

# Flow Modification in the Nation's Streams and Rivers

National Water-Quality Assessment Project

The Quality of Our Nation's Waters

## Flow Modification in the Nation's Streams and Rivers



National Water-Quality Program  
National Water-Quality Assessment Project

Circular 1461

U.S. Department of the Interior  
U.S. Geological Survey

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David Wolock, USGS

Greg McCabe, USGS

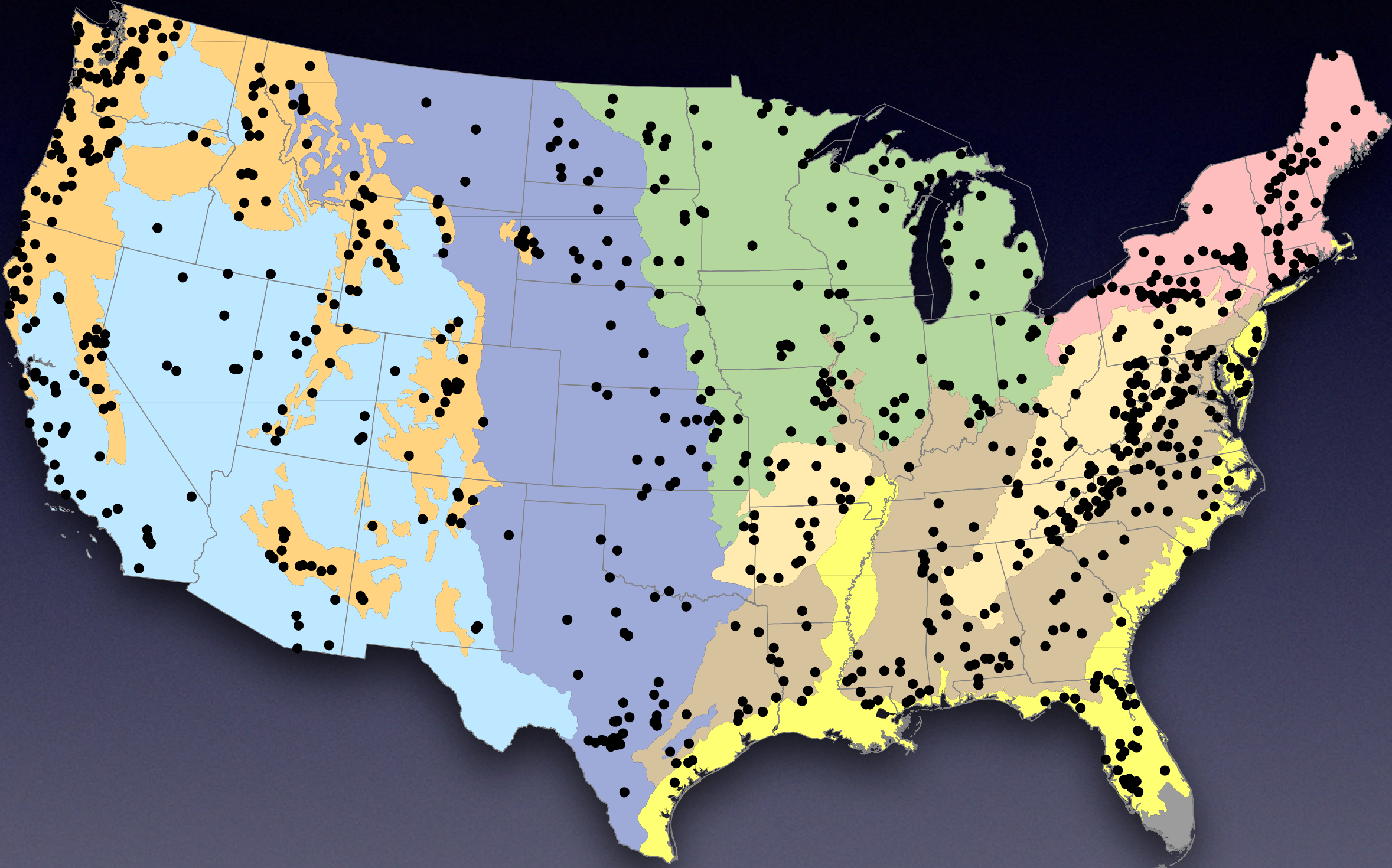
Ken Eng, USGS

Chris Konrad, USGS

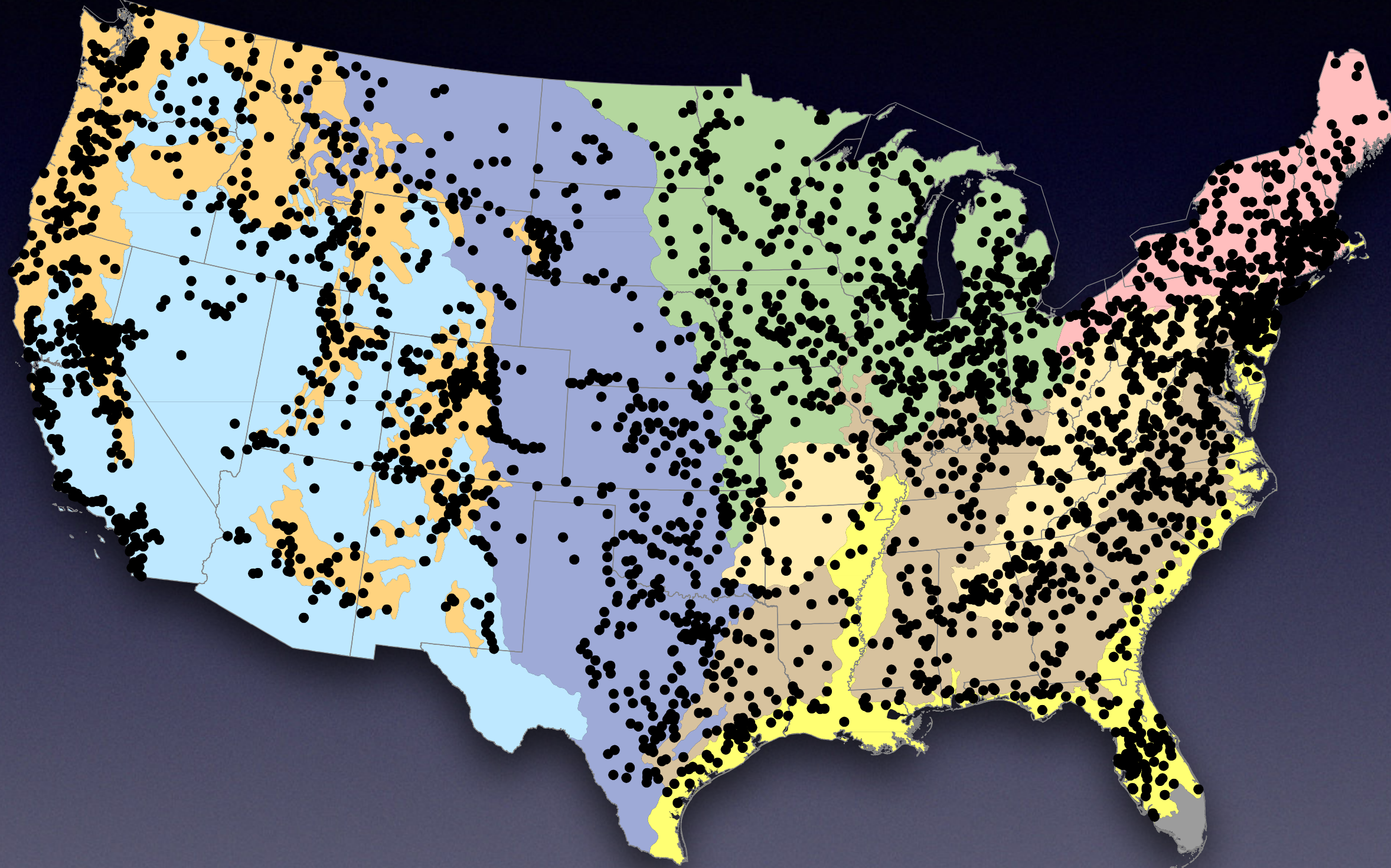
Ted Grantham, UC-Berkeley

# Natural Flow (reference) Sites

# Assessed Sites

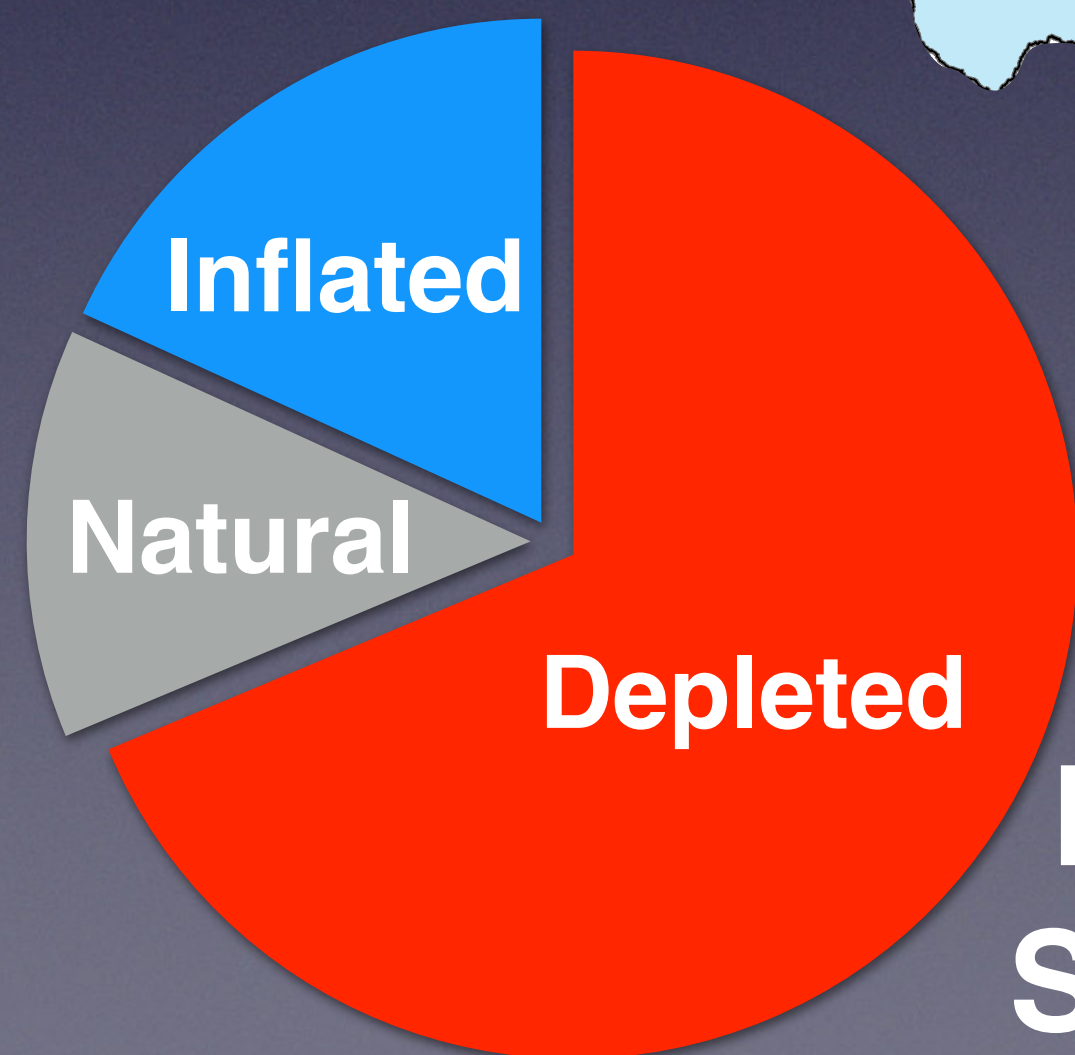
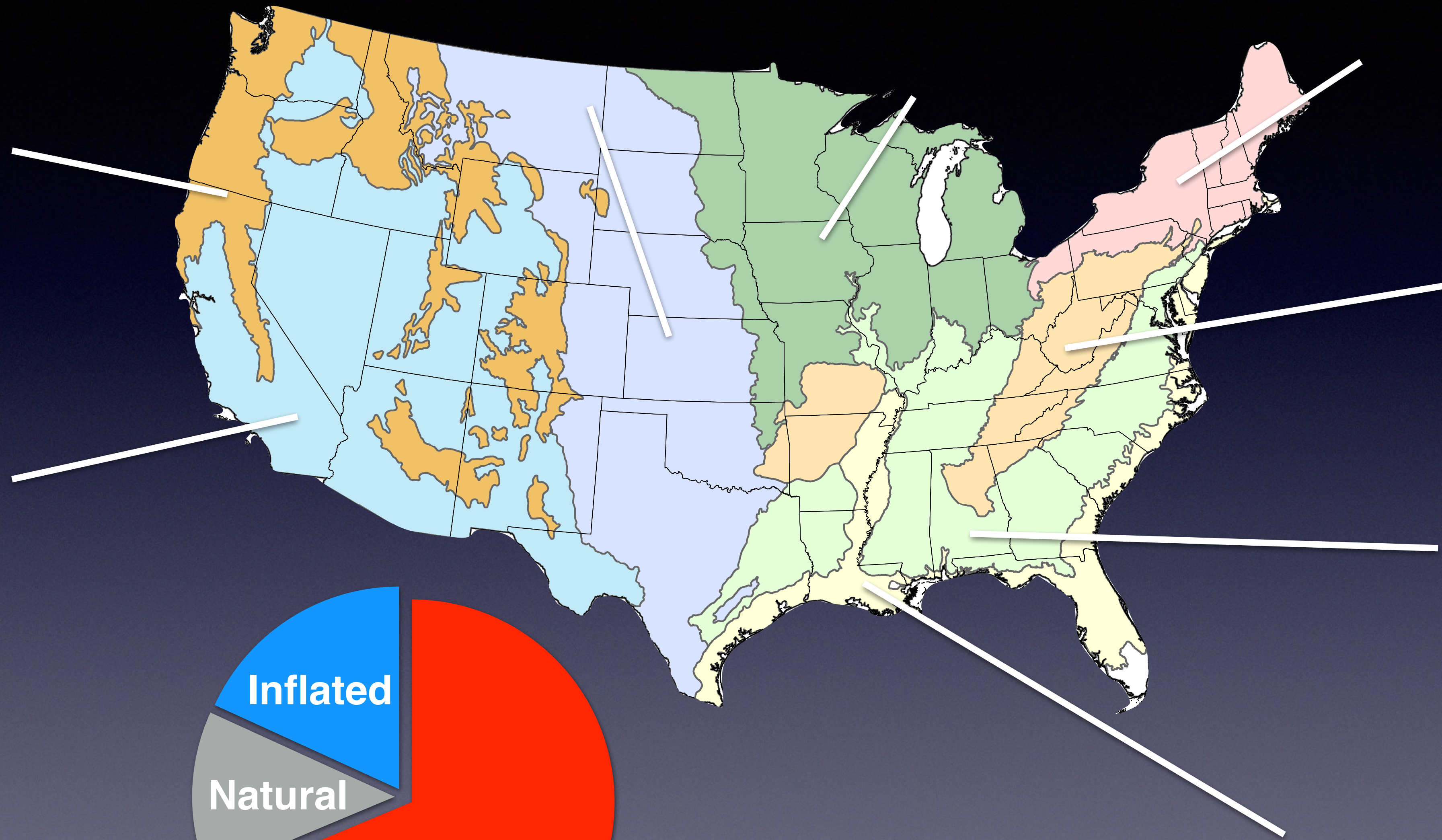


