Identifying dry weather water quality goals to inform urban stormwater management in San Diego County

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PARADIGM ENVIRONMENTAL

Outline

- Project Context
- Functional Flows Approach
- CEFF for Spring Valley
- Conclusions

Project Context

Project Overview

- Partnership of County of San Diego, San Diego Coastkeeper, and California Environmental Rights Foundation (CERF)
- Multi-benefit stormwater planning approach to address wet and dry weather stormwater runoff in the Spring Valley Creek watershed
- Identification of wet and dry weather water quality goals
  - Wet Weather – Fecal Indicator Bacteria
  - Dry Weather – Environmental Flow Recommendations
- Identification and prioritization of stormwater capture projects that address goals
- Assessment of climate change resiliency and flood control benefits
- Development of metrics that can support tracking through an adaptive management framework

Model Overview

Watershed Modeling

Use LSPC to simulate hourly watershed rainfall-runoff and pollutant concentration

Stormwater Runoff
(flow rate, FIB, sediment, nutrients, metals)*

BMP Modeling

Use SUSTAIN to identify management strategy that addresses wet and dry weather water quality goals

Green Streets and Regional BMPs

Water Quality Goals

Demonstrate that water quality goals are met with the management strategy

Wet Weather: Volume-based stormwater management goal (addresses FIB)
Dry Weather: Flow reduction (environmental flows)

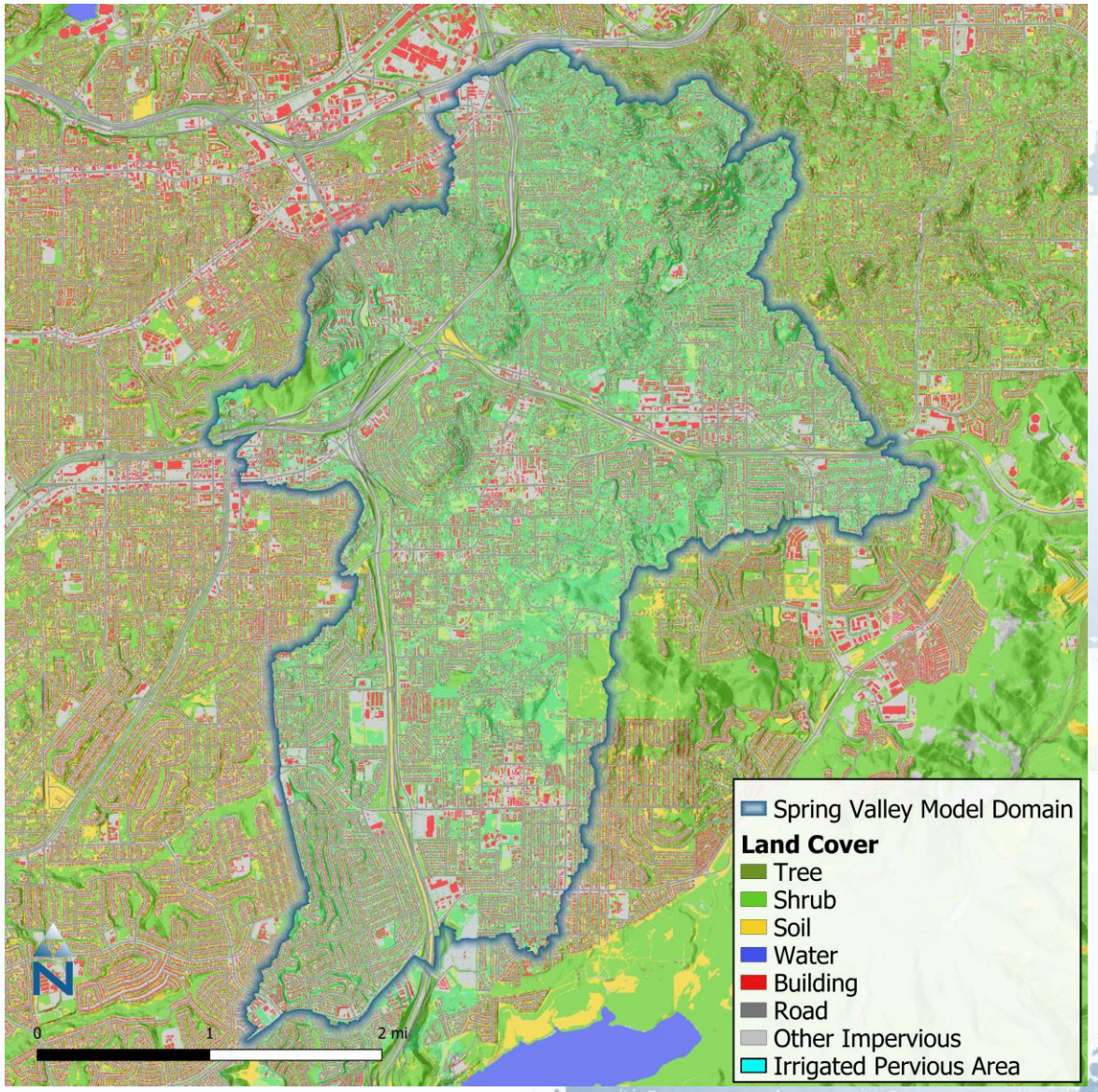
Demonstrate co-benefits of management strategy

Quantify load reductions of other pollutants (nutrients and metals) provided by management strategy

* Although the water quality goals focus on FIB (wet weather) and environmental flows (dry weather), the models include simulation of additional pollutants (nutrients, metals) to support adaptive management and the assessment of co-benefits of the management strategy.

