Flow regime shifts in intermittent streams across California

Jessica R. Ayers, Theodore E. Grantham, Sarah M. Yarnell,
Rob A. Lusardi and Ethan Baruch

Death Valley
Tim Fitz Harris

The world's rivers are drying up from extreme weather. See how 6 look from space

CNN

By Natalie Croker, Renée Rigdon, Judson Jones, Carlotta Dotto and Angela Dewan, CNN
Published 3:30 AM EDT, Sat August 20, 2022

Bodies of water all over North America are drying up due to drought, climate change: Experts

Riverbeds that used to be covered in ample water are now dehydrated by drought.

By Julia Jacobo
October 19, 2022, 3:11 PM

abcNEWS

California's paradox: Confronting too little water, and too much

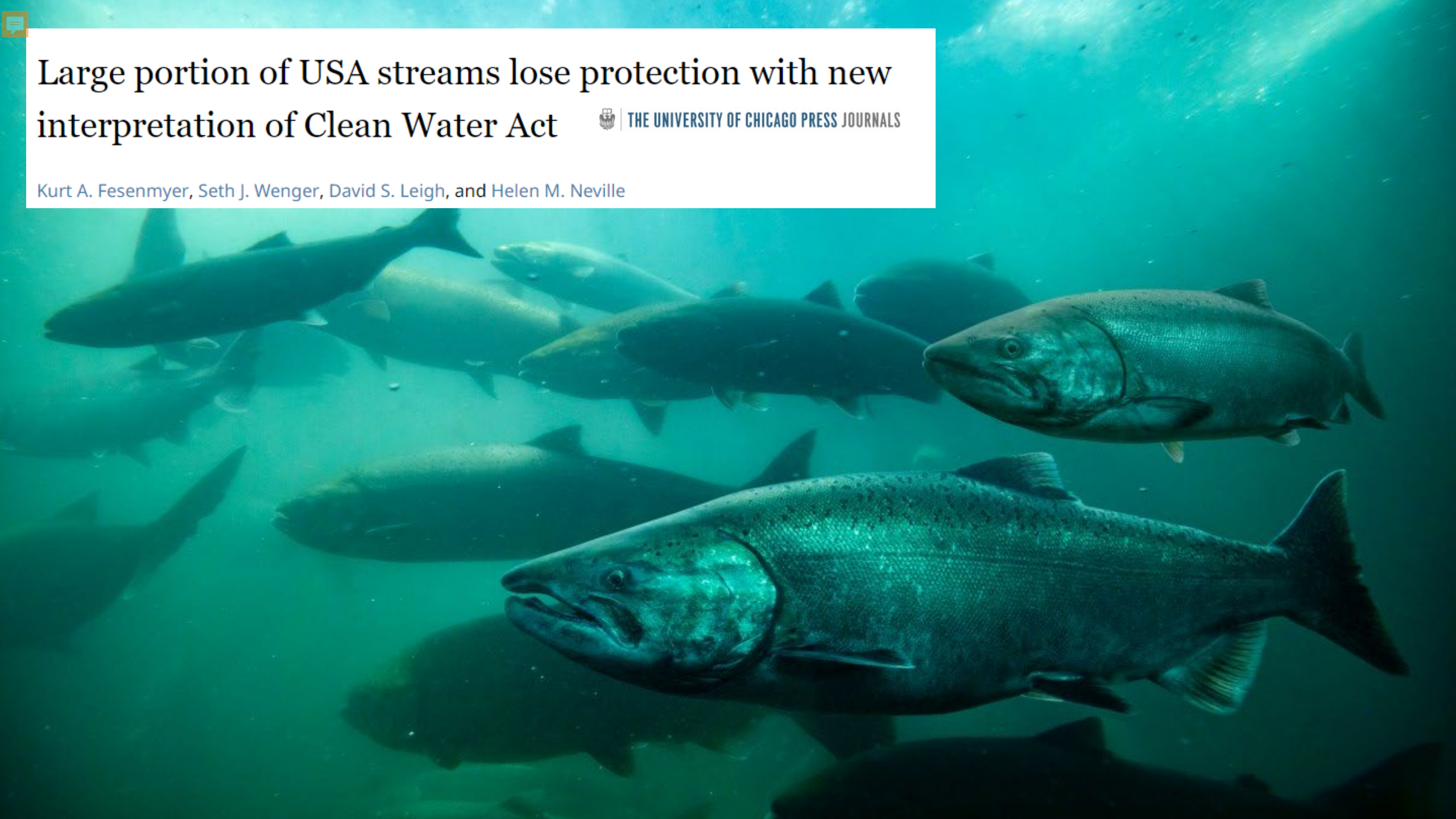
By Sarah Kaplan
January 10, 2023 at 6:19 p.m. EST

The Washington Post
Democracy Dies in Darkness

Large portion of USA streams lose protection with new interpretation of Clean Water Act

