*



# Intermittent streams

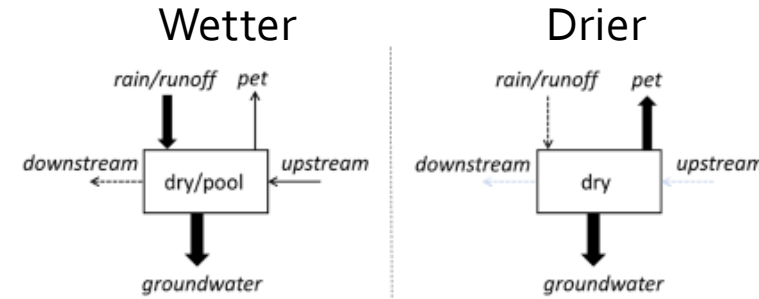
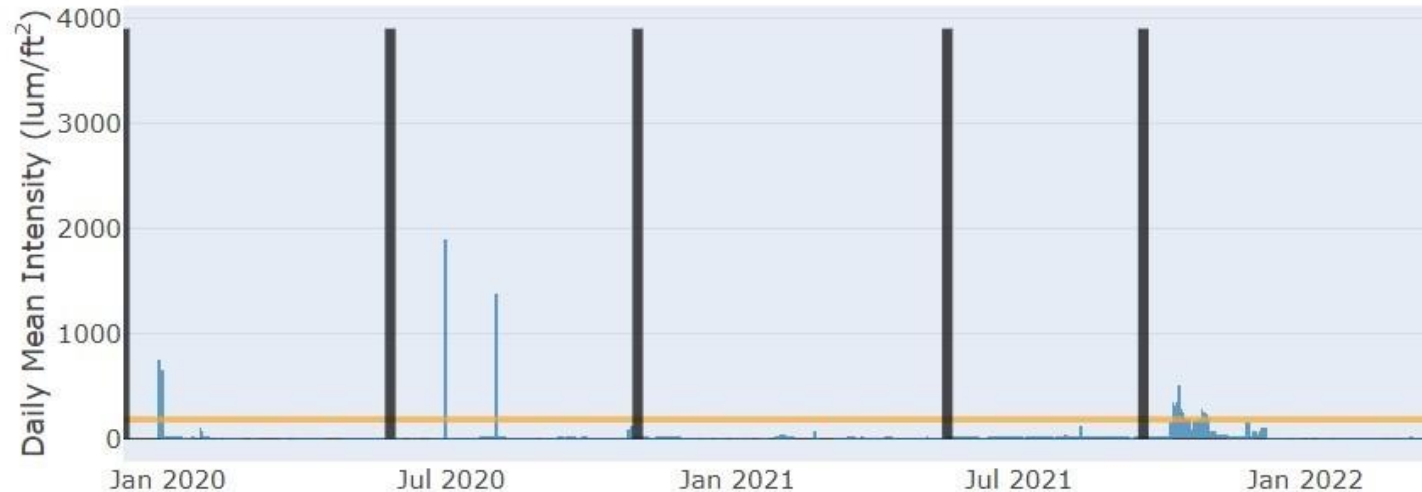
- *Intermittent reaches* are channels that contain flowing water for only part of the year, typically during the wet season, where the streambed may be below the water table and/or where the snowmelt from surrounding uplands provides sustained flow. The flow may vary greatly with stormwater runoff.



*Lick Run in Coopers Rock State Forest, WV; Daily flowing vs dry observations are derived from Stream Temperature, Intermittency, and Conductivity loggers deployed in the channel thalweg. Blue areas above the yellow line denotes flowing periods and black bars denote field visits when logger data was downloaded, and indicator data was collected.*

# Ephemeral streams

- *Ephemeral reaches* flow only in direct response to precipitation. Water typically flows only during and shortly after large precipitation events, the streambed is always above the water table, and stormwater runoff is the primary water source.



