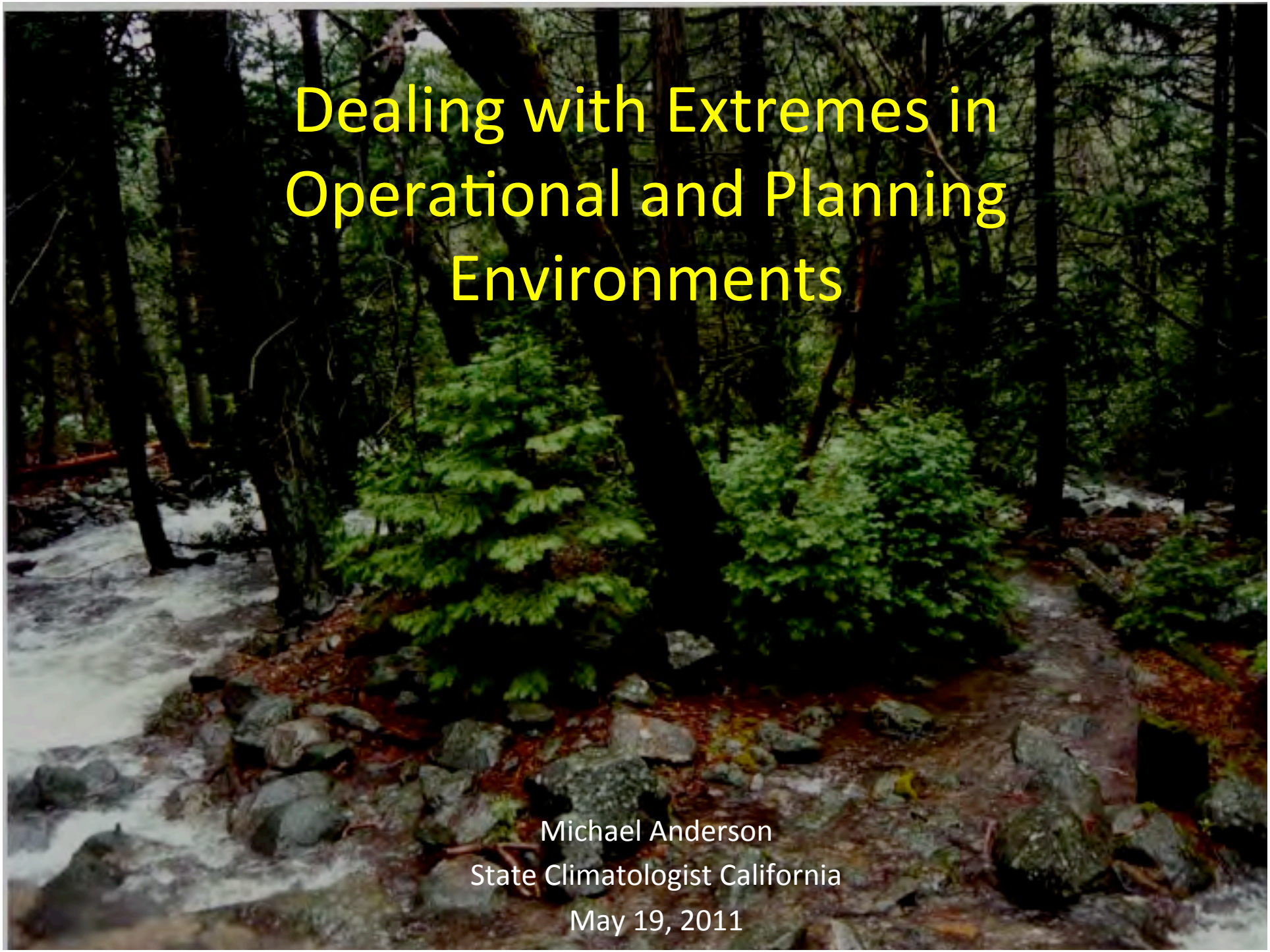
