Update on USGS Integrated Water Monitoring Initiatives

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USGS
science for a changing world

USGS Integrated Water Science

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OBSERVE

Next Generation Water Observing System (NGWOS)
NGWOS collects real-time data on water quantity and quality in more affordable, rapid, and widespread ways than has previously been possible. The flexible monitoring approach enables USGS networks to evolve with new technology and emerging threats.

ASSESS

Integrated Water Availability Assessments (IWAA)
IWAAs examine the supply, use, and availability of the nation's water. These regional and national assessments evaluate water quantity and quality in both surface and groundwater, as related to human and ecosystem needs and as affected by human and natural influences.

PREDICT

Integrated Water Prediction (IWP)
IWP builds a powerful set of modeling tools to predict the amount and quality of surface and groundwater, now and into the future. These models use the best available science to provide information for more rivers and aquifers than can be directly monitored.

DELIVER

National Water Information System (NWIS) Modernization
NWIS data systems that house USGS water information are being modernized to maximize data integrity, simplify data delivery to the general public, and automate early warning to enable faster response times during water emergencies.

Integrated Water Science Basins

- Regional focus areas for intensive monitoring, modeling and assessments
- 10 medium-sized basins (10,000-20,000 mi^2) representative of larger water-resource regions
- Our goal: Develop an integrated understanding that can extend to the broader region and Nation

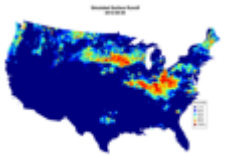
Components of the Integrated Water Science Basins

Catalog existing observation networks, models, and data and identify monitoring and knowledge gaps.

Establish integrated set of fixed and mobile monitoring assets in the water, ground, and air to fill data gaps.

Conduct targeted hydrologic research to fill knowledge gaps.

Use new and existing data and research to co-develop improved basin models.



Assess past, current, and future water availability – including water quantity, quality, and use.

Steps for Selecting Integrated Water Science Basins

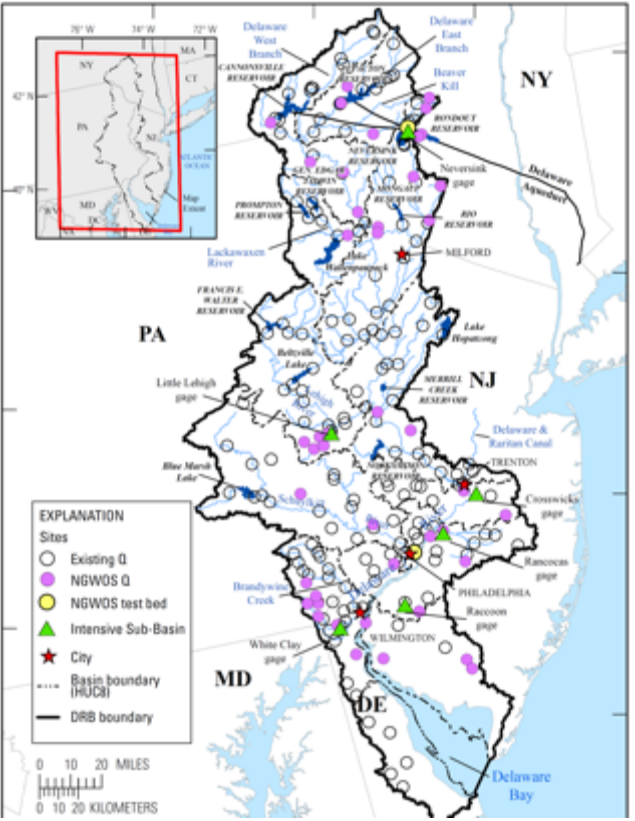
1. WMA Leadership establishes target Hydrologic Regions for next IWS Basin
2. Prioritize targeted Hydrologic Region(s) based on quantitative rankings of candidate HUC04 basins (*VanMetre et al, 2020*)
3. Solicit/review input on basin nominations/priorities from Regions, local USGS Science Centers
4. Engage national and regional stakeholders in each potential Region to understand science and monitoring gaps/priorities, and upcoming initiatives
5. Recommend potential basins to WMA Leadership for final selection
6. Select next IWS Basin

