Water Resources data developed for the 2020 Resources Planning Act (RPA) Assessment[1,2] and related efforts. These data can be used for numerous applications by private and public land management and research constituents. Examples include improving forest plan revisions, justifying management decisions, and improving stakeholder communication. For example, this information could support decision-making by identifying watersheds at risk of water shortage or water quality impairment to guide restoration efforts or water use adaptations. All listed datasets are available in GIS format.

DATA DESCRIPTION	UNITS	SPATIAL EXTENT	SPATIAL RESOLUTION[3]	TEMPORAL DOMAIN	POTENTIAL USE*
Current and Recent Past					
Water Supply Volume[†,4,5]	Millions of gallons per day; millimeters	Conterminous U.S.	8-digit HUC Watersheds	1950 – 2005 *Monthly timestep*	National-level to Mid-level applications. Values can be aggregated into categories (e.g., ownership, land cover type, state, National Forest) and used to estimate, for example, the amount of water originating in National Forests and different land cover types. Data include measures of soil moisture, base flow, and surface runoff, along with other fluxes and storages.
Water Demand Volume[†,6]	Millions of gallons per day	Conterminous U.S.	County, 4-digit HUC Watersheds	1985 – 2015 *5-year timestep*	National-level to Mid-level applications. Results can be summarized by county or municipality. Average historical water withdrawals are classified into different withdrawal categories including domestic and public, industrial and commercial, electric energy, irrigation, and livestock and aquaculture.
Watershed Condition Analysis[7,8]	Anthropogenic stress indices from 1 to 5 *(lowest to highest risk)*	Conterminous U.S.	10-digit HUC Watersheds *15,000 watersheds*	Current *Last updated in 2020*	National-level to Base-level applications. Anthropogenic stress can be evaluated based on individual indices, or with a combined stress index to understand the influence of human-caused stressors on watersheds. Stress factors include human population growth and urban development; agriculture; and energy development and mining. Can complement the Watershed Condition Framework[9] for non-National Forest System lands.

DATA DESCRIPTION	UNITS	SPATIAL EXTENT	SPATIAL RESOLUTION[3]	TEMPORAL DOMAIN	POTENTIAL USE*
Future Projections					
Water Supply Volume[†,4,5] *Available for RCP 4.5 & RCP 8.5; multiple climate models*[10]	Millions of gallons per day; millimeters	Conterminous U.S.	8-digit HUC Watersheds	2011 – 2099 *Monthly timestep*	National-level to Mid-level applications. Can be used to examine the effect of climate change on hydrology under multiple scenarios. Information can be summarized for watersheds of interest and used to understand future hydrologic regimes. Values can be aggregated into categories (e.g., ownership, land cover type, state, national forest) and used to estimate, for example, the amount of water that will originate in National Forests and different land cover types. Projections are also made for soil moisture, base flow, and surface runoff, among other fluxes and storages.
Water Demand Volume[†,6] *Available for each RPA scenario*[10]	Millions of gallons per day	Conterminous U.S.	County, 4-digit HUC Watersheds	2011 – 2070 *Annual timestep*	National-level to Mid-level applications. Results can be summarized by county or municipality. Average water withdrawal projections can be examined for different withdrawal categories including domestic and public, industrial and commercial, electric energy, irrigation, and livestock and aquaculture to examine overall projected water demand and relative demand by category. Demand model projections can be combined with supply projections to examine projected water shortage vulnerabilities.
Water Shortage Vulnerability[11,12] *Available for each RPA scenario*[10]	Millions of gallons per day	Conterminous U.S.	4-digit HUC Watersheds	2020, 2040, 2060 *20-year averages*	National-level to Mid-level applications. Information can be used to assess how climate change or changes in population may affect the balance between water supply and demand. Models look at how climate change could alter both supply and demand but do not include interactions with changes in vegetation, land use, or other changes. Can help National Forests understand future vulnerability of watersheds to climate change and other stressors and the long-term sustainability of water supplied by the Forest.

