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Washington/Oregon 2024 Water Year Hydropower Impacts

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Oregon-Washington Water Year 2024 Recap & 2025 Outlook Meeting

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U.S. DEPARTMENT OF ENERGY BATTELLE

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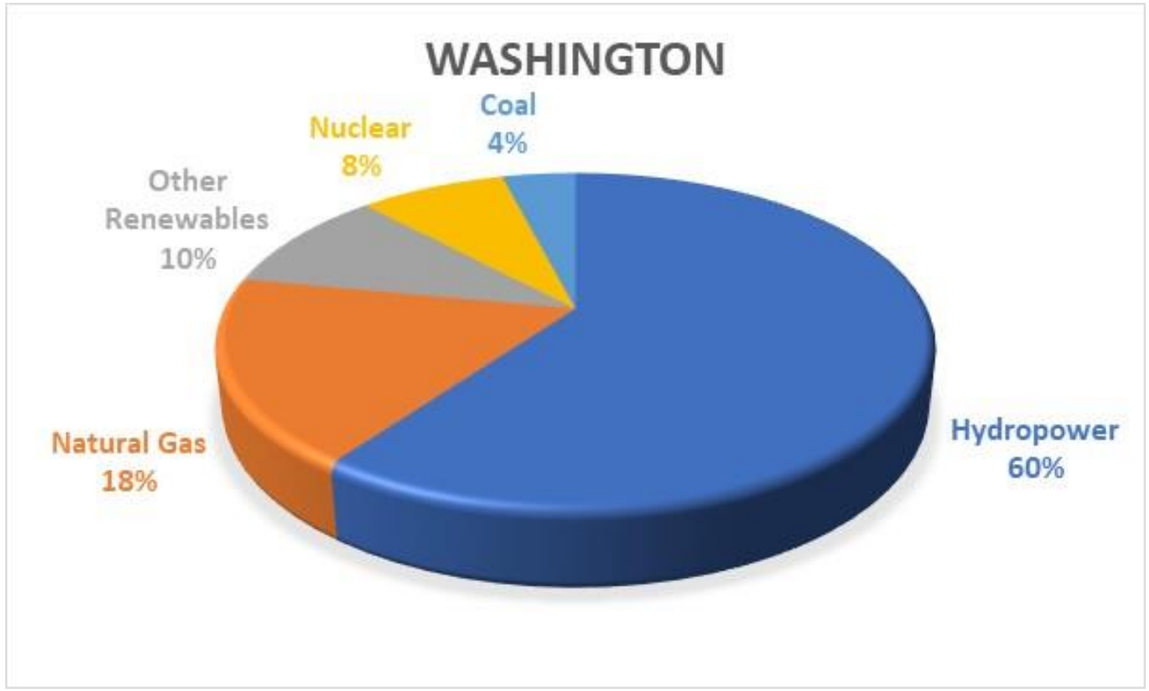
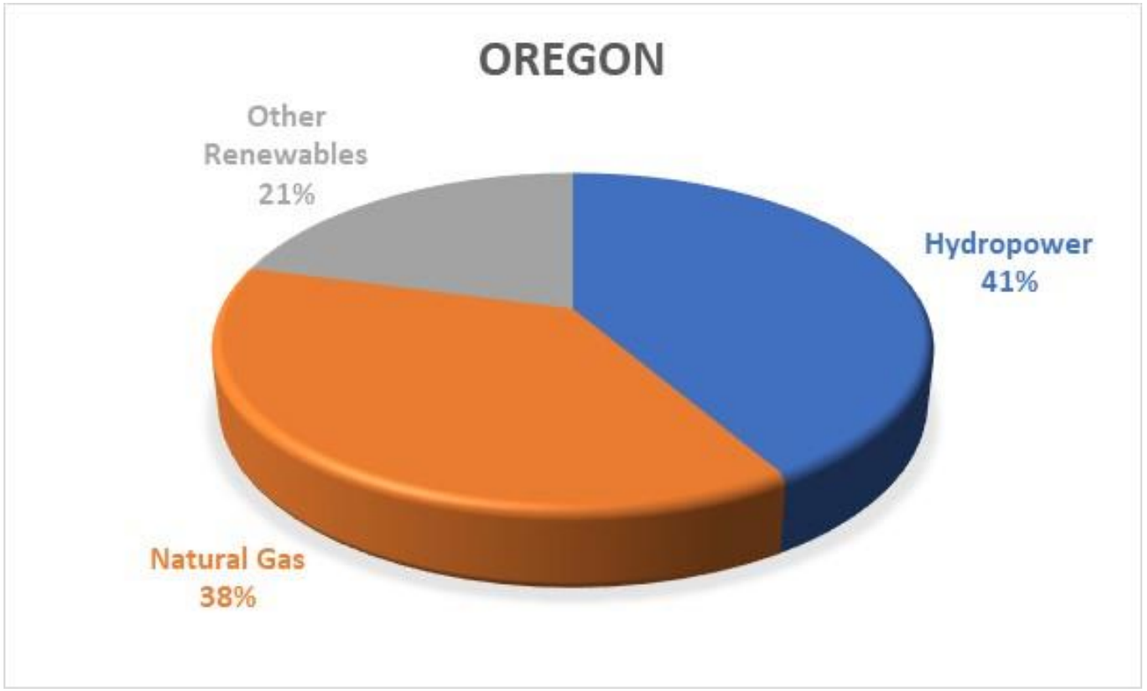
Objective

- Explore recent trends in hydropower production in the Pacific-Northwest
- Contextualize impacts:
  - Historical
  - Regional
  - Western electric grid
- Next Steps