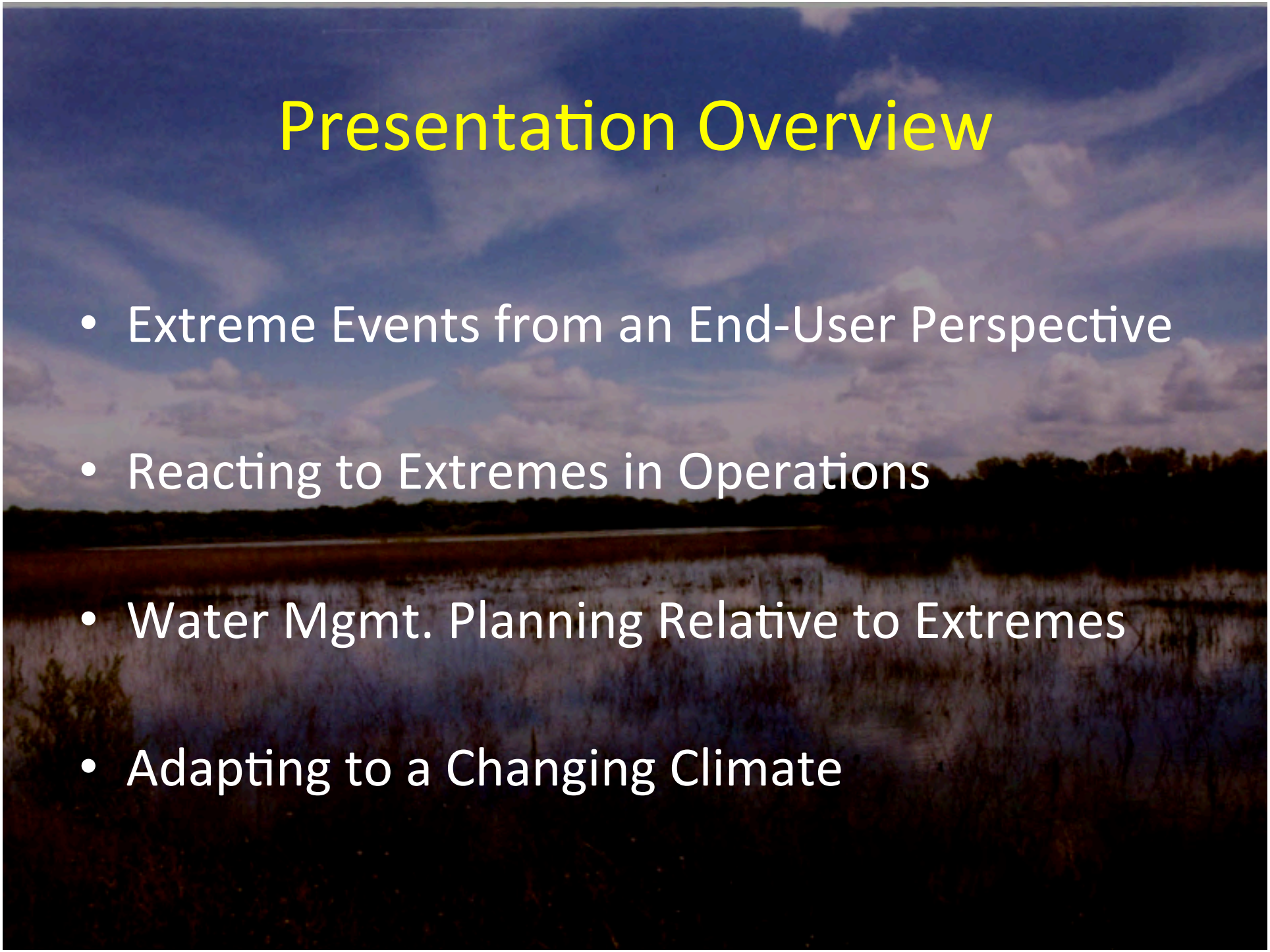