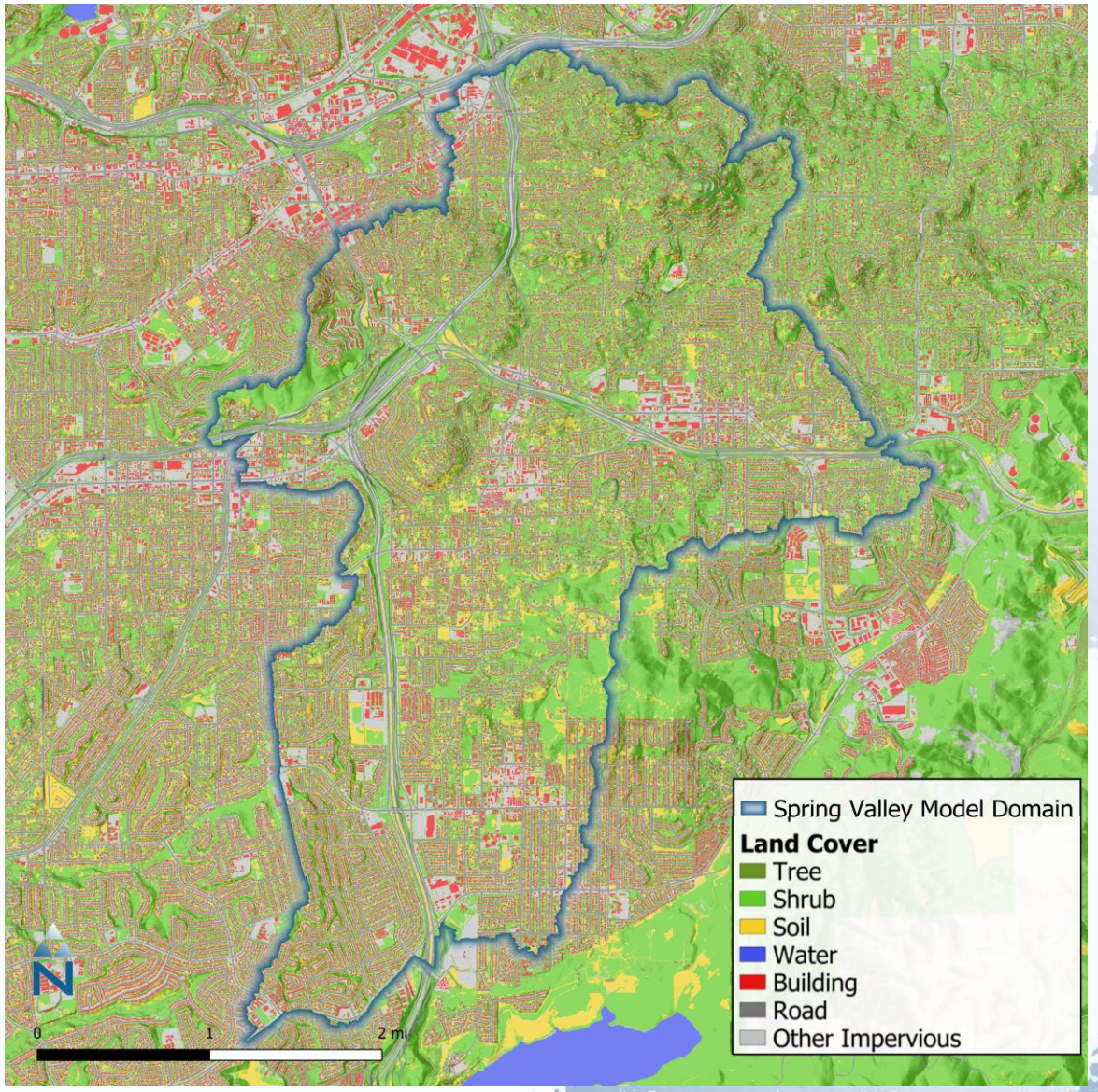
Model Scenarios

1. Existing Condition



Model Scenarios

1. Existing Condition
2. Existing Condition (excludes irrigation)



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1. Existing Condition
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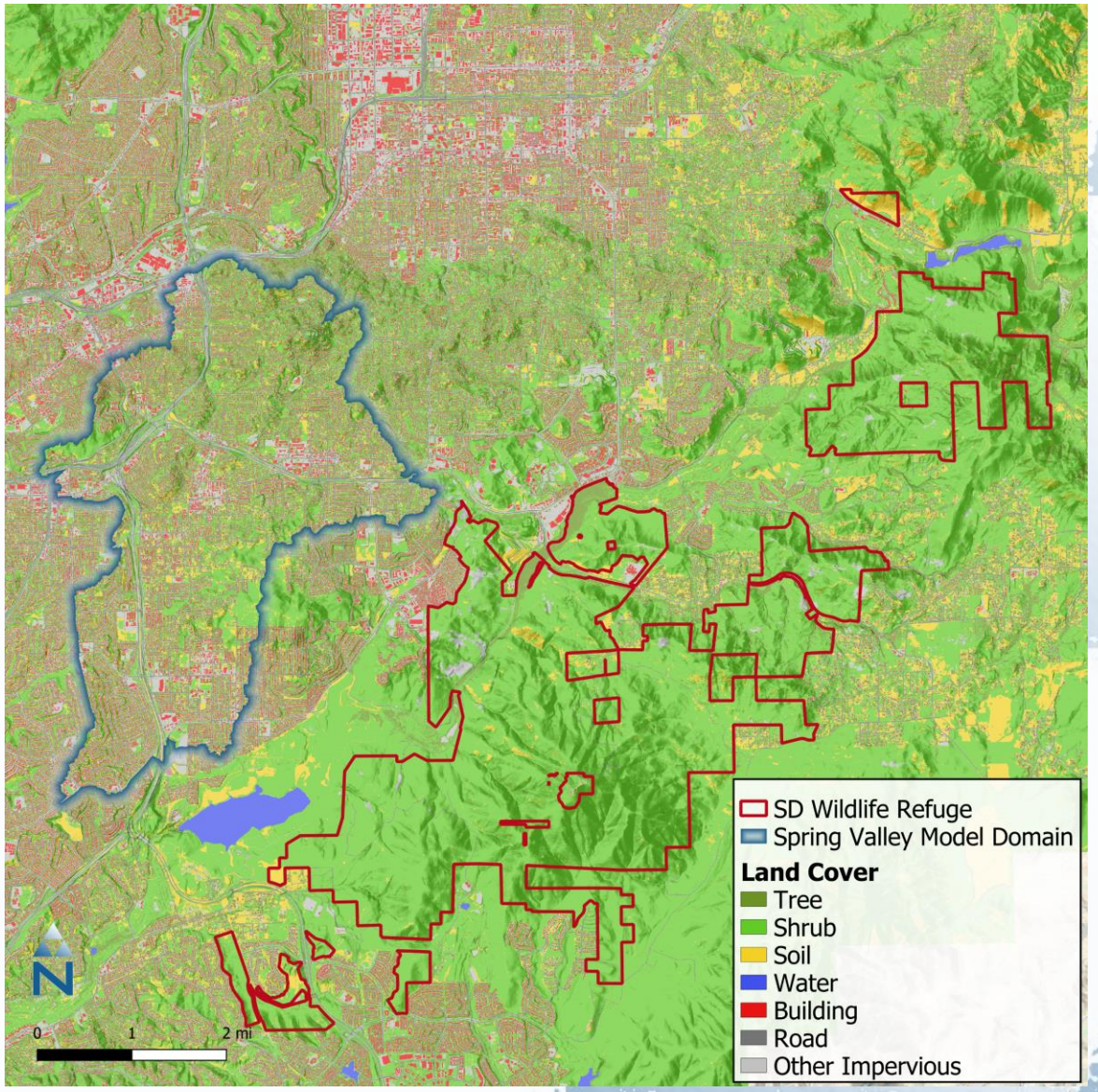
3. Predevelopment Scenario
   - Represents predeveloped condition
   - Template area: San Diego National Wildlife Refuge



