01.08.2025

Hydroclimatic Futures of the Southeast

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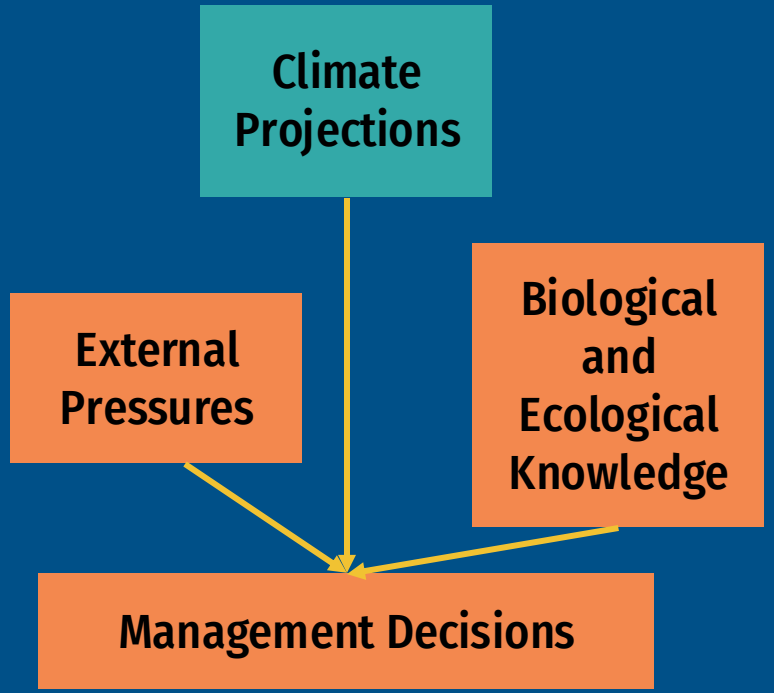