Dealing with Extremes in Operational and Planning Environments
Michael Anderson
State Climatologist California
May 19, 2011



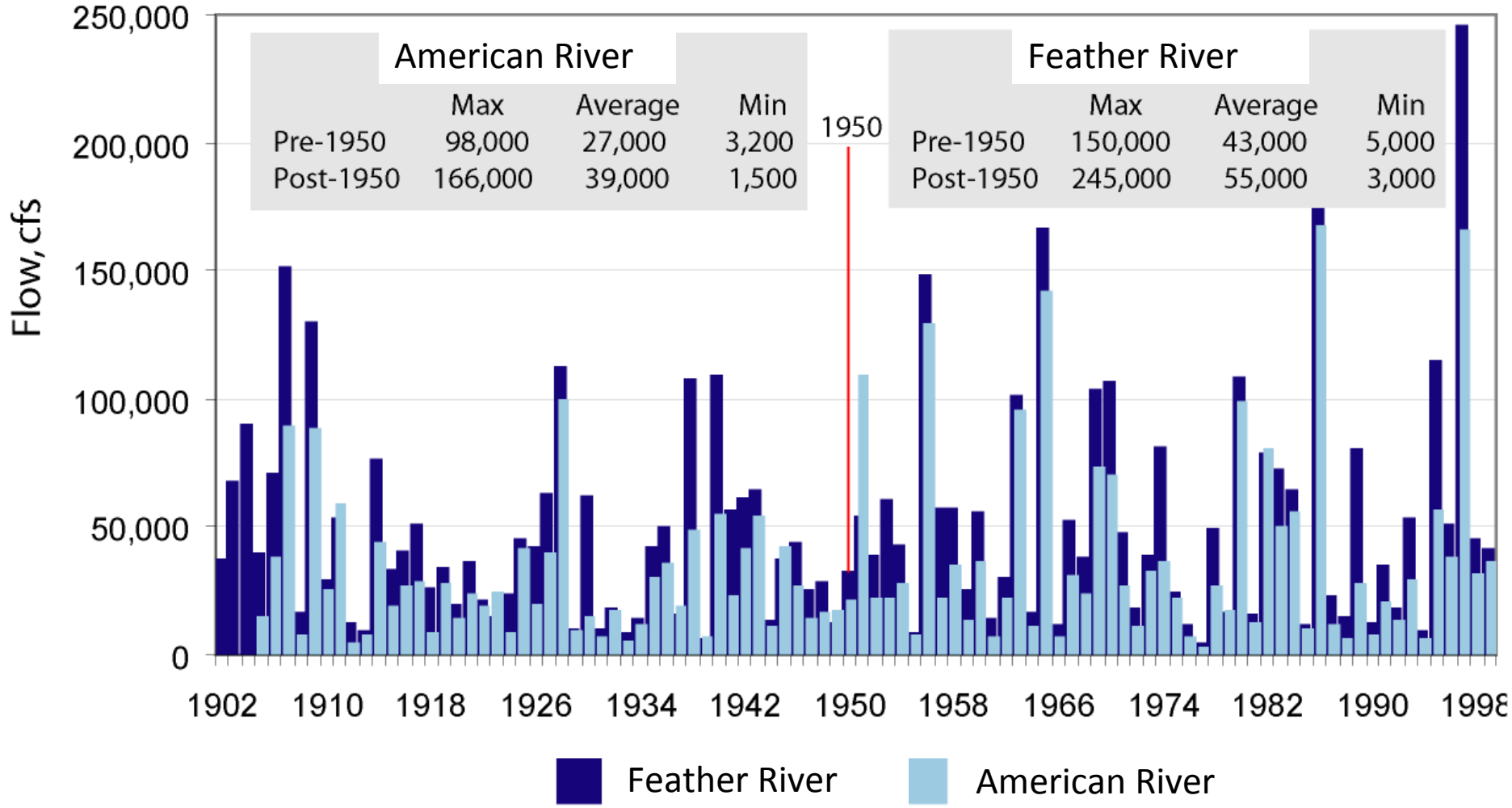
Presentation Overview

- Extreme Events from an End-User Perspective
- Reacting to Extremes in Operations
- Water Mgmt. Planning Relative to Extremes
- Adapting to a Changing Climate