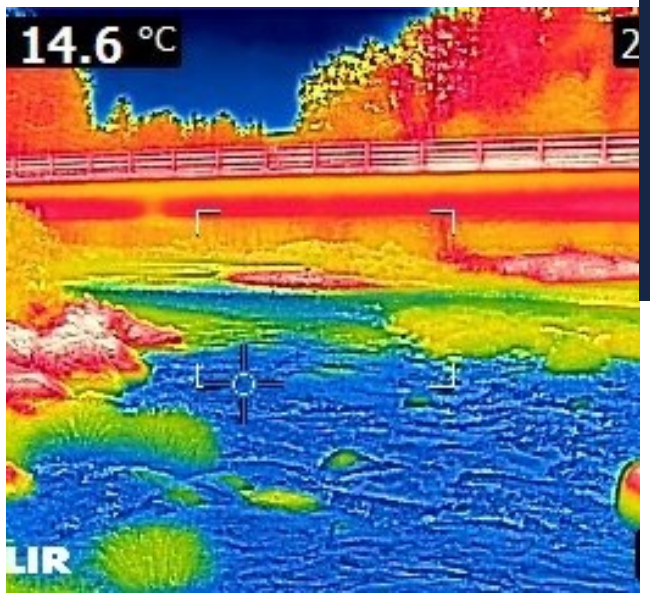
Integrated Water Science
OBSERVE / DELIVER

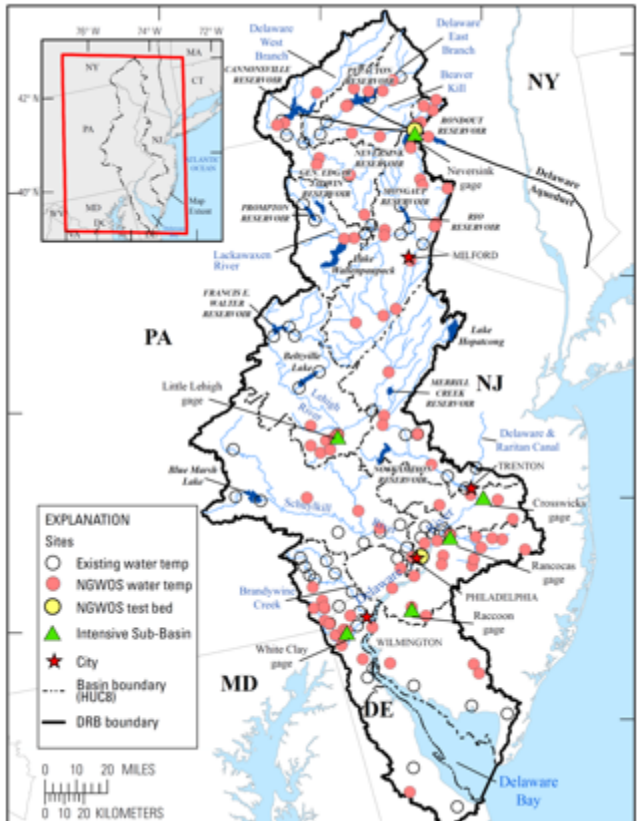
The USGS Next Generation Water Observing System (NGWOS) will provide high-resolution, real-time data on water quantity, quality, and use in Integrated Water Science Basins to support National modern water-availability prediction and decision support systems

- Approach
  - Increases spatial and temporal coverage of critical data
  - Dense array of sensors at selected sites
  - Use state-of-the-art data collection methods
  - Test and mature new technologies
  - Improved USGS operational efficiency
  - Modernized and timely data storage and delivery