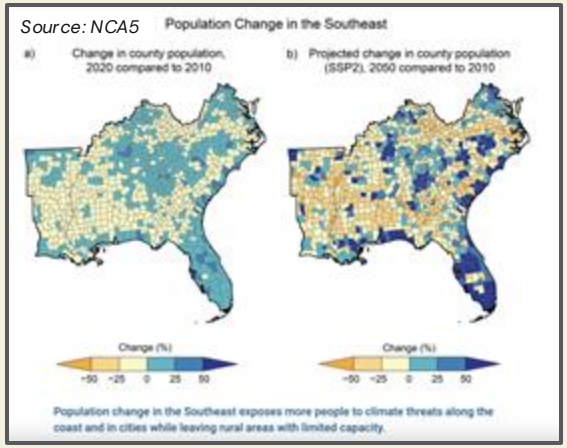
USGS science for a changing world

SOUTHEAST
Climate Adaptation Science Center

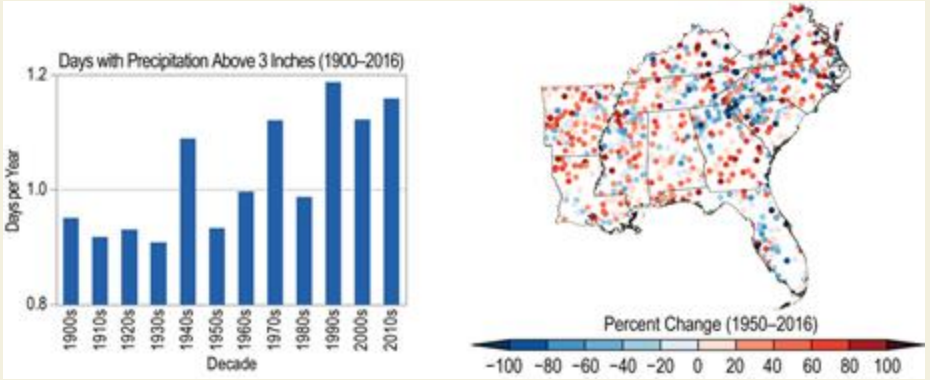
Session 10

The Southeast Faces Many Competing Pressures

Population Growth