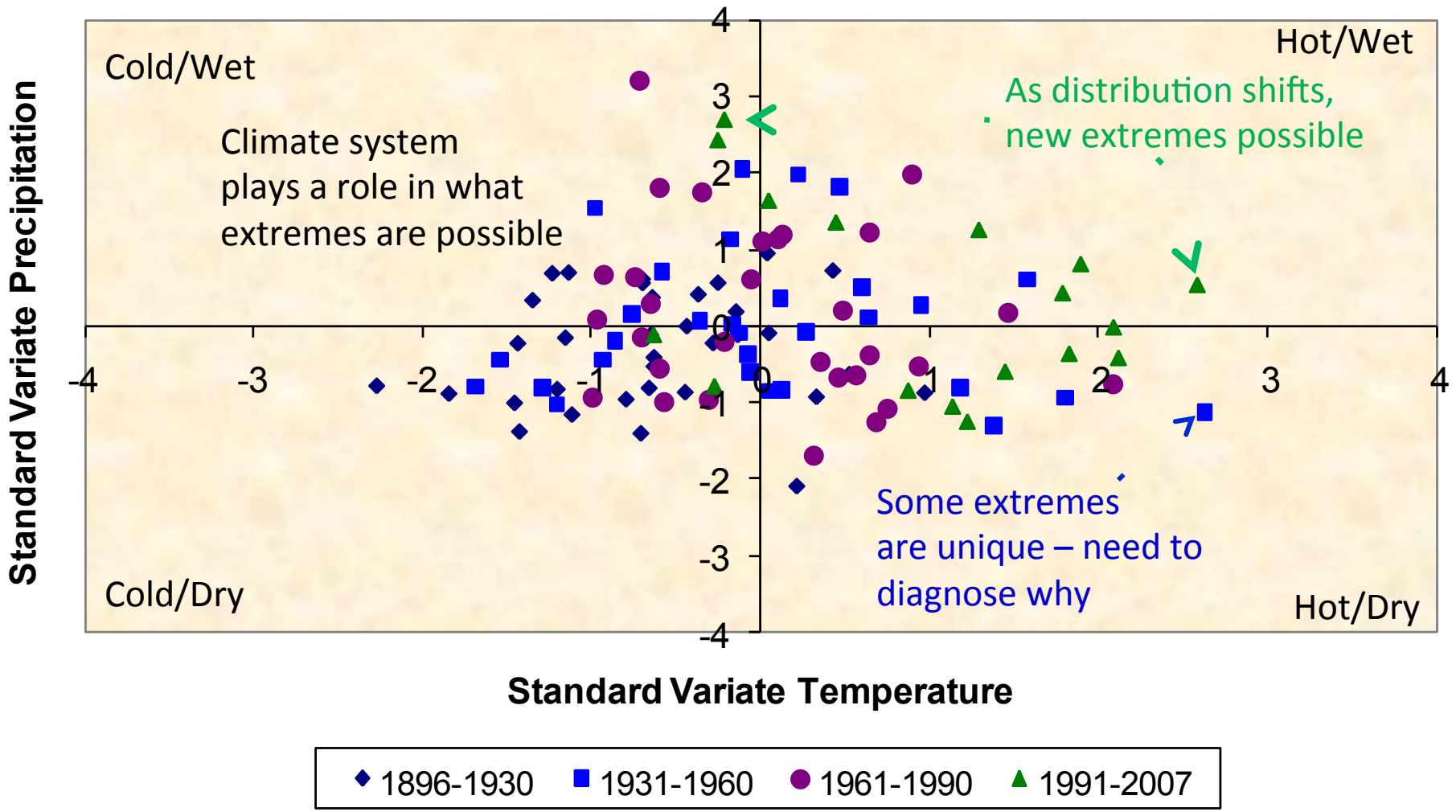
Extremes

- Extremes result from an alignment of multiple processes that interact with each other
- The individual processes are important as well as the interaction of the processes
- The individual process has a relation to the climate system that can change
- The interactions have a relation to the climate system that can change

20th Century Annual Peak 3-Day Flows without the Influence of Reservoirs



Precipitation/Temperature Distribution Plot



End User Activities

- Operations (More time = More Options)
  - Lead Time
  - Magnitude
  - Location
- Planning (Setting Expectations for Operations)
  - Capacity to Respond
  - Response Timing and Scale
  - Available Resources

Tools of the Trade

- Observations
  (right ones in right places at right times?)
- Forecast and Planning Models
  (right processes captured at correct scale?)
- Historical Data (frame of reference)
- Future Projection Data (what to anticipate)
- Decision Support Tools
  (Making information usable in operations)
- Knowledge and Experience