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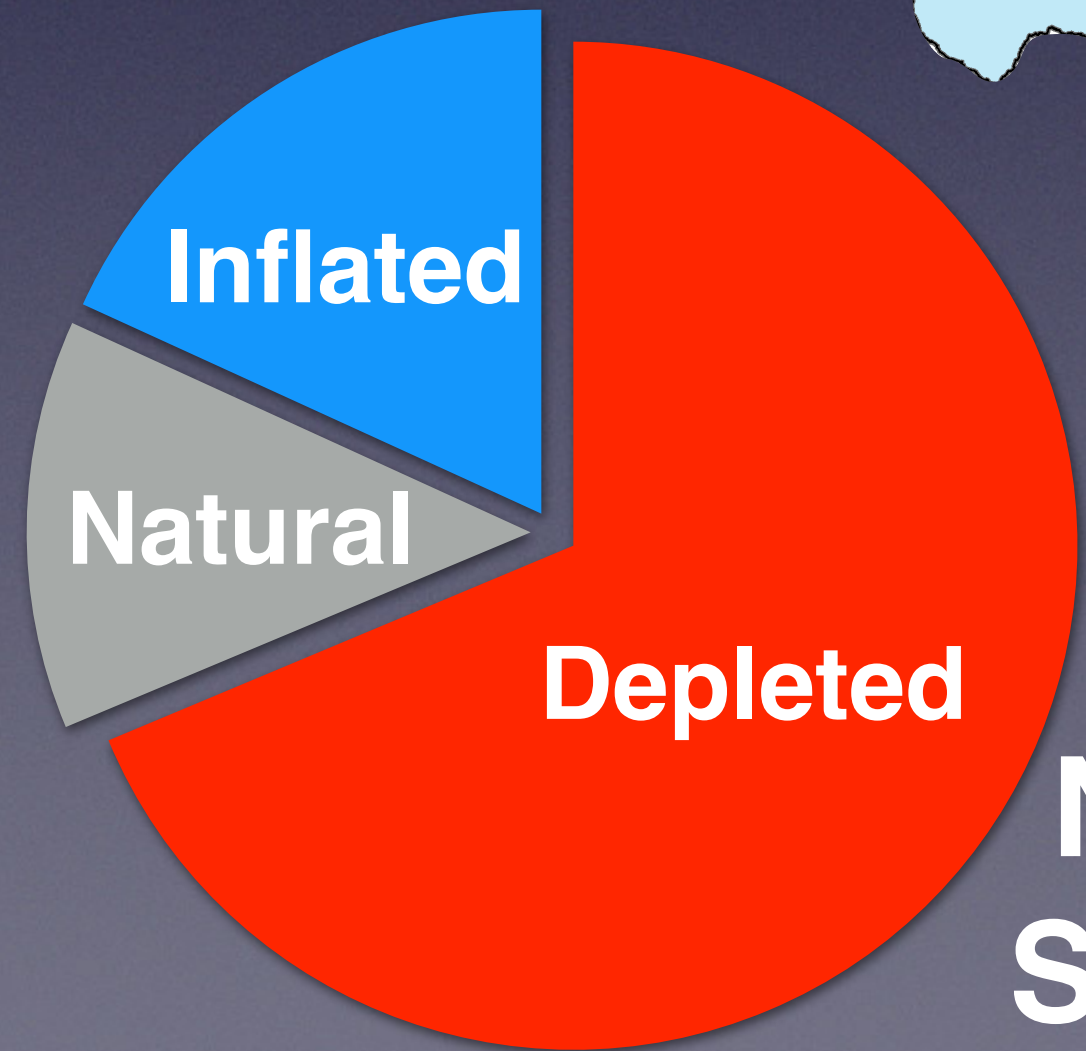
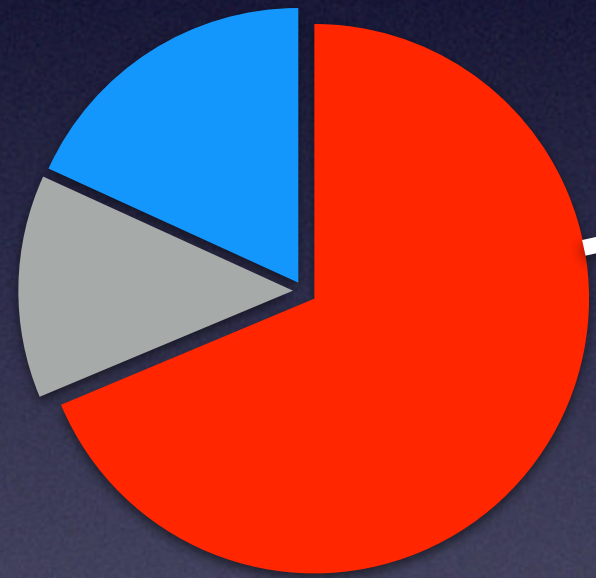
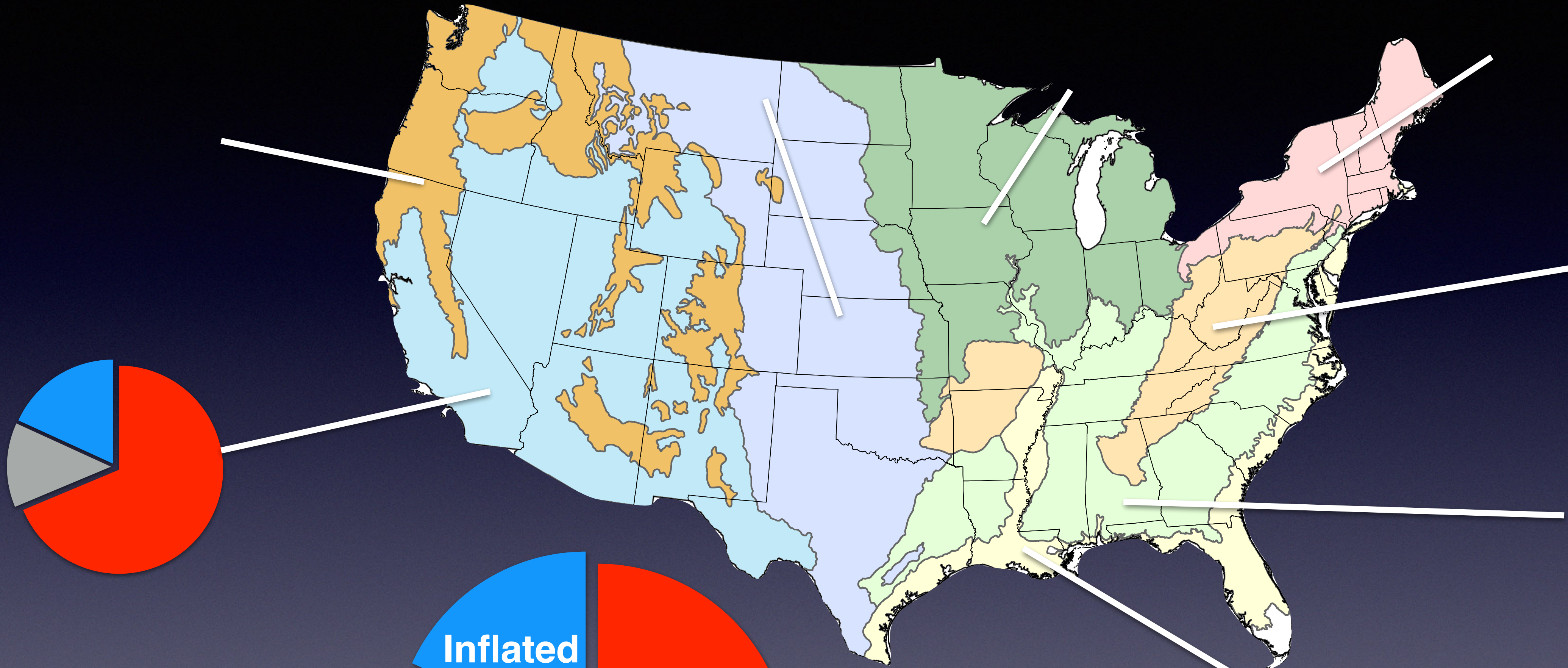
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# Low-Flow Magnitude