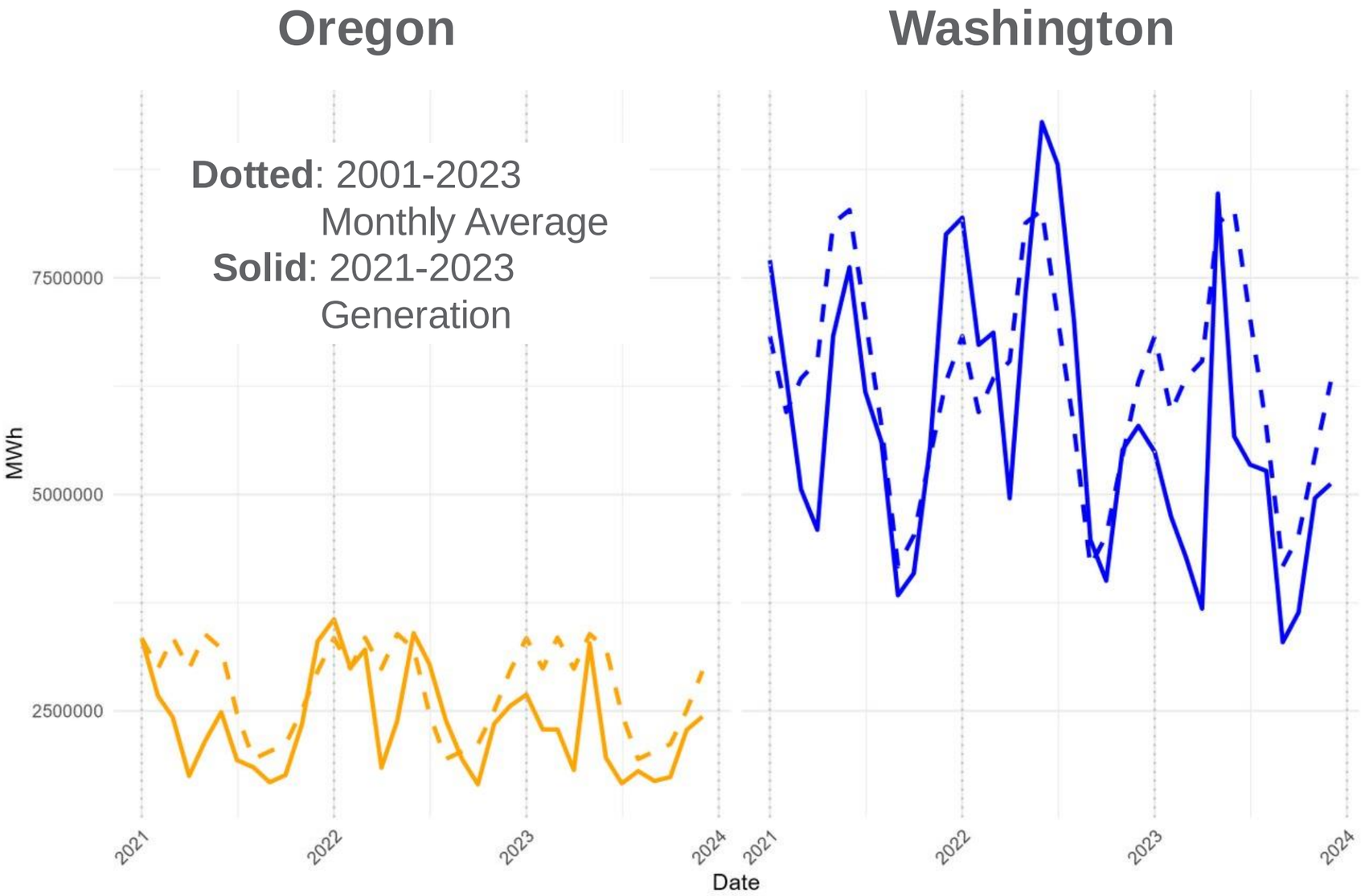
Electricity Generation Mix in Washington and Oregon, 2023





Source: EIA 2023

Recent Hydropower Generation in Washington and Oregon



- Roughly similar trends between states
- 2021 near average
- 2022 ~10% above average
- 2023 OR 9% below average
- 2023 WA 15% below average