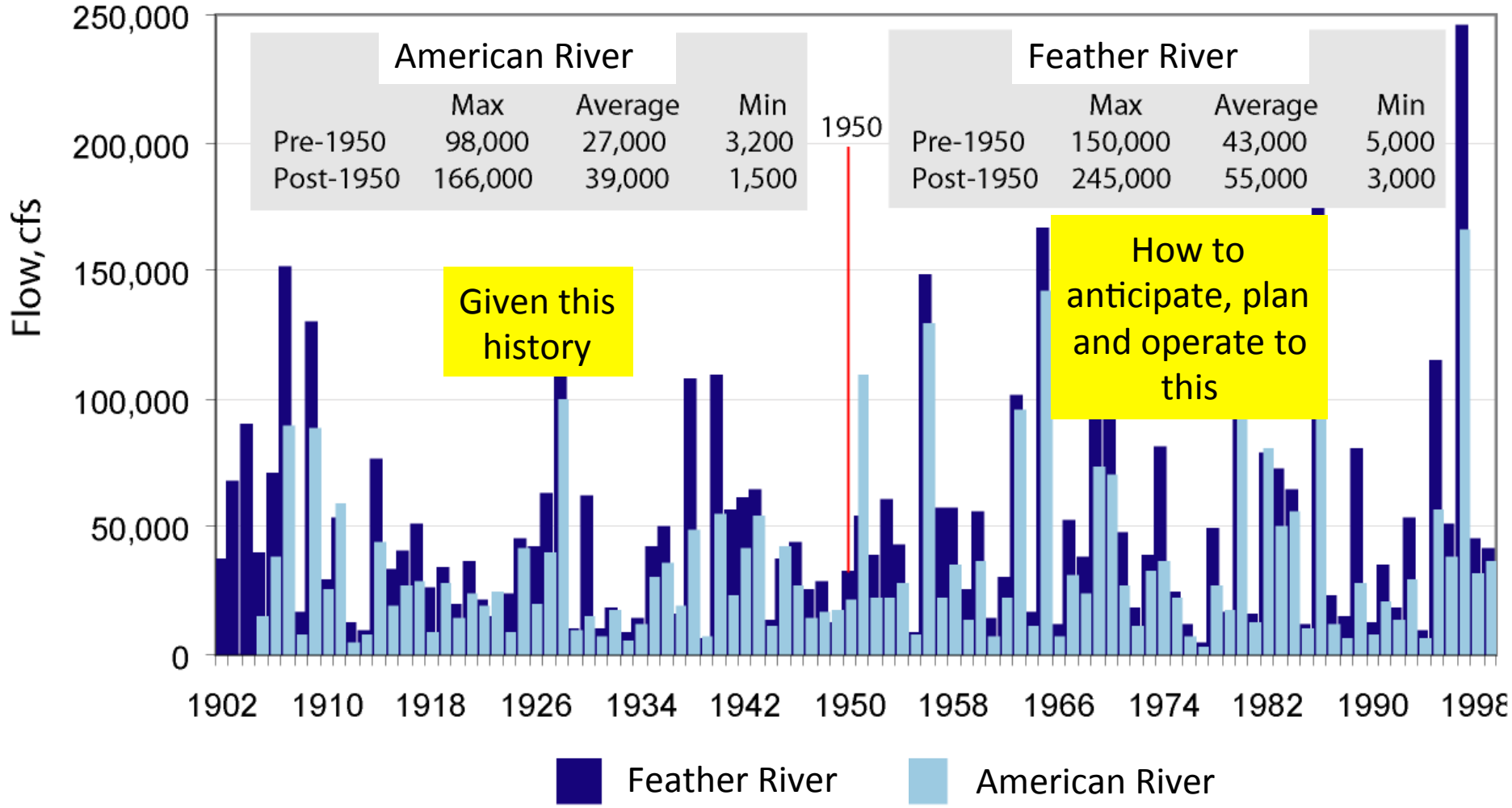
Extremes and Operations

- Inherent Skepticism at Long Lead Times
- Recognition Time Key to Response
  (1997 Flood or 2008 Dry Spring or WY1924)
- Test Boundaries of Capabilities
  (Most tools and procedures are not
  built for extremes)

Planning for Extremes

- Historical Record – Don't Ignore It
- Future Projections – What, How, When
- Thresholds and Consequences Important
- Investment Timeline and Economics vs. More Time More Options
- Worst Case Scenarios