Increasing Network Density







Delaware River Basin

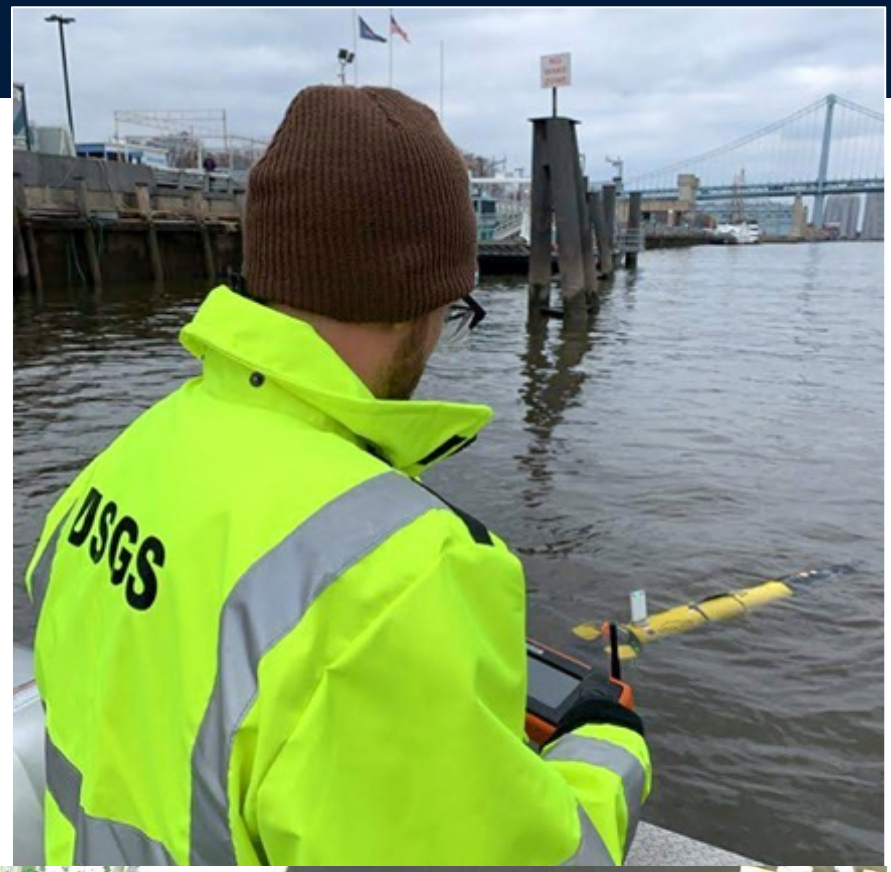
- 50 new or re-activated streamgages
- 99 new or re-activated temperature sites
- 64 new or re-activated salinity / specific conductance sites
- Guided by gap analysis / network design studies
- Enhancements to communications
- Evaluation of new technologies (non-contact sensors, UAS-based discharge/temp measurements)

Upper Colorado

- Mainly a planning year in the UCOL
- 3 upgraded real-time/discrete water-quality stations downstream of recently burned areas in the UCOL for evaluation of post-fire impacts on water-quality.

Synoptic Surveys
Delaware River Basin Examples

High spatial intensity, short duration monitoring that extends understanding from high temporal intensity sites



Salinity front mapping in the lower Delaware River

- Two AUV (ecomappers) deployed
- Cross sectional mapping at key locations
- Summer 2020 mainstem dissolved oxygen survey delayed to 2021

Salinity front mapping in aquifer

- Electromagnetic mapping using a towed time domain EM unit to map the fresh to saline groundwater transition

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Innovation Test Beds

Sites for testing / methods development

Independent Seaport Museum, PA

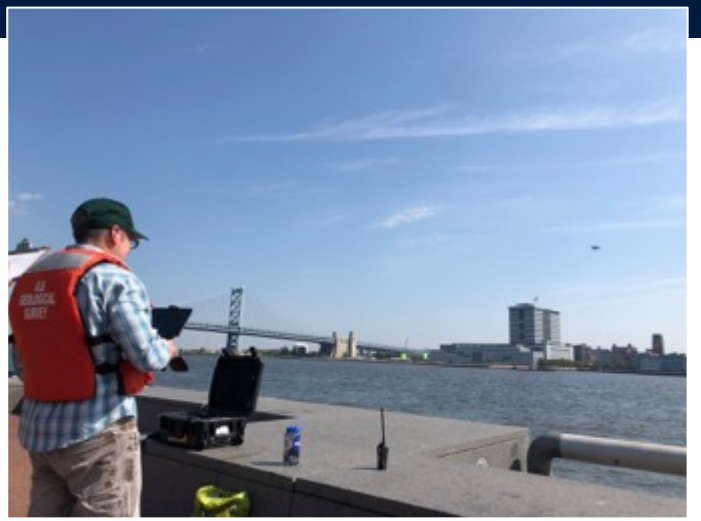
- Core measurements will include discharge, water quality (including nitrate), camera
- Temp/salinity string, lower cost nitrate sensor, e. coli sensor, UAS testing
- Significant opportunity for outreach / engagement with museum