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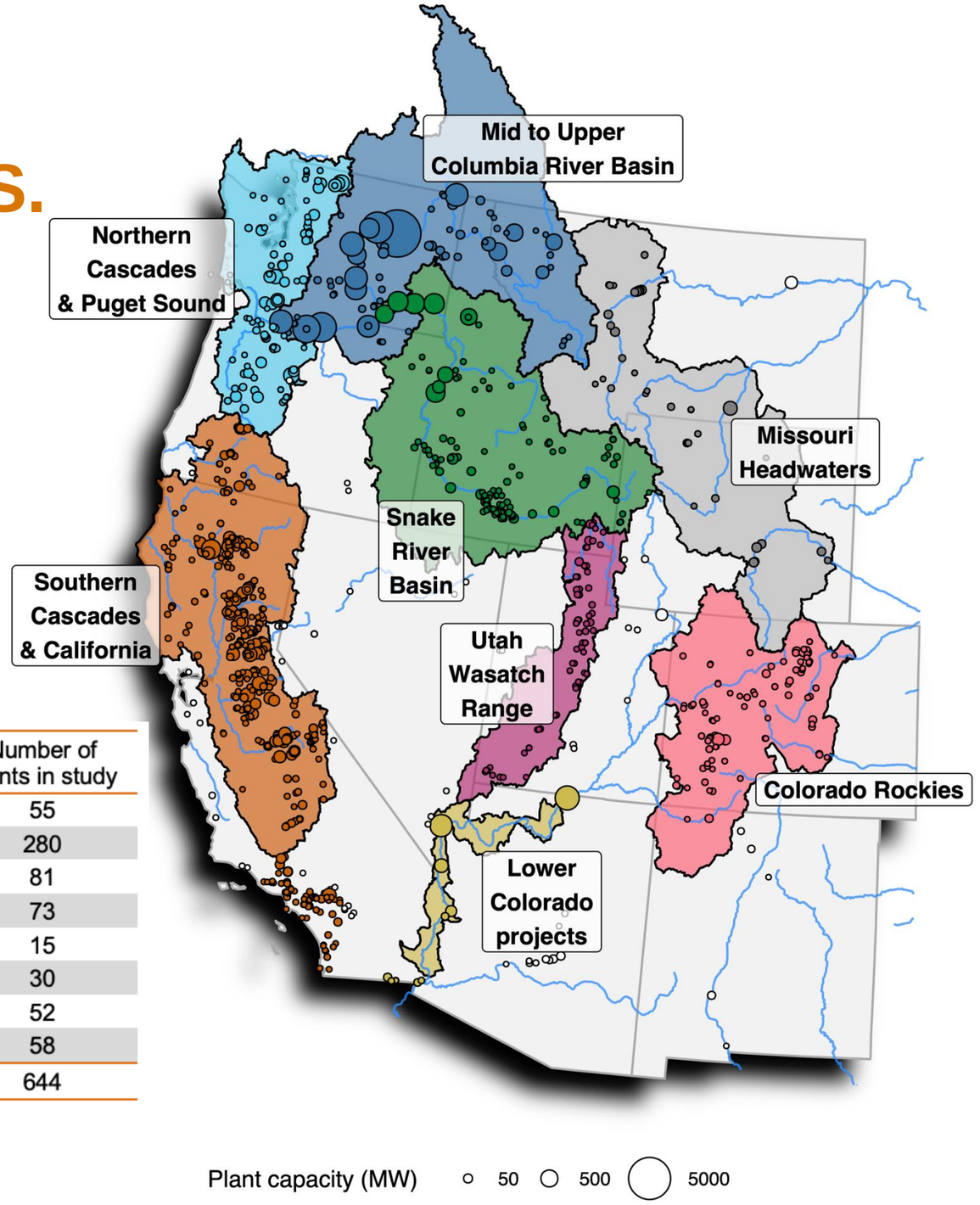
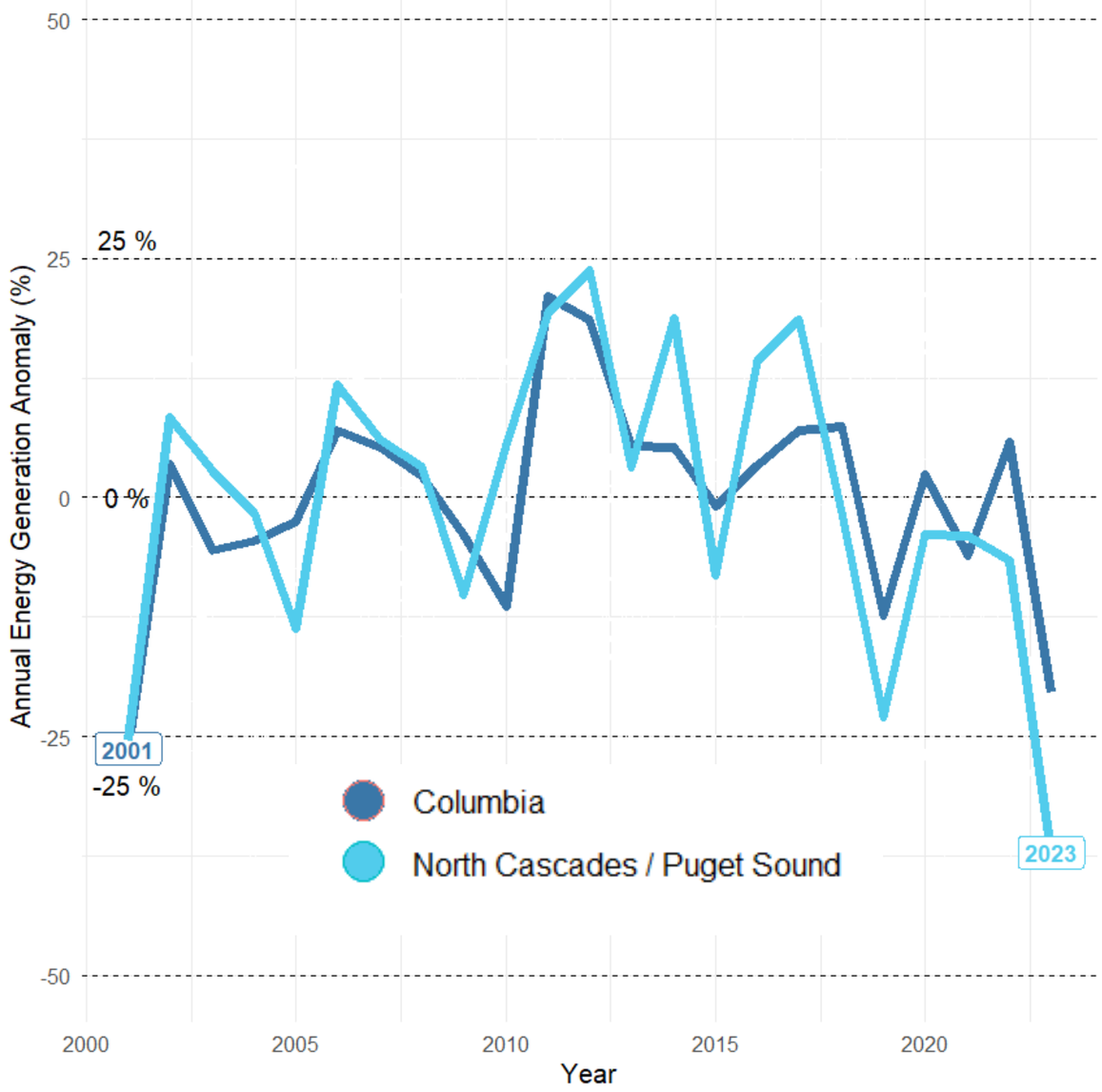
Hydropower Climate Regions of Western U.S.