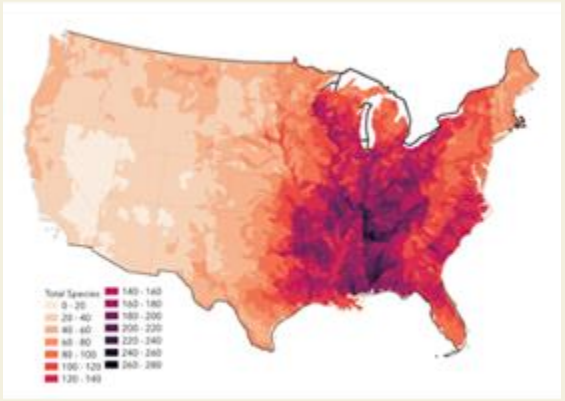


Climate Changes



Source: NCA5

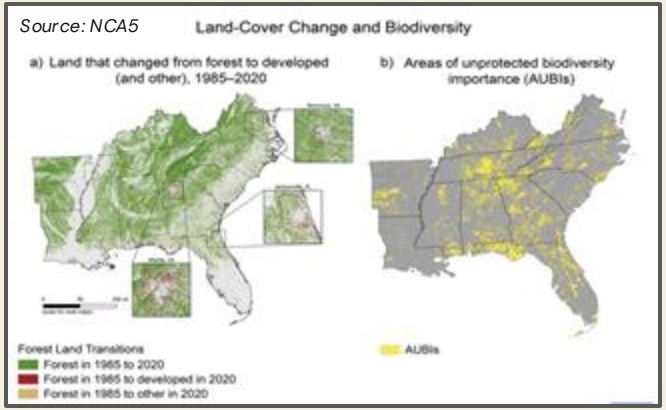
High Biodiversity



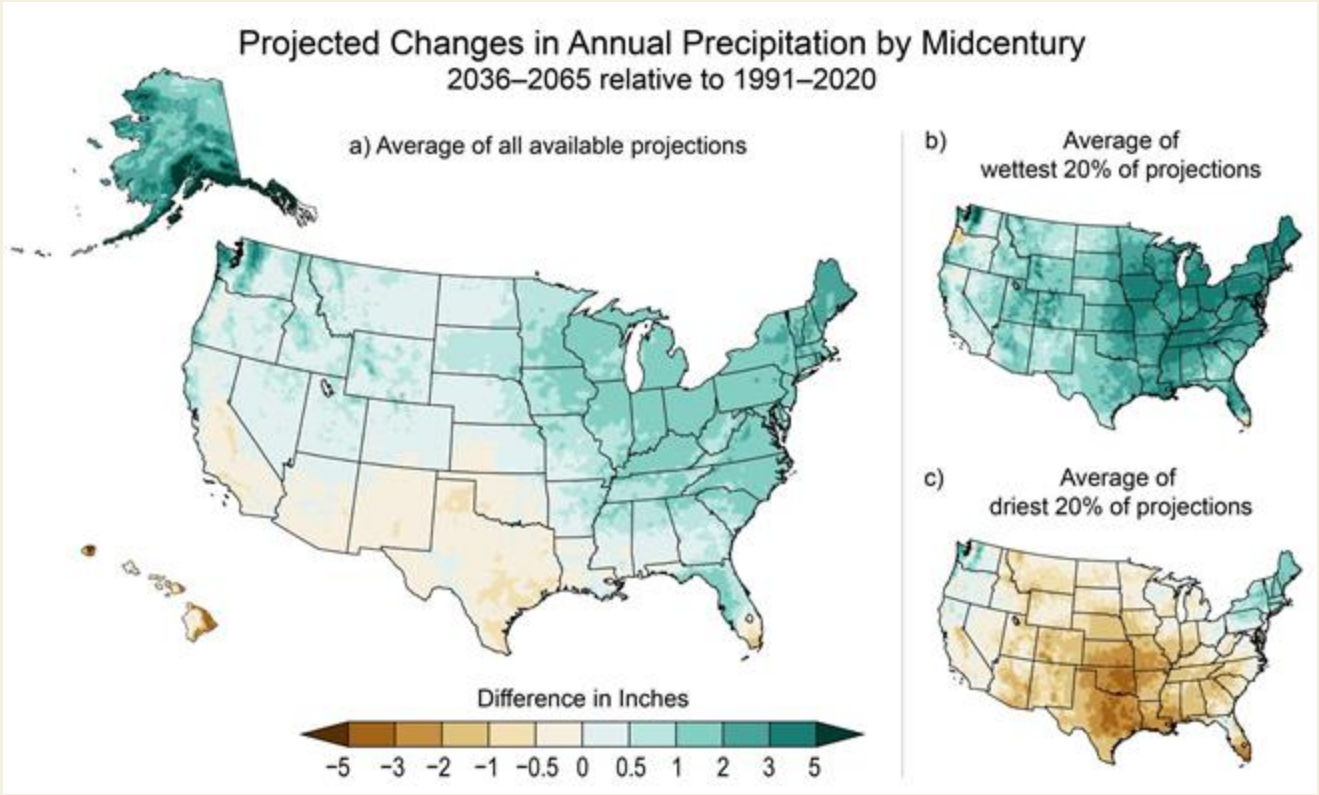
Total Aquatic Species Richness

EPA EnviroAtlas (Panlasigui and others, 2018)

