Ohio River Basin Climate Change Pilot Study

Collaborative Formulation of Adaptation Measures - Attenuating CC Effects on Infrastructure and Ecosystems

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BUILDING STRONG®

Institute for Water Resources Responses to Climate Change Program (RCCP)

- Program Goal - reducing impacts to Federal infrastructure from anticipated climate change (CC).

- USACE Infrastructure - 700 dams, 14,000 miles of constructed levees, 75 hydropower facilities, and 134 water supply projects.

- RCCP - gathers information, identifies impacts to infrastructure, and formulates adaptation strategies that attenuate affects and sustain mission capability.

IWR Pilot Study Program

- IWR Pilot Study Program –
  - investigates various components of climate change,
  - identifies affects on water resources development, operation and maintenance.

- 15 Nationwide pilot studies either completed or underway.

- The IWR pilots study program can be found at:
  https://corpsclimate.us/rccpad.cfm

Ohio River Basin CC Pilot Study

- The Ohio River Basin Comprehensive Recon Study completed in 2009;
  - Climate change identified as an issue by multiple stakeholders.
- The Ohio River Basin Alliance
  - Federal agencies, NGO's and departments in 13 states created Alliance in 2009
  - Showed willingness to cooperate in a CC study.
- Huntington submitted proposal for pilot study program in 2012. Proposal was approved.

Ohio River Basin
Pilot Study Objectives

- ORBCC Pilot Study identified multiple objectives:
  - Standing up new working group within the ORB Alliance dedicated to addressing CC issues and impacts.
  - downscaled modeling of precipitation and temperature,
  - identifying impacts to infrastructure and ecosystems,
  - formulating adaptation strategies and
  - disseminating study results to Alliance members and the general public.

Ohio River Basin Pilot Study Team

- Pilot study team composition:
  - Crucial in gathering experience, modeling capabilities, technical knowledge and working together as a team.
  - Alliance collaboration identified a number of candidates for the team.
  - Team members from USACE, IWR, NOAA, USGS, TNC, USEPA, Battelle, NGO's and regional/national academia.
- Work tasks defined in a project management plan and funded through IWR.

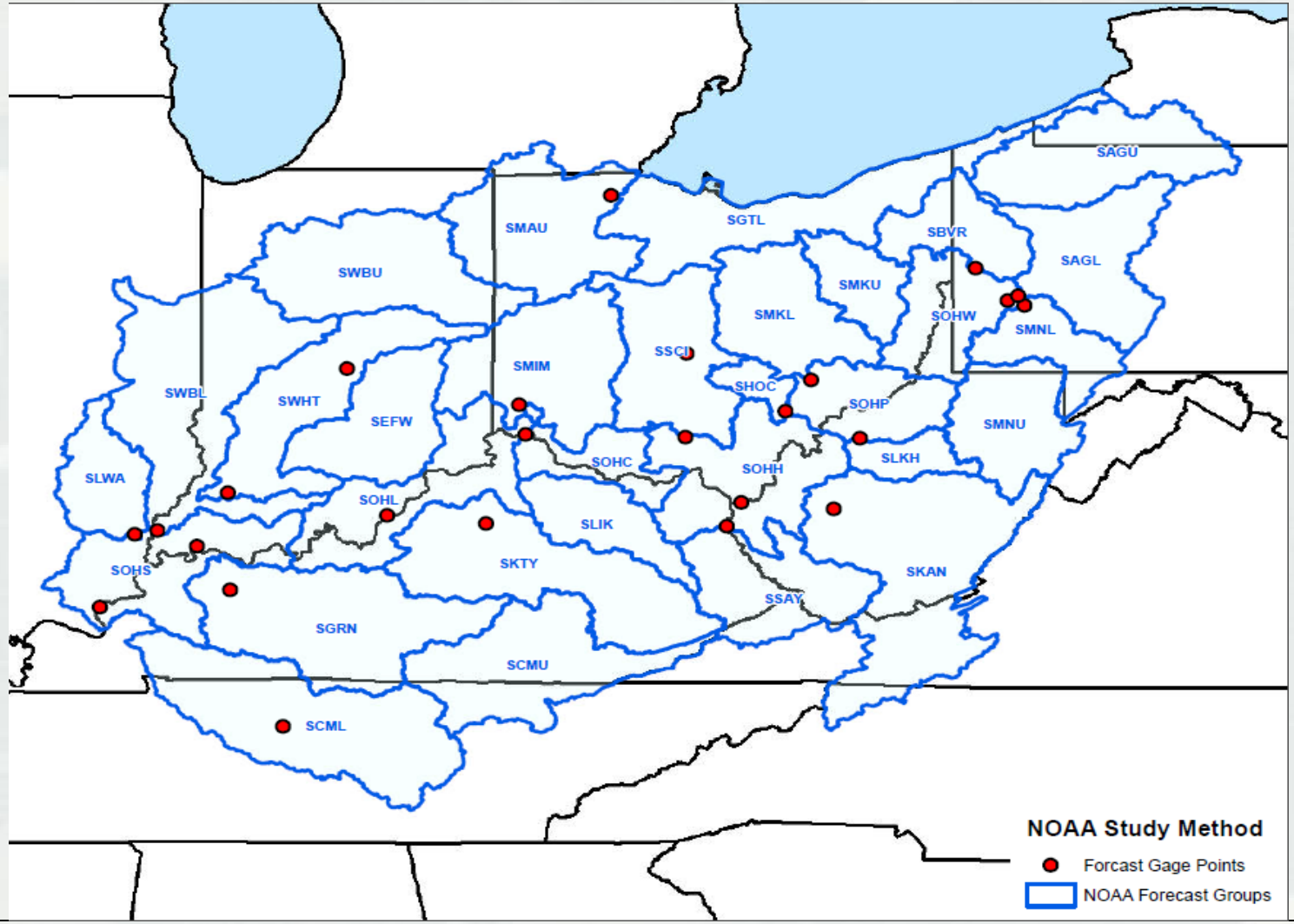
Ohio River Basin Alliance

- Climate Change working group
  - Met at Fall 2013 Alliance Conference.
  - CC working group currently part of the Sustainability and Competitiveness working group chaired by Dr. Harry Stone from Battelle.
  - Long–term plan to stand up the CC working group as an independent group when the pilot study is completed.