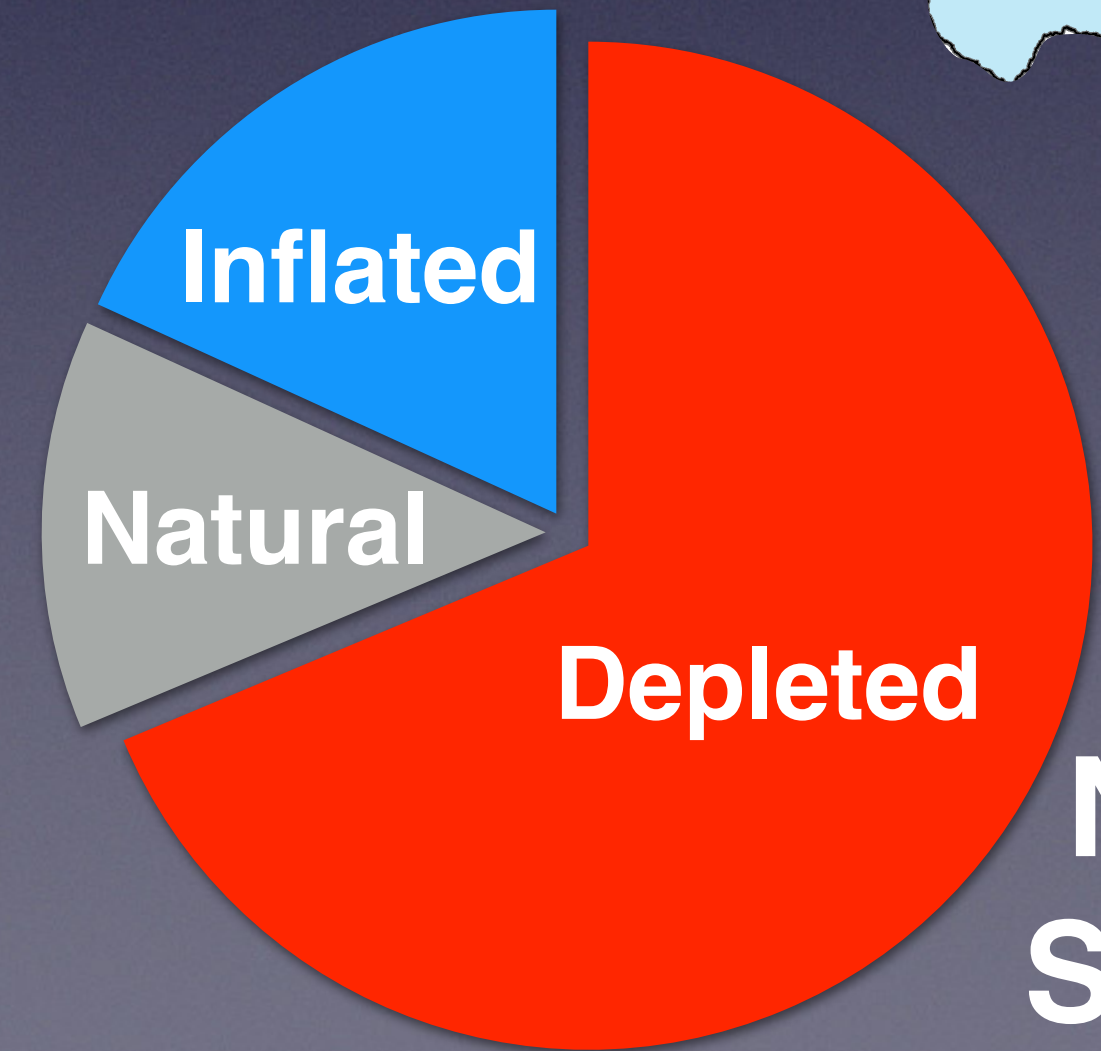
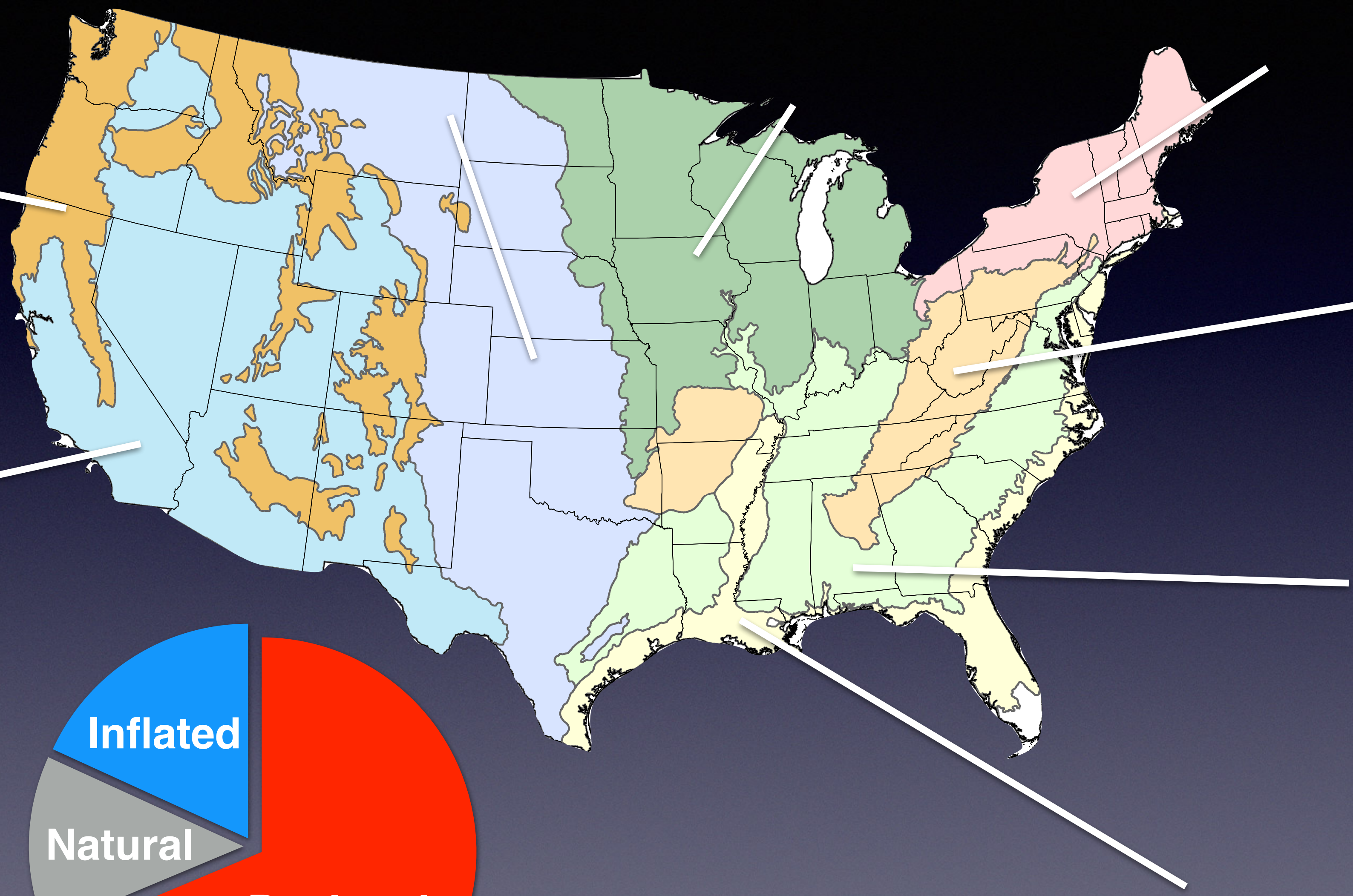
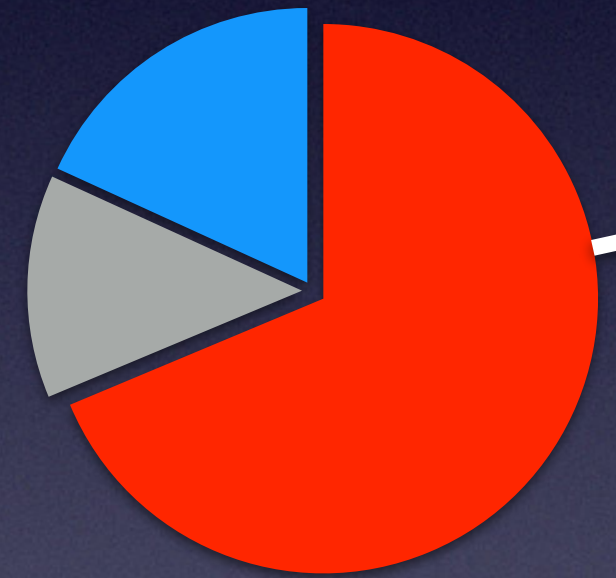
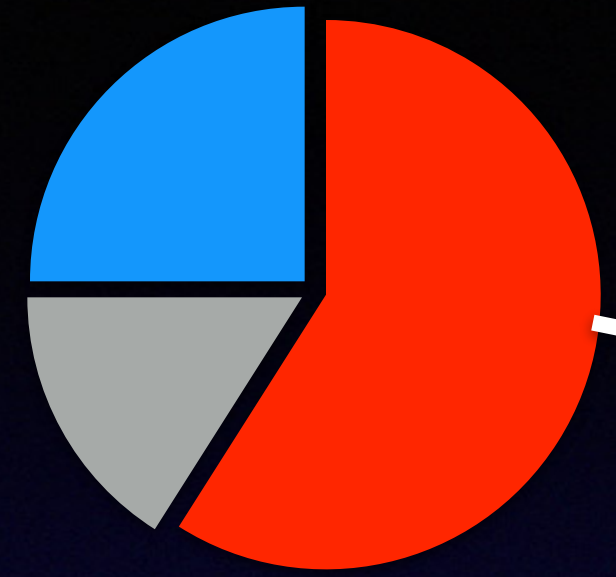
National  
Summary

# Low-Flow Magnitude



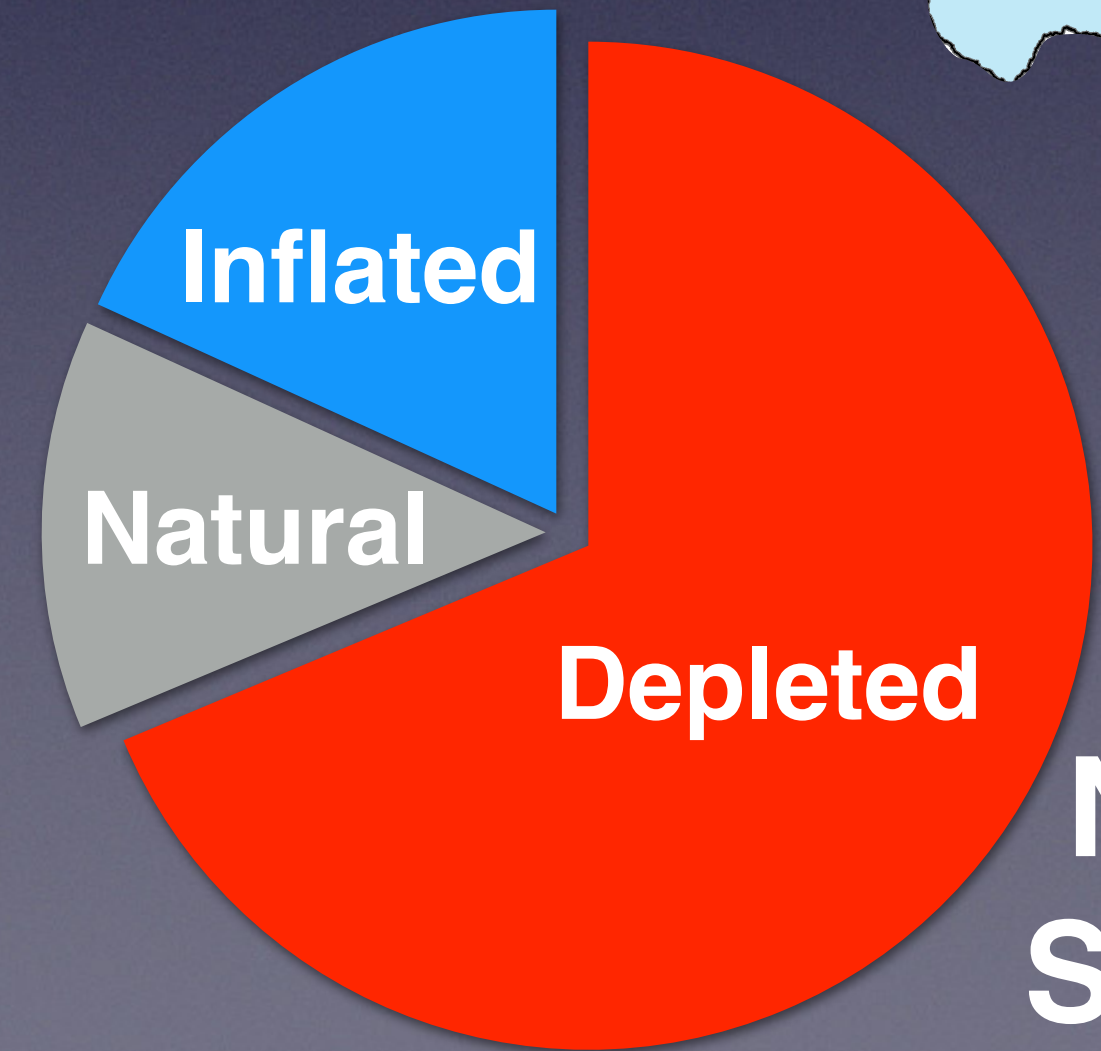
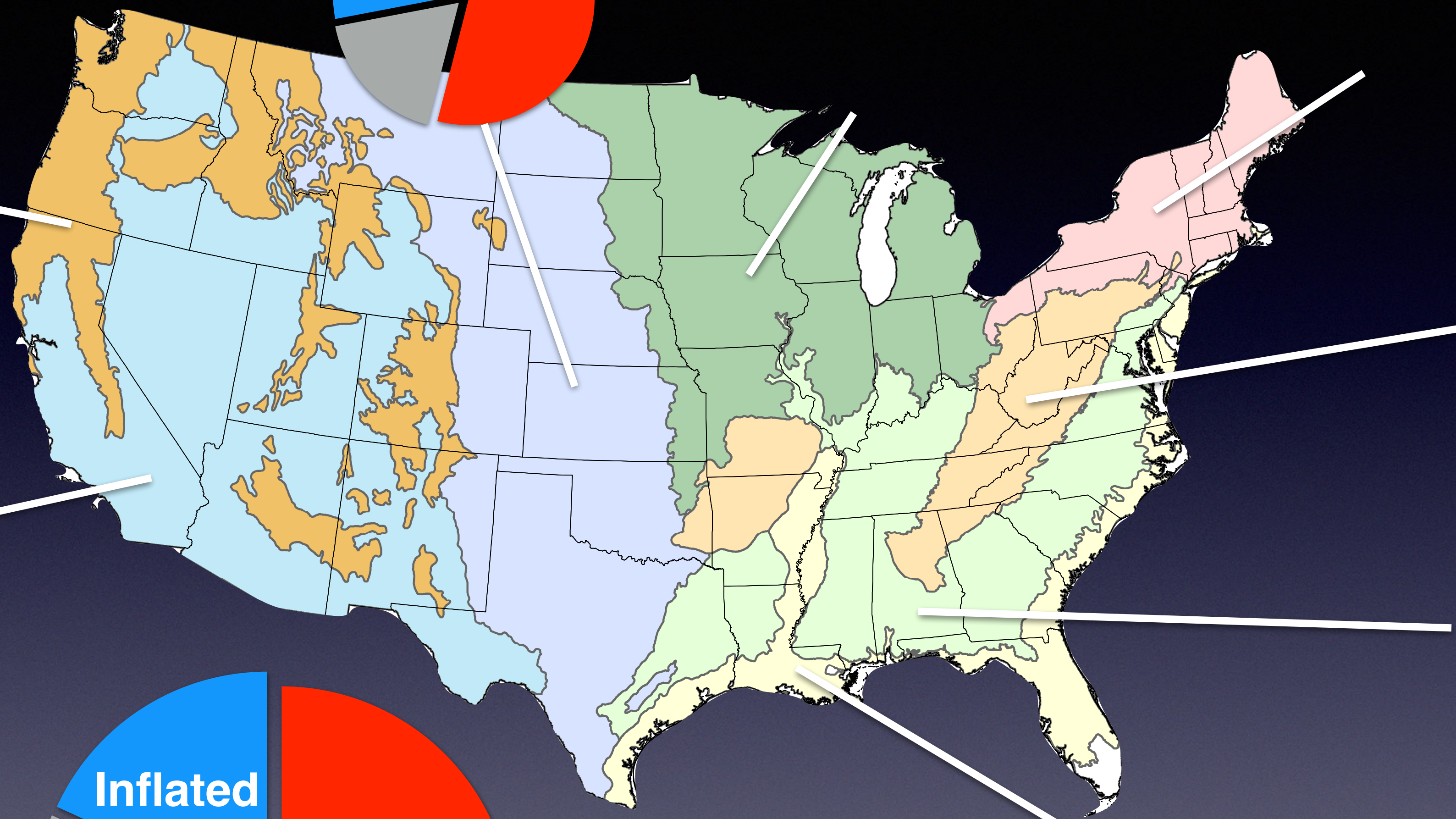
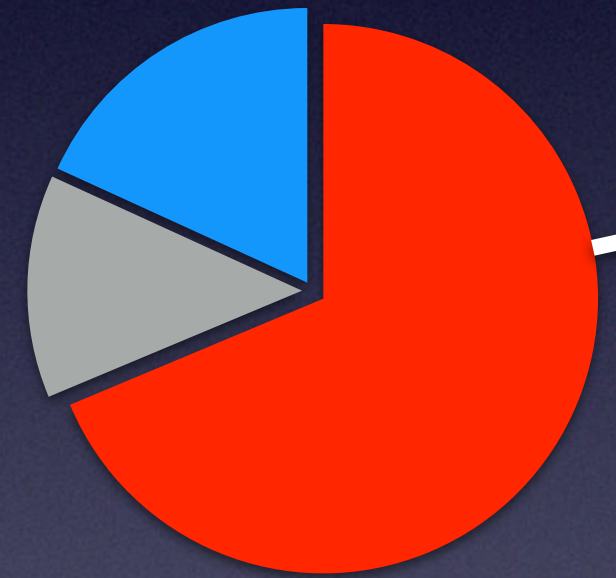
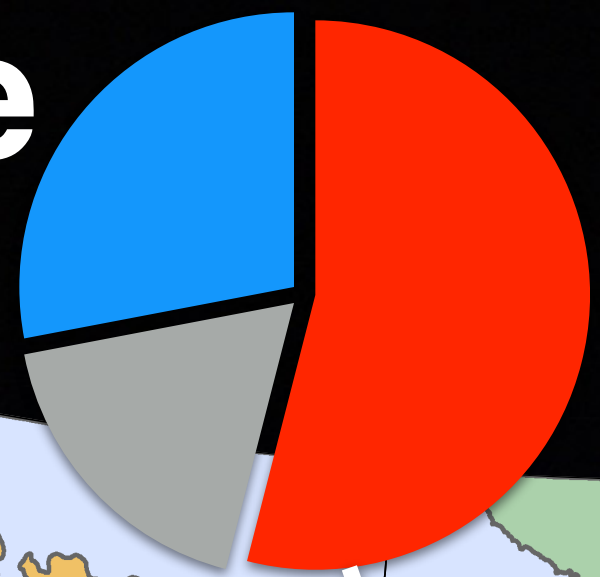
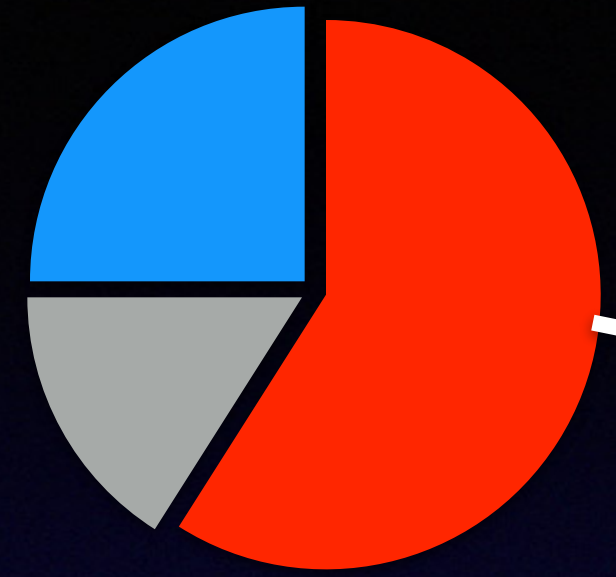
**National  
Summary**