Land Cover Change / Urbanization



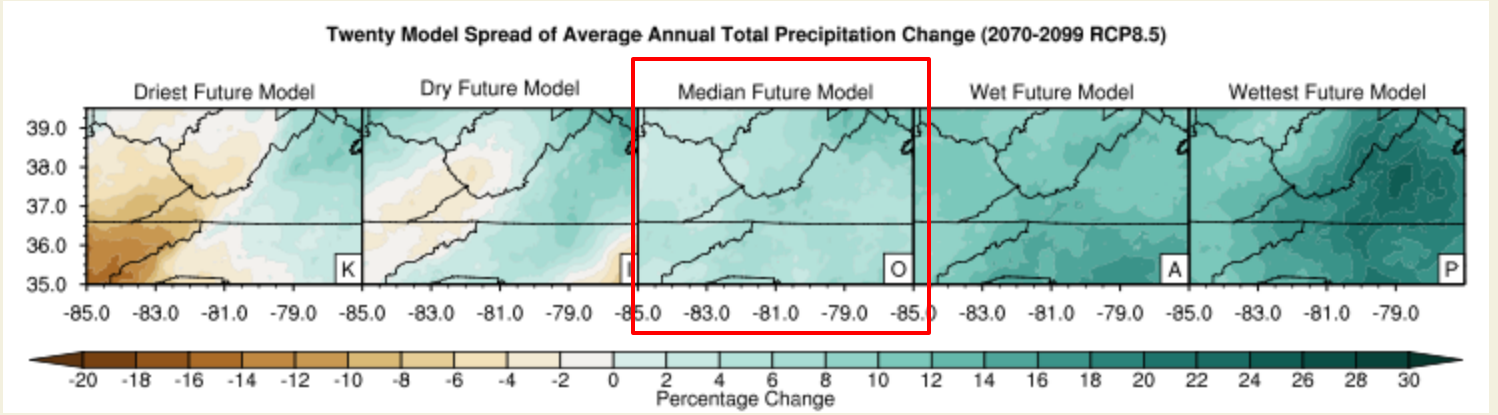
Current Projections

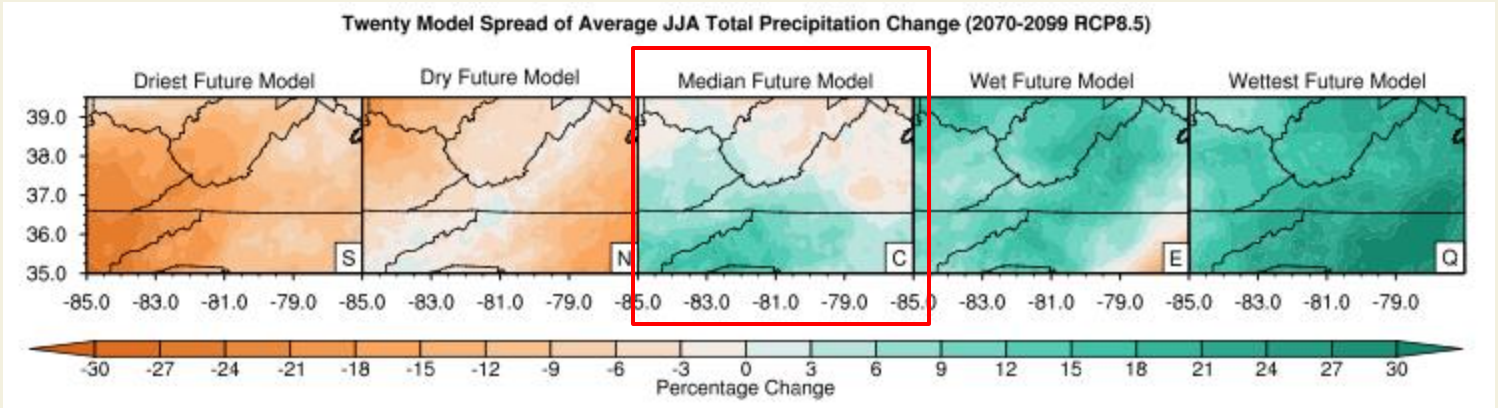


Source: NCA5

Changes in annual average precipitation don't show changes in **interannual variability**. Extreme wet and dry years will still occur

Changes in annual precipitation miss important **seasonal variation**.