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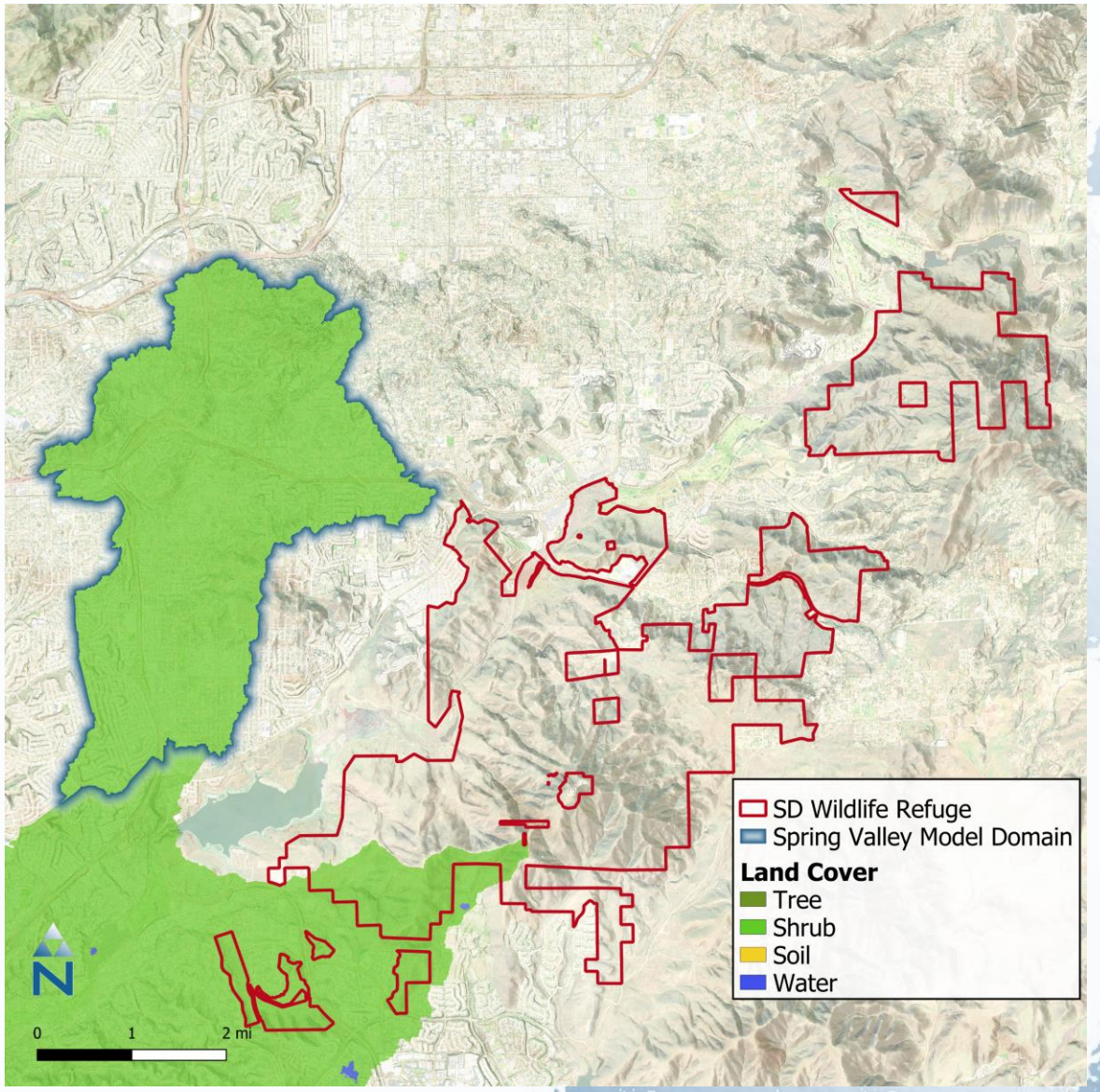
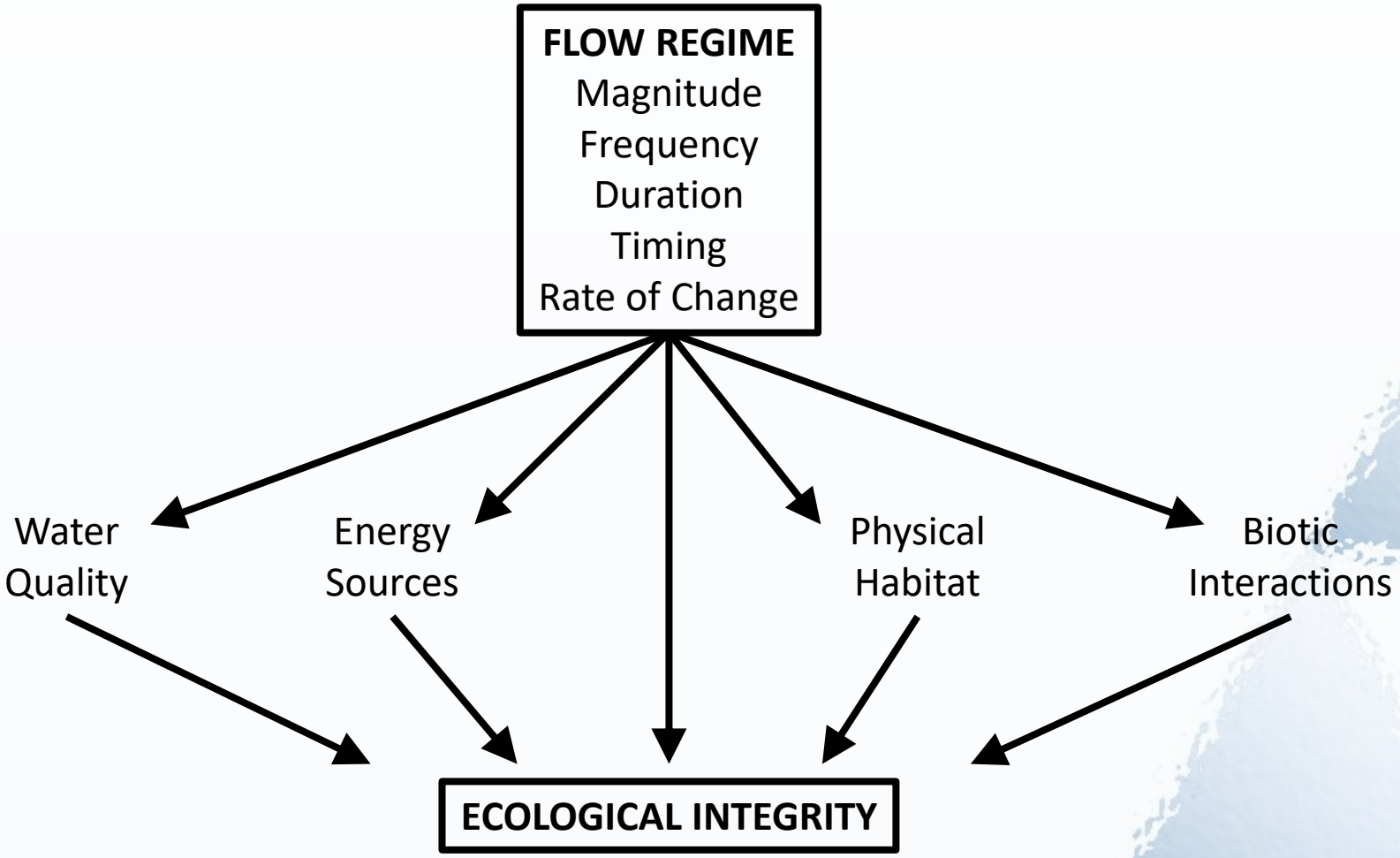


