



Balancing Hydropower Generation, Flood Control and Drought Management Services Under a Changing Climate: A Columbia River Basin Case Study

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EIA Hydropower Annex IX & XII workshop
Hydropower Services and Climate Change:
Adaptation Resilience and
Valuation of Climate Change Services

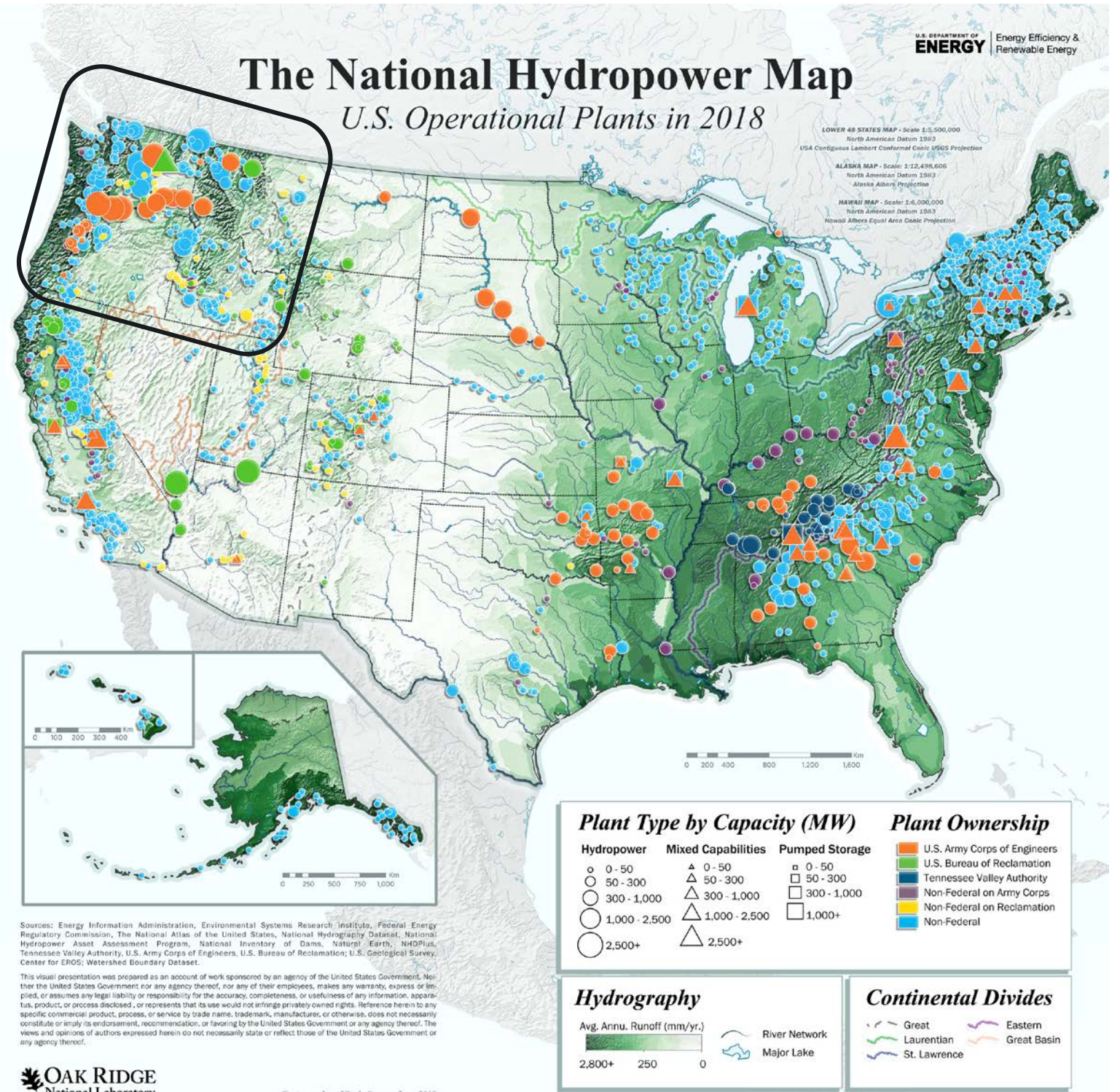


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Hydropower in the USA

- Over 2,000 hydropower plants
- 7% of annual electricity generation
- ~25% of generation capacity of the Western USA
- ~half of total hydropower generation is produced by 132 US federal plants