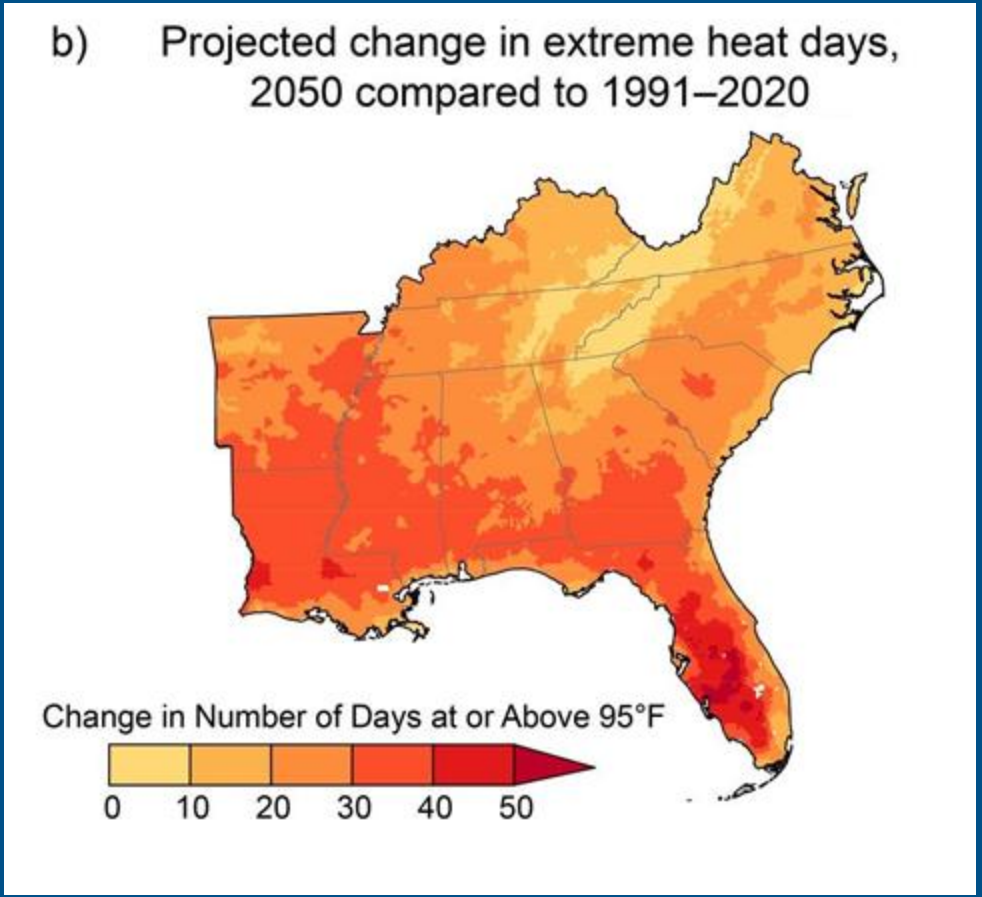




Timing of precipitation is critical for both **human water availability and ecosystem needs**.

What *can* we say?

Temperatures will increase

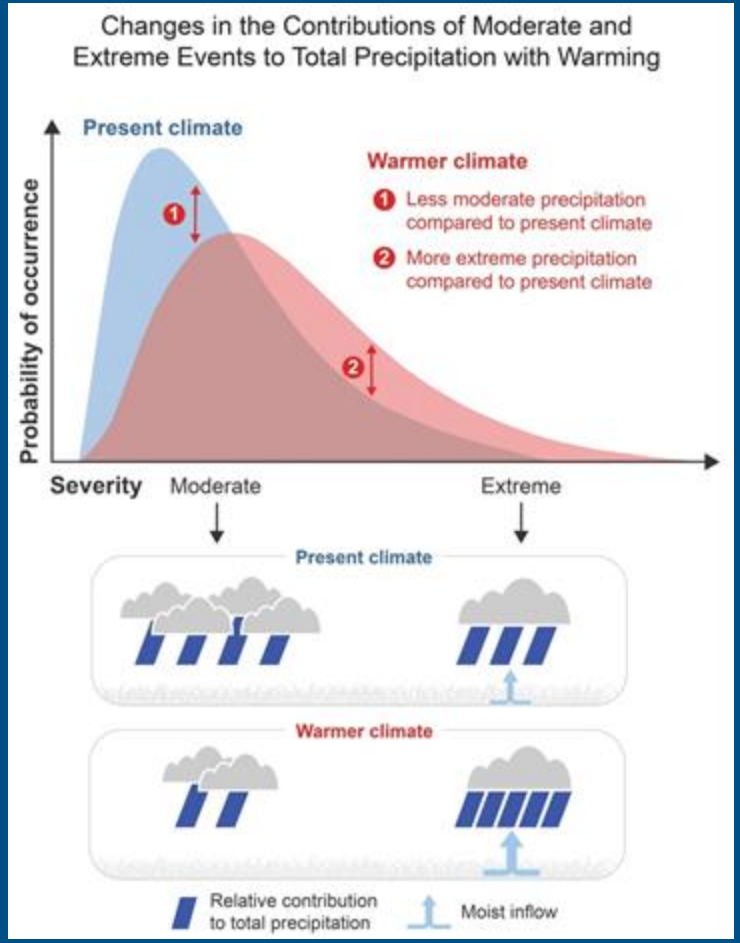


Source: NCA5

What *can* we say?