THE UNIVERSITY OF CHICAGO PRESS JOURNALS

Kurt A. Fesenmyer, Seth J. Wenger, David S. Leigh, and Helen M. Neville

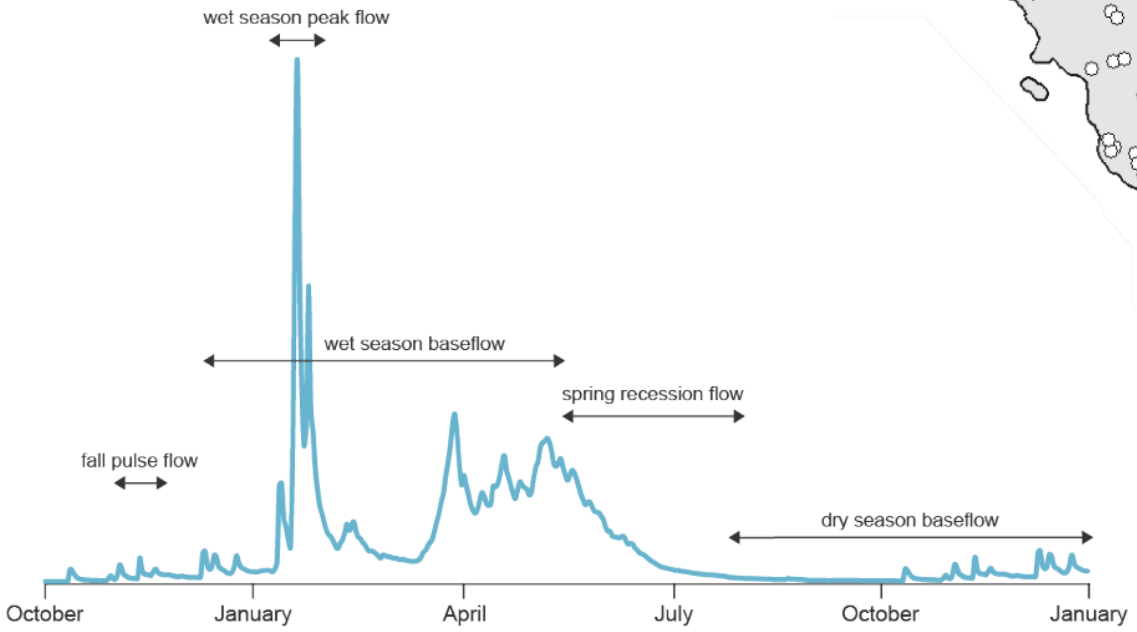


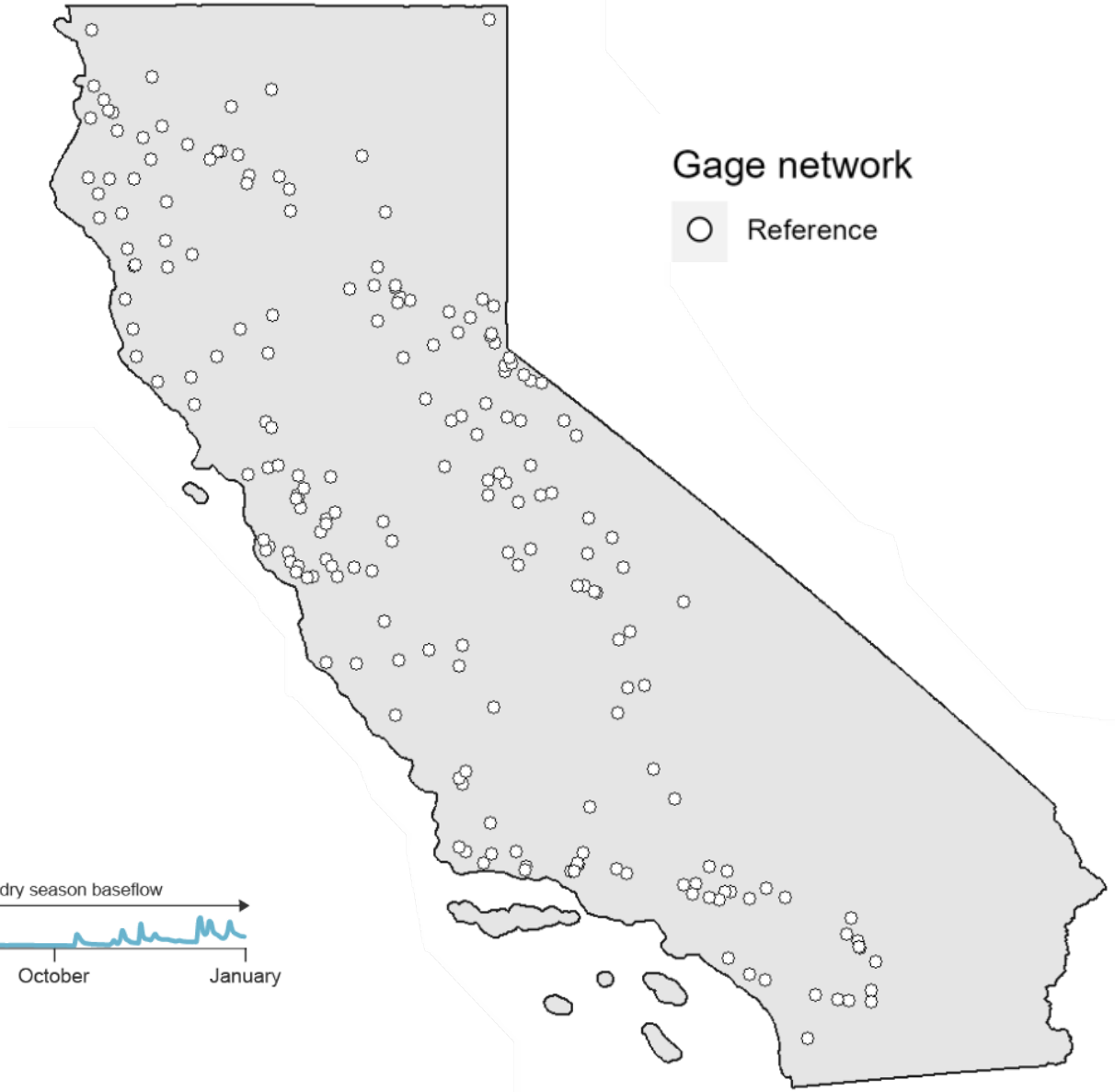
1. Where are natural intermittent streams located?