Columbia River Basin

- Transboundary basin; 668,000 km² drainage area; 7,500 cms mean annual flow
- 250 reservoirs, 150 hydropower plants:
 - 13M people in the region
 - 29 GW capacity, 44% of total US hydropower production
 - 21,000 km² of irrigated agriculture

Hydropower reservoirs over the Columbia River Basin and adjacent regions

Objectives

Discuss hydropower services (water supply, flood control, navigation and socio-economic benefits) and how those might change under future environmental conditions.



Hydro-Climate of the Columbia River Basin

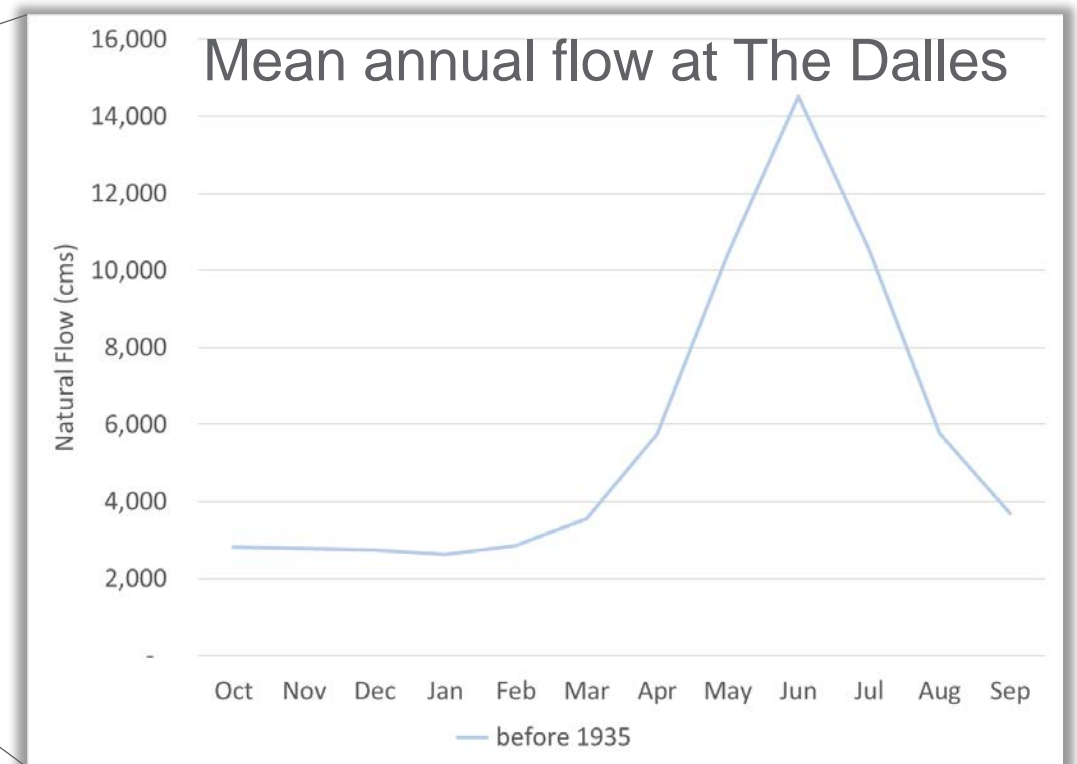
- Climate varying from mountainous to semi-arid to temperate
- Hydrologic regimes varying from snowmelt-controlled to rain-controlled