Temperatures will increase

Rain will fall in heavier events

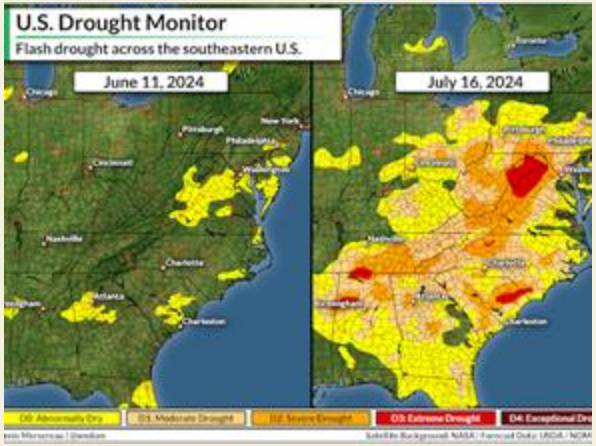


Source: NCA5

Drought in a Changing Climate

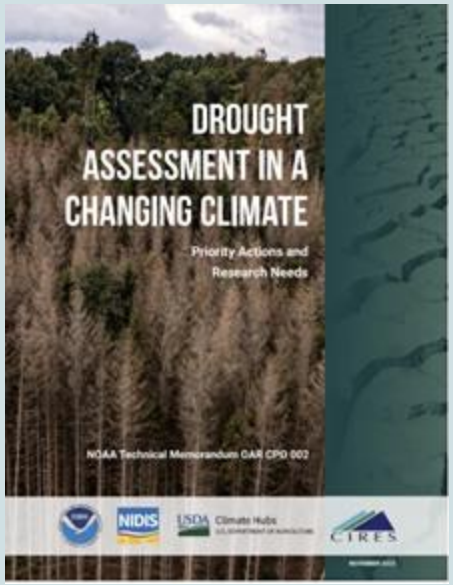
Longer periods between rainfall events may stress some systems. Heavy rainfall may not **recharge** systems.

Changing patterns of precipitation may cause water deficits in **critical periods of the year** and create **mismatches between water supply and demand**.



Extreme heat may contribute to more rapid drought development **(flash drought)** which can then propagate down into hydrologic systems.

Assessing Drought in a Changing Climate



Drought Indicator Performance

Uncertainty

Reference Periods

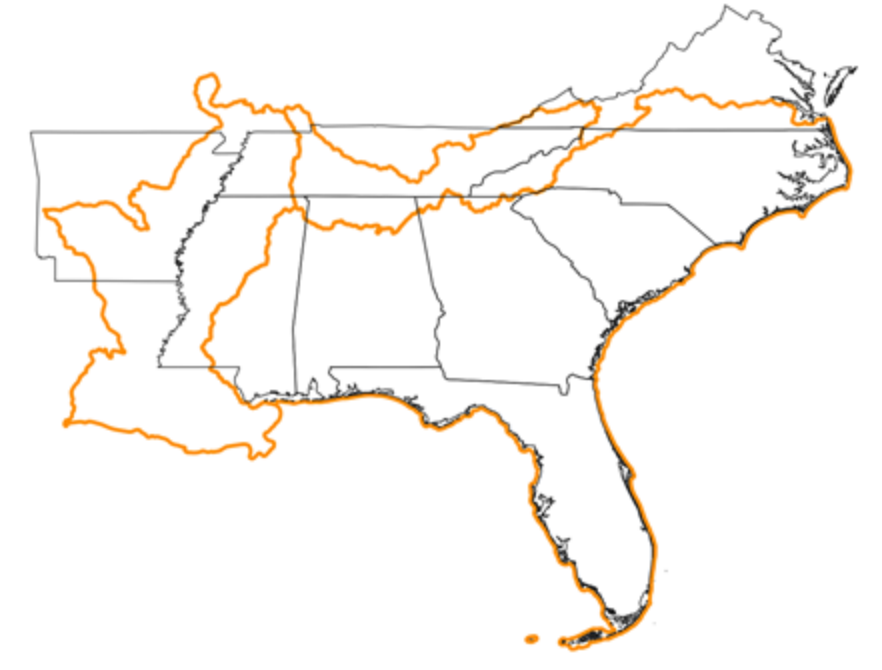
Aridification vs. Drought

Non-Stationarity

Connecting Climate to Impacts is Challenging

- Antecedent Conditions
- Timing and Locally Resolved Heavy Precipitation
- Teleconnections
- Vegetation Impacts
- Drought Indicators

Recent National Scale Models Let us Look at Regional Trends



Regional Averages

Decreases in Seasonal and Mean Annual Flow

Decreases in Annual Minimum Low Flows

Increase in frequency of Low Flow Event Counts

Decrease in flashiness

Strong Increases in Flow Variability

Data from PRMS CONUS Data Release (LaFontaine and Riley, 2023)