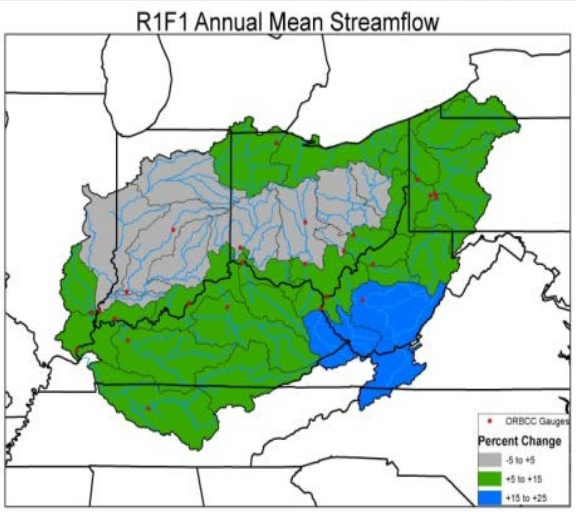
CC Pilot Study Modeling Process

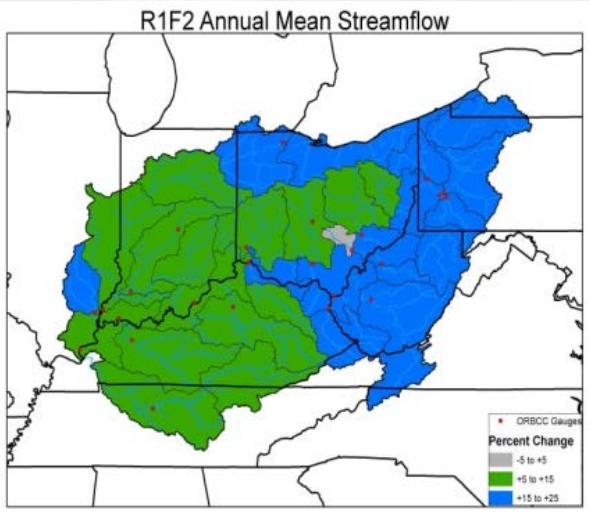
- IWR downscaled ensembles of 9 GCM models out of 77 archived models (USACE, NOAA, USGS and BOR)
  - Three 30-year periods 2011-2040 (F1), 2041-2070 (F2) , 2071-2099 (F3)
  - Two emissions scenarios – “A1B” and “A2”
  - Monthly precipitation and temperature changes for 698 – 1/8th degree grid squares across the Ohio River basin.
- NOAA – Ohio River Forecast Center
  - Used Sacramento Soil Moisture Accounting Hydrologic Model
  - Modeling produced
    - Runoff - River discharge for 25 gage points in basin
    - Monthly mean temperature changes through 2099
  - Back-casted model to 1952-2001 period – within 2% of observed in all 25 points.

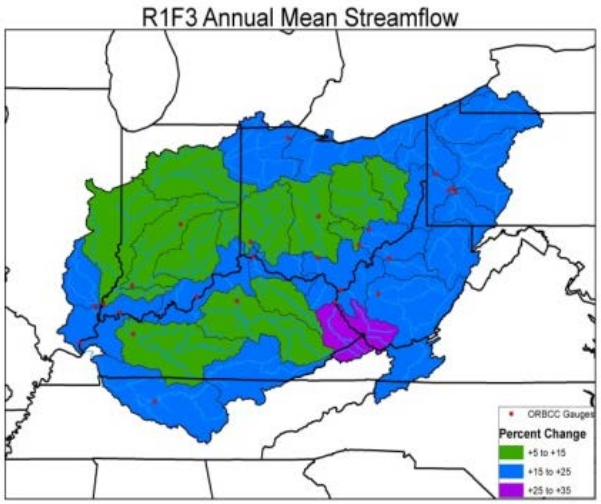
OHRFC Forecast Groups and Gage Points



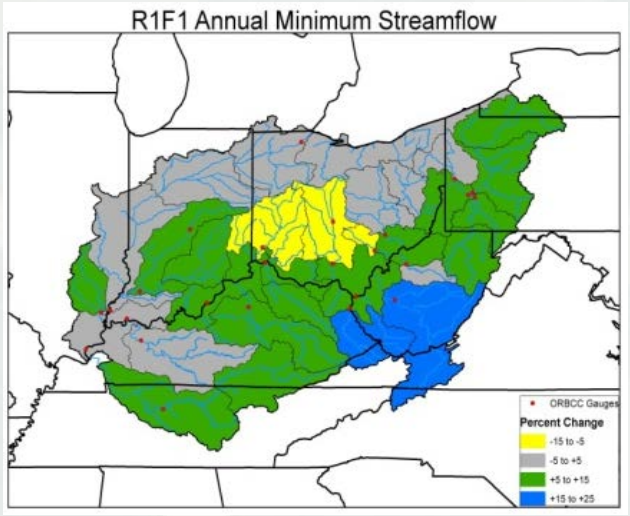
Modeling Results
Annual Mean Discharge Changes

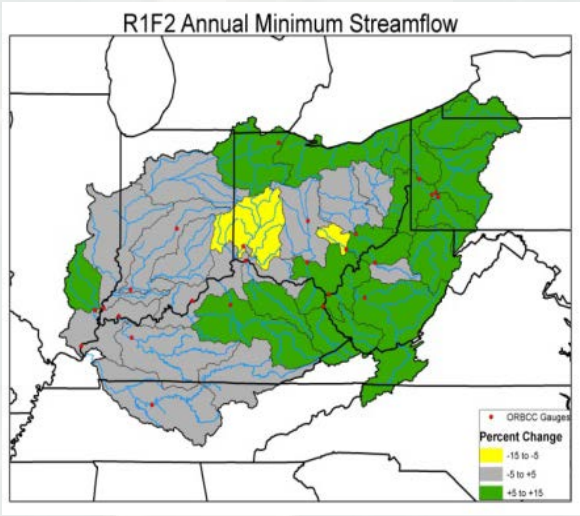


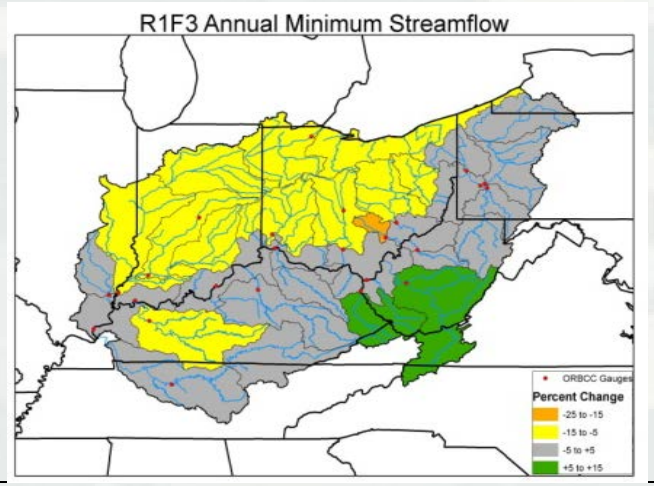




Modeling Results
Annual Minimum Discharge Changes







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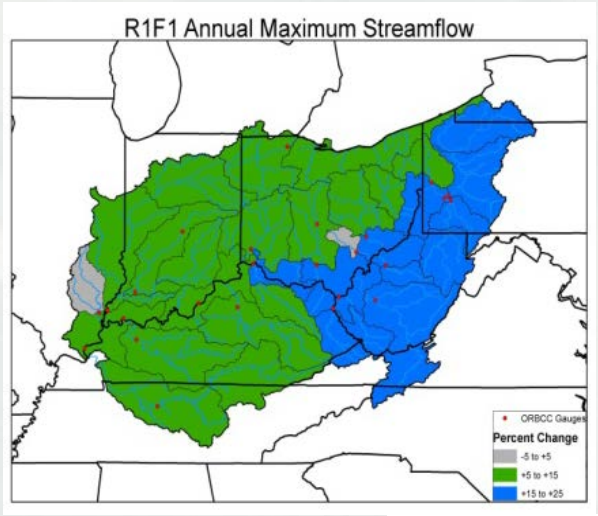