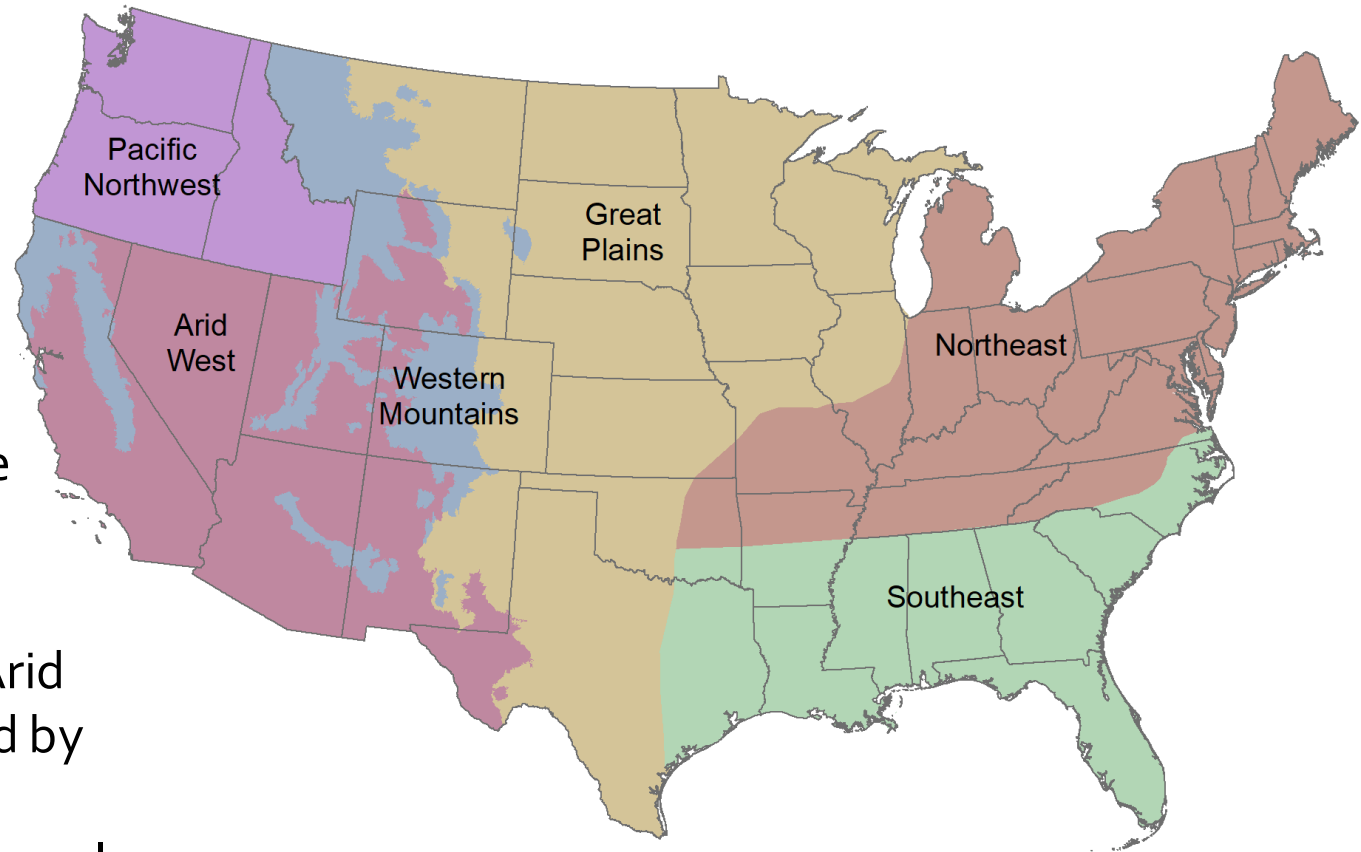
*Tributary to North Fork Solomon River (at Kirwin Reservoir), Kirwin National Wildlife Refuge, KS; Daily flowing vs dry observations are derived from Stream Temperature, Intermittency, and Conductivity loggers deployed in the channel thalweg. Blue areas above the yellow lines denote flowing periods and black bars denote field visits when logger data was downloaded, and indicator data was collected.*



# SDAM Regions

SDAMs have been developed for the co-terminous United States.