Functional Flows Approach

Environmental Flows



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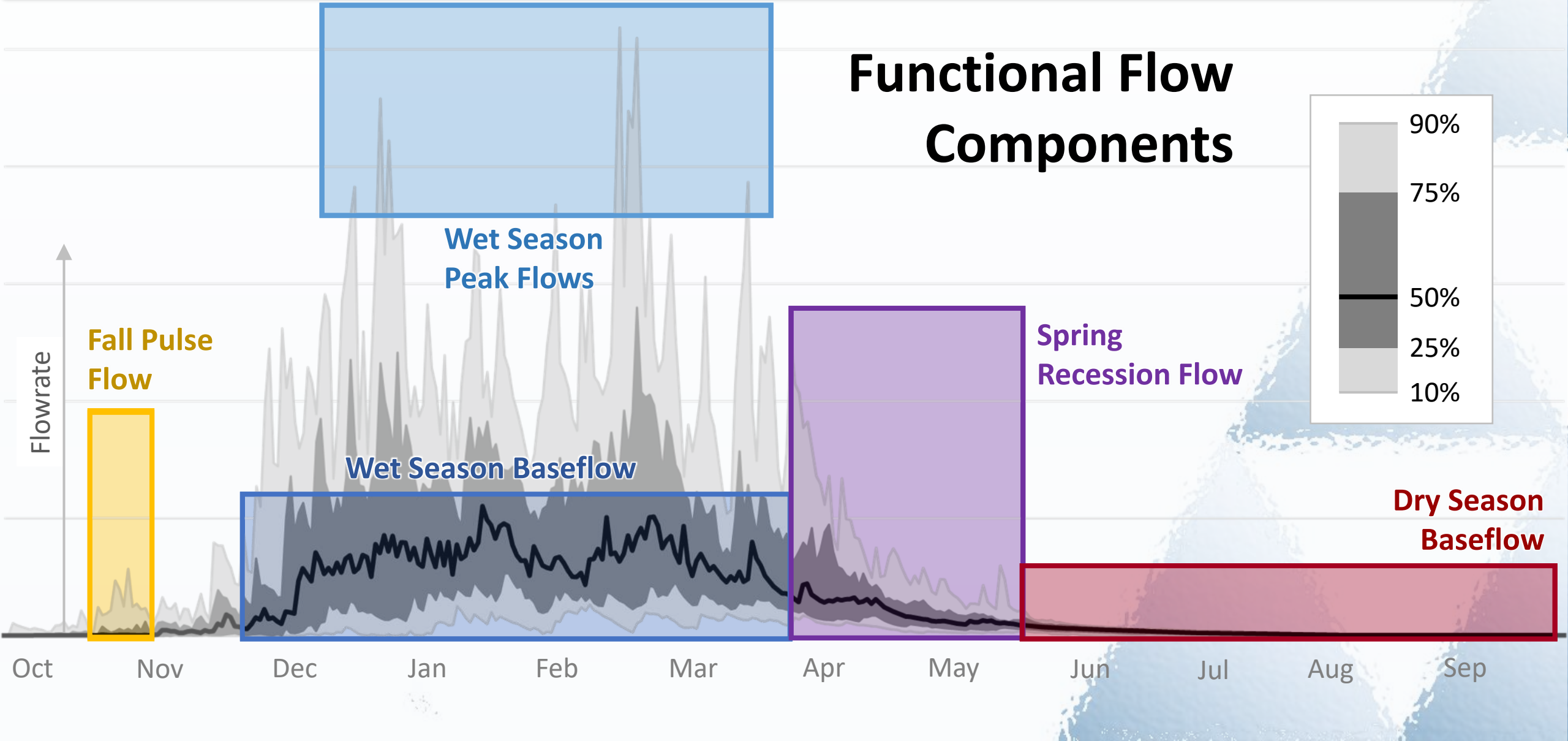


Functional Flows Approach

Functional Flow Metrics

Fall Pulse Flow

1. Fall Pulse Magnitude
2. Fall Pulse Timing
3. Fall Pulse Duration

Wet Season Baseflow

4. Wet Season Low Baseflow
5. Wet Season Median Baseflow
6. Wet Season Timing
7. Wet Season Duration

Wet Season Peak Flows

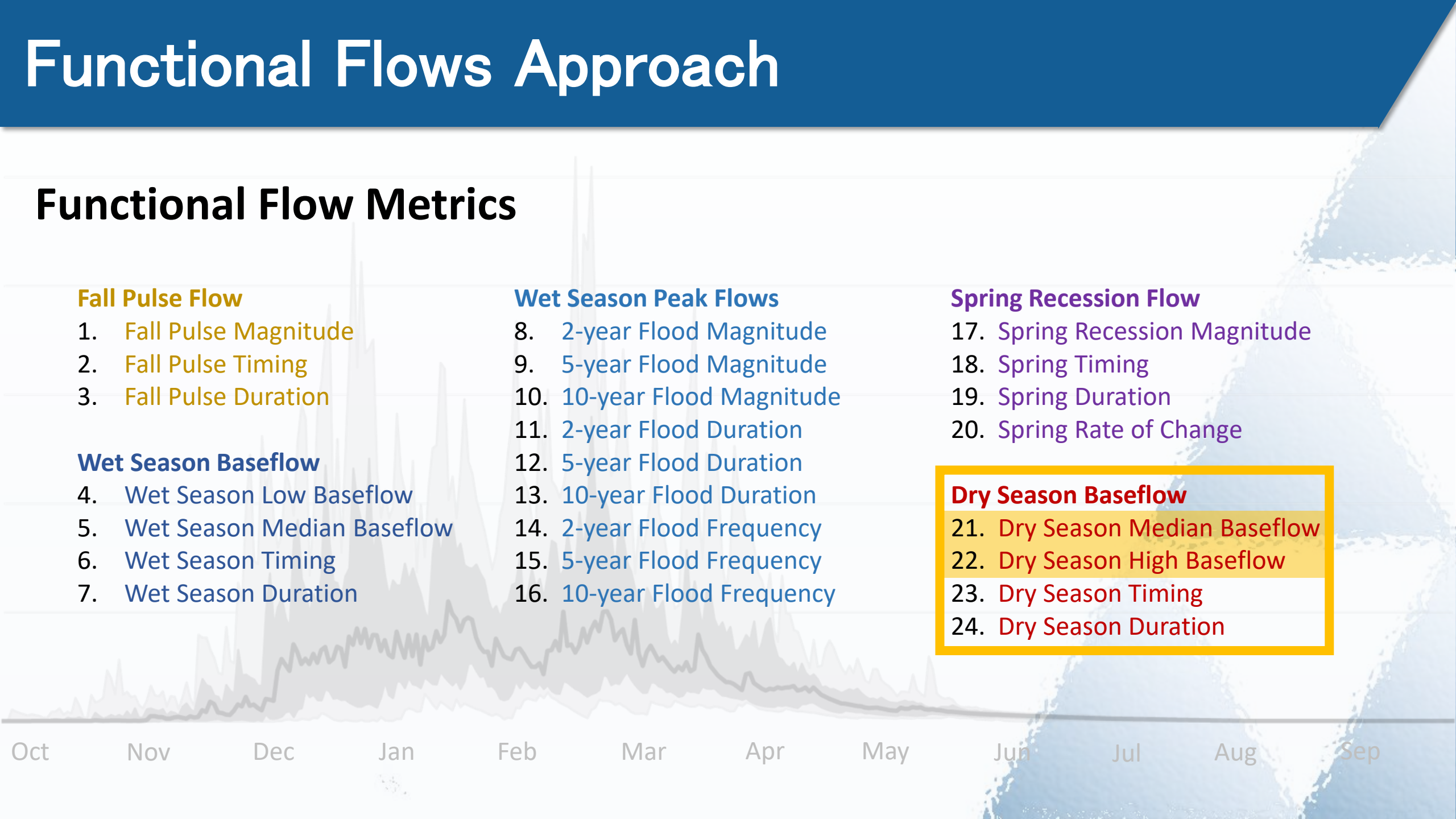
8. 2-year Flood Magnitude
9. 5-year Flood Magnitude
10. 10-year Flood Magnitude
11. 2-year Flood Duration
12. 5-year Flood Duration
13. 10-year Flood Duration
14. 2-year Flood Frequency
15. 5-year Flood Frequency
16. 10-year Flood Frequency

Spring Recession Flow

17. Spring Recession Magnitude
18. Spring Timing
19. Spring Duration
20. Spring Rate of Change

Dry Season Baseflow

21. Dry Season Median Baseflow
22. Dry Season High Baseflow
23. Dry Season Timing
24. Dry Season Duration



CEFF for Spring Valley

California Environmental Flows Framework

Section A

At my location(s) of interest, what are the natural ranges of flow metrics for each of my five functional flow components? What are the corresponding ecological flow criteria?

STEPS 1 – 4

Identify ecological flow criteria using natural functional flows

1. Define ecological management goals
2. Obtain natural ranges of flow metrics for five functional flow components
3. Evaluate if non-flow factors may affect the ability of natural flow ranges of functional flow metrics to achieve ecological management goals
4. Select ecological flow criteria for functional flow components that do not require additional consideration

OUTCOME: Ecological flow criteria from Step 4 and identification of functional flow components requiring further assessment in Section B

Section B

(as applicable) How do I use additional information to develop ecological flow criteria given physical and biological constraints?