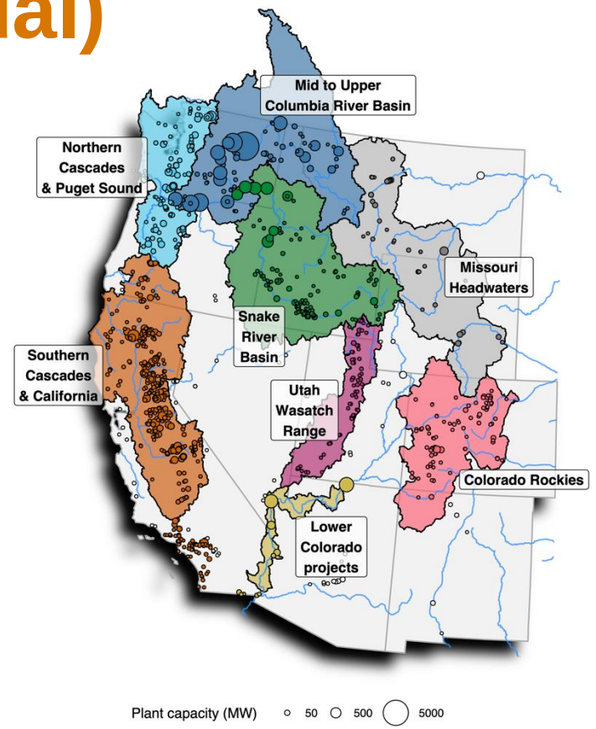
- Expand context for exploring relationship between drought and hydropower
- Grouped hydropower facilities by major river basins guided by cluster analysis

Hydropower climate region	Share of Western hydropower capacity	Share of Western hydropower generation	Number of plants in study
1. Mid to Upper Columbia River Basin	44.8 %	50.9 %	55
2. South Cascades / California	19.0 %	18.1 %	280
3. Snake River Basin	11.7 %	11.1 %	81
4. Northern Cascades / Puget Sound	10.3 %	10.0 %	73
5. Lower Colorado Projects	7.6 %	5.5 %	15
6. Missouri Headwaters	2.0 %	2.2 %	30
7. Colorado Rockies	1.5 %	1.0 %	52
8. Utah Wasatch Range	0.4 %	0.2 %	58
Total	97.3 %	99.0 %	644



Columbia and Northern Cascades Hydropower Generation 2001 to Present (Annual)





- Broadly similar trends
- Variability on ~5yr period
- Both vary on the order of ±25%