Neversink Basin, NY

- measuring ET, soil moisture, snowpack, GW-SW interaction and water quantity / quality
- FY20 planned tests – thermal imaging, UAS, soil moisture sensors, snowpack sensors, sediment sensors
- Protocols and methods development

Upper Colorado

- Stations equipped with multiple new sensors for measuring snow-water equivalent, snow density, liquid water content, snow depth, soil moisture, and meteorological parameters.
- A NextGen non-contact streamgage on Middle Fork Ranch Creek to allow for model evaluation of natural streamflow from the test-bed basin



Highlights of 2021 Planned DRB NGWOS Activities

- SEDIMENT: Additional of sediment fingerprinting to intensive monitoring of sediment transport and to improve sediment modelling in the basin.
- GROUNDWATER: Coupled air – water temperature measurements at 53 sites in the headwaters to improve modeling of GW-SW relationships
- WATER-USE: Expansion of self-supplied domestic water use monitoring from 5 to 20+ sites
- TEMP: A planned synoptic study to evaluate the determine the spatial variability of water temperature to support machine learning models
- R&D: testing / methods development includes ongoing evaluations of cameras for stage and velocity estimation, ice detection; in situ e. coli sensor testing; long-range, low-power communications testing; autonomous surface / underwater vehicles for water quality and bathymetry.

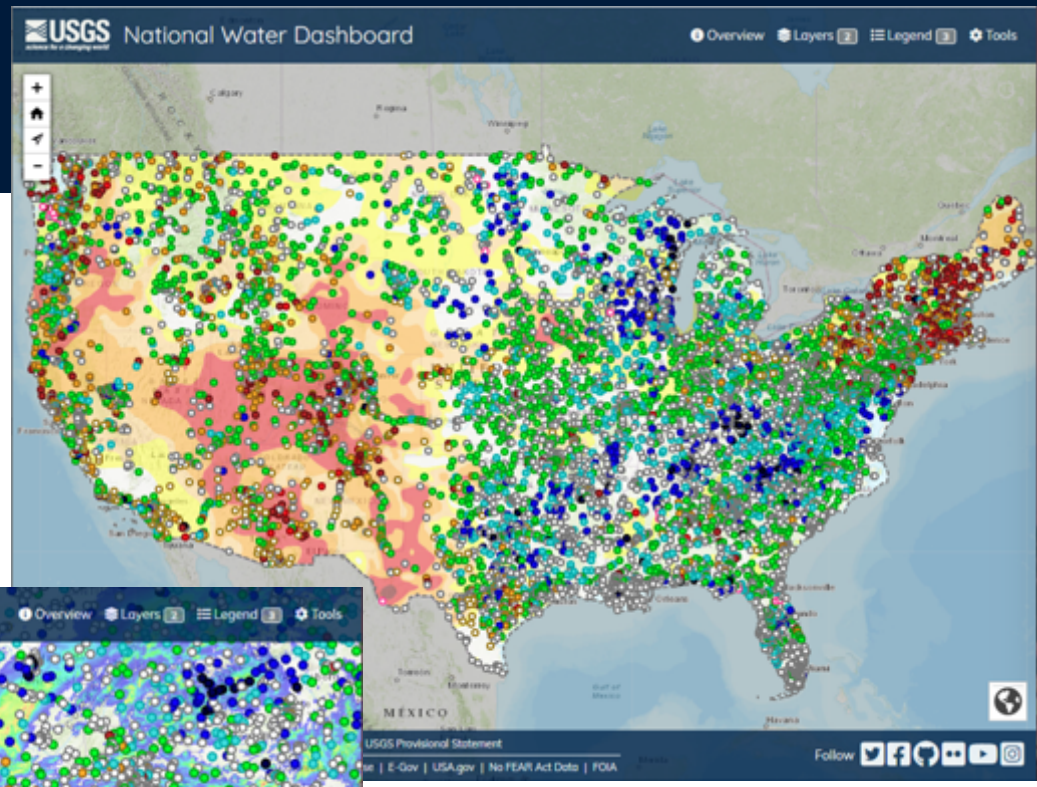
Highlights of 2021 Planned UCOL NGWOS Activities