# Low-Flow Magnitude



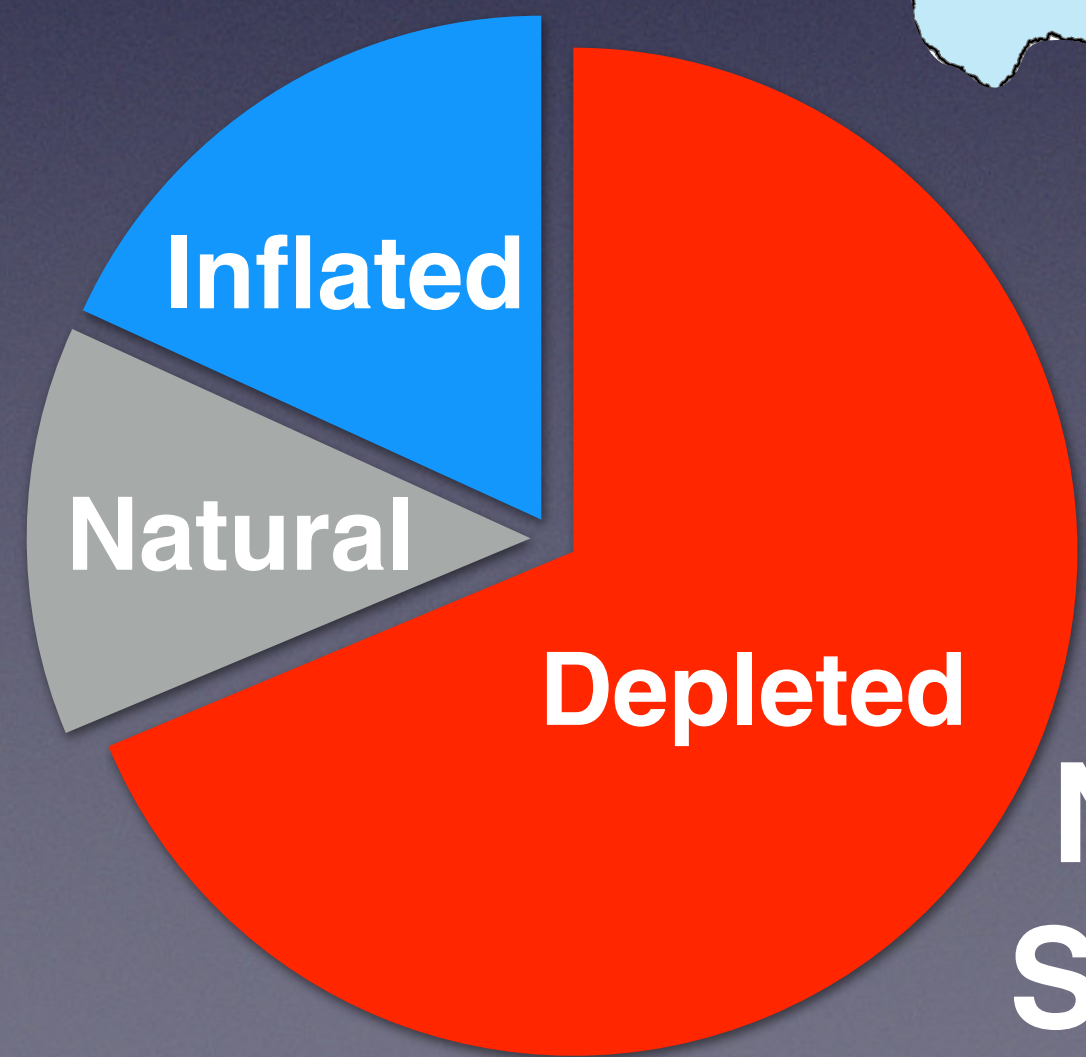
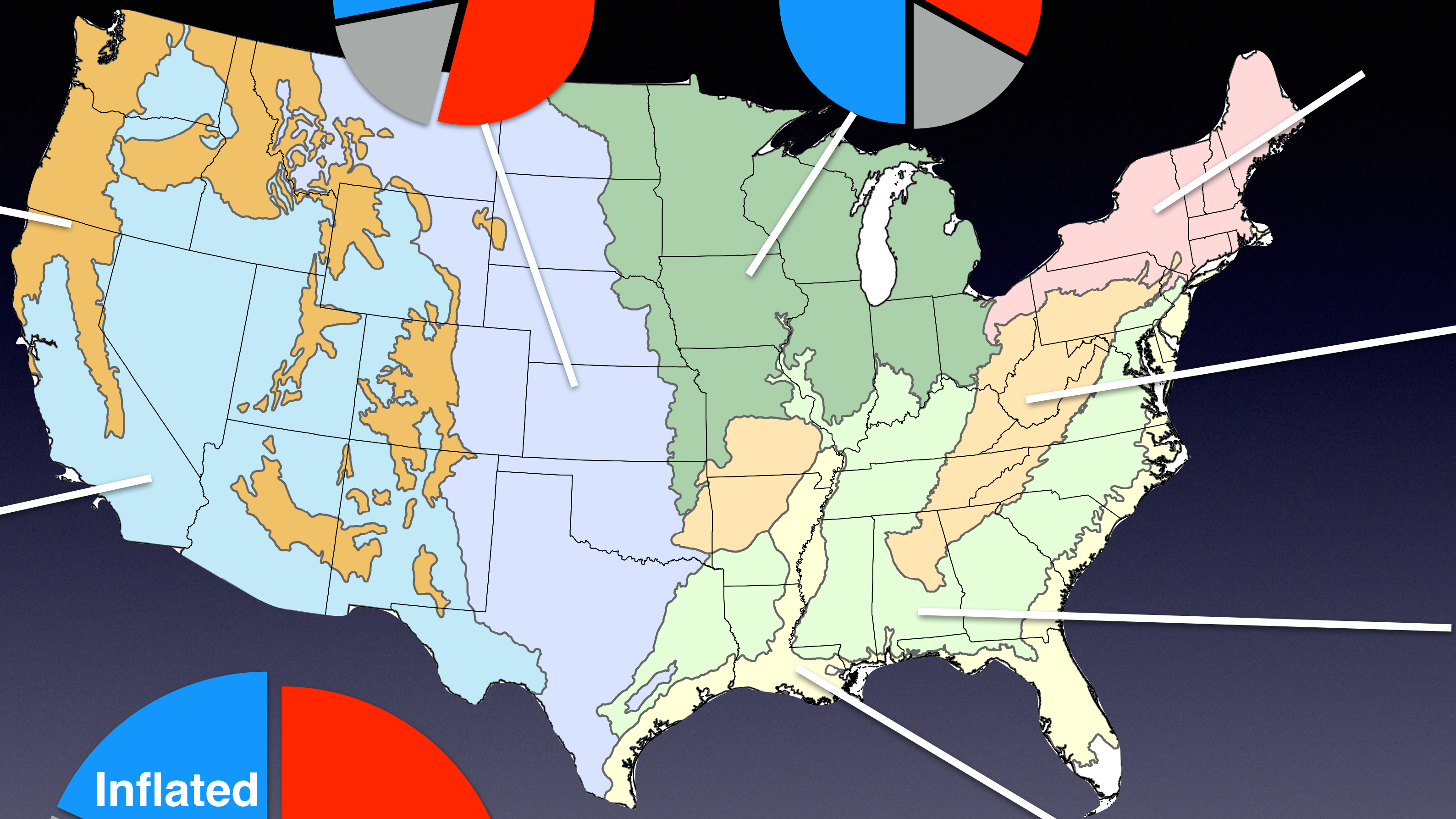
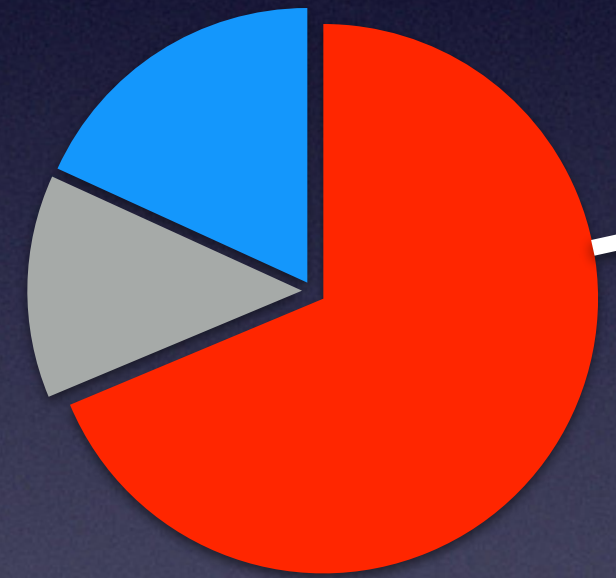
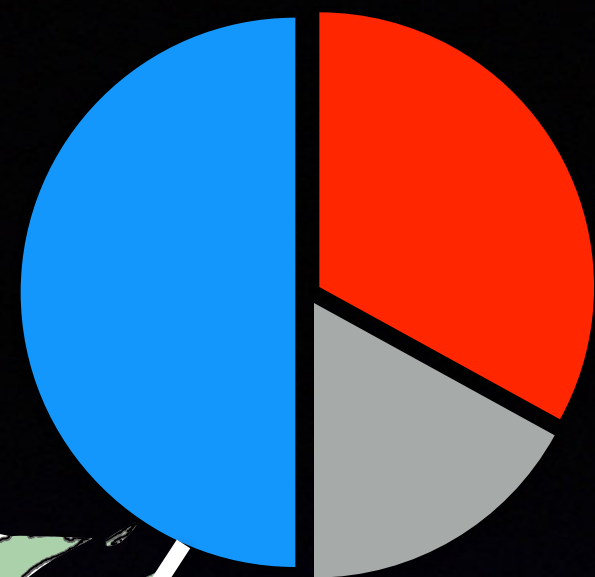
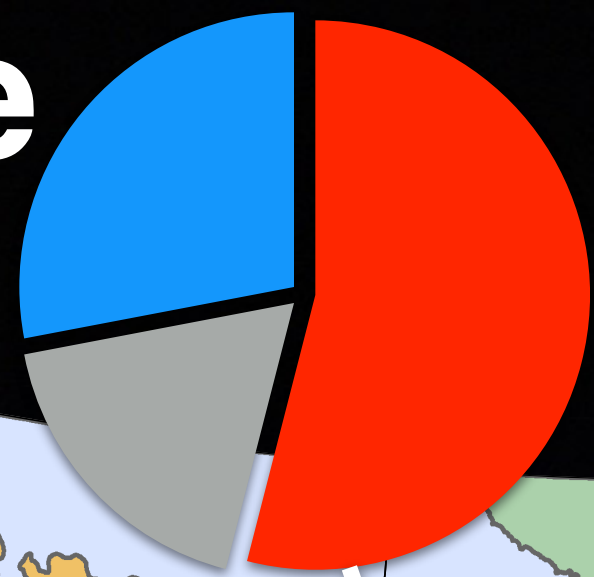
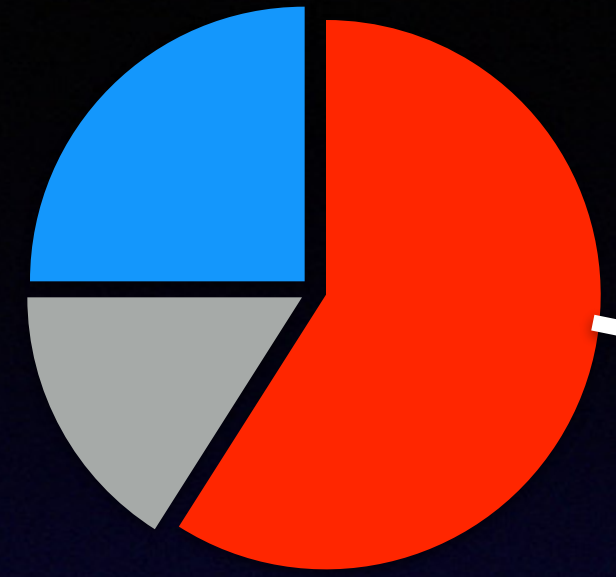
National  
Summary