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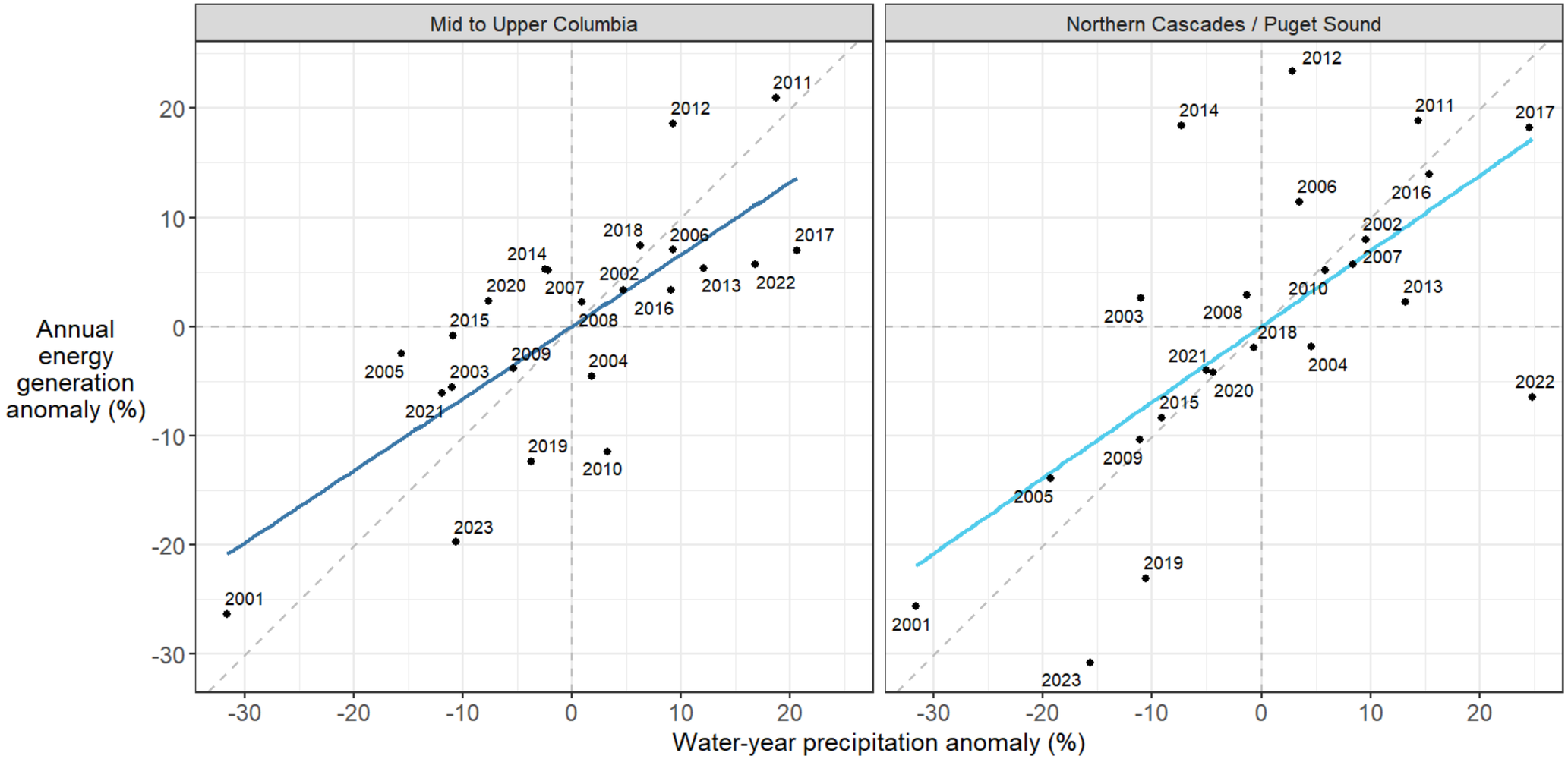
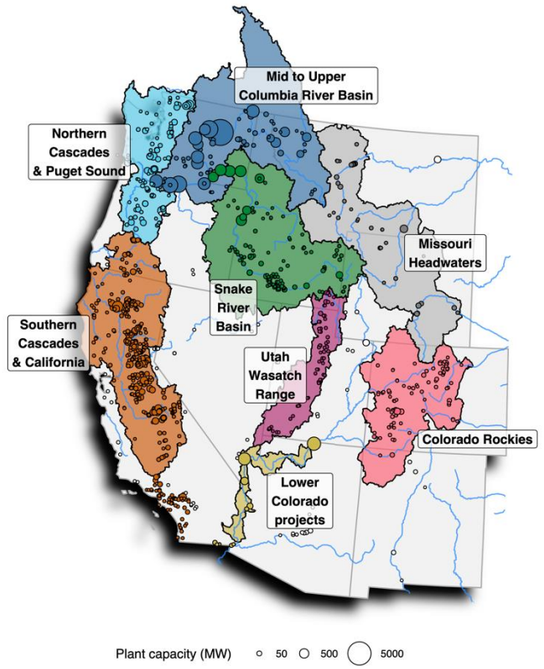
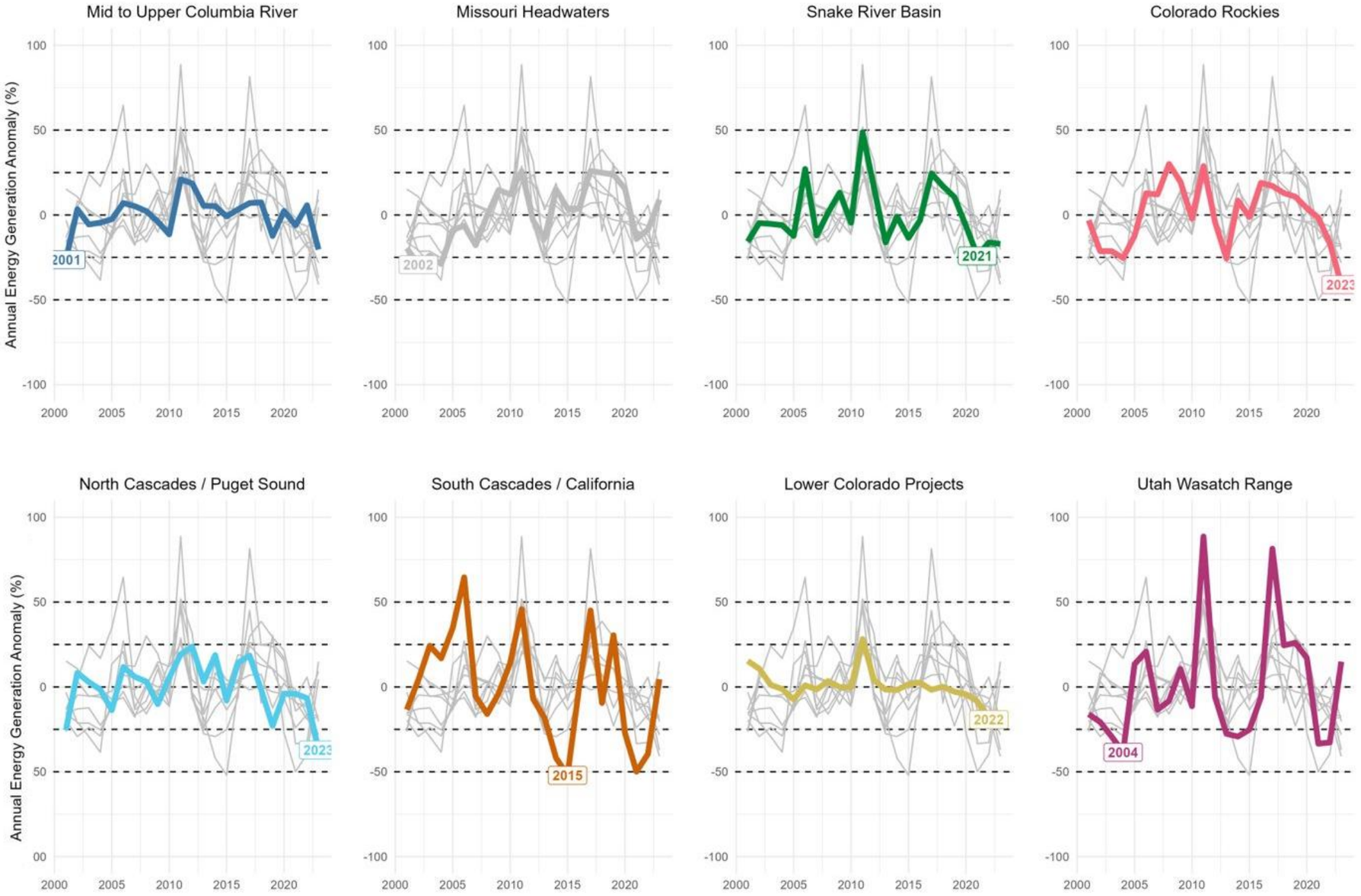
Hydropower Generation Follows Precipitation