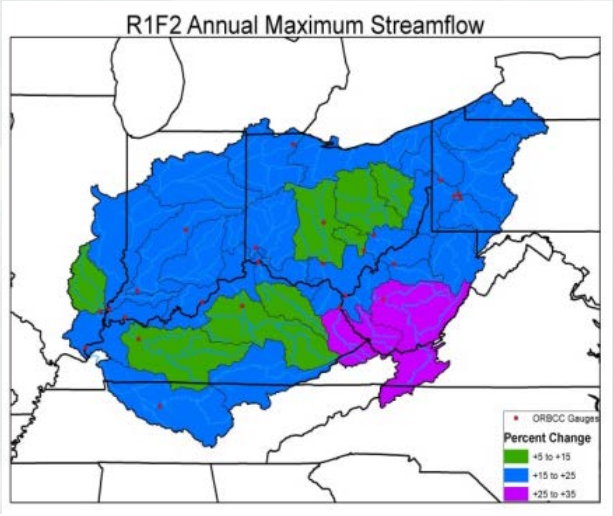

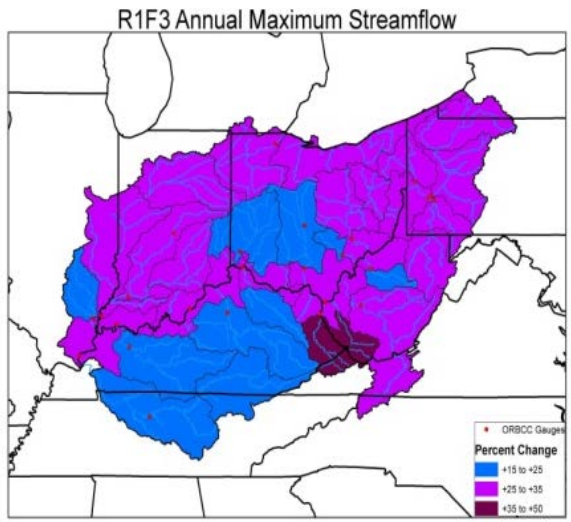

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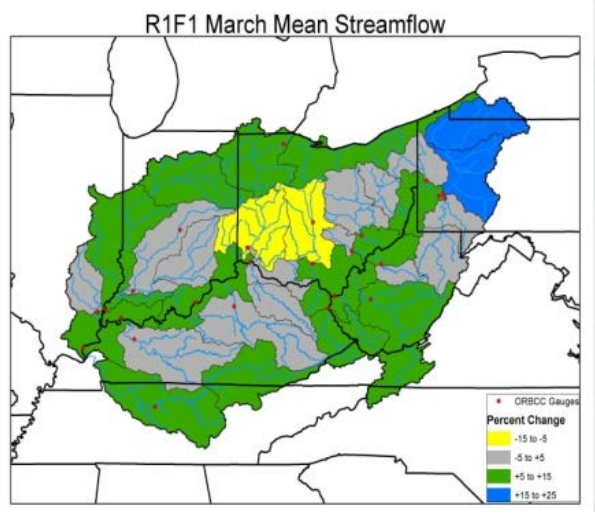
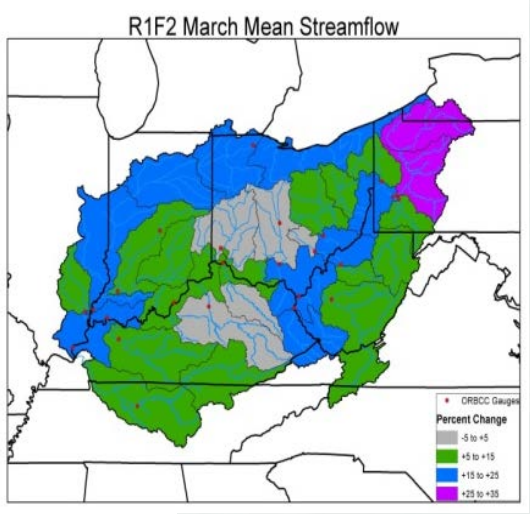
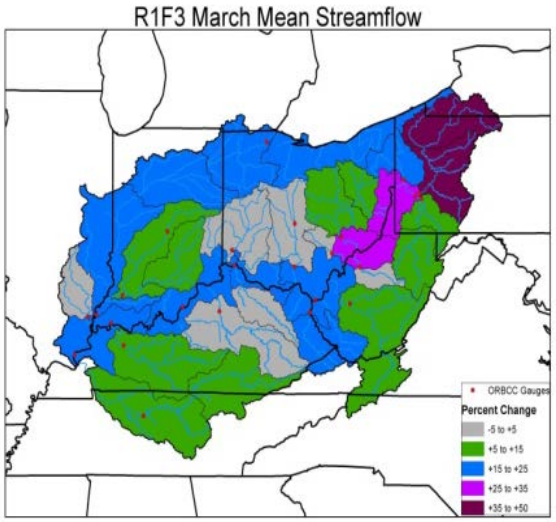
March Mean Discharge Changes







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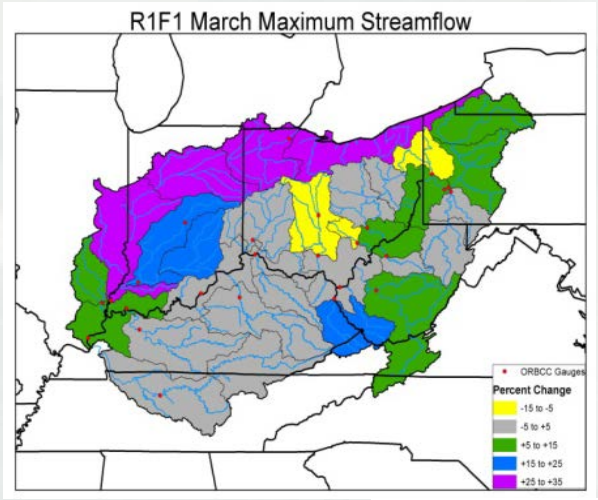