2. Is there evidence that perennial streams have become intermittent?

3. How are low flows changing within intermittent and perennial streams?

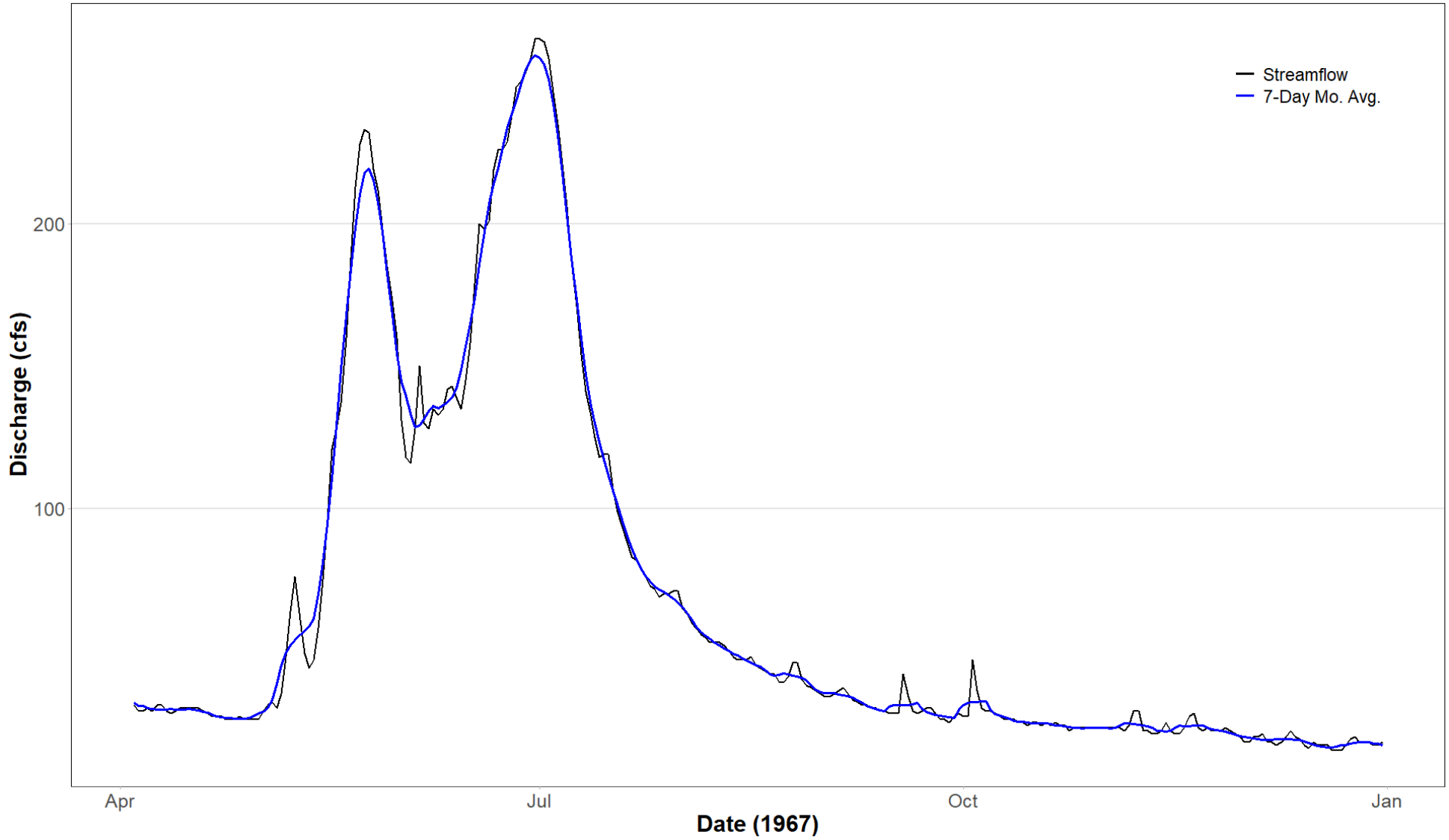
We examined stream intermittence at reference USGS stations across California.





Grantham, T. E., Mount, J. F., Stein, E. D., and Yarnell, S. M. (2020). *Making the Most of Water for the Environment: A Functional Flows Approach for California Rivers*. San Francisco, California, United States: Public Policy Institute of California.

The minimum 7-day moving average indicates the severity of low-flow throughout the year, accounting for variability in daily streamflow and the number of zero flow days.



To determine intermittent stream class:

1. Set zero flow threshold

$$Zero\ flow\ day = Daily\ discharge \leq 0.1\ cfs$$

2. Calculate the number of consecutive zero flow days for each stream gage and dry season

3. Determine intermittent years

$$\geq 5\ consecutive\ zero\ flow\ days$$

$Intermittent\ year$

$Perennial\ year$

Overall stream class was determined:

4. Determine intermittent and perennial stream class

$> 15\%$ *intermittent years within record*

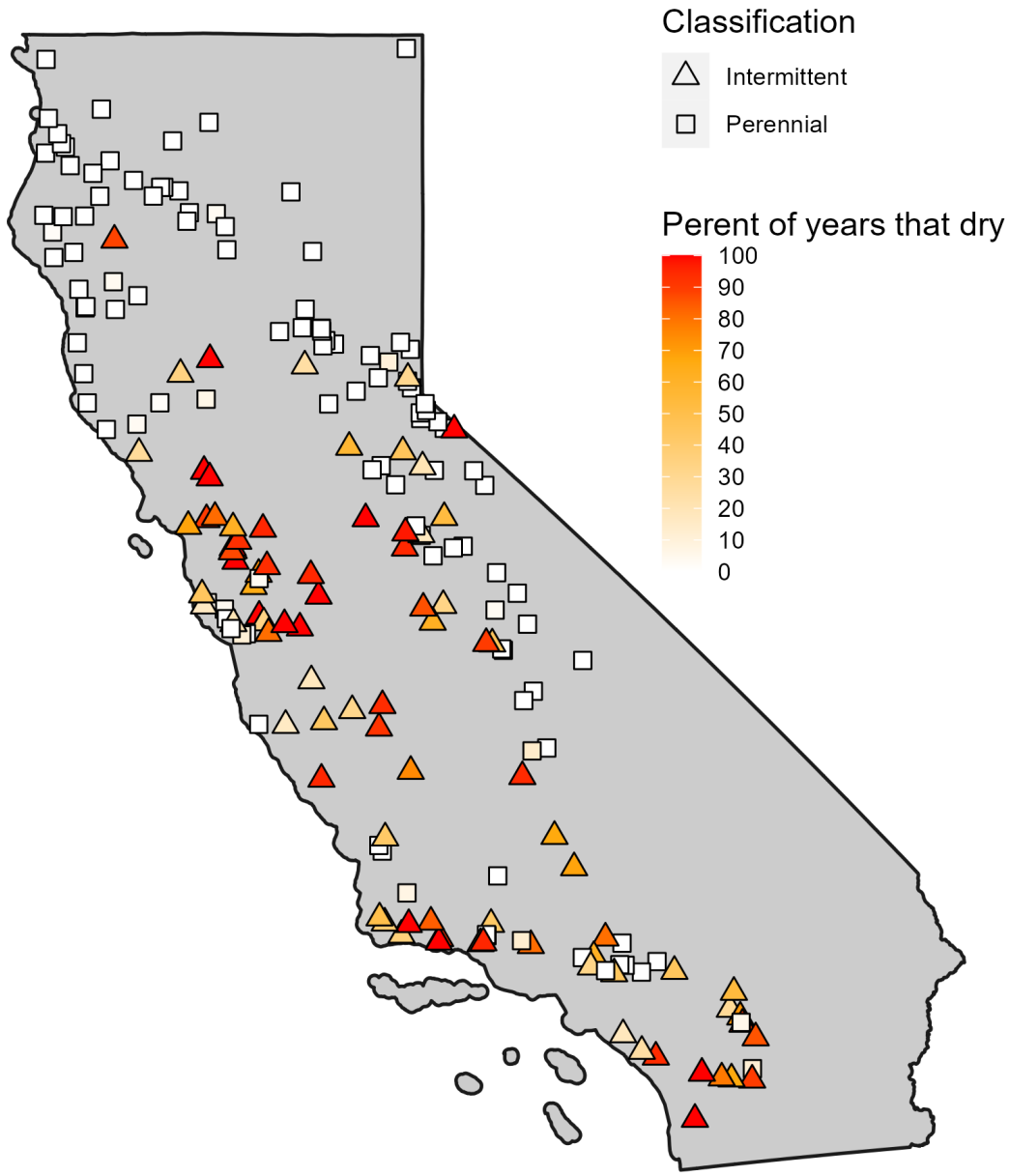
yes → *Intermittent stream*

no → *Perennial stream*

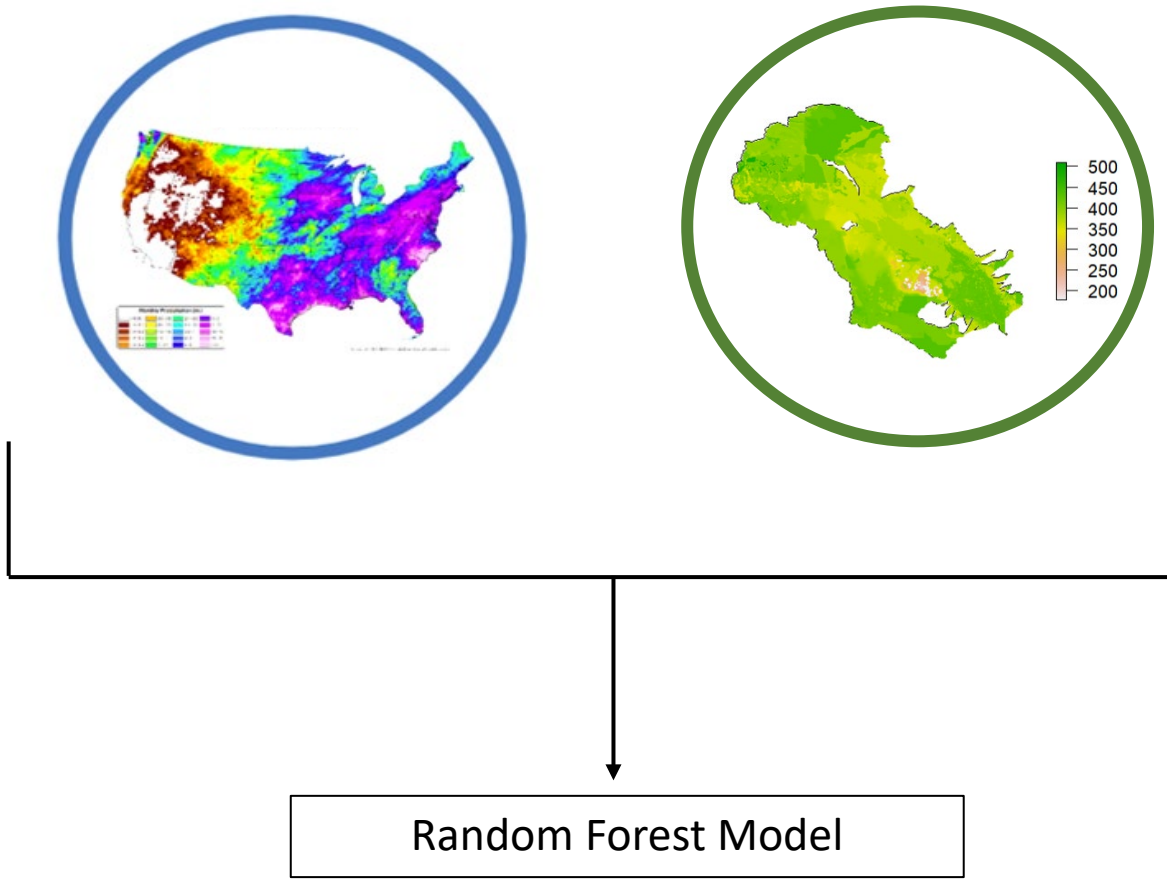
Dry Creek, CA

Russian River, CA