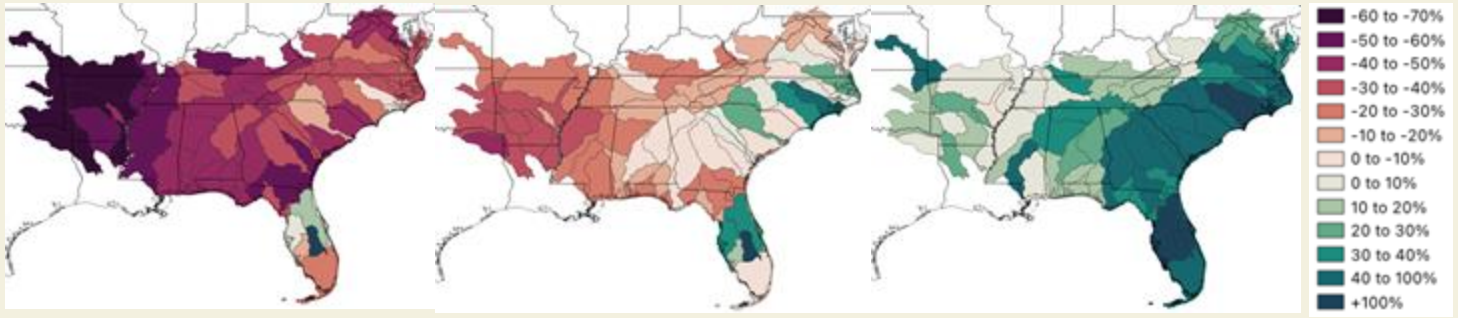
Preliminary Data. Subject to Change.

Then Look Closer

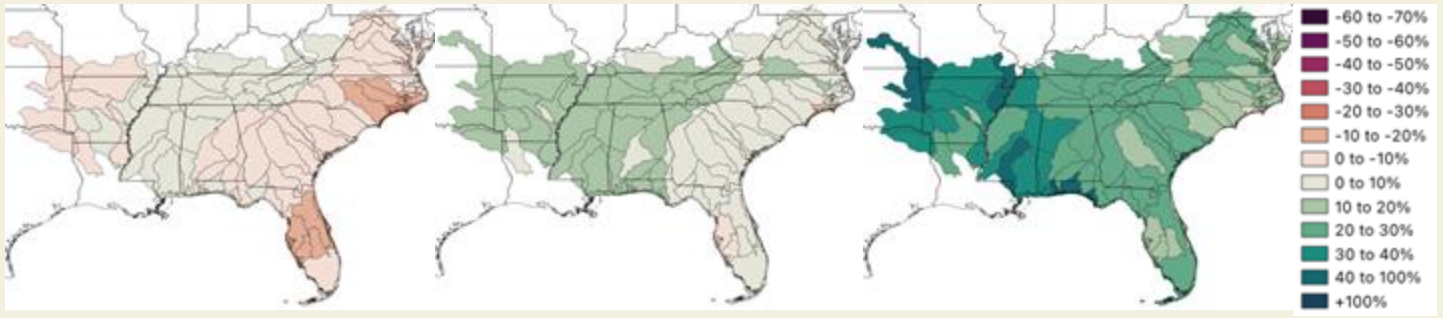
Change from Historical Period (1975-2005) to Mid-Century (2046-2075) under RCP 8.5

Minimum Model Change by HUC6 | Median Model Change by HUC6 | Maximum Model Change by HUC6

Annual Minimum of 7-day Moving Average Flow (% change)



Coefficient of Variation (standard deviation/mean of daily flow) (% change)