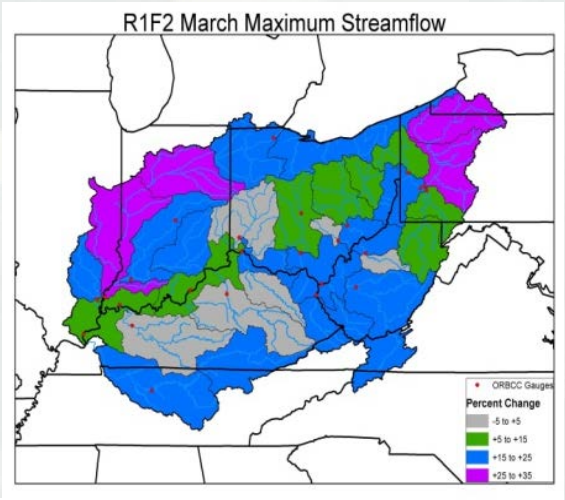

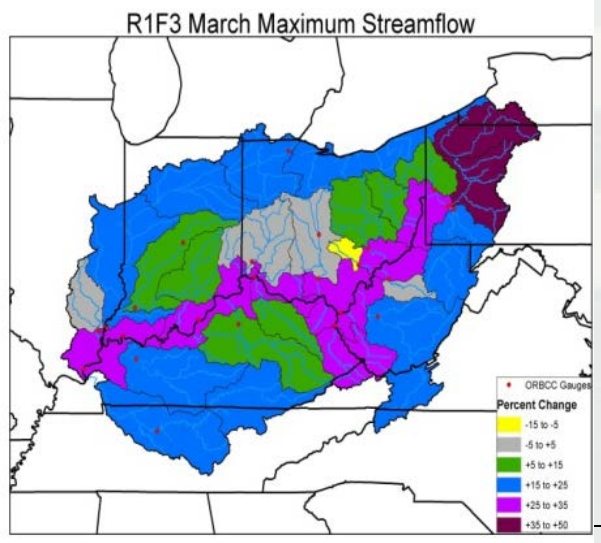

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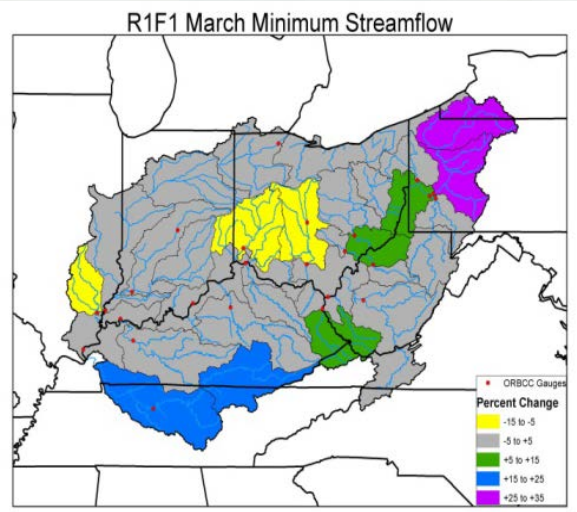
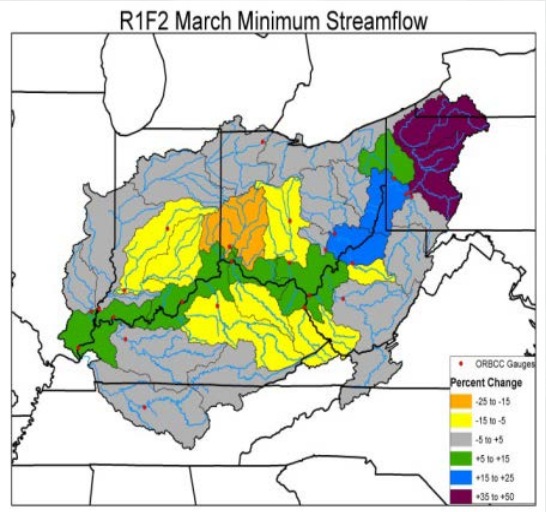
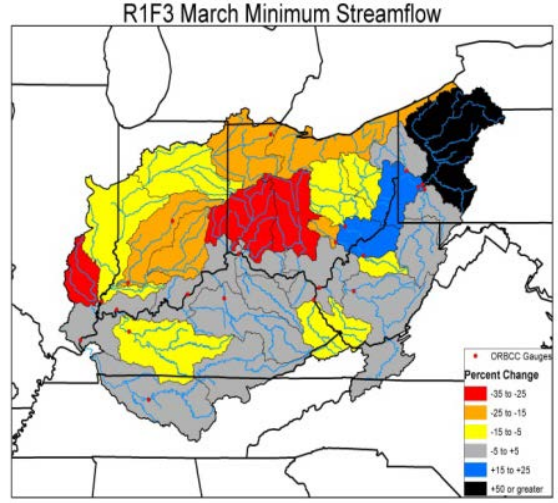
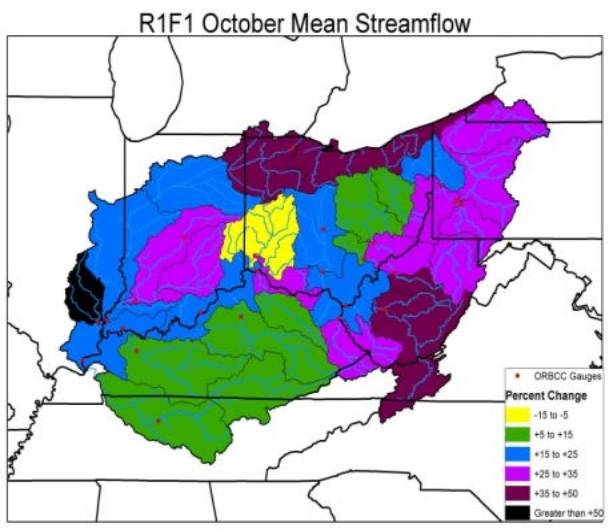
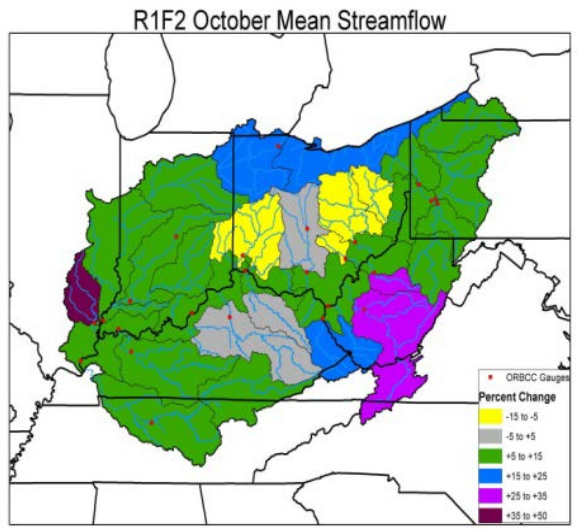


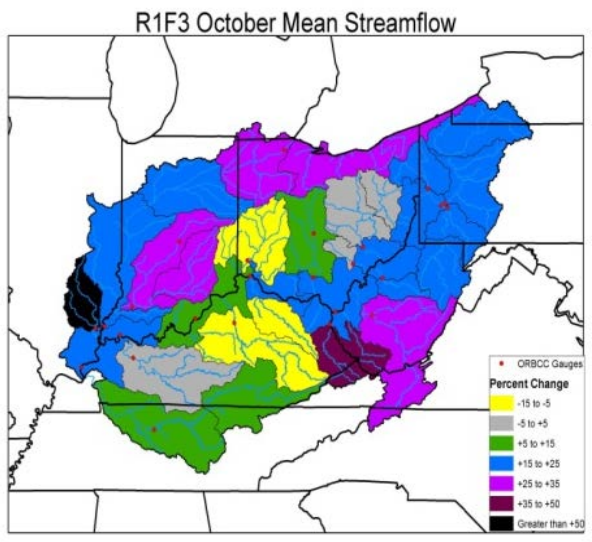




Modeling Results
October Mean Discharge Changes







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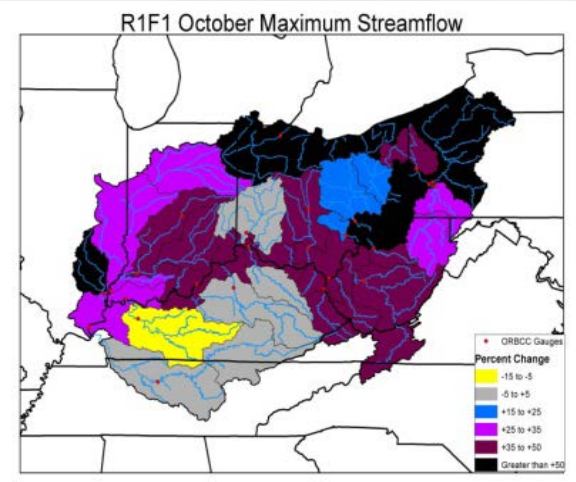