Regional Annual Generation, 2001-2023





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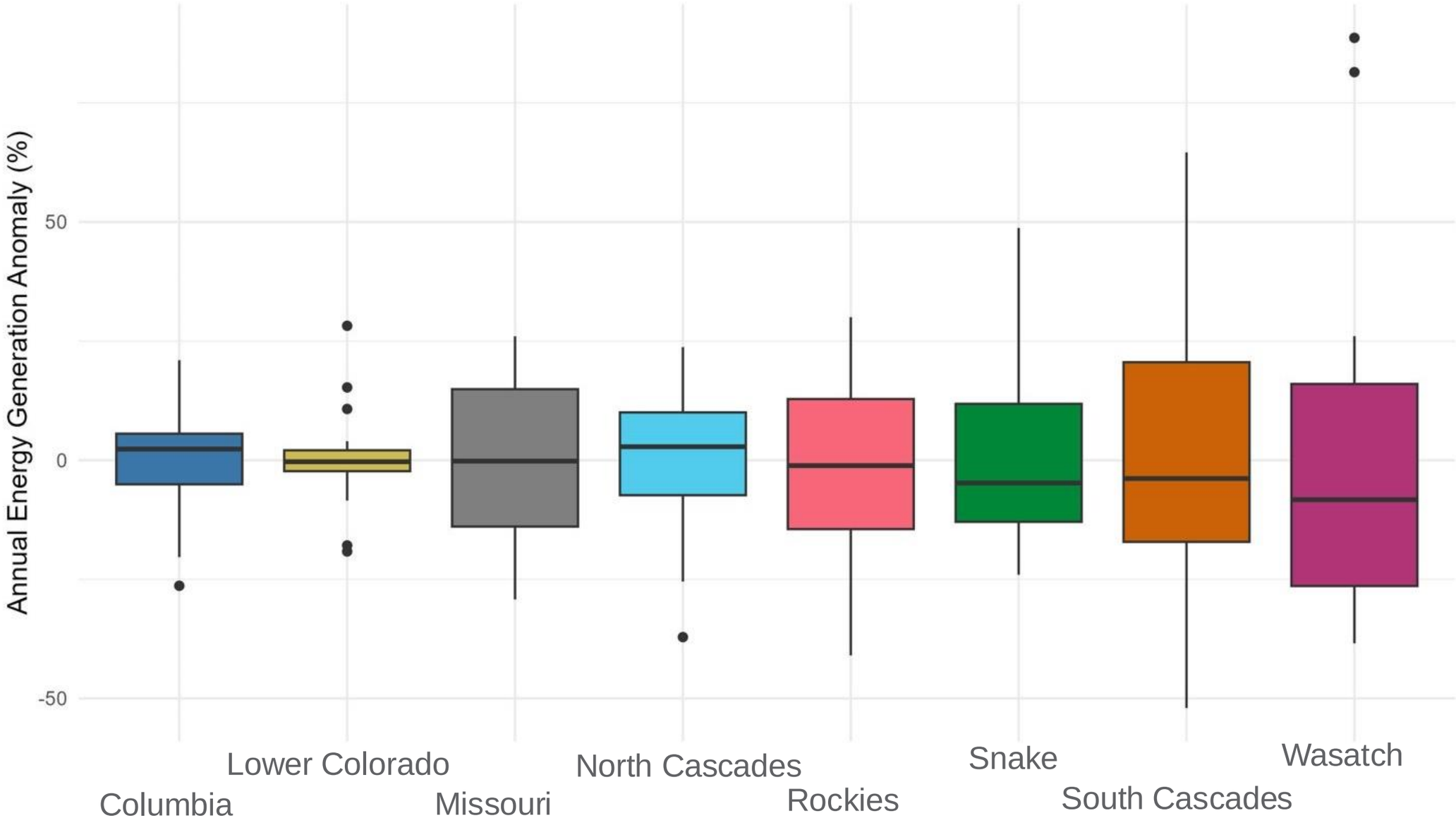
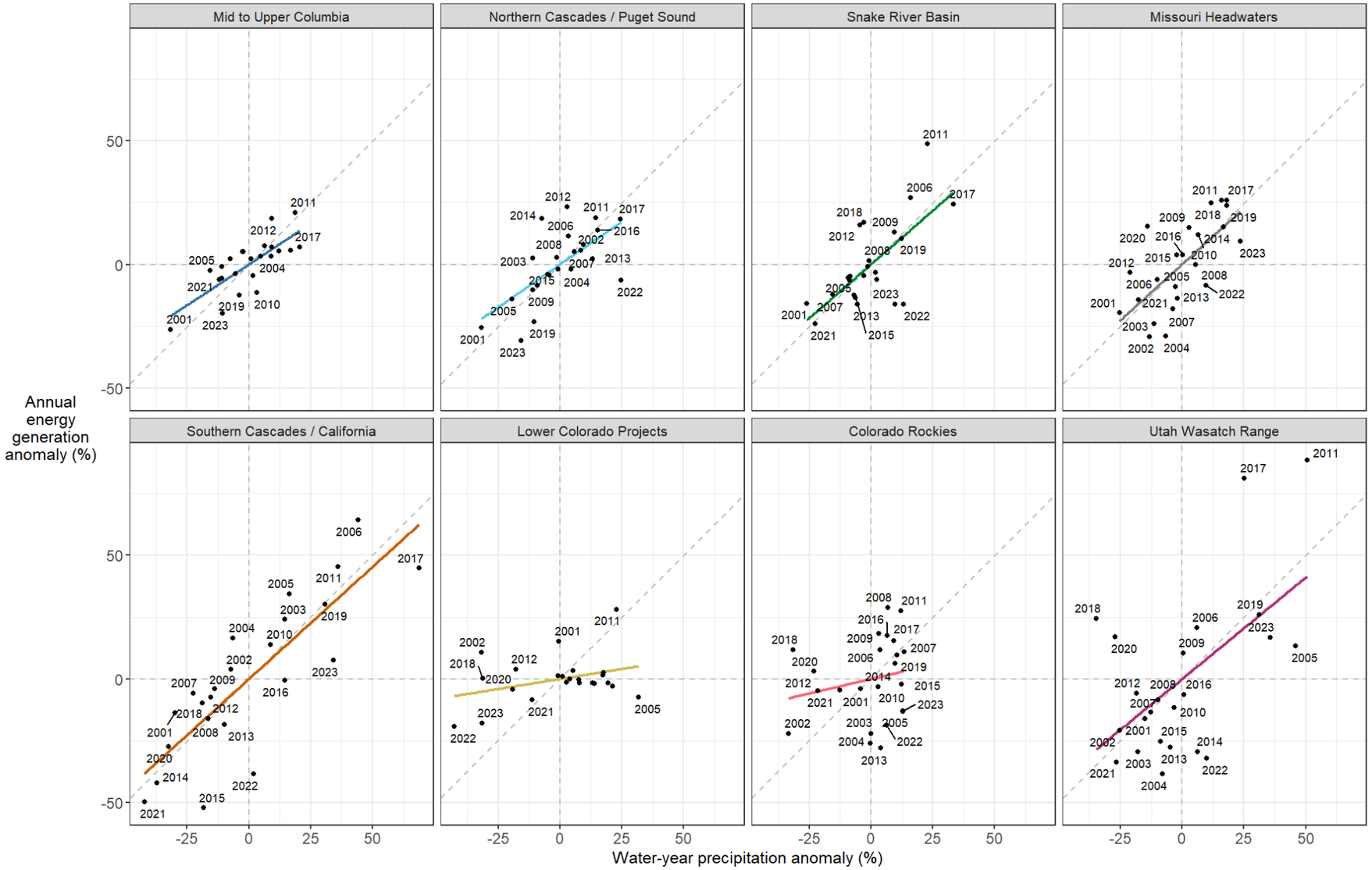
Regional Annual Generation, 2001-2023