STEPS 5 – 7

Develop ecological flow criteria for each flow component requiring additional consideration

5. Develop detailed conceptual model relating focal functional flow components to ecological management goals
6. Quantify flow-ecology relationships
7. Define ecological flow criteria for local functional flow components

OUTCOME: Synthesis of ecological flow criteria from Steps 4 and 7

Section C

How do I reconcile ecological flow needs with non-ecological management objectives to create balanced environmental flow recommendation?

STEPS 8 – 12

Develop environmental flow recommendations

8. Identify management objectives
9. Assess flow alteration
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OUTCOME: Environmental flow recommendations and implementation plan

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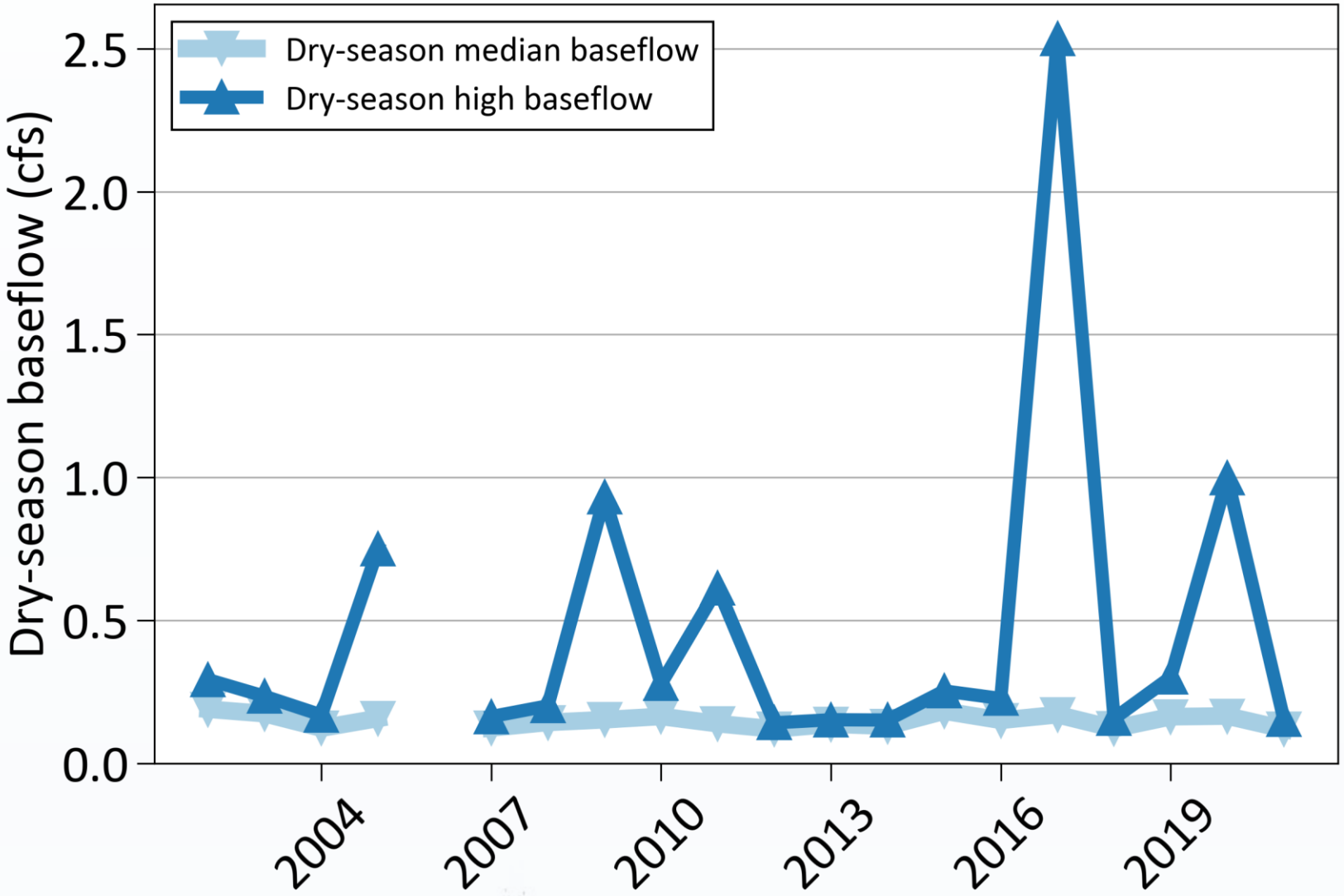
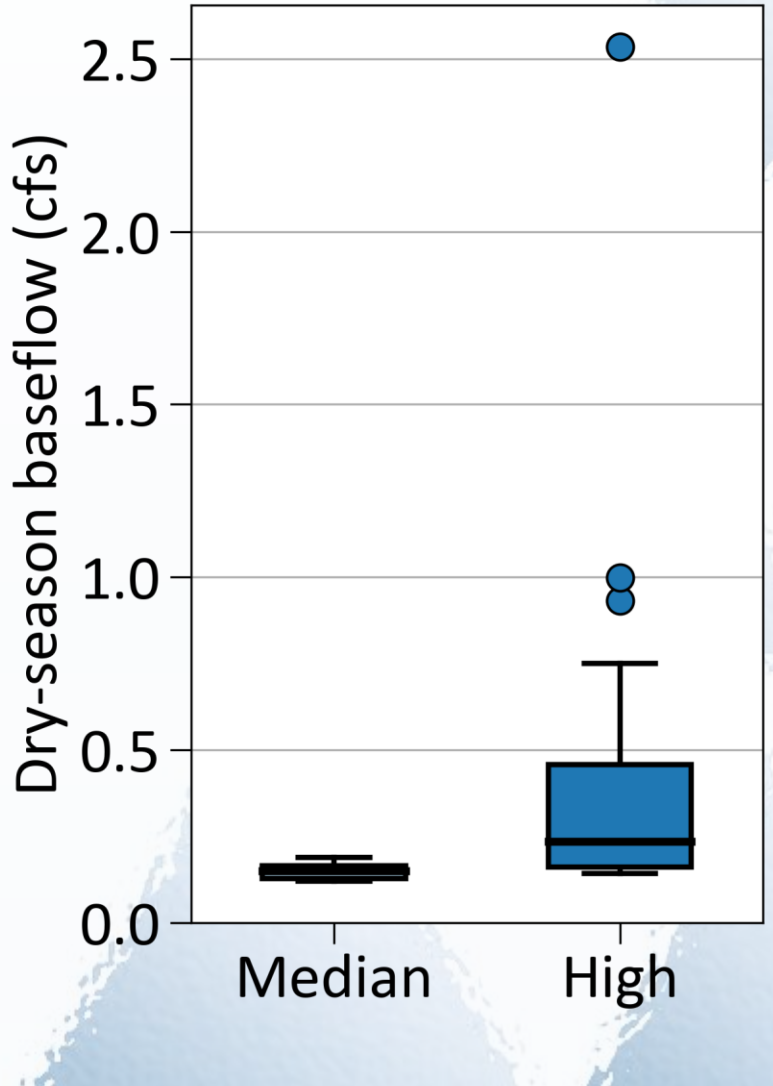
Dry-Season Functional Flow Magnitudes