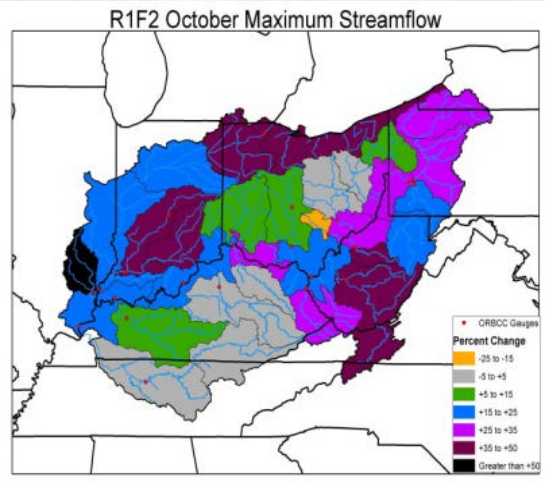

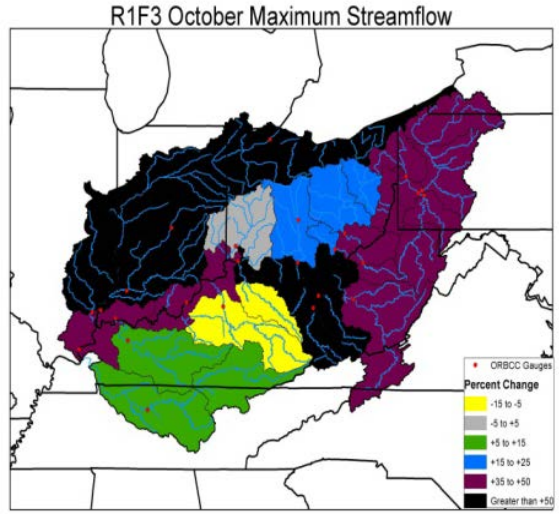

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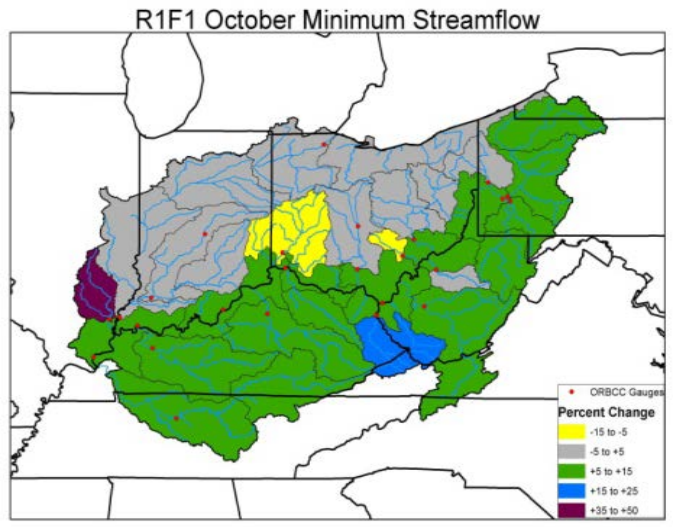
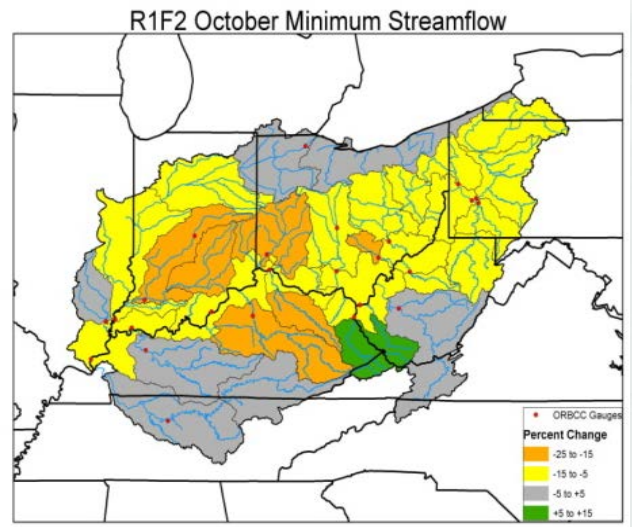
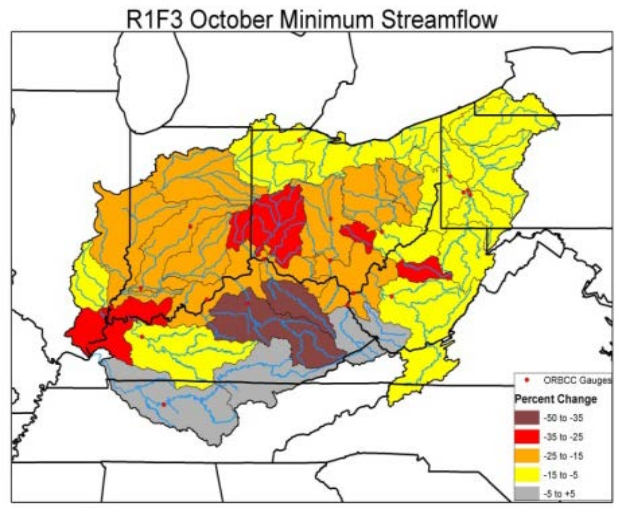
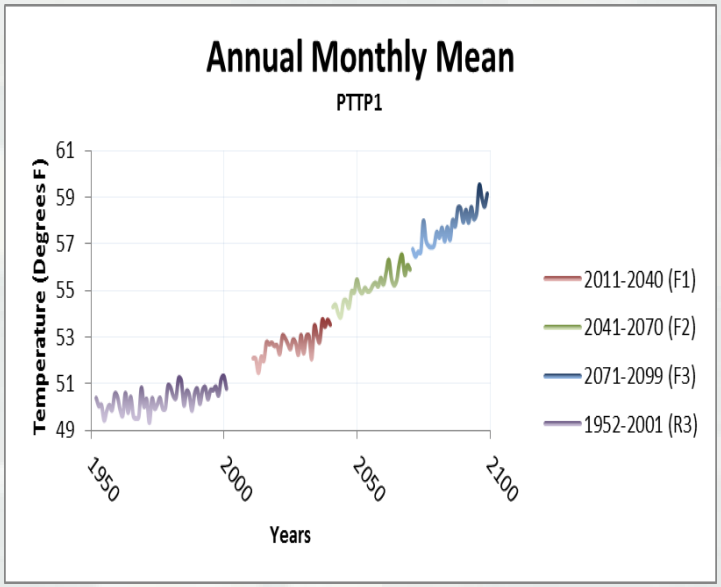