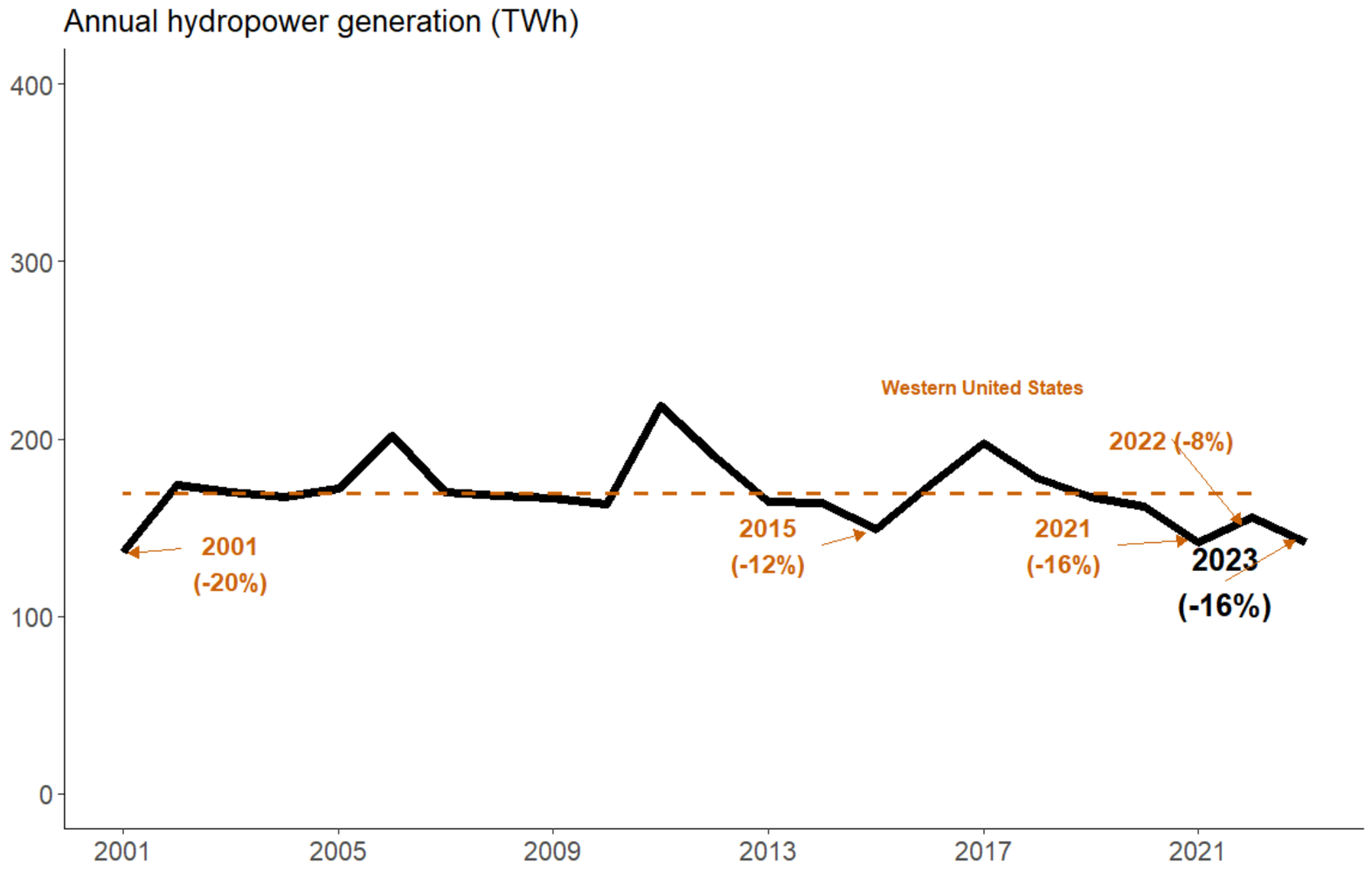


Drivers of Hydropower Generation



- Water-year rainfall totals correlate strongly with total annual hydropower generation in five of eight hydropower climate regions

Western Interconnection Hydropower Generation



- West-wide hydropower accounts for ~25% of generation share
- 2001 remains the year of lowest western hydropower generation of the 21st century so far
- Even during the most severe droughts experienced since the turn of the century, the western hydropower fleet sustained four-fifths or more of its typical annual generation

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Summary

- Oregon and Washington experienced lower than normal hydropower generation in 2023 (2024 has not been published).
- 2001 remains the year of lowest western hydropower generation of the 21st century, year the Columbia Basin experienced its low
- Even during the most severe droughts the western hydropower fleet sustained four-fifths or more of its typical annual generation
- Rainfall correlates strongly with annual hydropower generation in five of eight regions