# Low-Flow Magnitude



**National  
Summary**

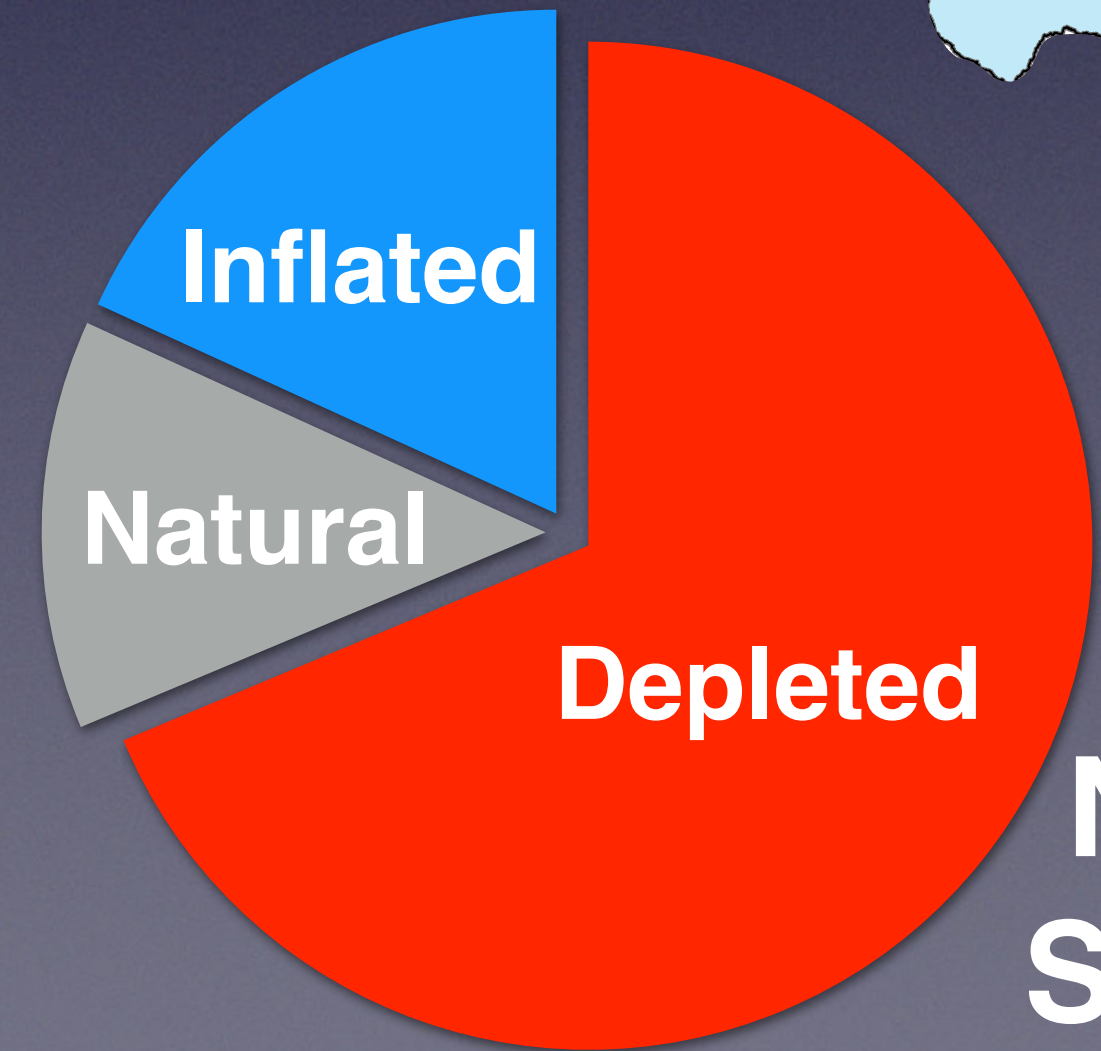
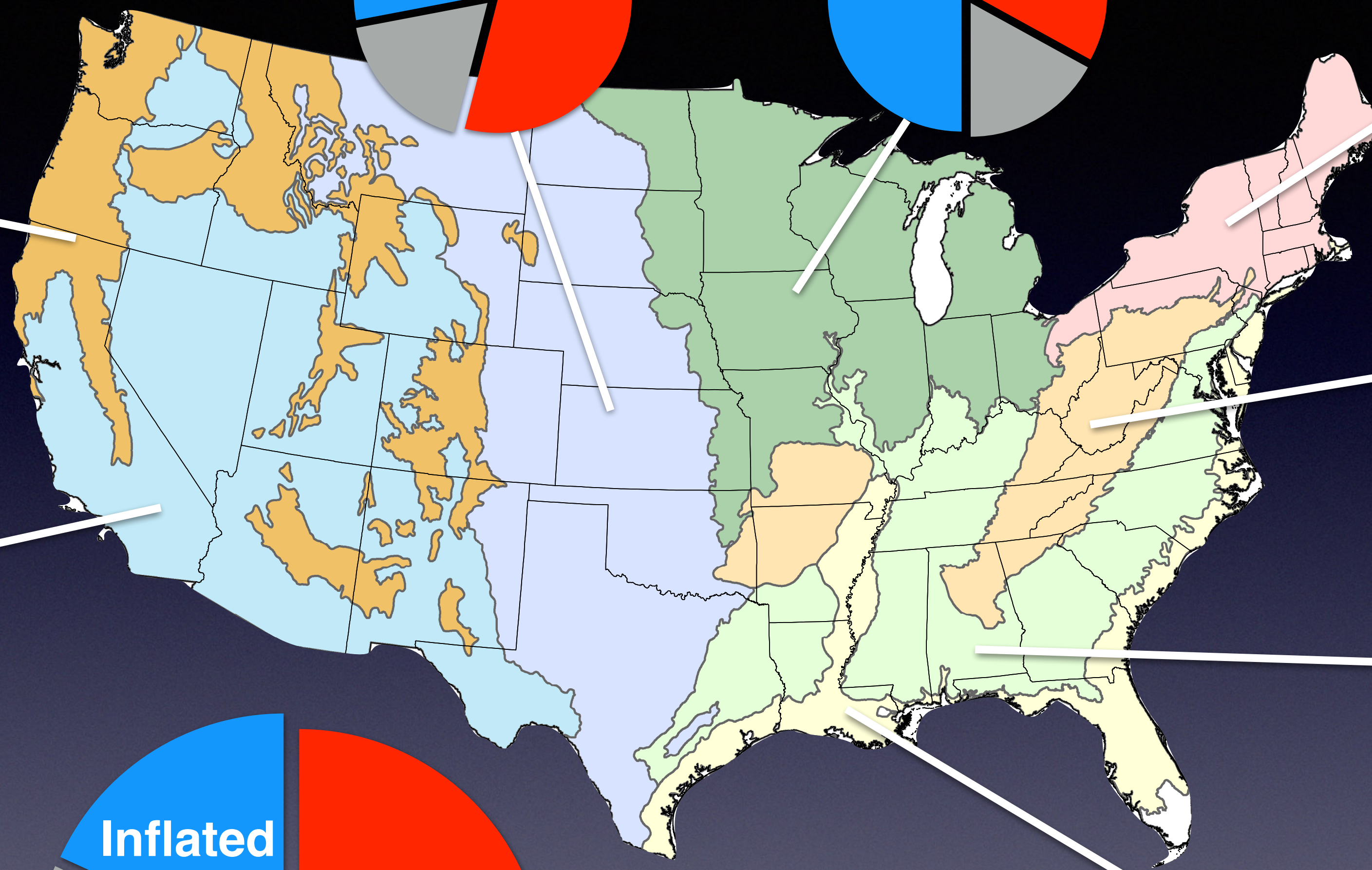
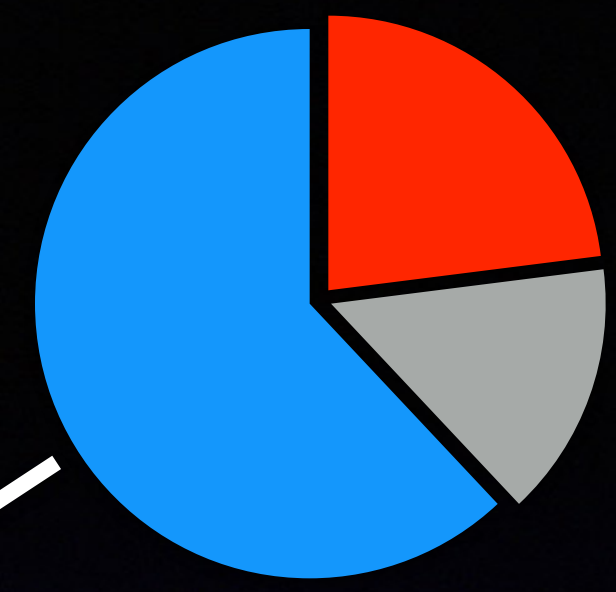
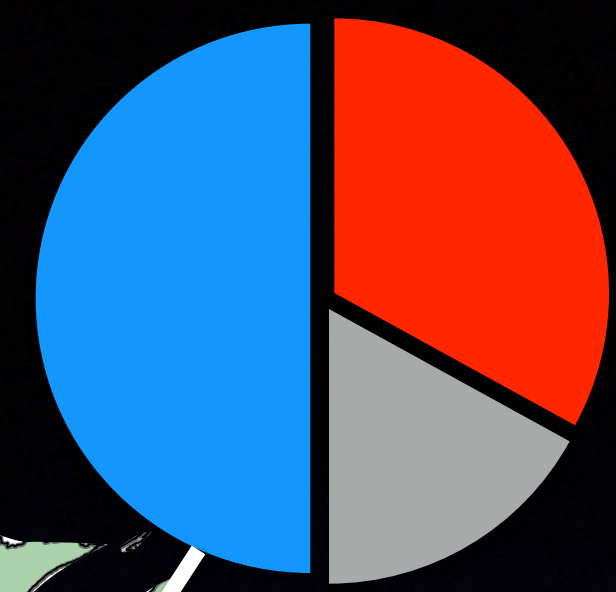
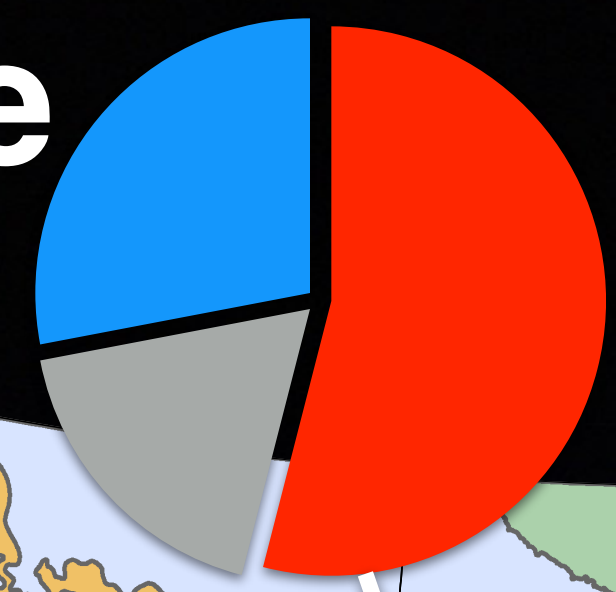
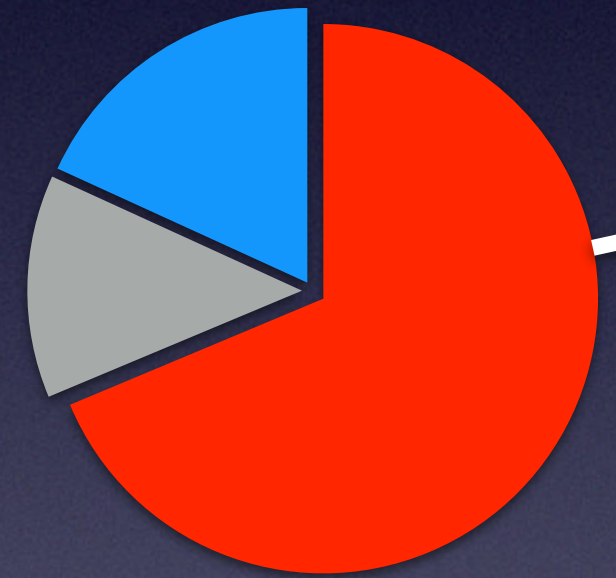
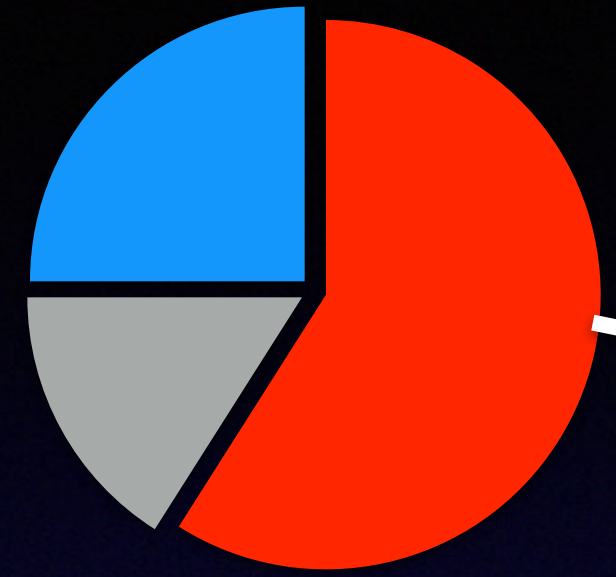
# Low-Flow Magnitude