20th Century Annual Peak 3-Day Flows without the Influence of Reservoirs

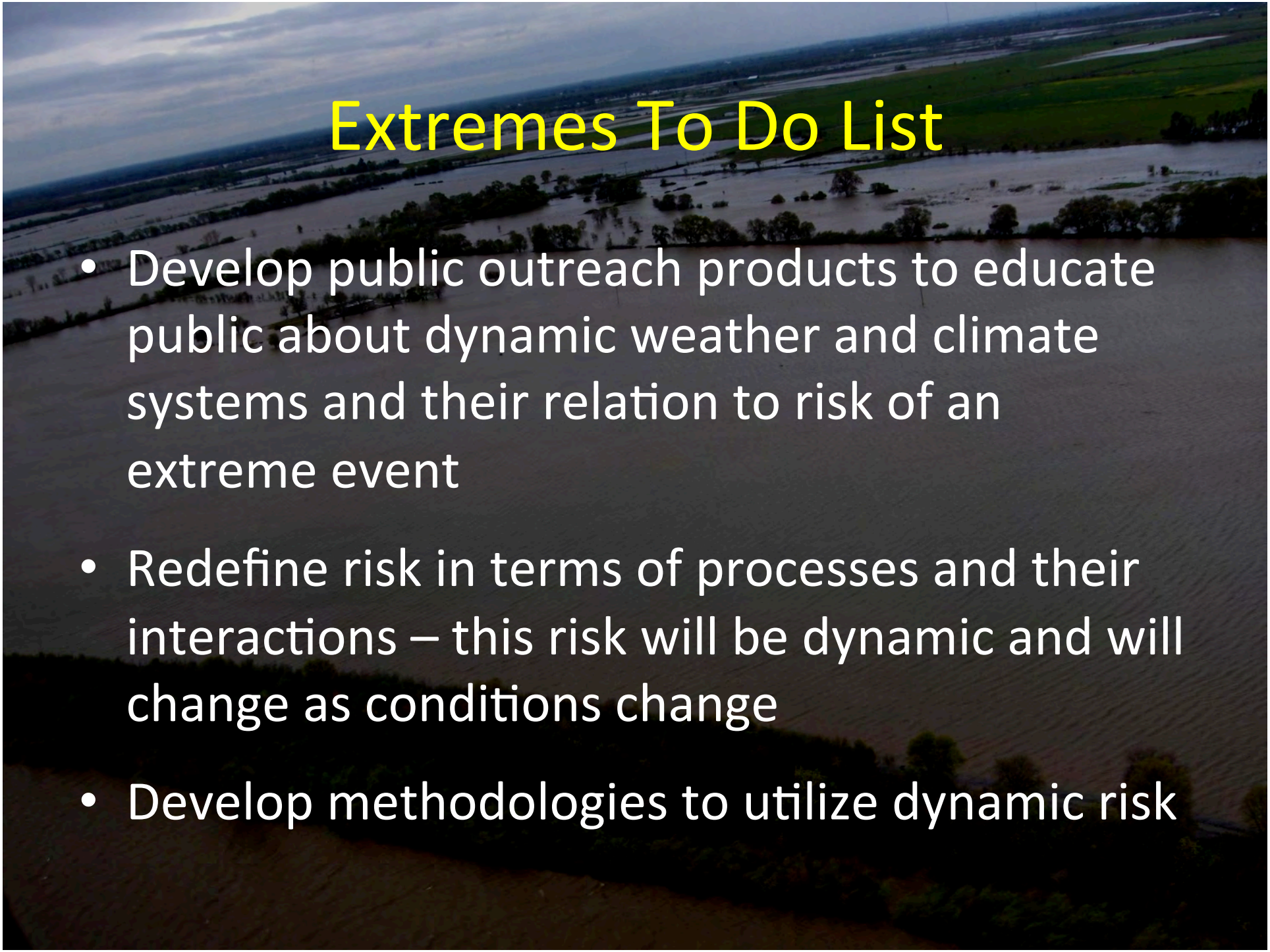


Extremes To Do List

- Develop observing system elements that can track processes and change
- Identify and gain understanding of processes that line up to create extremes and their interactions
- Identify evolution of processes and their interactions as climate changes

Extremes To Do List

- Develop operations support tools to facilitate identification of extreme conditions
  - Lead time
  - Location
  - Magnitude
- Develop planning support tools to facilitate description of extremes and their role in various planning activities
- Understand system thresholds and their role



Extremes To Do List

- Develop public outreach products to educate public about dynamic weather and climate systems and their relation to risk of an extreme event
- Redefine risk in terms of processes and their interactions – this risk will be dynamic and will change as conditions change
- Develop methodologies to utilize dynamic risk


Questions?
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