Stream classification results show more intermittent streams along the central coast and southern California.

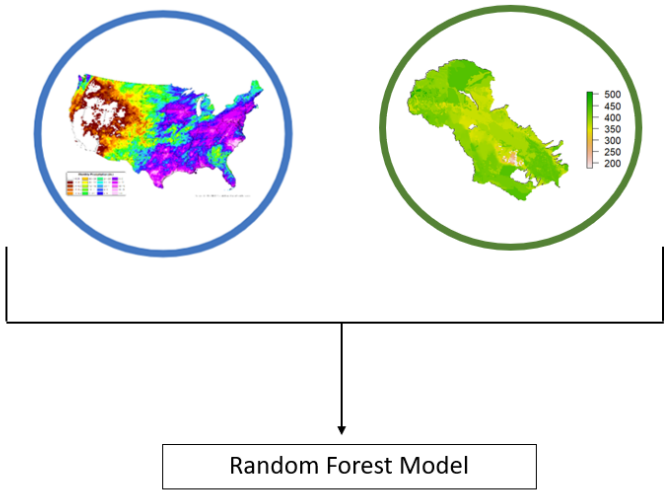


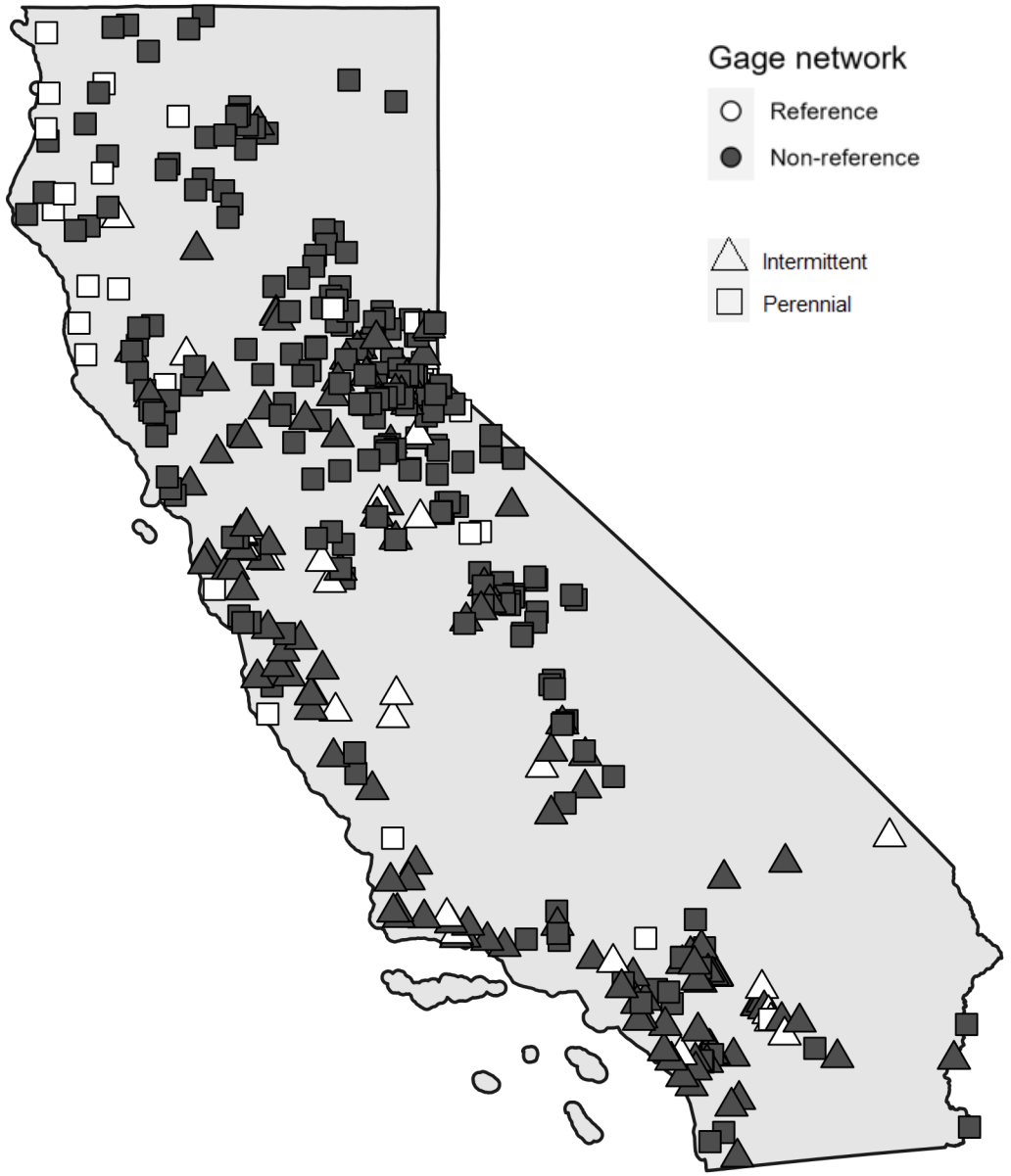
A random forest model was developed to predict natural intermittent stream using reference gages