Mean annual precipitation (in)

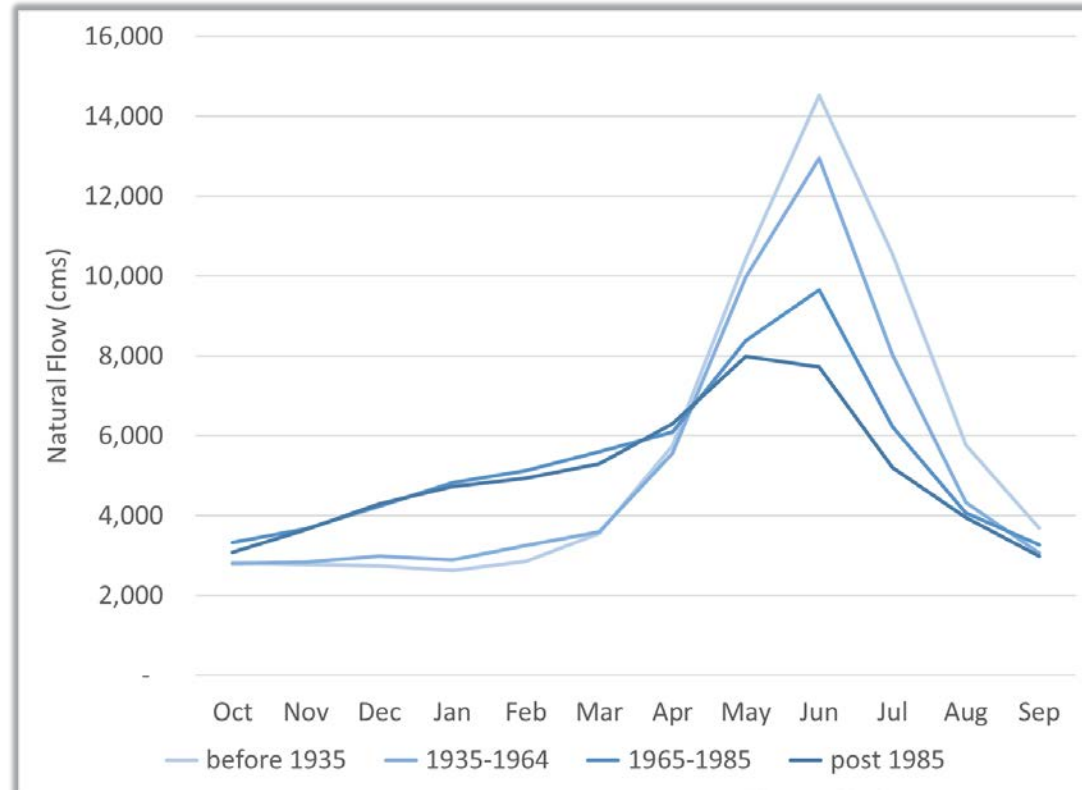


Hydrologic sub-regions



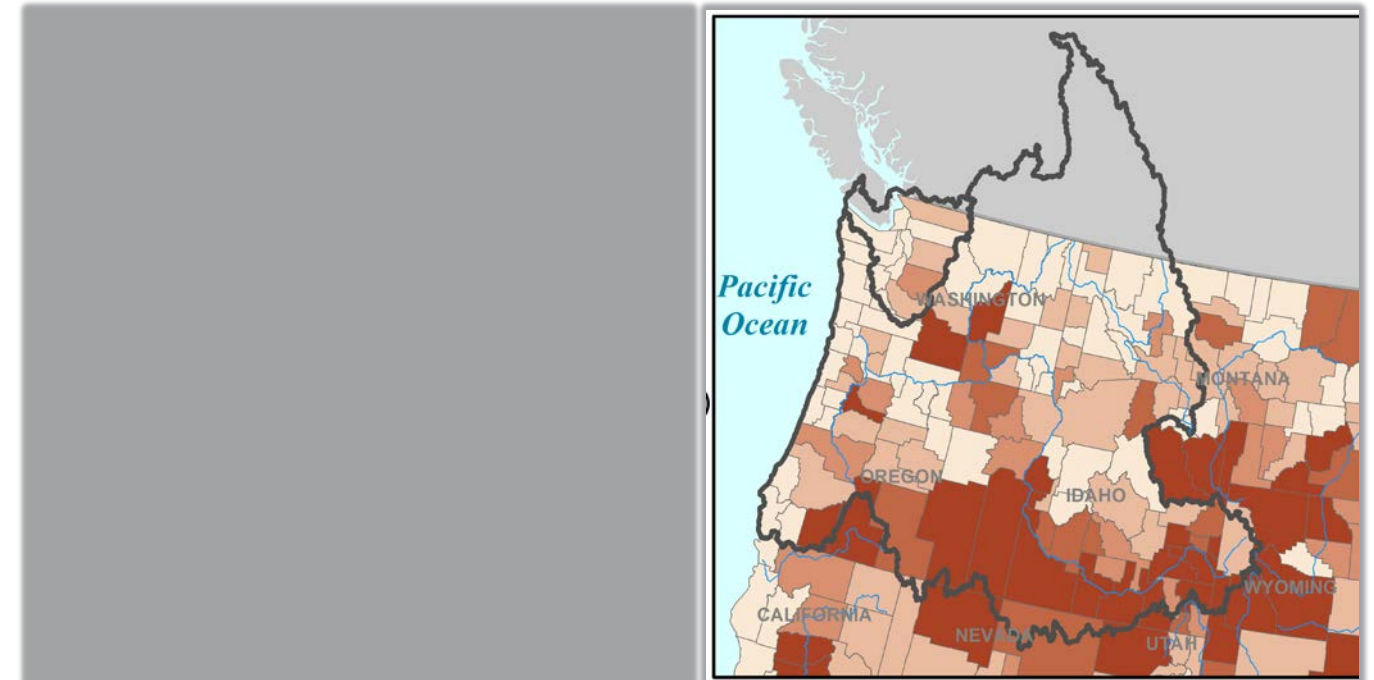
Socio-economic benefits in and outside the basin

Evolution of the mean annual flow at The Dalles



- 1930-1960: US dams
- 1964: US-Canada Treaty
- 1985: all major dams constructed

Flood Control, Water Supply, Conservation, Hydropower, Navigation, Electricity



Governance of flood and drought management services

- US-Canada Treaty and Conservation: overall operations
- USACE and Flood Control
- Reclamation and water supply
- BPA and hydropower marketing