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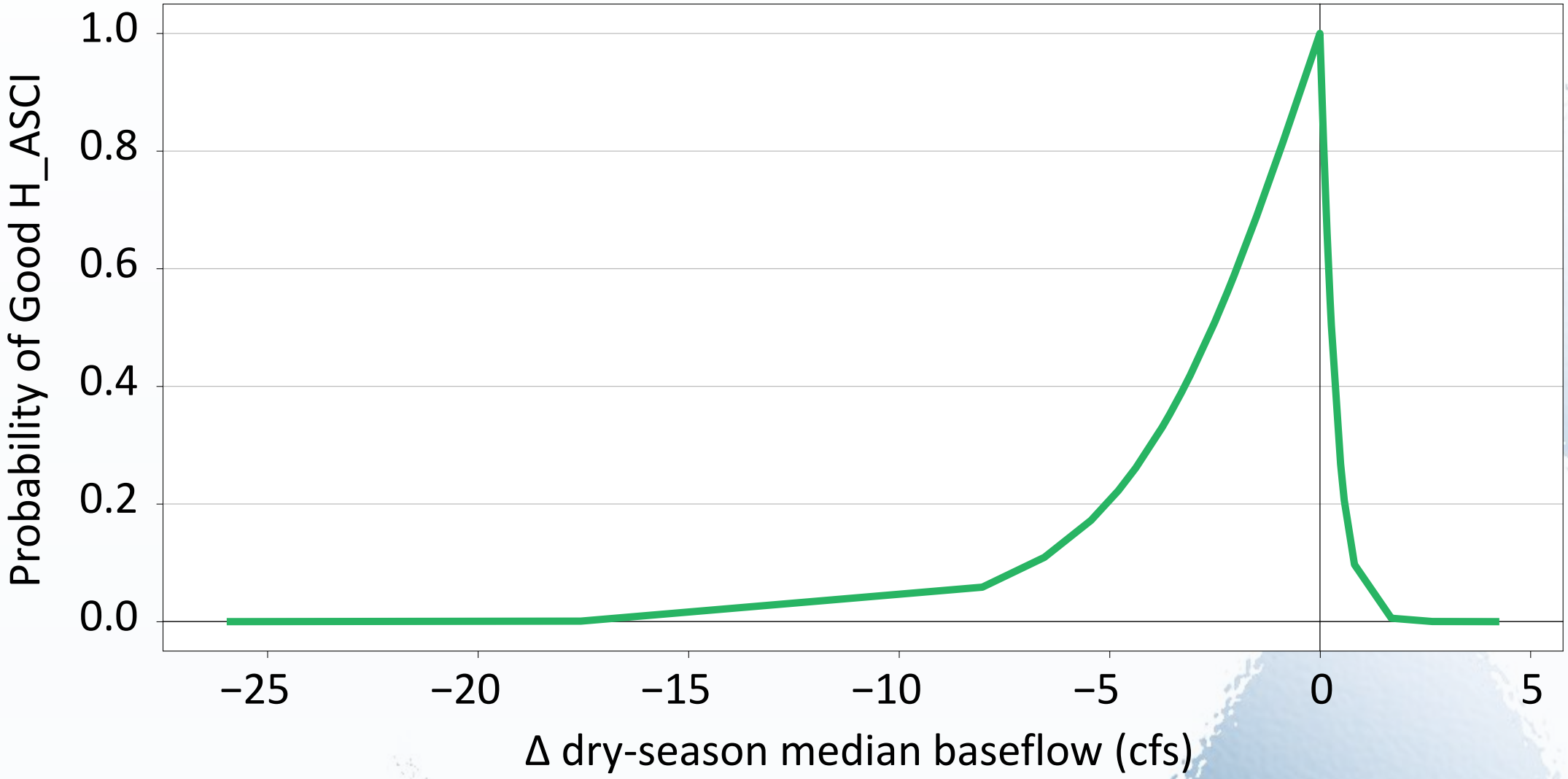
Indices of Biotic Integrity

- **CSCI**: California Stream Condition Index
  - **Multi-metric index**
  - **Ratio of observed/expected taxa**
  - **https://doi.org/10.1086/684130**
- **ASCI**: Algal Stream Condition Index
  - **Multi-metric index**
  - **Combination of diatoms and soft-bodied algae**
  - **Incorporates multiple assemblages**
  - **https://doi.org/10.1016/j.ecolind.2020.106421**

Index–Metric Relationships



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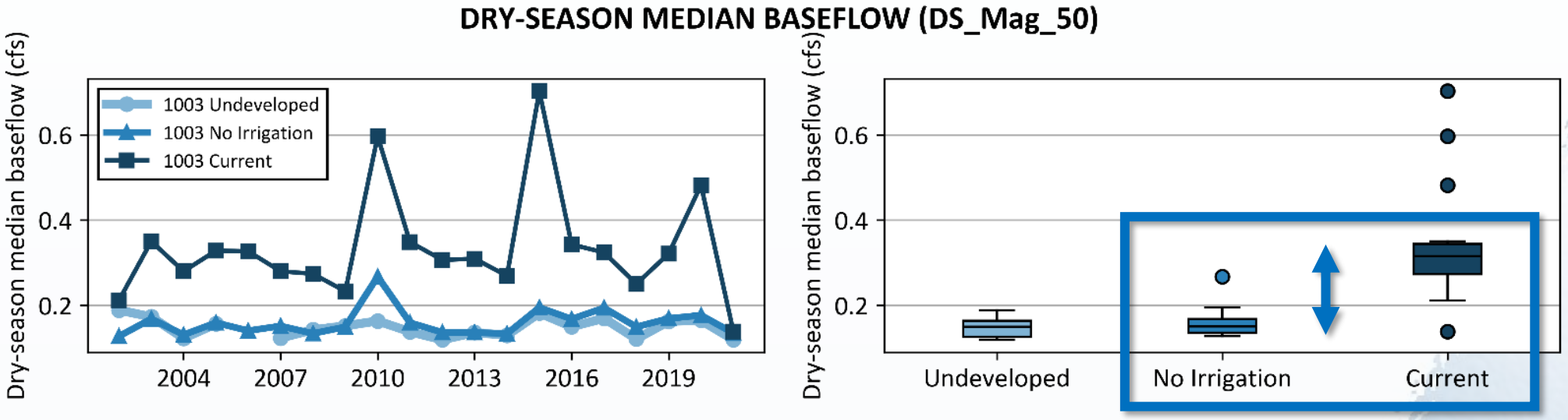
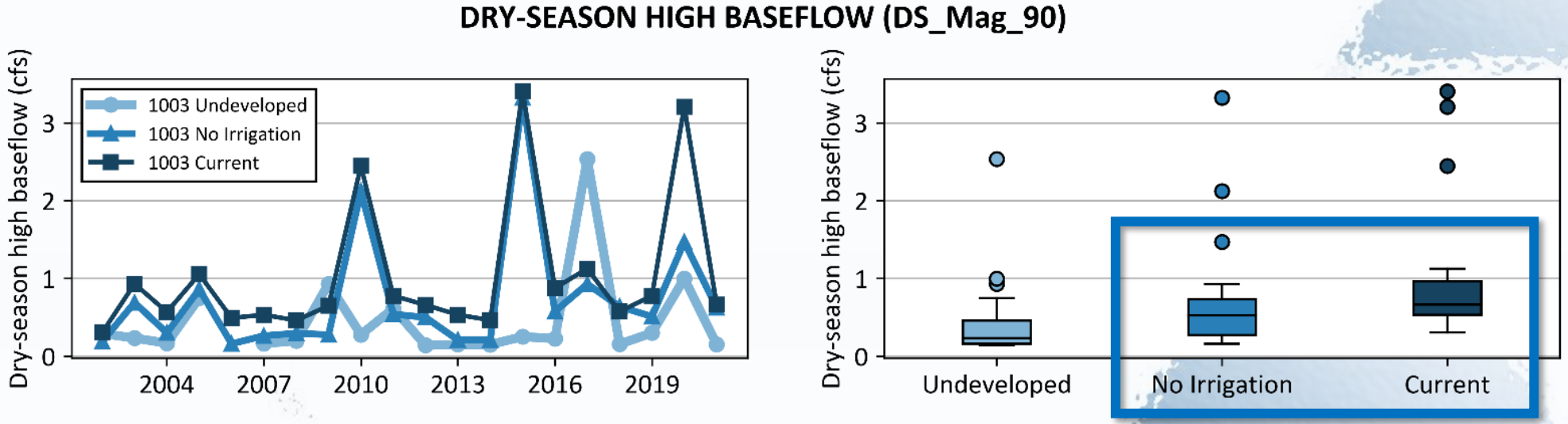
Functional Flow Metric Assessment





