Streamflow Duration Assessment Methods: Method Development for the Arid West and Western Mountains

Video Training

2024

SDAM Regions

These methods cover the Arid West (AW) and Western Mountains (WM), as defined by U. S. Army Corps of Engineers Regional Supplements to the Wetland Delineation Manuals (minus states in the Pacific Northwest)

- Regions identified based on, regional differences in climate, dominant native vegetation type, hydrology, geology, and topography.

- The Arid West includes inland deserts and Mediterranean coastal California. Rainfall is typically under 15 inches per year.

- The Western Mountains includes the Rocky Mountains, Sierra Nevada, and North Coast of California. Rainfall can be extremely high!
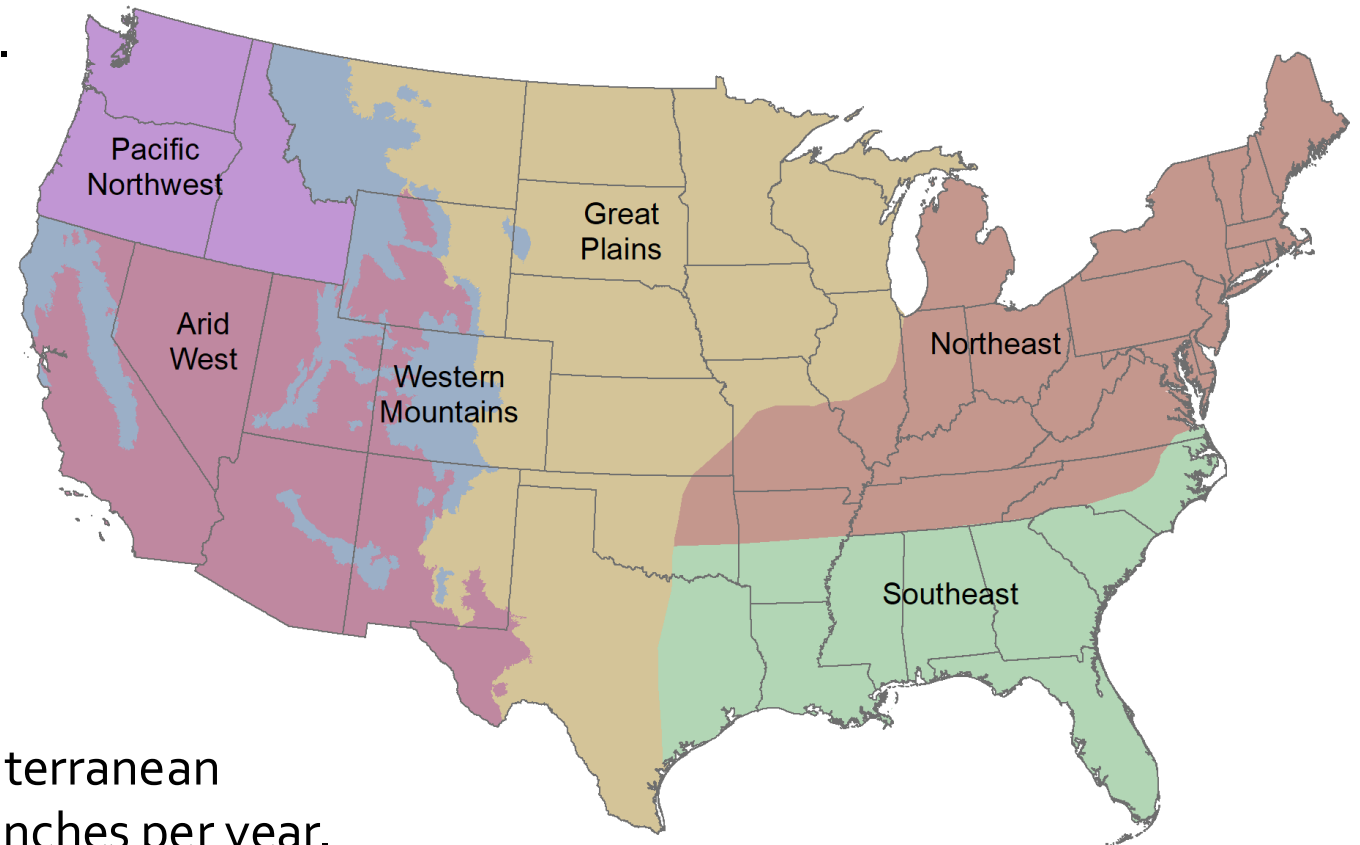
Method development