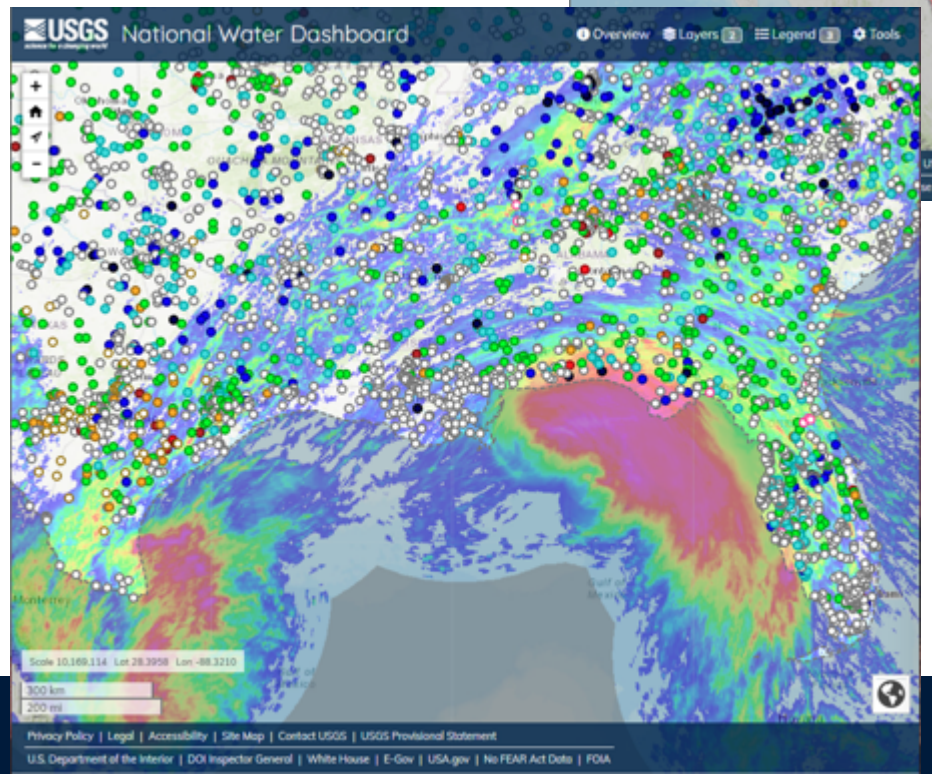
- SNOW MONITORING: Snow test-bed site with two snow-observation locations (one above tree line and one below tree line) equipped with multiple sensors for measuring snow-water equivalent, snow density, liquid water content, snow depth, soil moisture, and meteorological parameters; also includes a non-contact stream gage.
- GROUNDWATER: Application of ground-based geophysical techniques and potentially a forward-looking infrared camera to identify groundwater-recharge and -discharge zones in French Gulch.
- WATER BUDGET: Initiate water-isotope sampling of the Colorado and Gunnison Rivers and major tributaries in the NGWOS study area to evaluate relative contribution of groundwater.
- WATER QUALITY: Establish a water-quality test-bed site with multiple water-quality sensors including a nitrate sensor, chlorophyll sensors, an acoustic doppler velocity sensor, and a web cam at a key monitoring location for water uses in the Grand Valley.

National Water Dashboard

NATIONAL WATER DASHBOARD
(Experimental Release - October 2020):

- The NWD presents real-time stream, lake and reservoir, precipitation and groundwater data for more than 13,500 USGS real-time observation stations across the country.
- Monitoring data shown along with weather data such as radar, watches and warnings, past precipitation totals, precipitation forecasts and drought conditions from other sources.
- The NWD will also link to the USGS WaterAlert system, which sends out instant, customized updates about water conditions