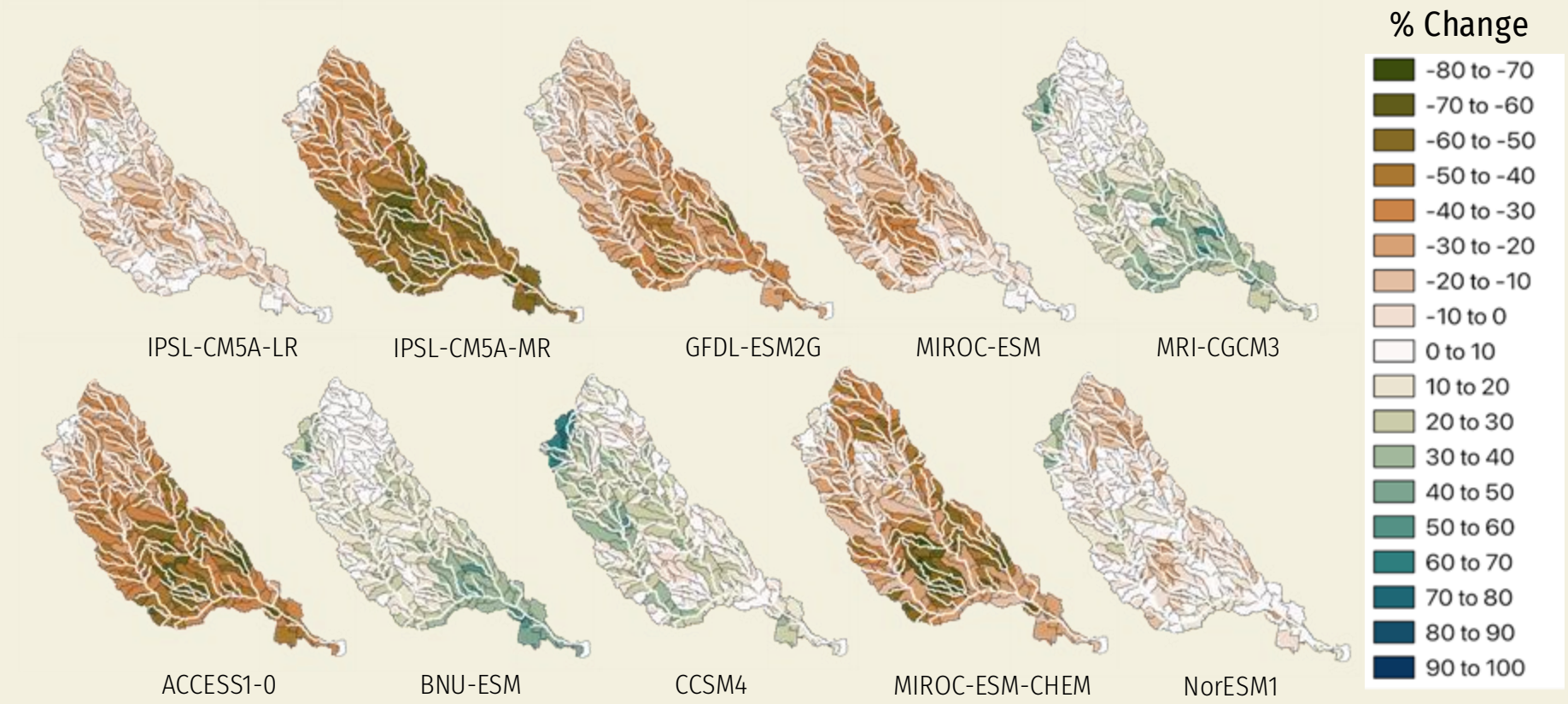


** of thirteen downscaled climate models, stream length area weighted average*

Preliminary Data. Subject to Change.

And Closer

Percent Change in March Mean Runoff
Historical (1976-2005) to Future (2046-2075) under RCP4.5



Data from GCPO Simulations of PRMS-MWBM, Citation: LaFontaine et al. 2019

Preliminary Data. Subject to Change.

Accepting Complexity And Moving Forward

Rising Temperatures

Increased Heavy Precipitation

Humans are a significant component of uncertainty.

Are current impact models fit for purpose and can they be improved?

- ➔ Calibration Methodology
- ➔ Accuracy of low/high flow
- ➔ Representation of Dams
- ➔ Water Withdrawals
- ➔ Groundwater Influence

There will always be tradeoffs - scale vs. detail.

Ecosystem Impacts

Best Practices Include:

1. Understand model assumptions and limitations before applying them
2. Look at the full range of climate projections and approach management in a scenario context
3. Learn from wealth of adaptation knowledge in the Southeast but assimilate and adapt to new information.

Source: National Park Service

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