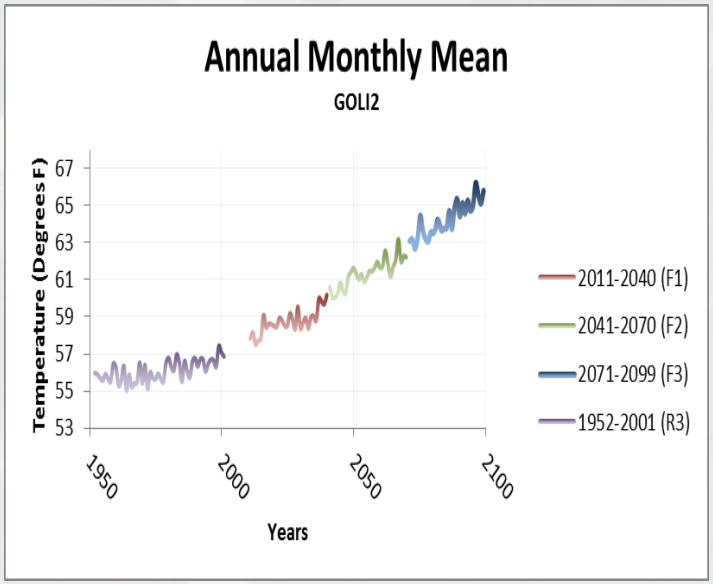




Modeling Results - Temperatures



Pittsburgh, PA



Golconda, IL

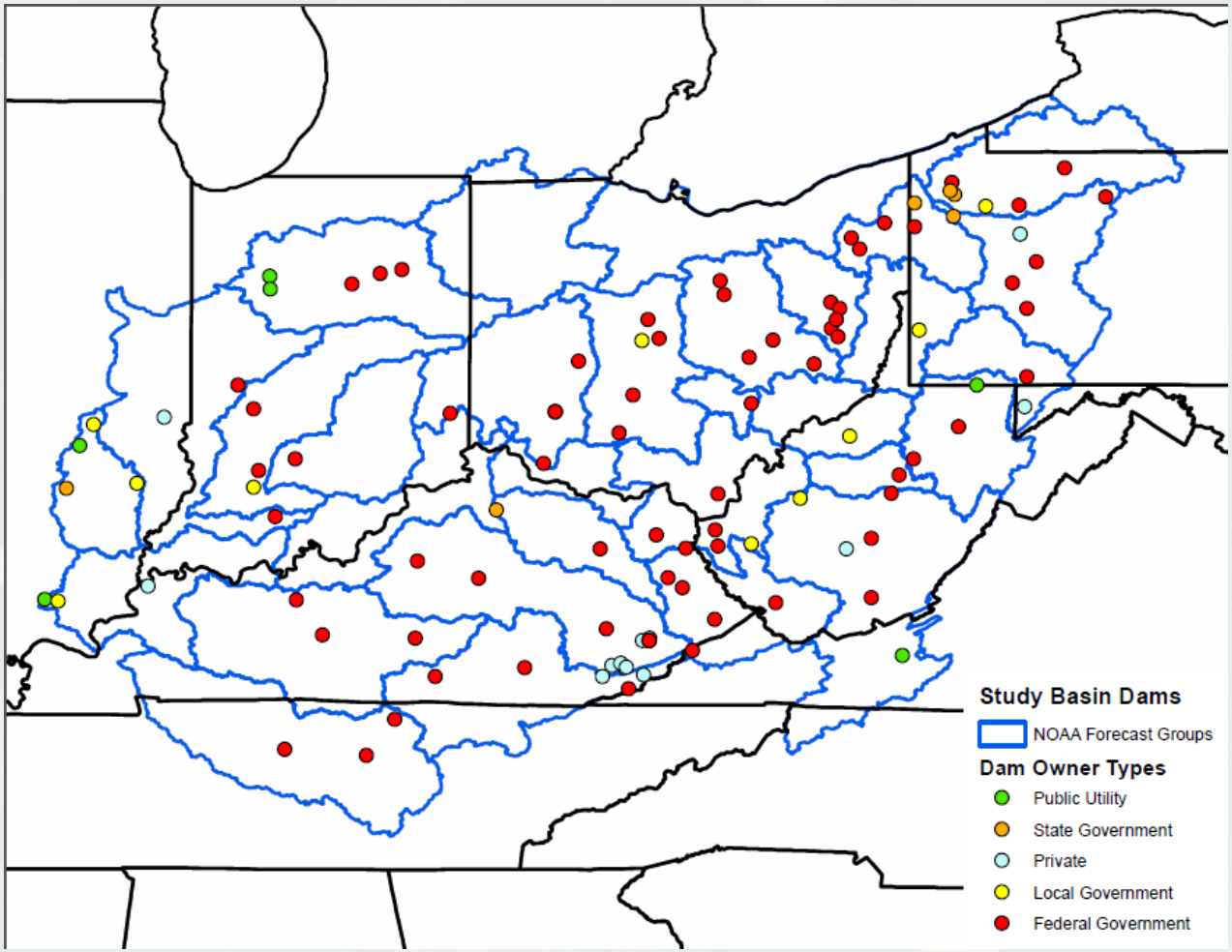
Temperatures forecasted to climb ½ degree per decade between 2011 and 2040 and 1 degree per decade between 2040 and 2099.

Impacted Systems

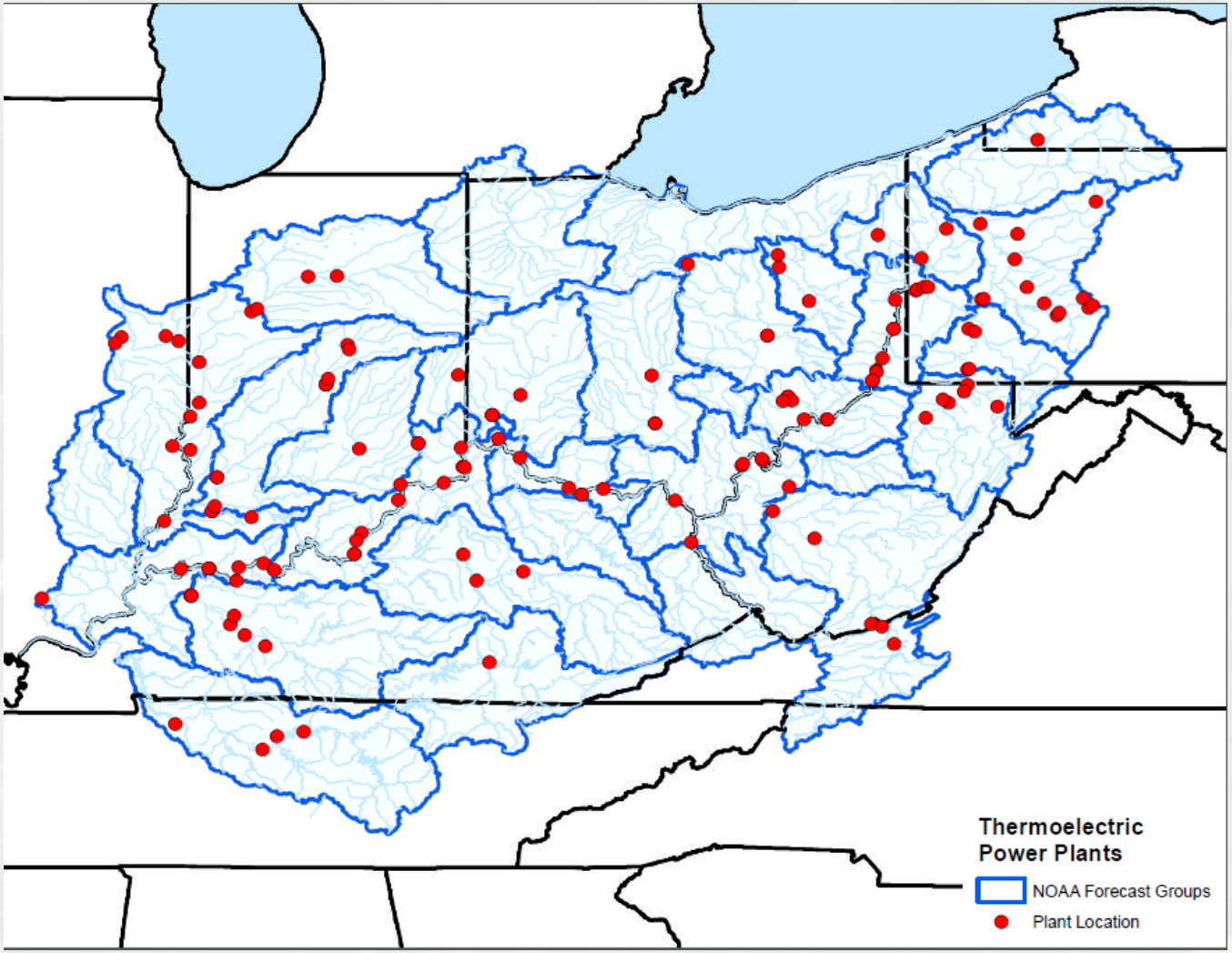
- Infrastructure
  - Dams, levees, thermoelectric power plants, navigation, water supply, hydropower, transportation, etc.
- Ecosystems
  - Aquatic systems
  - Terrestrial systems
  - Ecosystem services