- Form Regional Steering Committees of EPA and Corps staff

- Identify candidate indicators through review of technical literature (Mazor et al. 2021a, b) and existing SDAMs (e.g., NMED 2011, Nadeau 2015)

  - ➤ Geomorphological (e.g., slope, sinuosity)

  - ➤ Hydrological, both direct and indirect (e.g., presence of baseflow [direct], organic debris lines or piles [indirect])

  - ➤ Biological (e.g., fish presence, presence of perennial indicator taxa)

  - ➤ Geospatial indicators and additional field indicators with available data identified during analysis stage.

- Identify candidate study reaches through literature review, reviewing hydrologic databases, and consulting local experts.

Beta methods

- Collect indicators at study reaches (AW: 89; WM: 149).
  - ➢ AW: 30 ephemeral, 34 intermittent, 25 perennial.
  - ➢ WM: 31 ephemeral, 66 intermittent, 52 perennial

- Create machine learning statistical model(s) to predict streamflow-duration class from 72 candidate indicators.

- Refine and simplify then publish beta methods (2021).

- Published in 2021 and followed by a more than one year trial period to garner feedback from user community.

Final Regional SDAMs

- Data set greatly expanded through revisits (up to 10 visits per reach) and data collection at new sites.

Region	Eph	Int	Per
AW	68	71	48
WM	56	78	66

- Create machine learning statistical model(s) to predict class from 97 candidate indicators.

- Refine and simplify the final method based on agency experience with beta method and public comment.

- Publish final method, web app, and trainings.
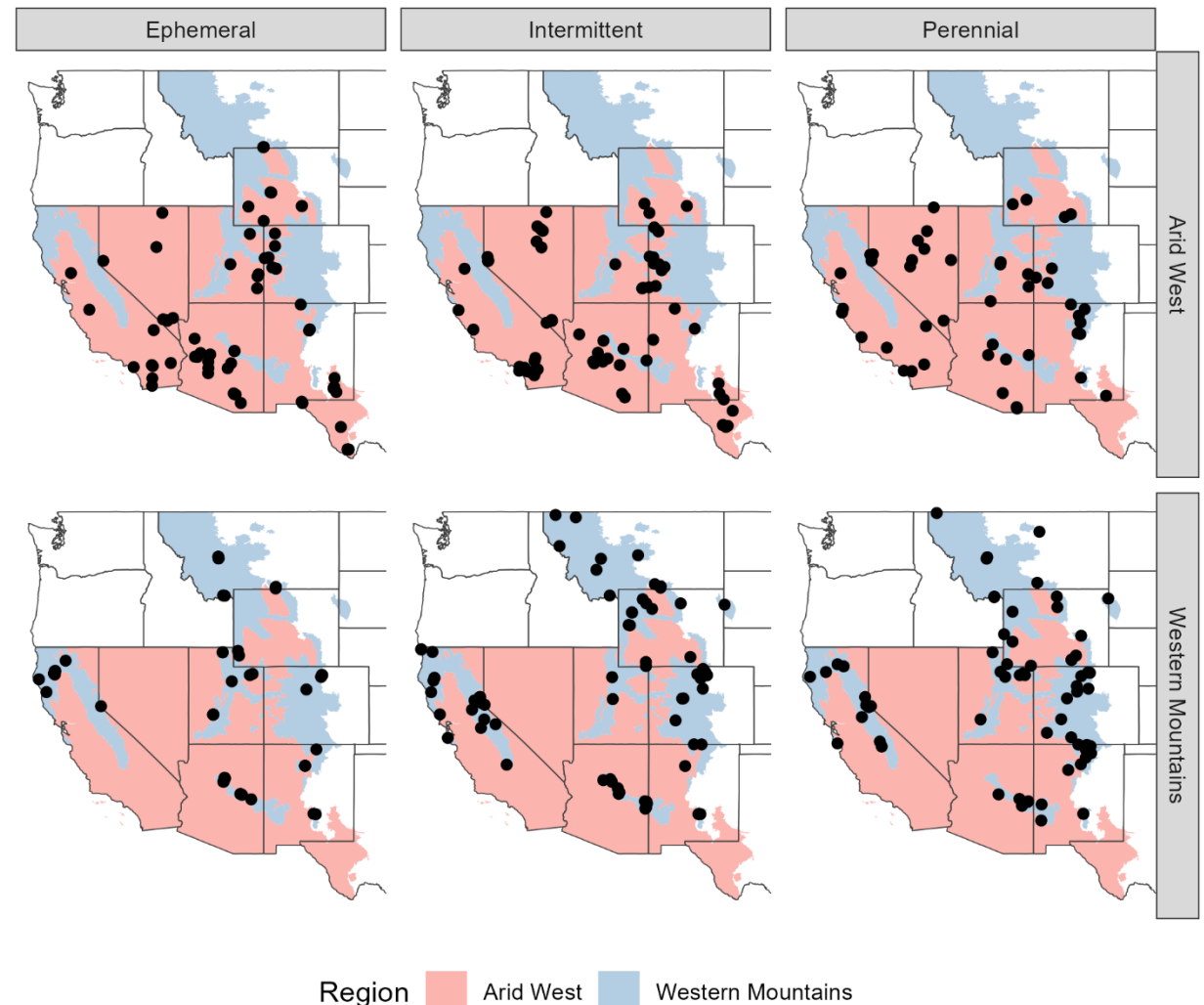
The SDAMs are based on 11 indicators:

All indicators are measured in the **field**

7 are shared by both SDAMs, plus:
- One only used in AW SDAM
- Three only used in WM SDAM

Biological indicators
1. Prevalence of rooted upland plants in the streambed
2. Differences in vegetation
3. Shading (WM only)
4. Algal cover (AW only)
5. Aquatic macroinvertebrate indicators
   - Abundance of perennial indicator taxa
   - Abundance of Ephemeroptera, Plecoptera, and Trichoptera (WM only)
7. Number of hydrophytic plant species

Geomorphological indicators
8. Bankfull channel width
9. Slope
10. Riffle-pool sequence
11. Particle size or stream substrate sorting (WM only)

Classifications are based on outputs from a statistical model

- A web application is required to obtain classifications for both SDAMs.

- The web application automatically determines which SDAM is appropriate for a set of coordinates.

- The web application runs a statistical model to interpret field data provided by the user to obtain one of six possible classifications:
  - ➢Ephemeral
  - ➢Intermittent
  - ➢Perennial
  - ➢At least intermittent
  - ➢Less than perennial
  - ➢Needs more information

SDAMs classify stream reaches into 3 main categories

Less Than Perennial

Perennial **Intermittent** **Ephemeral**

?

At Least Intermittent
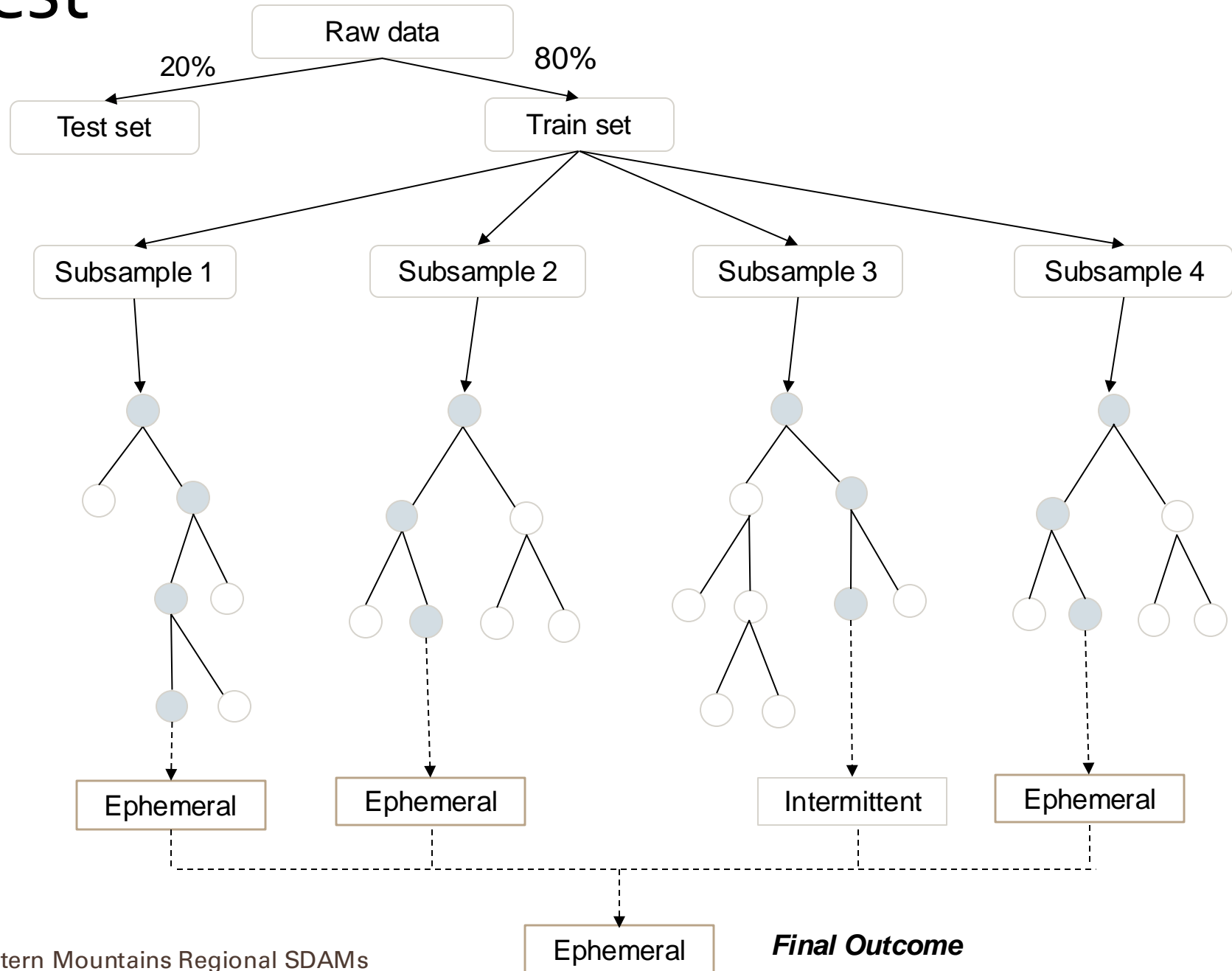
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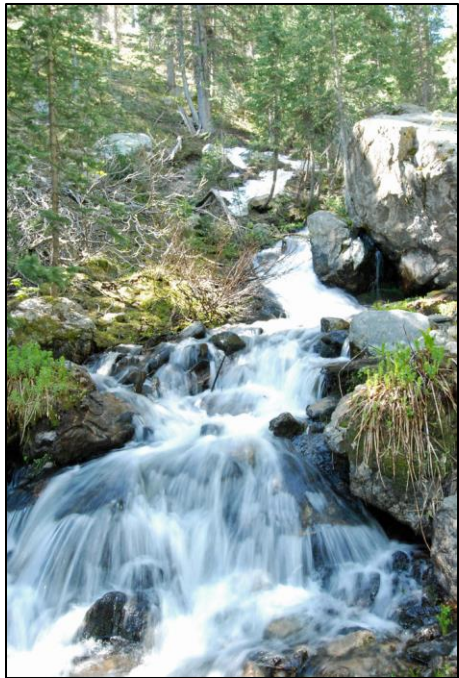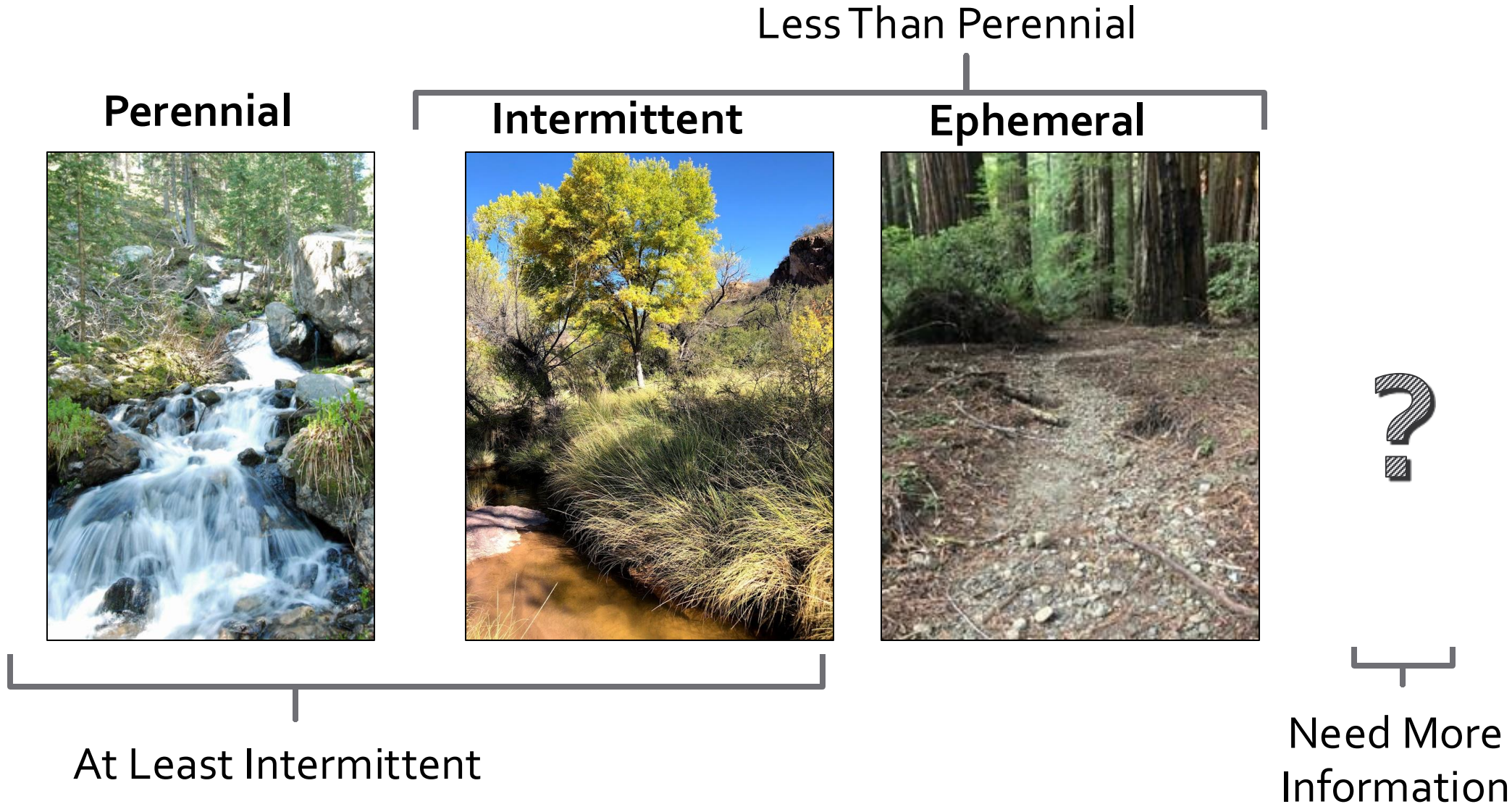
Random forest