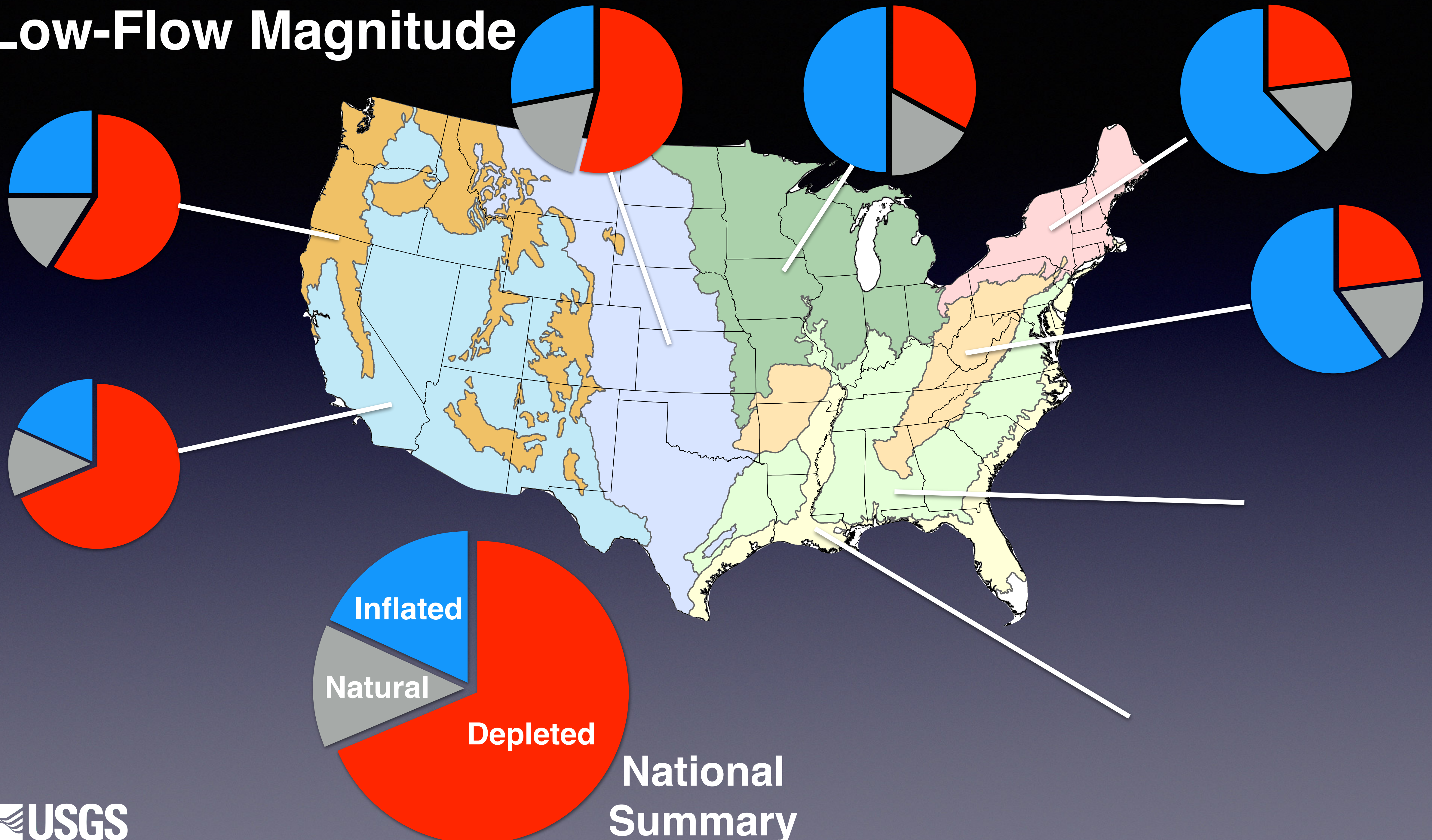
National  
Summary



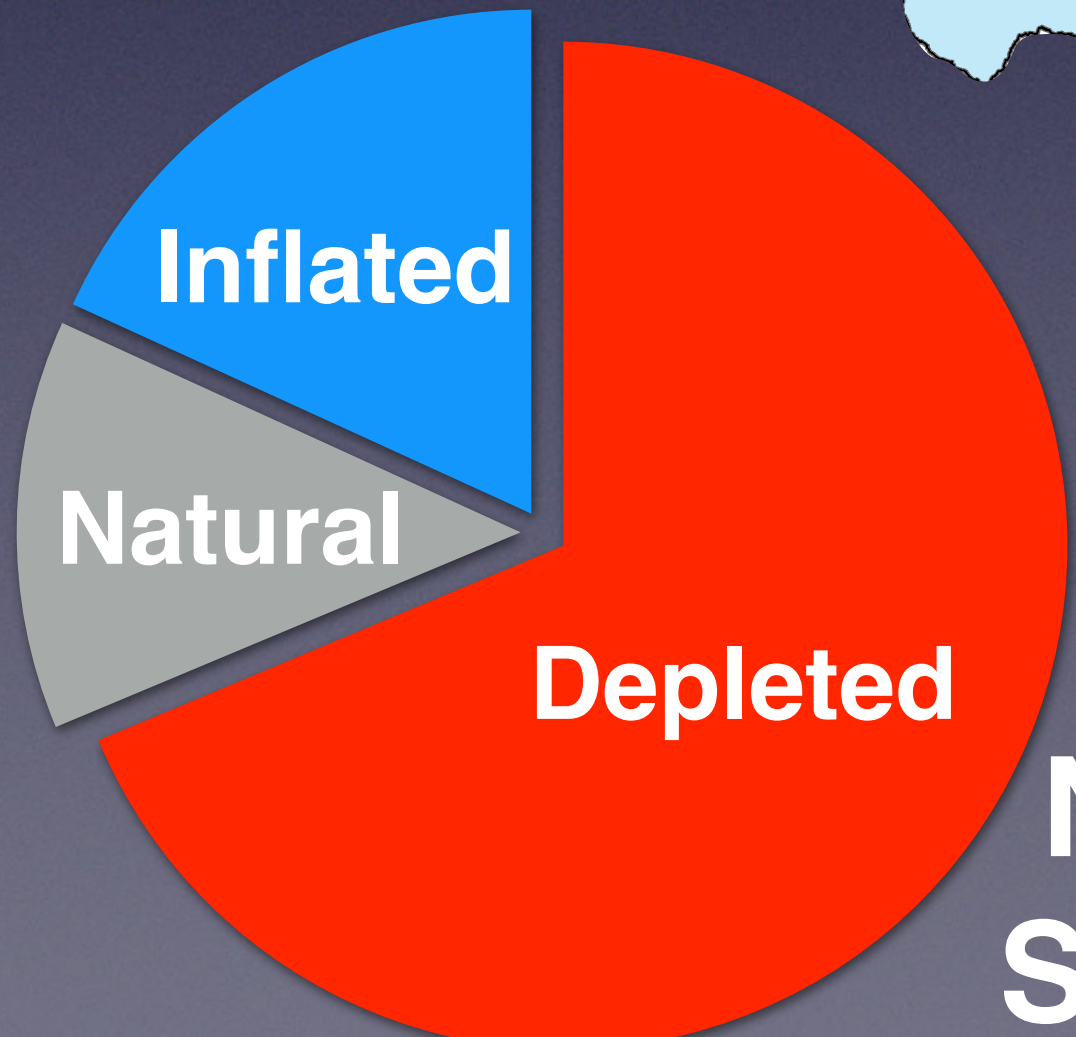
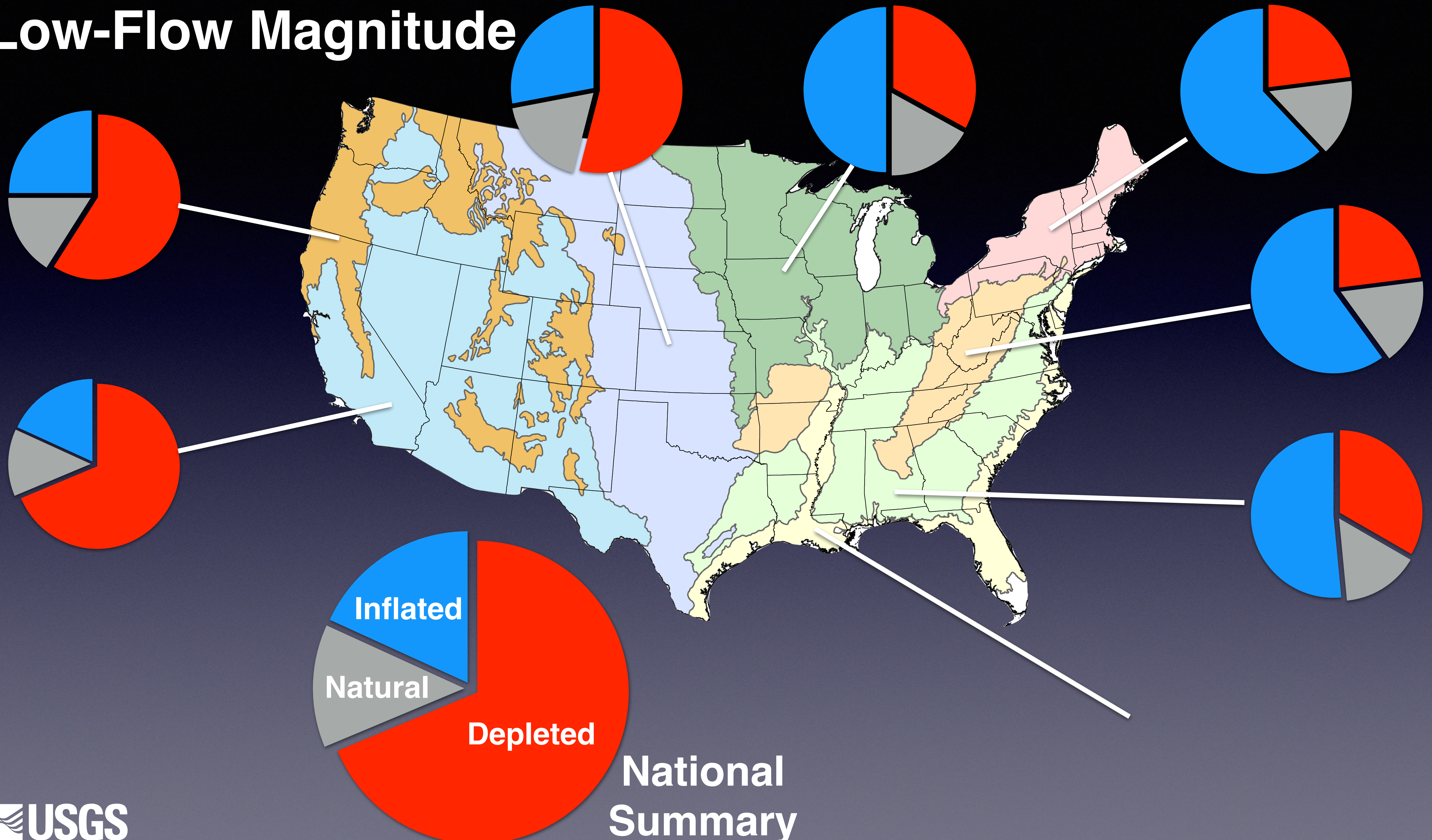
# Low-Flow Magnitude