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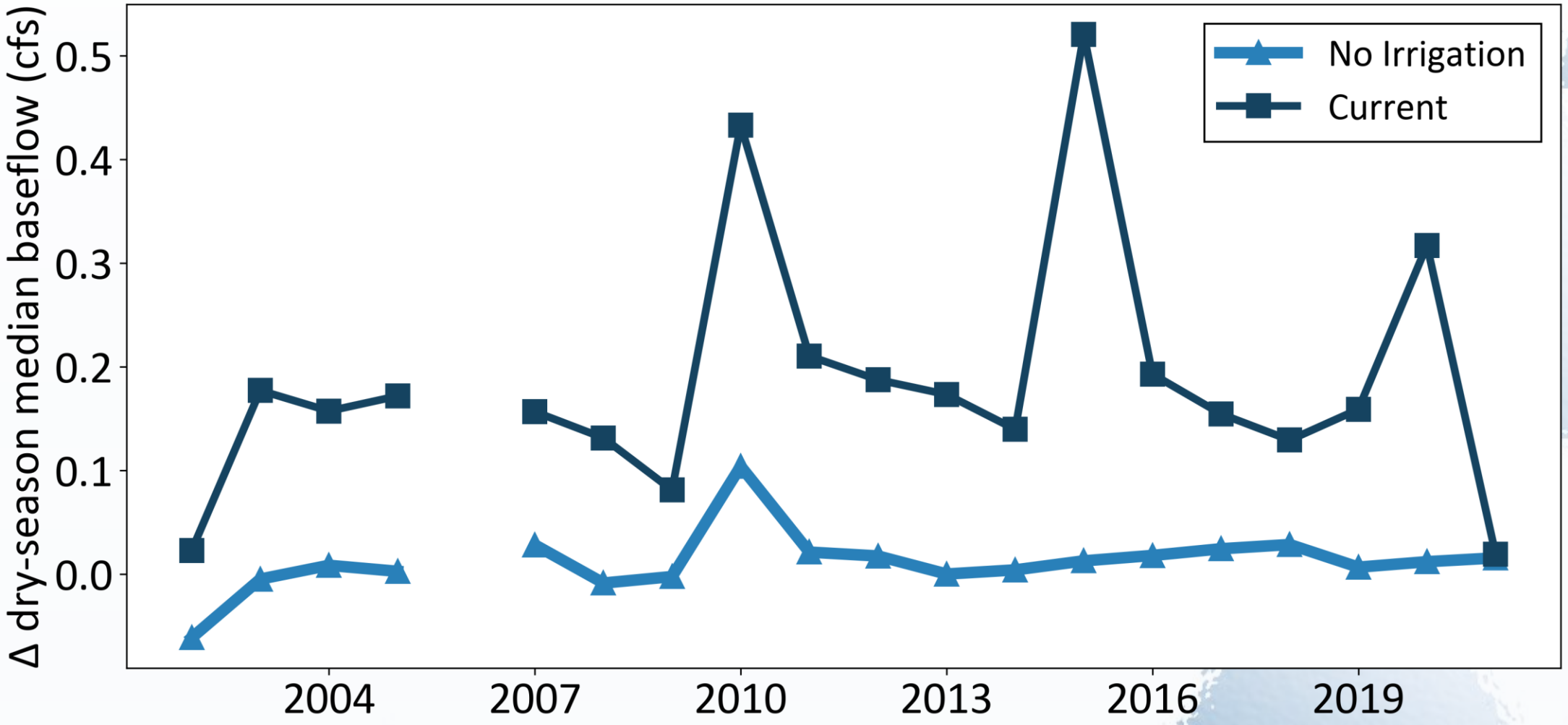
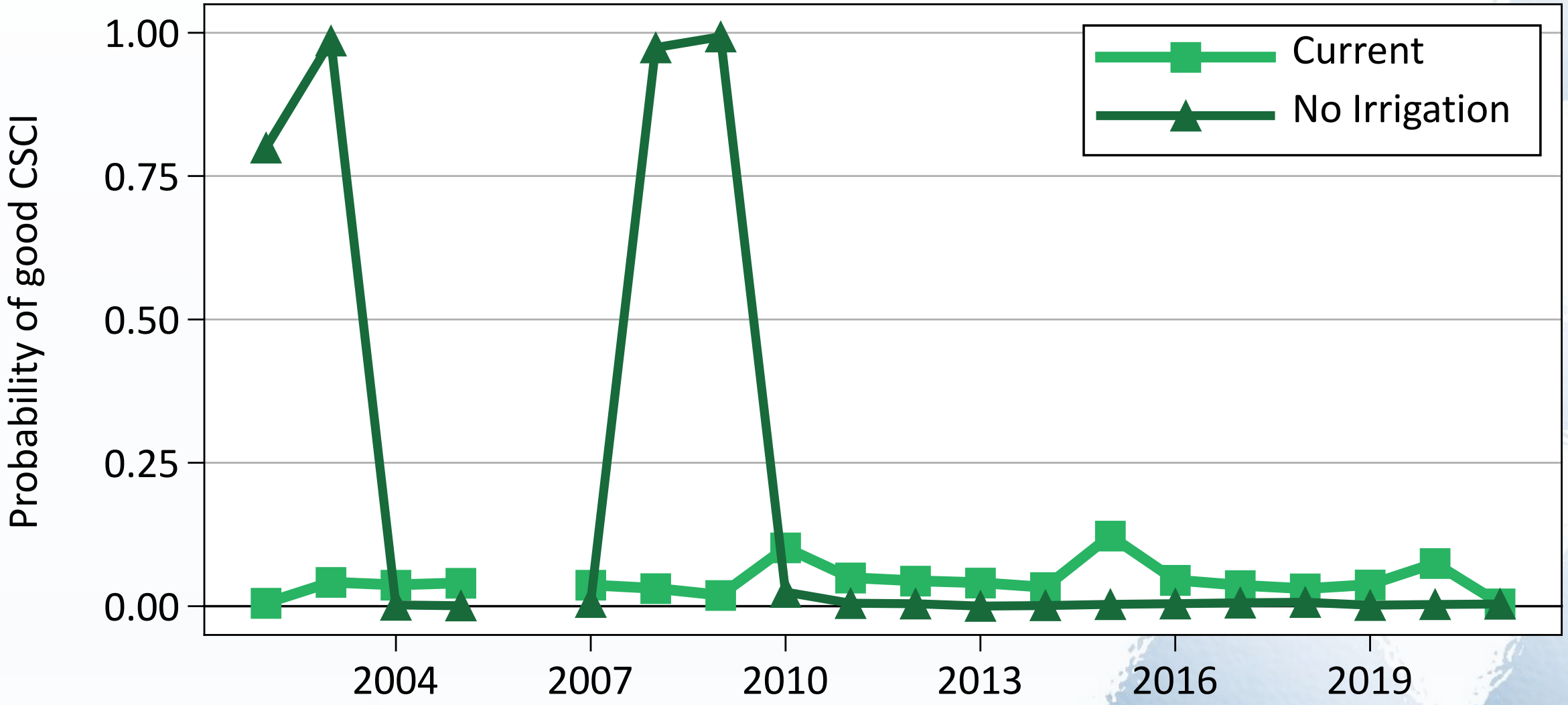
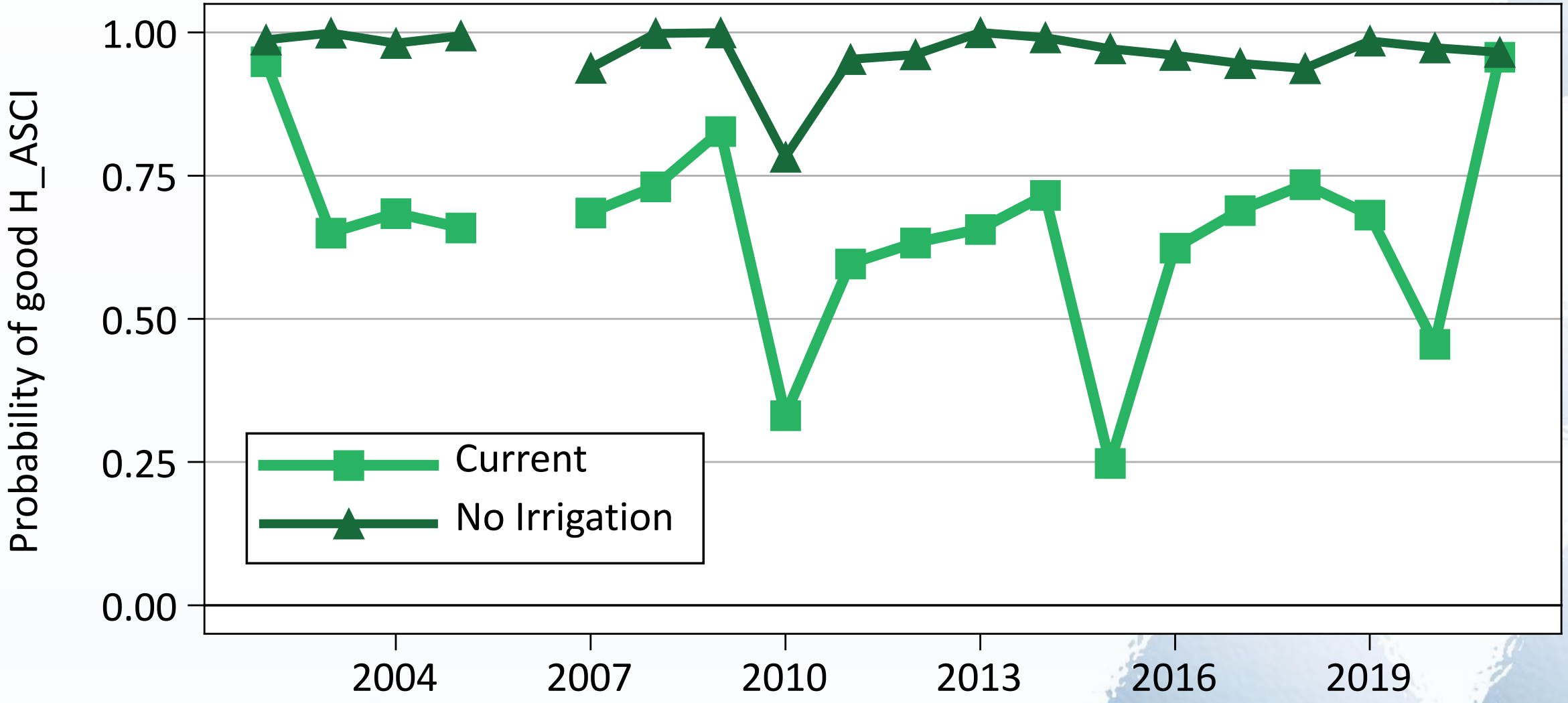