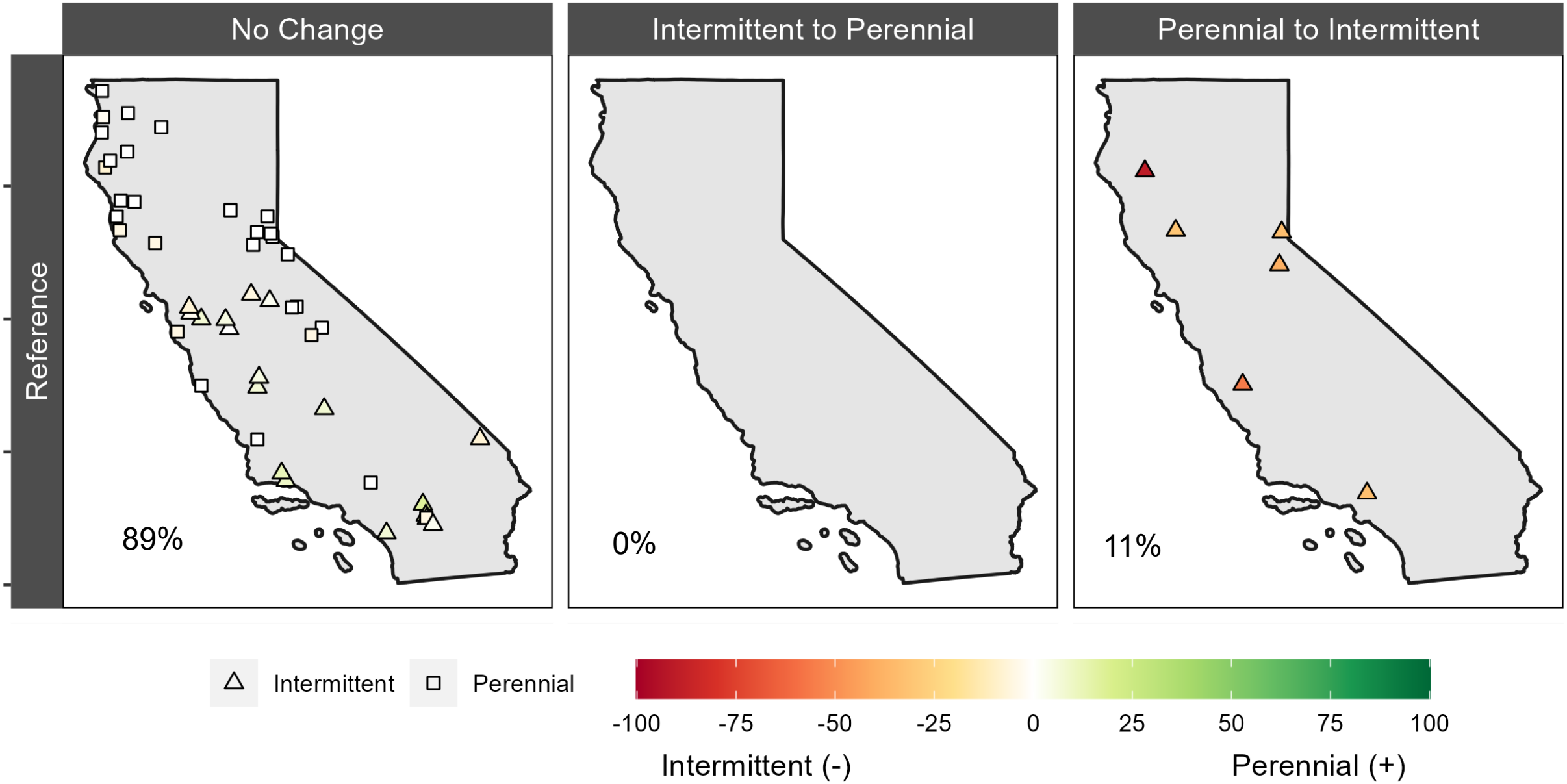
	Percent of gages correctly classified
Perennial	92%
Intermittent	73%

The same criteria was applied to observed streamflow at contemporary stream gages from 1980-2020