# Low-Flow Magnitude

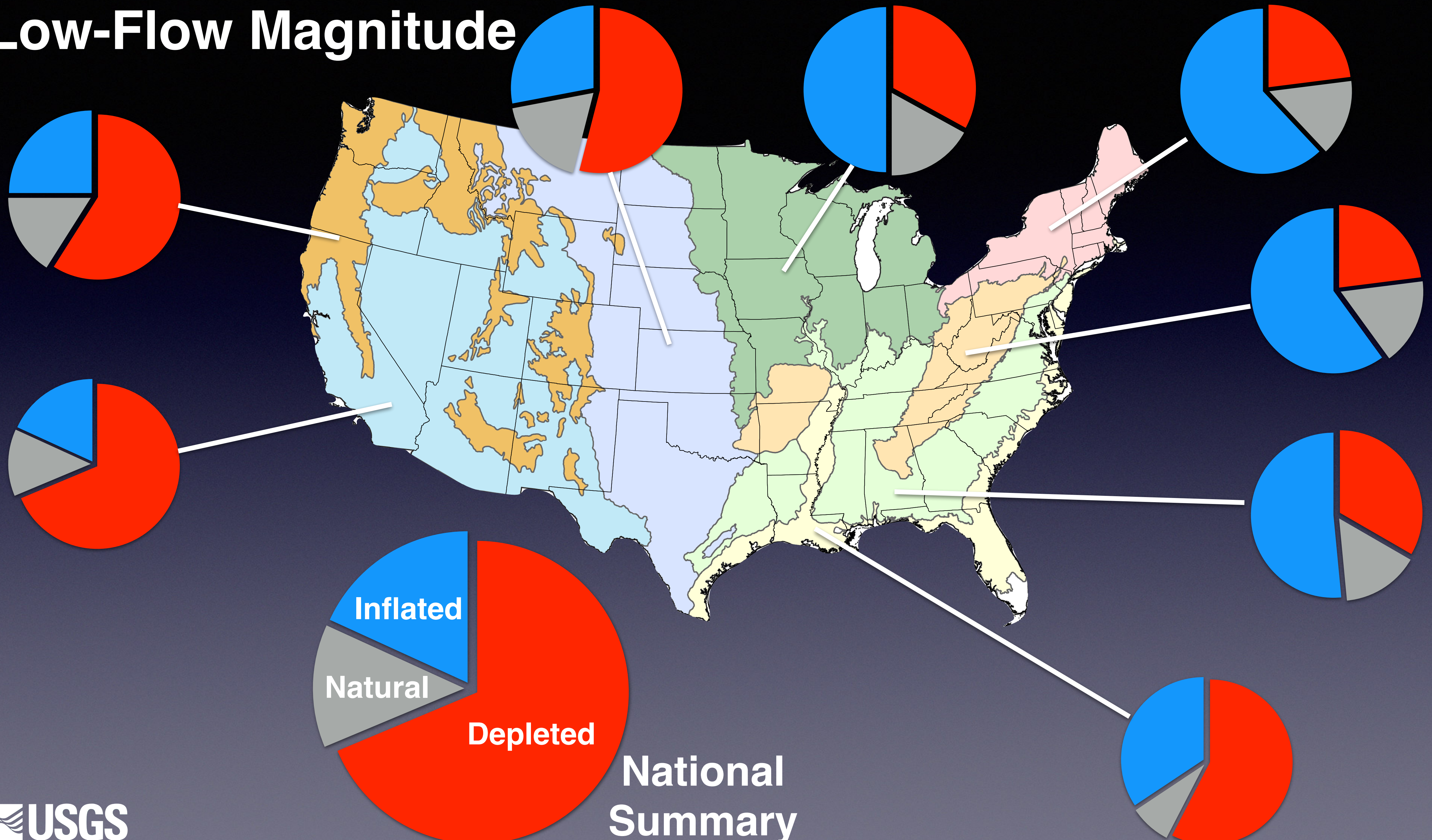


# Low-Flow Magnitude

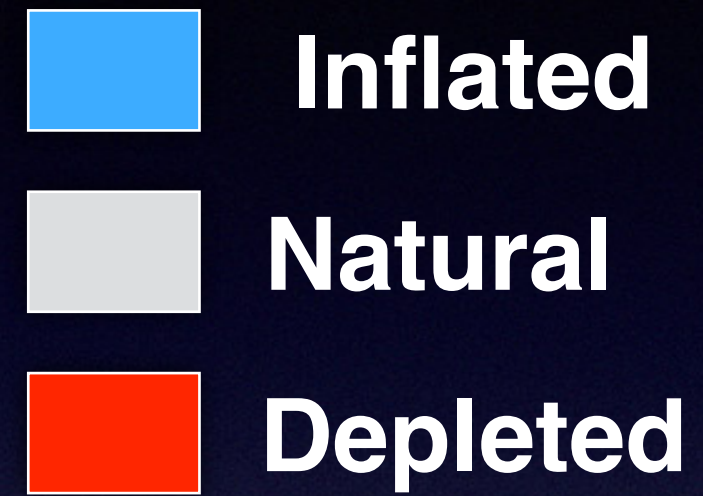


**National  
Summary**

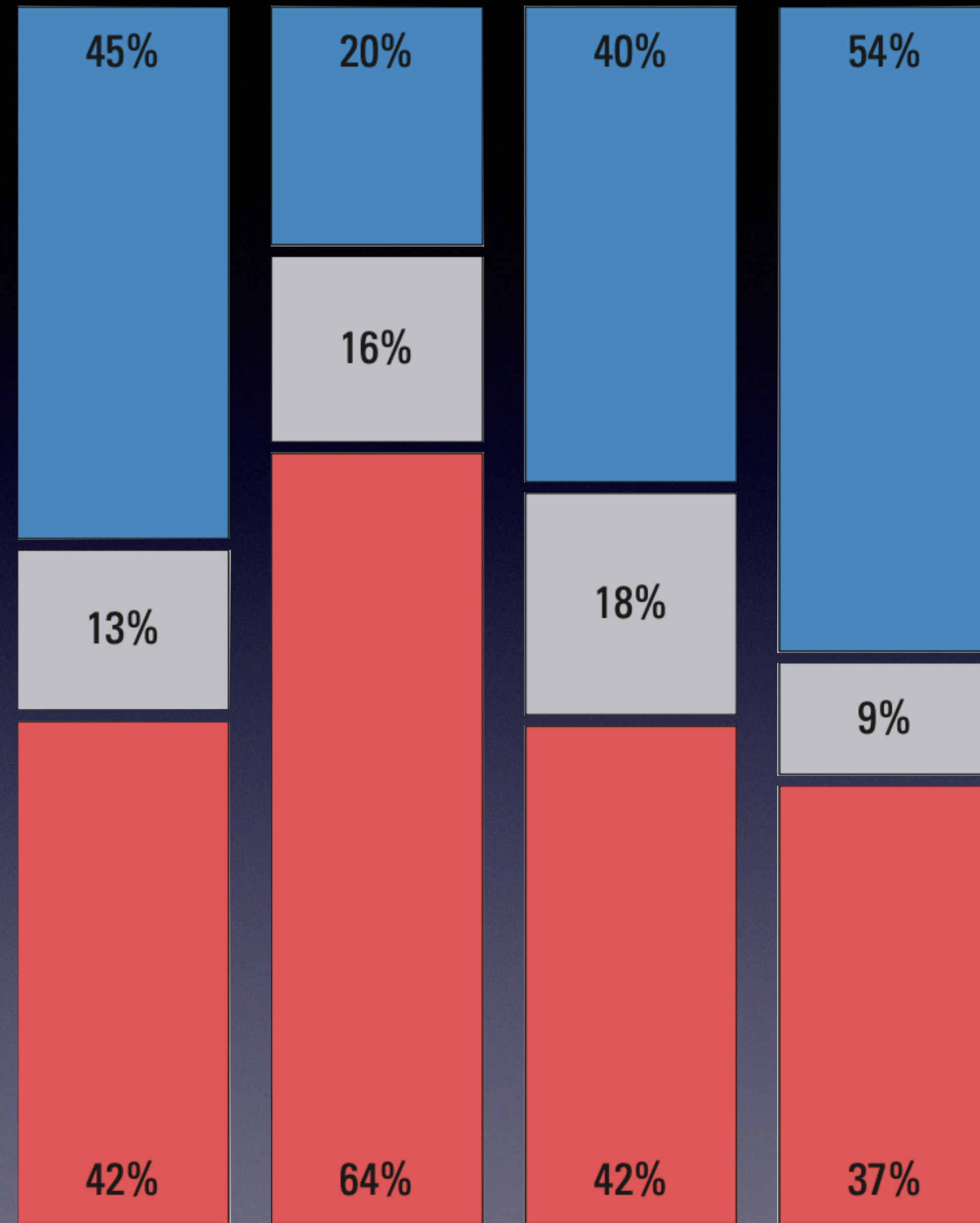
# Low-Flow Magnitude



# Low-Flow Magnitude



Percent  
of sites



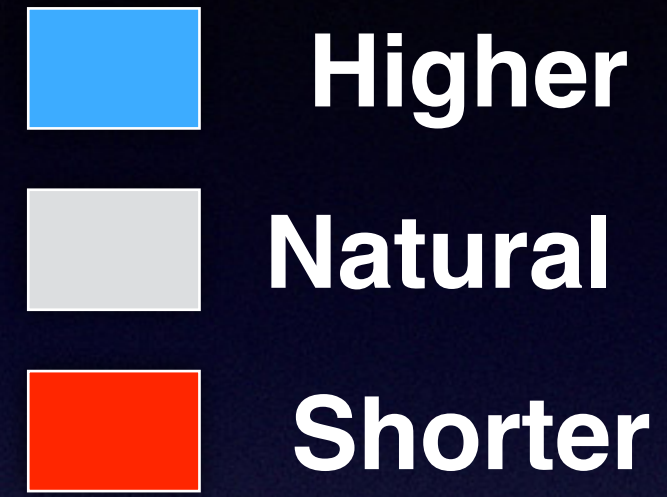
Reser-  
voir

Irri-  
gation

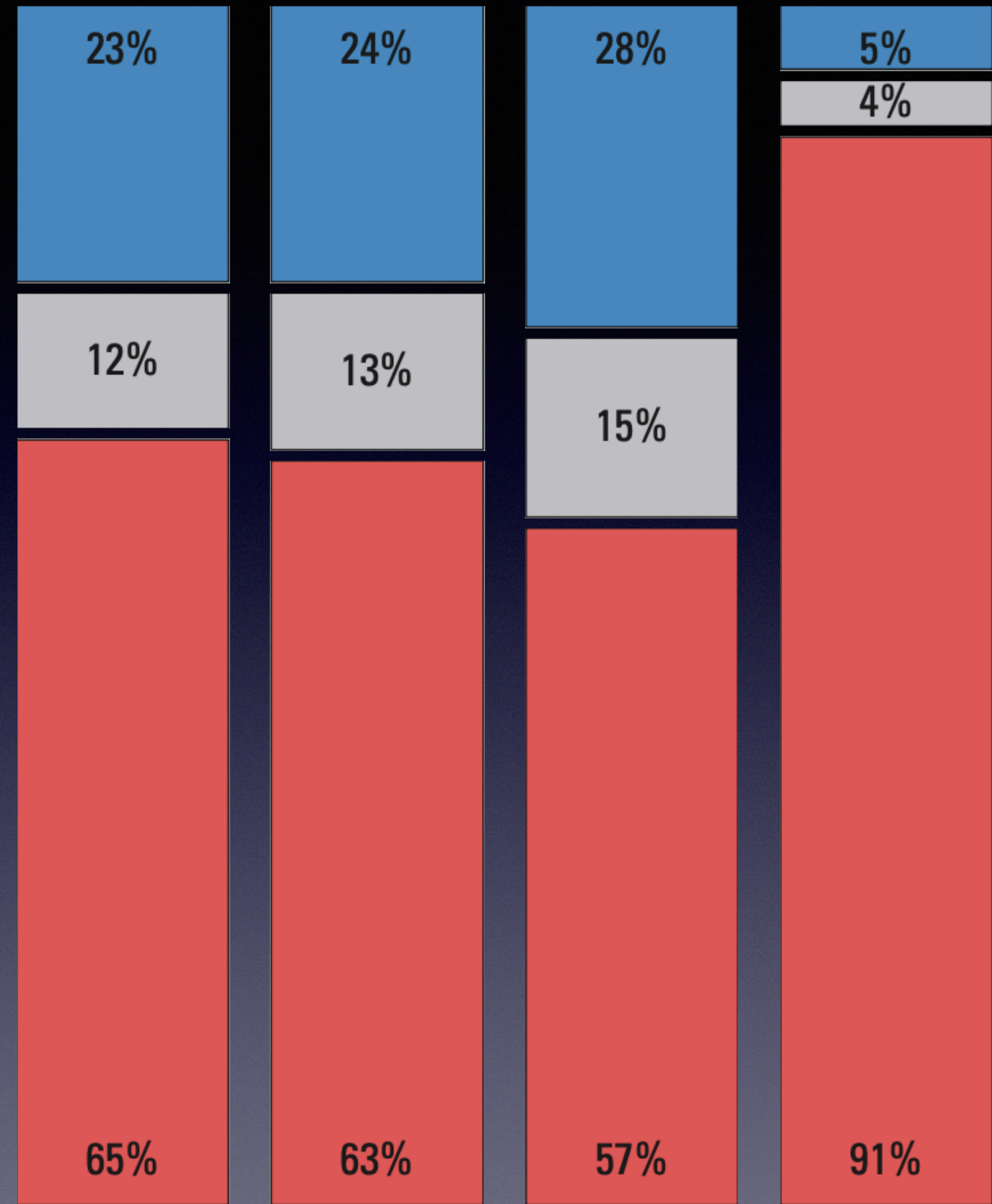
Row  
crop

Urban

# Low-Flow Duration



Percent of sites



Reser-  
voir

Irri-  
gation

Row  
crop

Urban

# Changes in High-Flow Timing (Climate)

From spring and winter to summer

From summer and fall to spring

From spring to summer

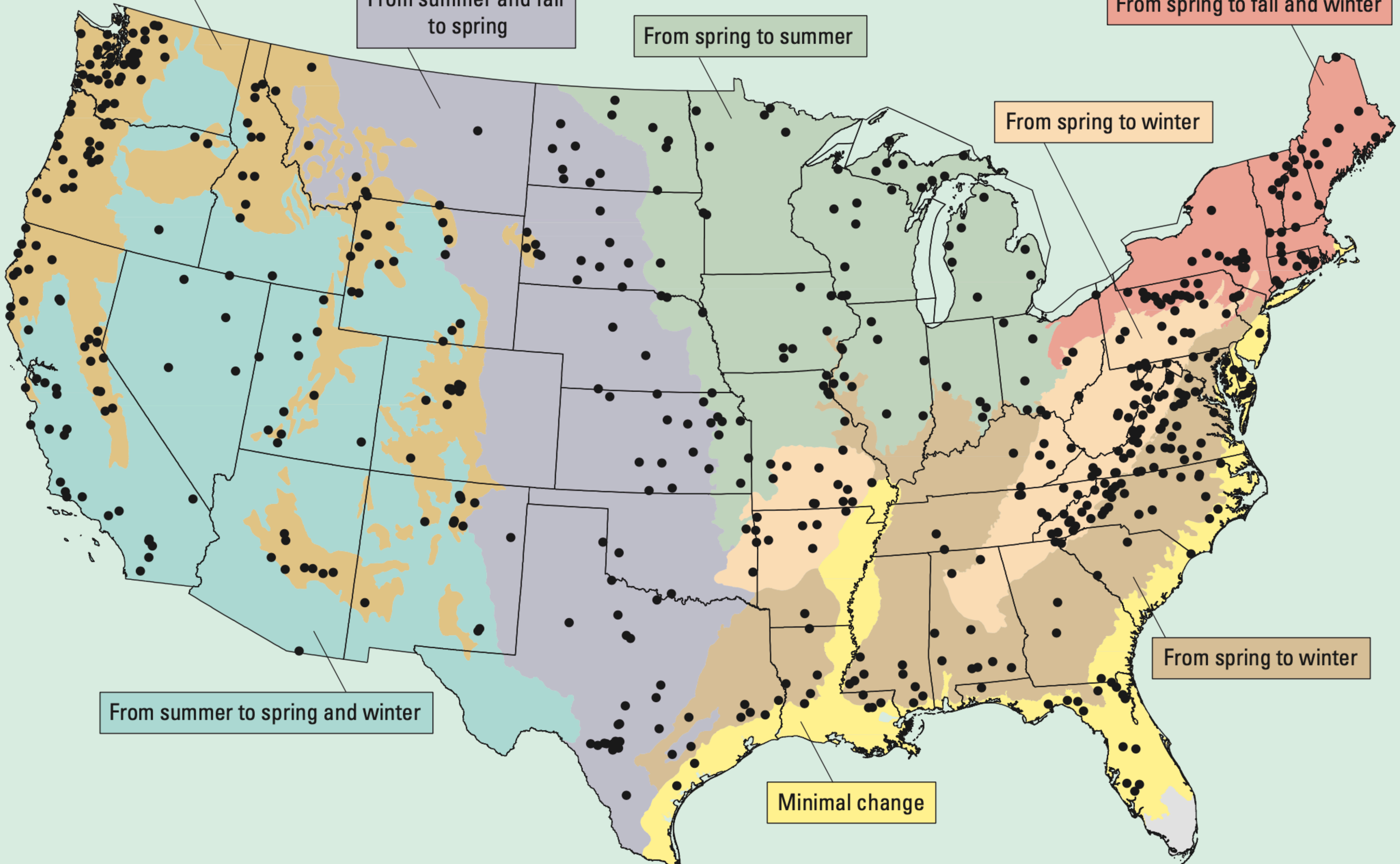
From spring to fall and winter

From spring to winter

From summer to spring and winter

From spring to winter

Minimal change



# Climate vs. Land / Water Management? (1980-2014)



# High-flow Magnitude

**% Change**

**20**

**-20**

**-40**

**Central  
Plains**

**East  
High-  
lands**

**North  
east**

**Coastal  
Plains**

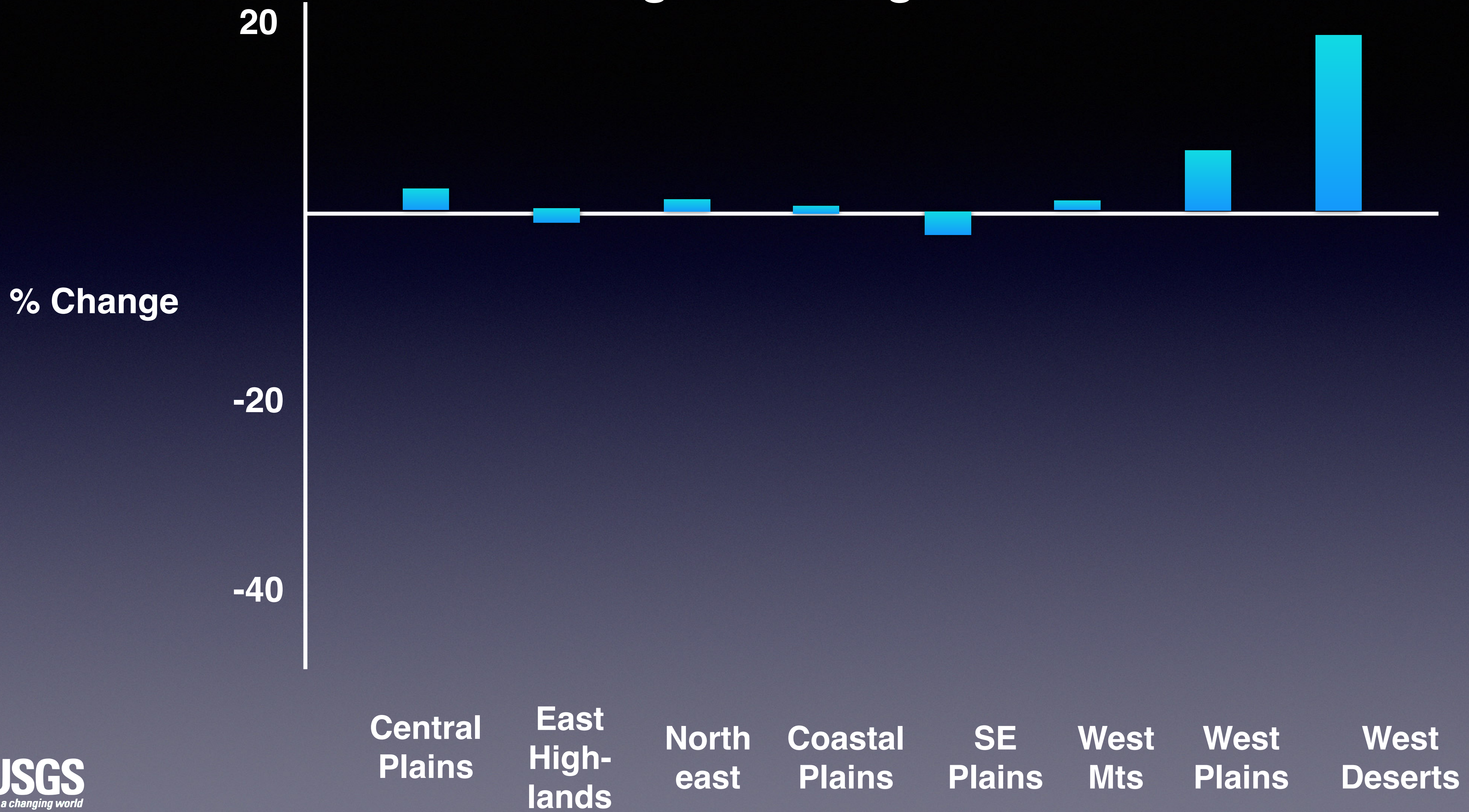
**SE  
Plains**