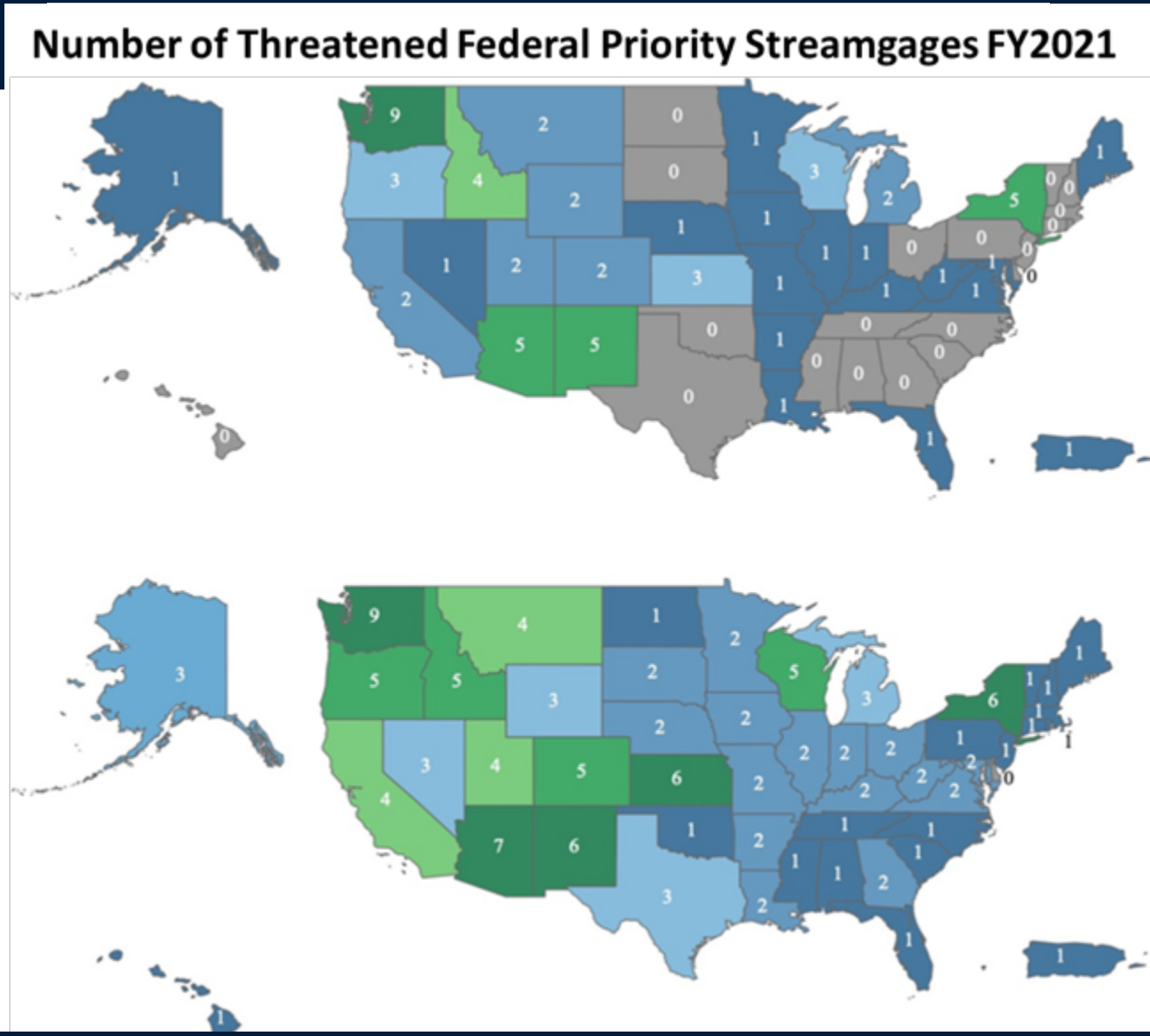


Select Highlights of New 2021 National Observing Activities

- INSTRUMENTATION R&D:
  - Test and, as appropriate, transition new and innovative hydrologic monitoring related techniques, methods, and instrumentation. (AUVs, Real-time P, algal classification, and e coli sensors)
  - Camera innovations (storage/processing, stage estimation, ice detection)
  - Implementation and testing of new telemetry systems
- DISCRETE SAMPING R&D:
  - Develop, test, identify, and document procedures that allow for collection of a representative water samples for the analysis of PFAS, that is reproducible within defined limits of variability.
- REMOTE SENSING R&D:
  - Evaluate technologically ready approaches for remotely sensing water quality and to develop an IT framework for data processing, display, and delivery.
- NATIONAL TEMPERATURE DATA:
  - Promote expanded delivery of historic and future water temperature observations across the Nation.

Threatened Federal Priority Streamgages

- The FPS program has been flat funded since 2016.
- FPS Network costs have continued to increase by 1%-3% every year due to increases in salary, travel, equipment, and communication costs.
- Cost increases have been covered by 1) USGS partners, where gages are jointly funded, or 2) delaying planned network enhancements where possible.
- Network enhancements can no longer be delayed, and operational costs are estimated to increase another 1%-3%.
- As a result, gages will begin to be discontinued in FY2021, if additional funds are not provided.




Questions?
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