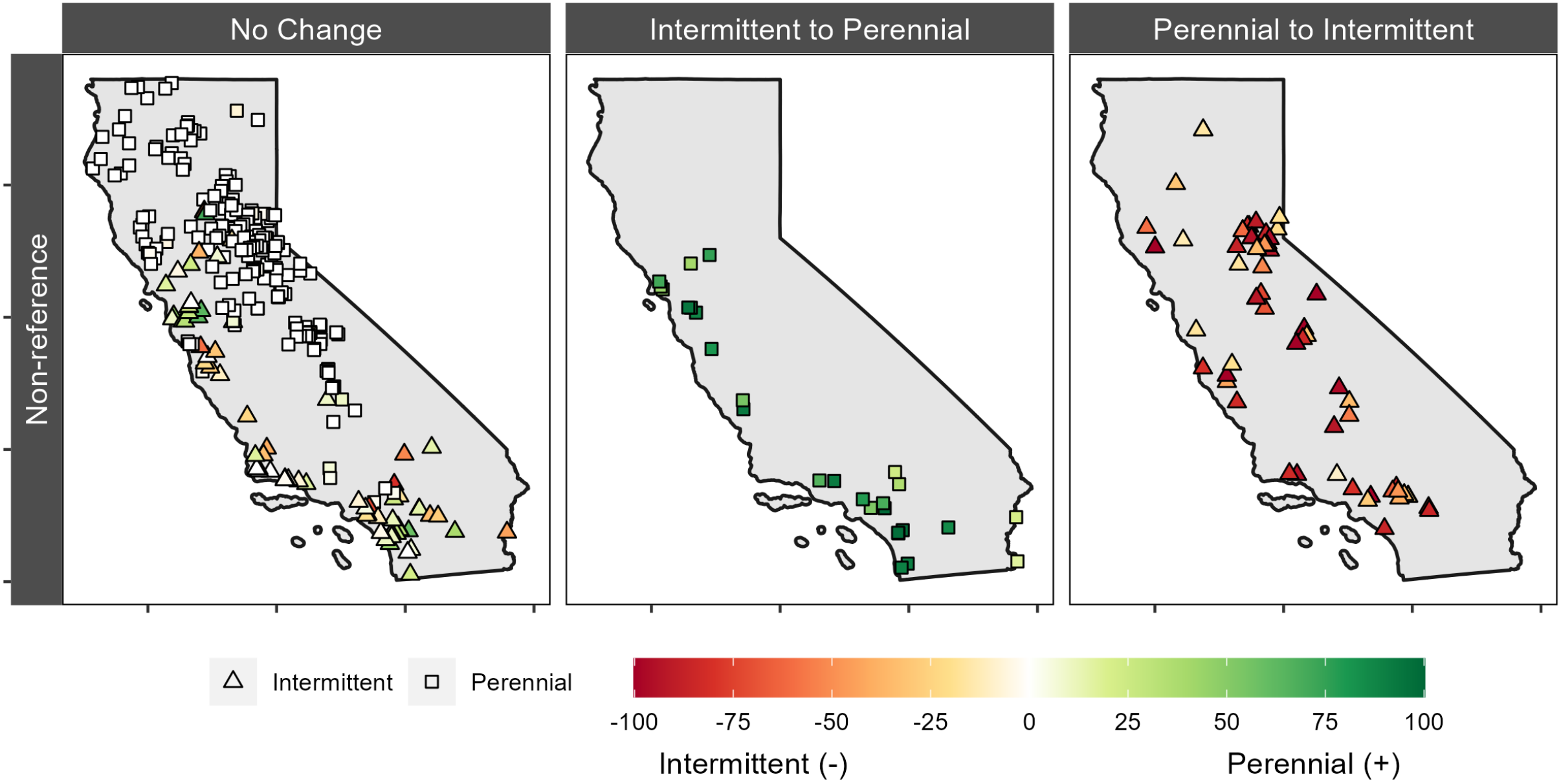




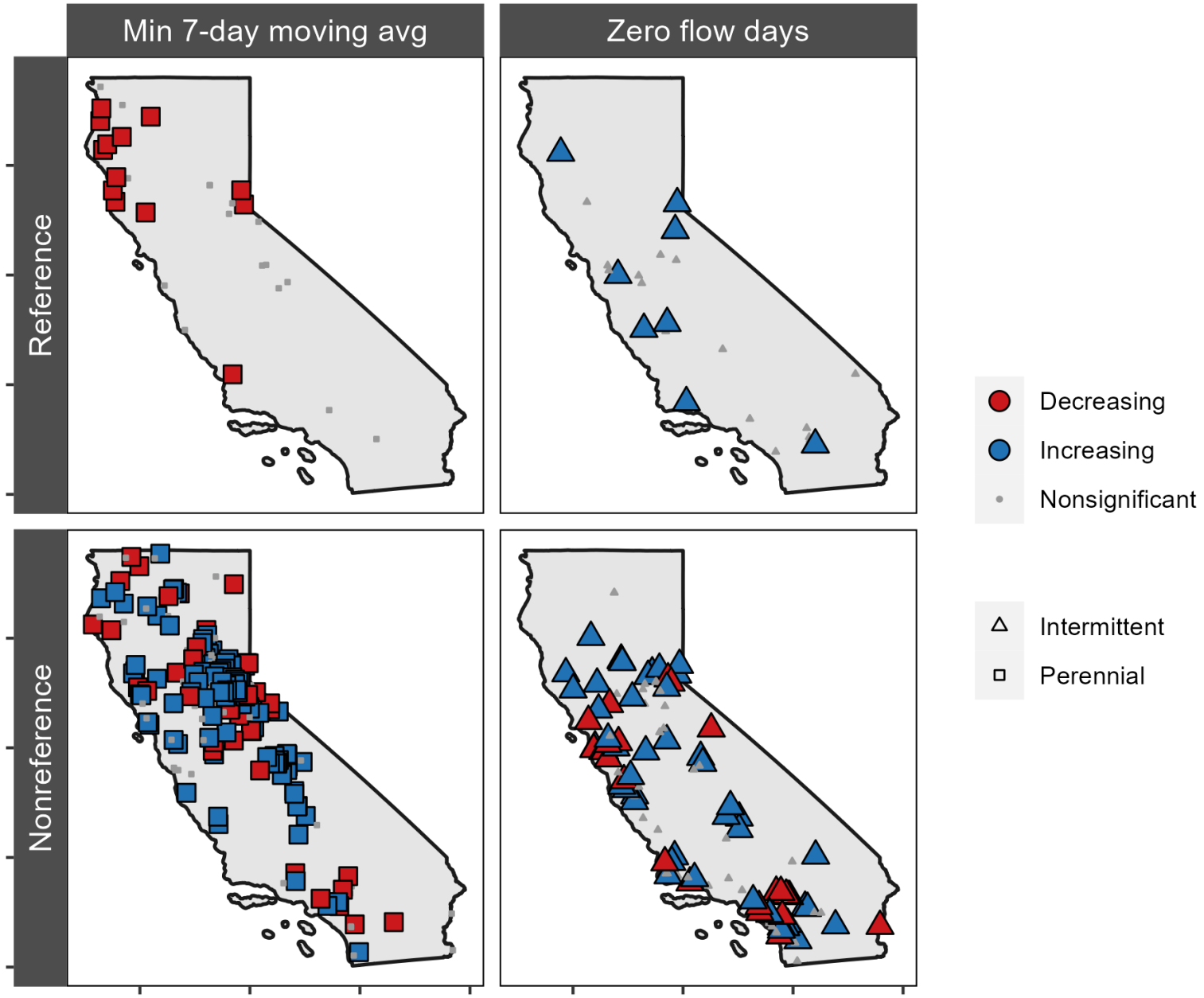
Changes at current reference gages show few shifts, but a tendency towards increasing intermittency.