**West  
Mts**

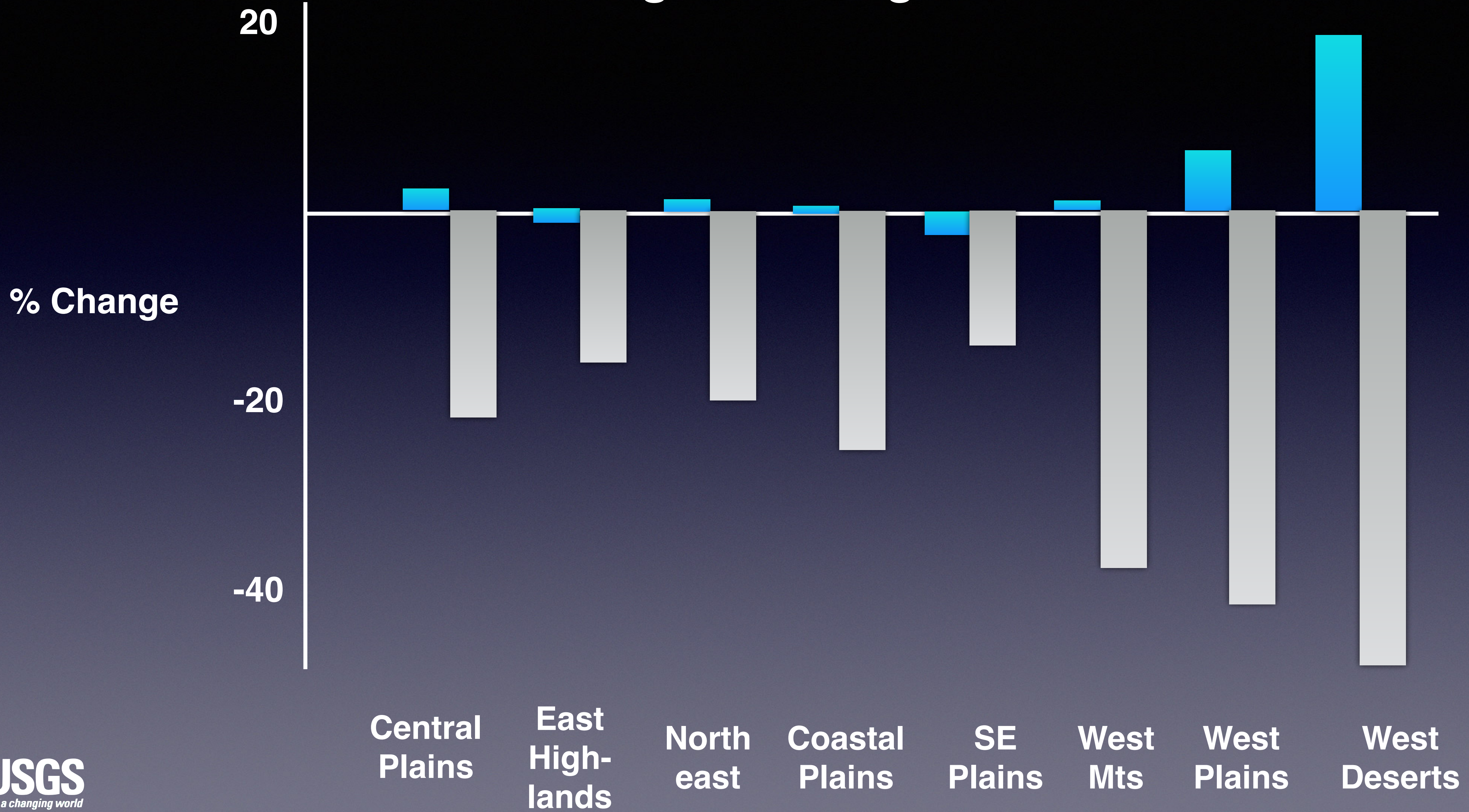
**West  
Plains**

**West  
Deserts**

# High-flow Magnitude



# High-flow Magnitude



# Low-flow Magnitude

% Change



Central  
Plains

East  
High-  
lands

North  
east

Coastal  
Plains

SE  
Plains

West  
Mts

West  
Plains

West  
Deserts

# Low-flow Magnitude

% Change



Central  
Plains

East  
High-  
lands

North  
east

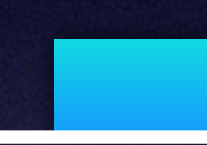
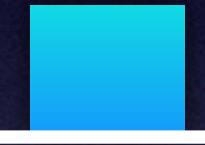
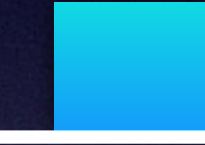
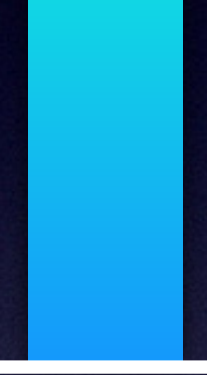
Coastal  
Plains

SE  
Plains

West  
Mts

West  
Plains

West  
Deserts



# Low-flow Magnitude

% Change



Central  
Plains

East  
High-  
lands

North  
east

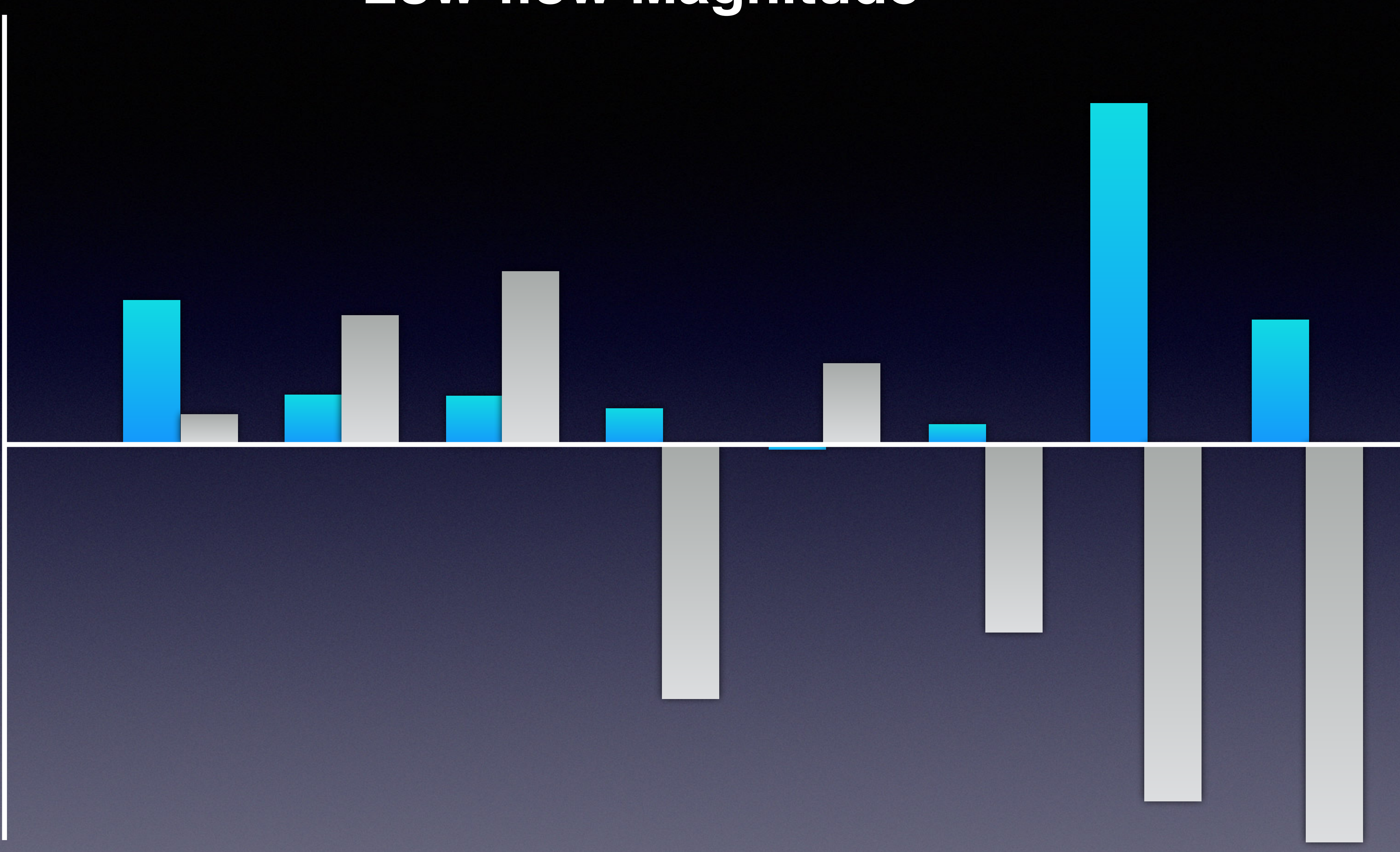
Coastal  
Plains

SE  
Plains

West  
Mts

West  
Plains

West  
Deserts



# The Upshot

Land & Water Management effects on streamflow:

- varies by region
- much stronger than climate-induced changes (1980)

Climate (1950+) changing the timing of ecologically important flow events