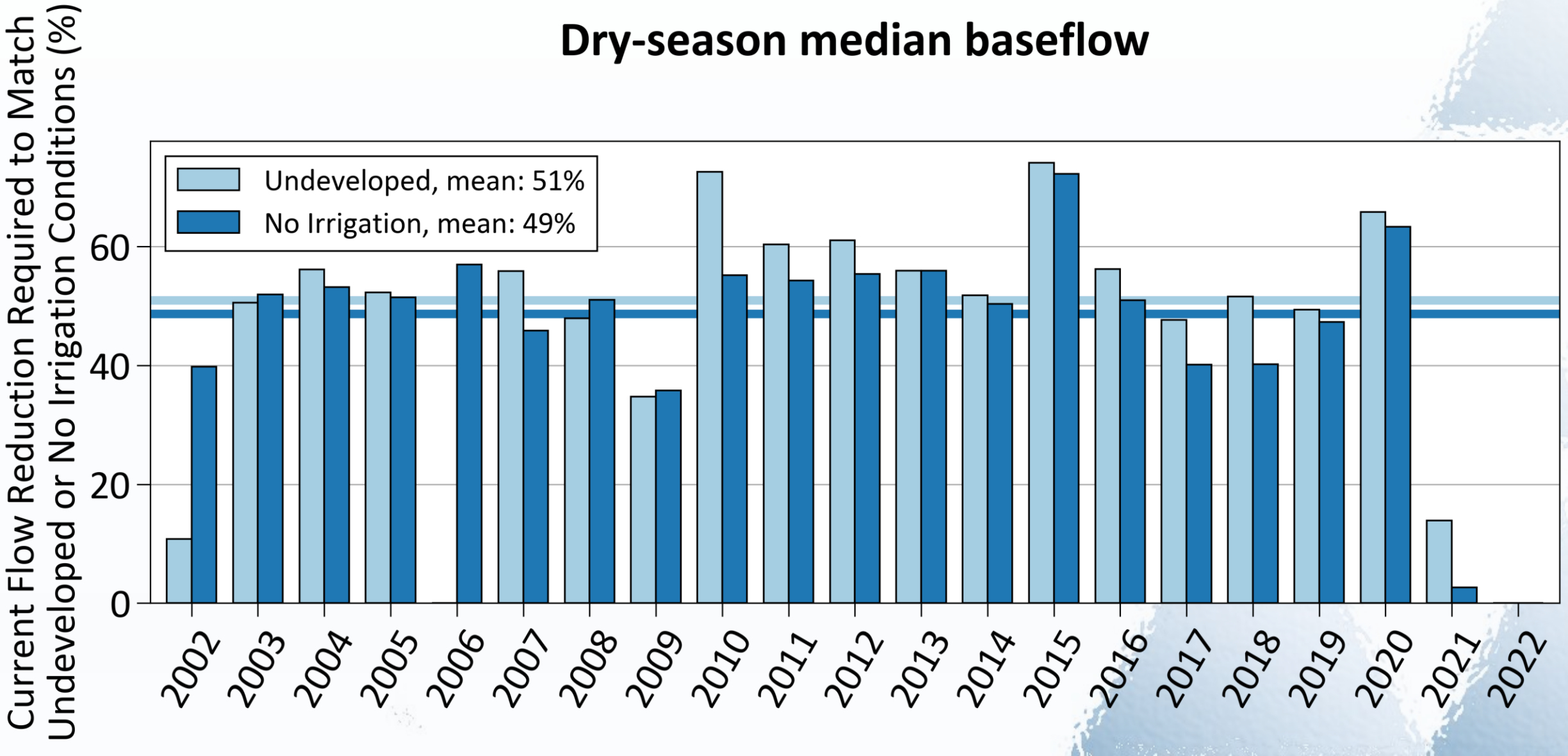
CSCI Assessment



H_ASCI Assessment



Recommended Flow Reduction



Conclusions

Summary and Conclusions

- Functional flow metric
  - Dry-season median baseflow
- Ecological Indicators
  - CSCI and H_ASCI
- Altered streams less sensitive
- 50% reduction in current dry season baseflows
  - Match undeveloped baseflows
  - Match undeveloped ecological indicators