Shifts in streamflow regimes were more prevalent for nonreference gages, with more streams changing from perennial to intermittent.



Low flow trends at reference gages showed increases in drying. Variability in the direction of trends at nonreference gages highlights the effect of human impacts



In summary, streamflow drying from climate change is prevalent, but a slow process that has caused few reference streams to become intermittent.

Human activities have exacerbated drying in many streams, and in some cases caused intermittent streams to become perennial.

Questions?

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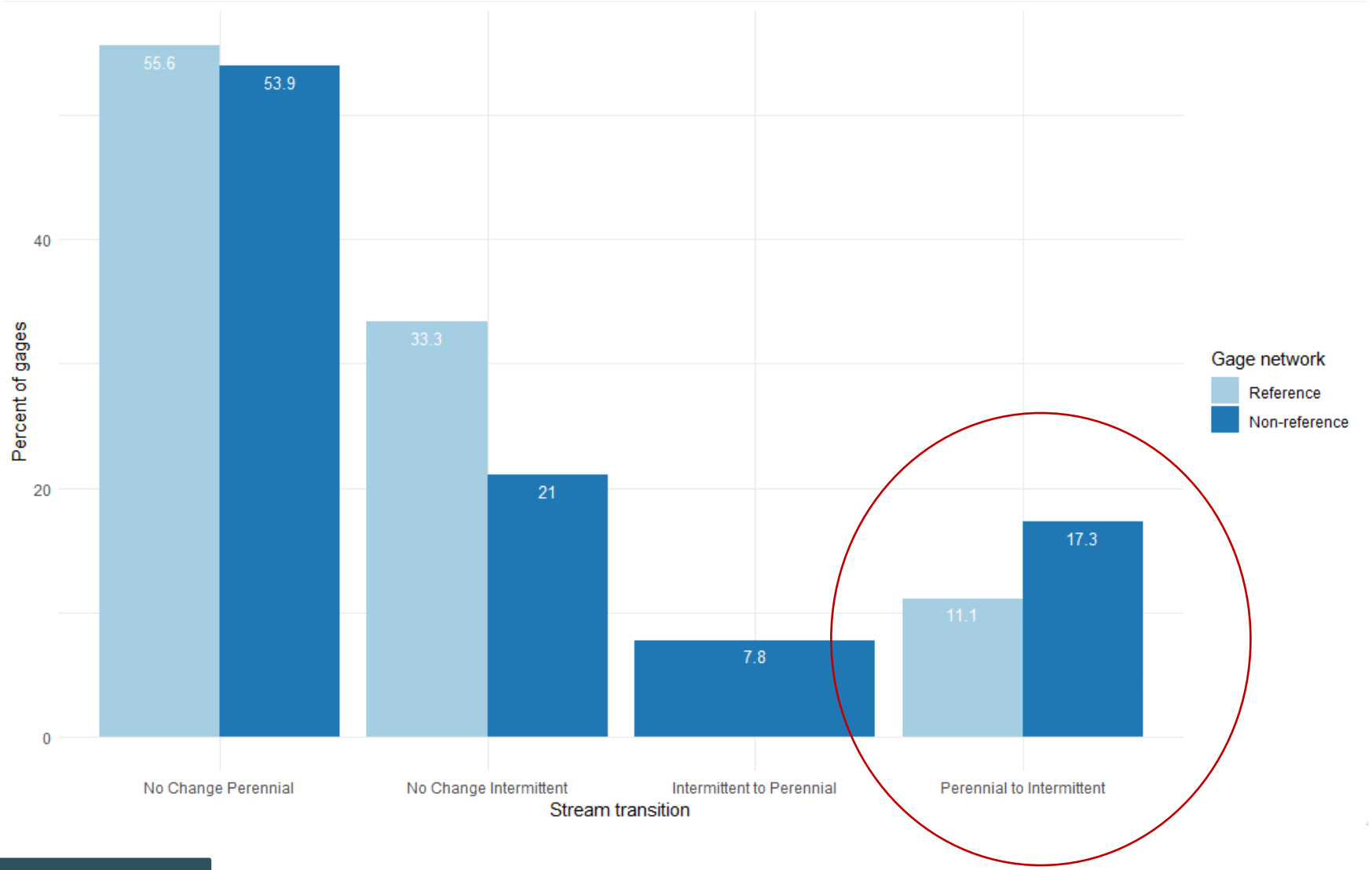
Overall, there are more shifts towards streamflow drying with perennial to intermittent stream



2. Is there evidence that intermittent streams have become perennialized and vice versa?

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