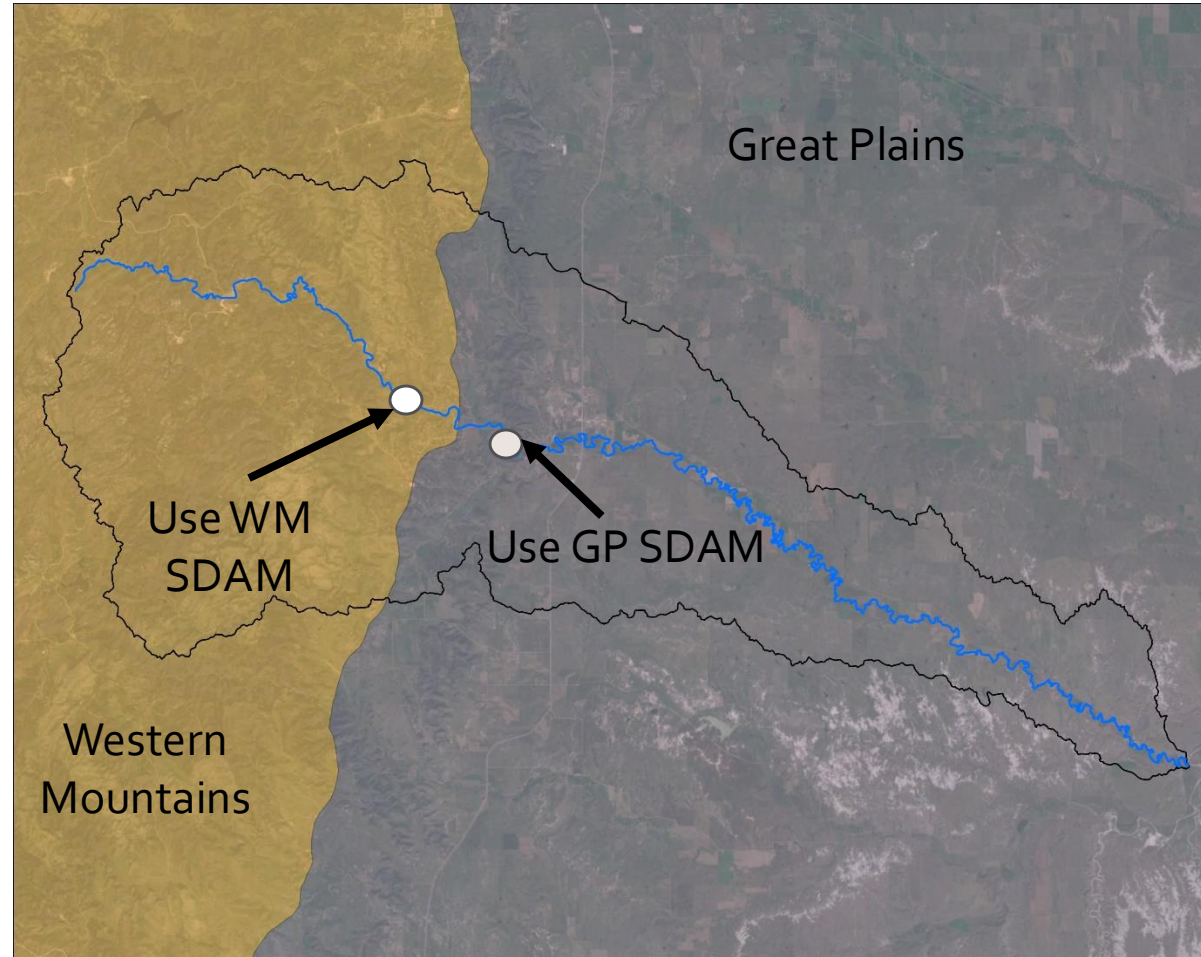
- The first methods were developed in the Pacific Northwest following state boundaries.
- Then methods were developed for the Arid West and Western Mountains, as defined by U. S. Army Corps of Engineers Regional Supplements to Wetland Delineation Manual (minus states in the Pacific Northwest).
- The Great Plains region is defined by the Regional supplements to the wetland delineation manual for the western border and the U. S. Army Corps of Engineers Synthesizing the Scientific Foundation for Ordinary High Water Mark Delineation in Fluvial Systems regions for the eastern border.
- The Northeast and Southeast regions are defined by the Synthesizing the Scientific Foundation for Ordinary High Water Mark Delineation in Fluvial Systems regions





# SDAMs in adjacent Regions

- The location of the assessment reach (not the watershed) determines which SDAM to use.
- If your site is more like a neighboring SDAM region conduct both SDAMs and compare results.
  - For comparing site characteristics between the Arid West, Western Mountains, or Great Plains consult the Army Corp's Regional Supplements for Wetland Delineation.
  - For comparing site characteristics between the Great Plains and the Northeast or Southeast consult Wohl et al. 2016 (*Synthesizing the Scientific Foundation for Ordinary High-Water Mark Delineation in Fluvial Systems*).



# Knowledge check!

Which of these stream reaches fits the definition of **intermittent**? Check all that apply.

- A. A stream reach that flows only in direct response to rainfall and has no groundwater influence
- B. A stream reach that is dry in the summer but is sustained by groundwater sources throughout the entire winter and spring, and sometimes early summer
- C. A stream reach that is dry for one month of the year in most years
- D. A stream reach that is comprised of isolated pools except during times of significant rainfall

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# Knowledge check!

An SDAM can be used for which of these?

Check all that apply

- A. To classify streams where the necessary hydrologic data are lacking
- B. As a jurisdictional determination for ephemeral streams
- C. To provide info to support applying Water Quality Standards



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C. To provide info to support applying Water Quality Standards

A. **YES:** long-term hydrologic data is only collected at a small number of sites (e.g., USGS stream gages)

B. **NO:** Jurisdictional determinations are based on current regulatory guidance and policy which can be informed by the results of an SDAM.

C. **YES:** Stream classification determinations underpin several regulatory and management decisions, including WQS and JDs.

# For more information about SDAMs visit



<https://www.epa.gov/streamflow-duration-assessment>