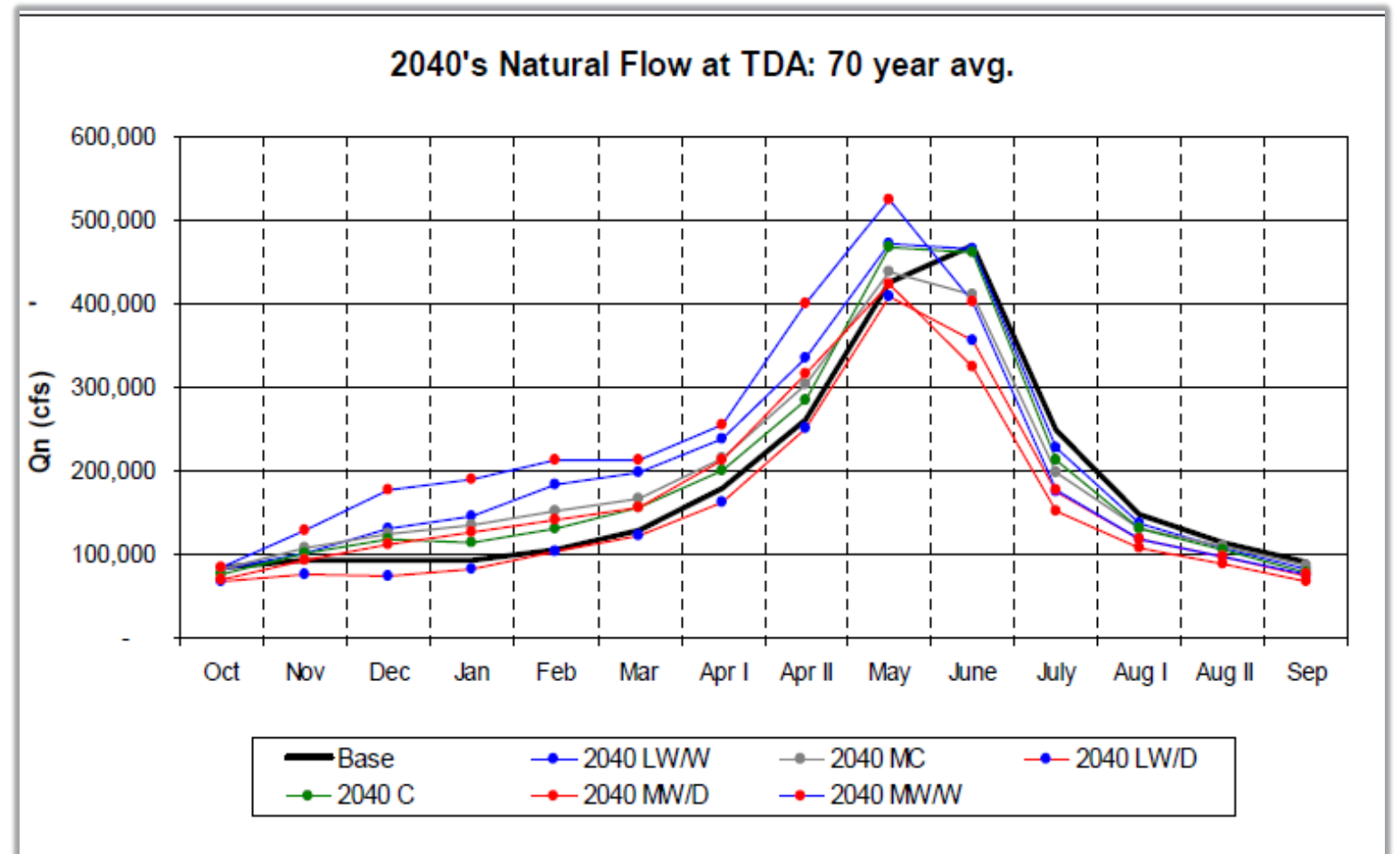
Complex governance of the Columbia River Basin

River Services Under Future Environmental Conditions

Evaluations performed with varying levels of coordination by the governing agencies;

- Treaty, Conservation
- Secure Water Act (*water security, energy security*)
- USACE, Reclamation, BPA (*River Management Joint Operating Committee - RMJOC*)
- Northwest Power and Conservation Council (*advising*)

Earlier snowmelt projected at the Dalles



RMJOC-II. Climate and Hydrology Datasets for use in the RMJOC Long-Term Planning Studies: Second Edition (RMJOC-II). Part I: Hydroclimate Projections and Analyses. (<https://www.bpa.gov/p/Generation/Hydro/hydro/cc/RMJOC-II-Report-Part-I.pdf> June 2018).

River services in the Western U.S.

- River services: hydropower, supply, navigation, flood control, agriculture, recreation
- Projected environmental change: earlier snowmelt
- Changes in services?
 - Diversity of agencies and stakeholders
 - Transboundary basin treaty

Hydropower is recognized as a driving engine for river services because it financially supports the maintenance of the dams. It is a complex exercise to maintain or enhance hydropower value to grid while hydropower operations might evolve or adapt under changing environmental conditions to maintain current-day river services.

Thank you