Set aside 20% for testing

Sample from the original training set with replacement to create independent subsamples

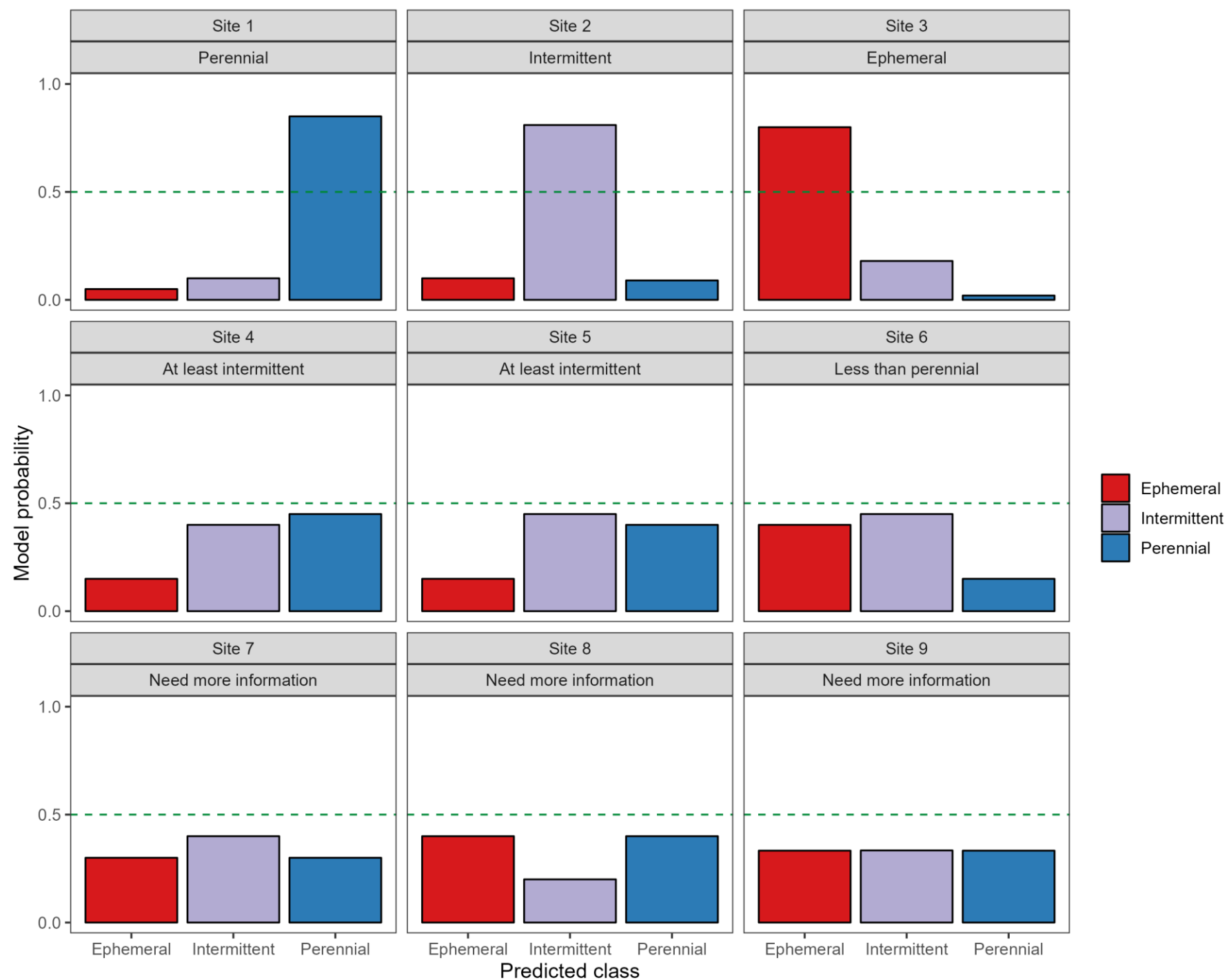*Build the trees on a random subset of indicators*

Aggregate classifications

50% voting

Six outcomes

- Perennial (P)
- Intermittent (I)
- Ephemeral (E)
- At least intermittent (ALI)
- Less than perennial (LTP)
- Needs more info (NMI)

Knowledge check!

Which of the following indicators are part of the AW SDAM? Select all that apply.

A. Total aquatic macroinvertebrate abundance

B. Bankfull channel width

C. Algal cover on the streambed

D. Sinuosity

E. Hydrophytic plants

F. Fish

G. Differences in vegetation

H. Riffle-pool sequence

The AW SDAM is based on 8 indicators, including the 5 circled answers, plus:

- Prevalence of upland rooted plants in the streambed
- Abundance of perennial indicator aquatic invertebrates
- Slope

Knowledge check!

Which of the following indicators are part of the WM SDAM? Select all that apply.

A. Total aquatic macroinvertebrate abundance

B. Bankfull channel width

C. Algal cover on the streambed

D. Sinuosity

E. Hydrophytic plants

F. Fish

G. Differences in vegetation

H. Riffle-pool sequence

The WM SDAM is based on 10 indicators, including the 4 circled answers (minus algal cover), plus:

- Prevalence of upland rooted plants in the streambed
- Abundance of perennial indicator aquatic invertebrates
- Abundance of EPT
- Slope
- Stream substrate sorting

For more information about SDAMs visit

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