Ohio River Basin Dams

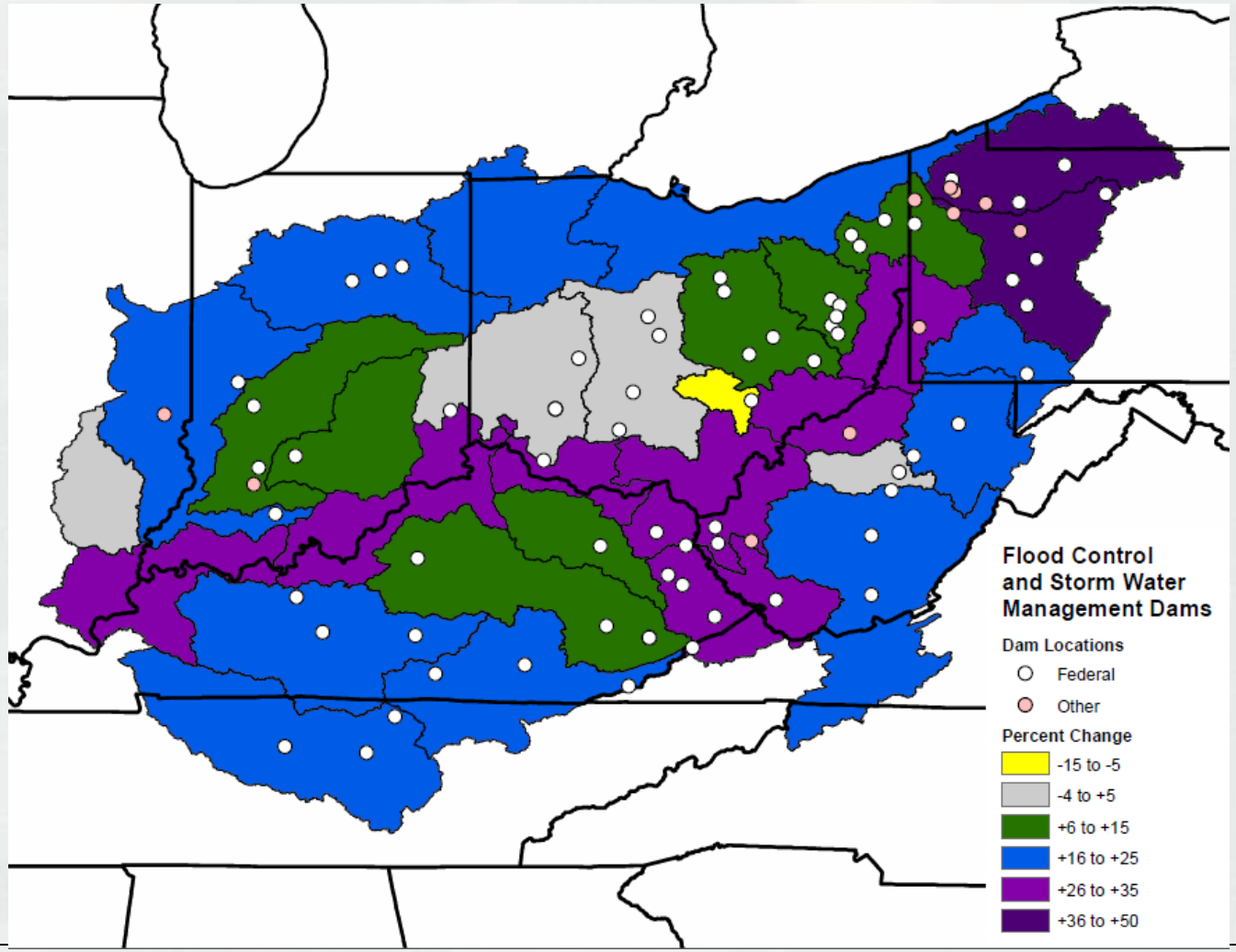
>3,000 acre feet storage



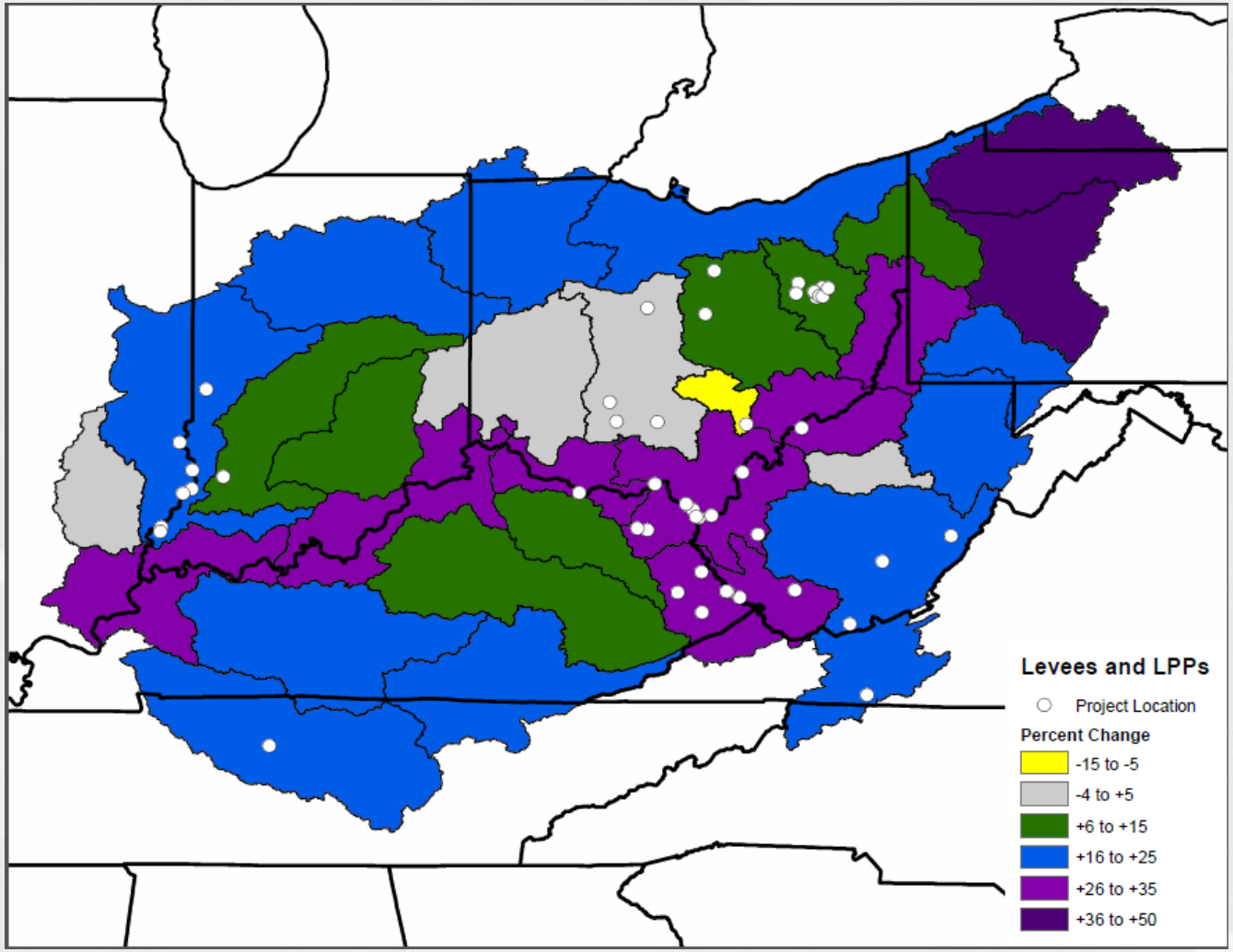
Thermoelectric Power Plants



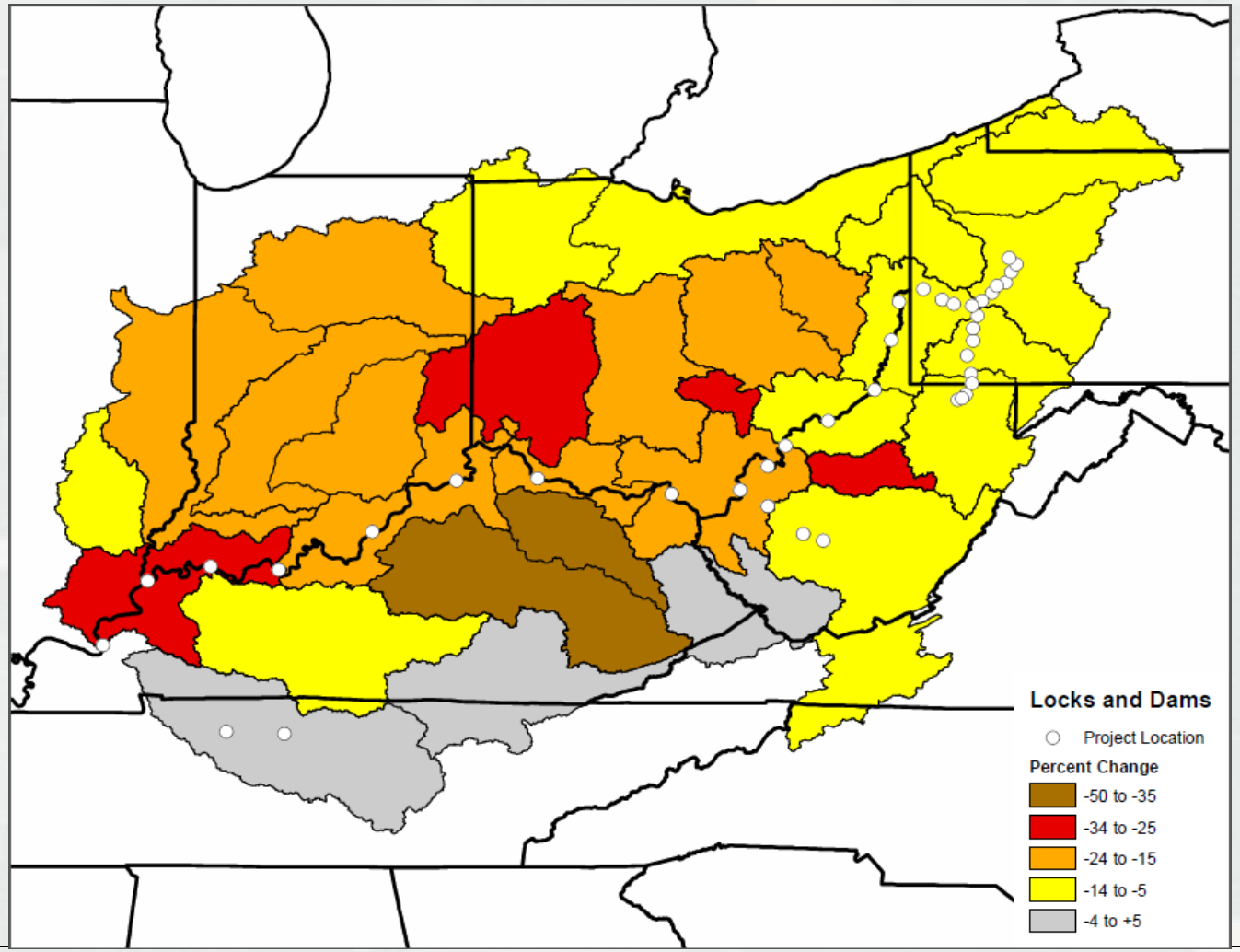
FC Dams and Reservoirs
March Maximum Flows 2070-2099



Floodwalls and Levees
March Maximum Flows 2070-2099



Navigation L&D
October Minimum Flows 2070-2099



Thermoelectric Power Plants
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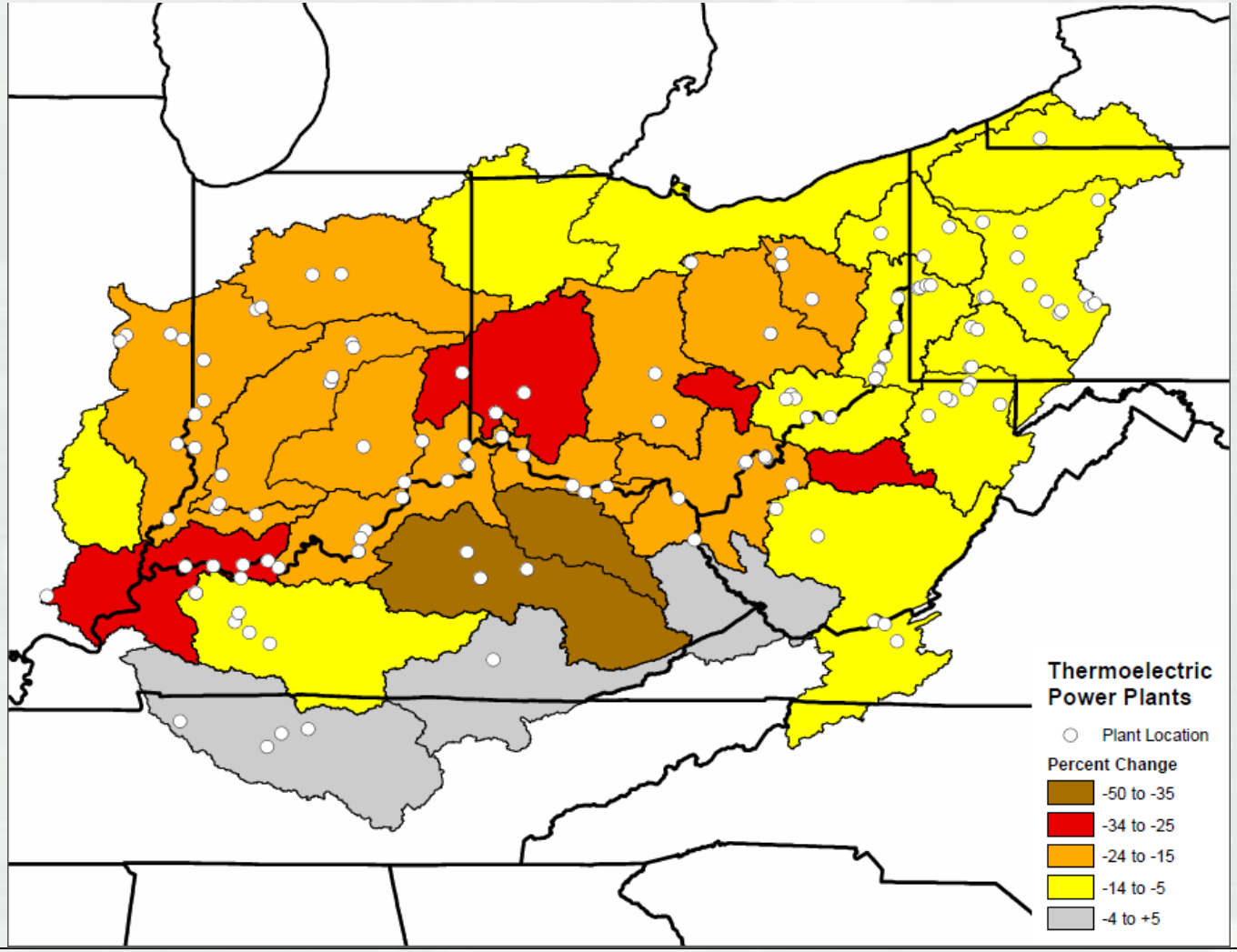

Adaptation Strategies

- Attenuate effects on:
  - Ecosystem components & services
  - Water resources infrastructure, etc.
- Integrated Water Resources Management
- Temporal implementation
  - Pre-2040
  - 2040-2099
- “No regret” and “robust” strategies

Policy Considerations

- Water resources projects future O&M
  - ► Storage and discharge for authorized purposes
  - ► Meet water quality/quantity targets downstream
- Water resources projects' rehabilitation
  - ► Future hydrologic changes = design changes?
- Authorized project purposes
  - ► Purposes still viable under new hydrologic regimes
  - ► Manage competition for water (WS, HYDRO, REC)
- Compliance with contractual agreements for water supply and hydroelectric power

Implementation of Strategies

- Corps division and district offices
- Ohio River Basin Alliance membership
- Other Federal and state agencies
- Private and corporate