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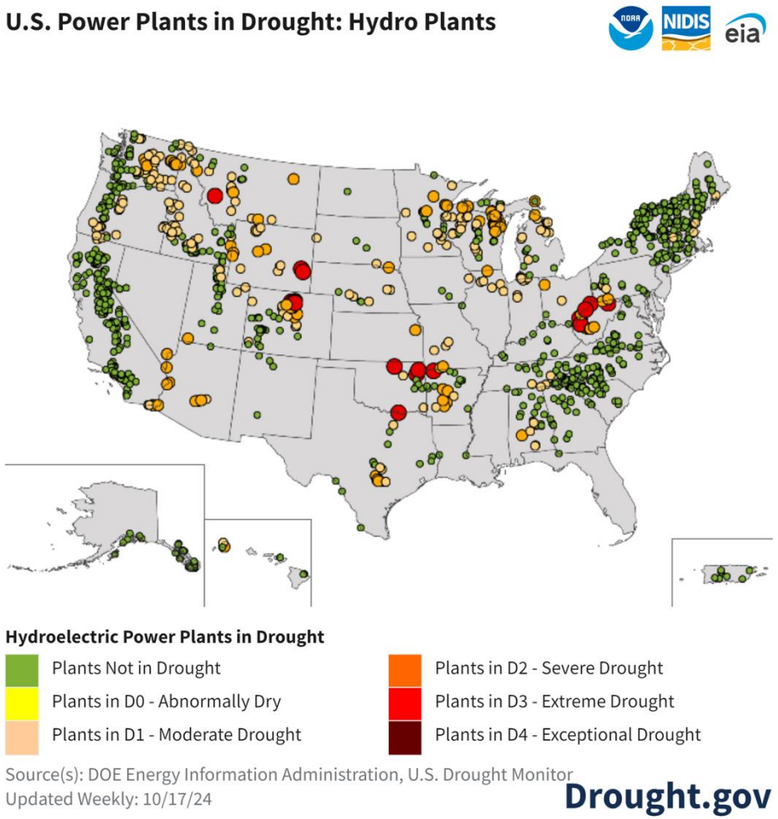
Next Steps

Coincident Climate and Hydropower Extremes Dataset (CCHED)

- Develop hydrologic extreme characterization and impact measures
- Develop drought/hydropower data products supporting long-term resource planning
- Develop drought/hydropower data products supporting seasonal resource planning



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WATER POWER TECHNOLOGIES OFFICE

Thank You

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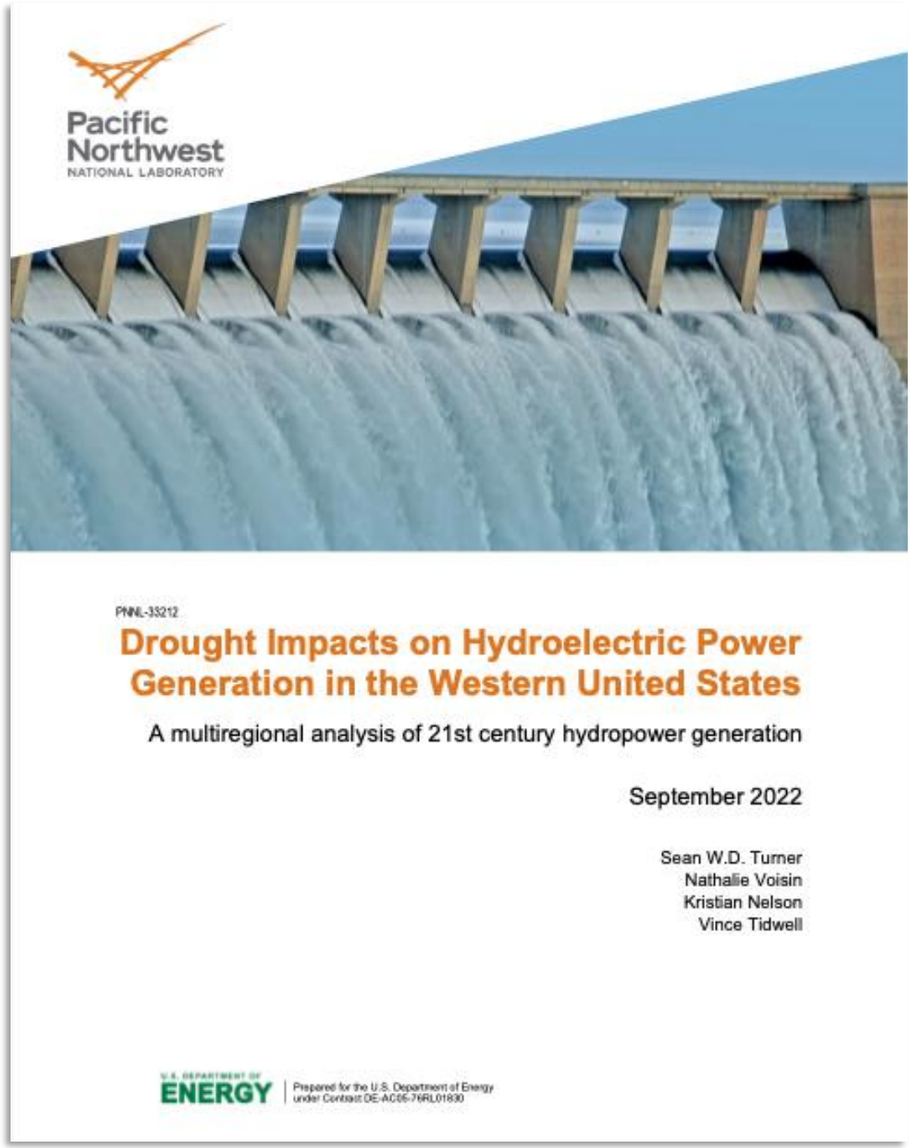

www.pnnl.gov/projects/drought-impacts-hydroelectric-power-generation-western-united-states