DATA DESCRIPTION	UNITS	SPATIAL EXTENT	SPATIAL RESOLUTION[3]	TEMPORAL DOMAIN	POTENTIAL USE*
Water Shortage Adaptation Option Evaluation[13]	Number of assessment subregions experiencing water shortage	Conterminous U.S.	Assessment subregions	2020, 2040, 2060, 2080 *20-year averages*	National-level to Broad-level applications. Provides a broad-brush idea of the degree to which different adaptations could be successful under alternative future population and climatic conditions. Analysis suggests that a very aggressive campaign of adaptation would be needed to fully adjust to the combined effects of population and economic growth and climatic change.

* A description of FS business applications by spatial scales is available in Table 1-1 of the Existing Vegetation Classification, Mapping, and Inventory Technical Guide, v2.0
† Denotes corresponding datasets exist in both the *Current and Recent Past* and *Future Projection* sections of the table

References and Footnotes:

[1] Warziniack, Travis; Arabi, Mazdak; Froemke, Pamela; Ghosh, Rohini; Heidari, Hadi; Rasmussen, Shaundra; Swartzentruber, Ryan. 2023. Water Resources. In: U.S. Department of Agriculture, Forest Service. 2023. Future of America's Forest and Rangelands: Forest Service 2020 Resources Planning Act Assessment. Gen. Tech. Rep. WO-102. Washington, DC: xxx-xxx. Chapter 9. https://doi.org/10.2737/WO-GTR-102-Chap9.

[2] The RPA website provides links to current and past RPA Assessments, as well as supporting data, technical reports, and webinars: https://www.fs.usda.gov/research/inventory/rpaa

[3] Water HUC (hydrologic unit code) and assessment subregions are defined by USGS: https://water.usgs.gov/GIS/huc.html

[4] Brown, T. C., Froemke, P., Mahat, V., & Ramirez, J. A. (2016). Mean annual renewable water supply of the contiguous United States. Briefing paper. Rocky Mountain Research Station, Fort Collins, CO.

[5] Water supply is defined as water yield combined with potential reservoir storage. Water yield values are also available, with the same associated metadata.

[6] Brown, T. C., Foti, R., & Ramirez, J. A. (2013). Projected freshwater withdrawals in the United States under a changing climate. *Water Resources Research*, *49*(3), 1259-1276.

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[8] Brown, Thomas C; Froemke, Pamela. Risk of impaired condition of watersheds containing National Forest lands. Gen. Tech. Rep. RMRS-GTR-251. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 57 p.

[9] More information on Watershed Condition Framework and Watershed Condition Classification: https://www.fs.usda.gov/naturalresources/watershed/condition_framework.shtml

[10] The RPA Assessment scenarios integrate a subset of Representative Concentration Pathways and Shared Socioeconomic Pathways developed by the Intergovernmental Panel on Climate Change to explore plausible future levels of emissions and development. See: Langner, Linda L.; Joyce, Linda A.; Wear, David N.; Prestemon, Jeffrey P.; Coulson, David; O'Dea, Claire B. 2020. Future scenarios: A technical document supporting the USDA Forest Service 2020 RPA Assessment. Gen. Tech. Rep. RMRS-GTR-412. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 34 p. https://doi.org/10.2737/RMRS-GTR-412

[11] Foti, R., Ramirez, J. A., & Brown, T. C. (2014). A probabilistic framework for assessing vulnerability to climate variability and change: the case of the US water supply system. *Climatic change*, *125*(3-4), 413-427.

[12] Heidari, H., Arabi, M., Ghanbari, M., & Warziniack, T. (2020). A Probabilistic Approach for Characterization of Sub-Annual Socioeconomic Drought Intensity-Duration-Frequency (IDF) Relationships in a Changing Environment. *Water*, *12*(6), 1522.

[13] Warziniack, T., & Brown, T. C. (2019). The importance of municipal and agricultural demands in future water shortages in the United States. *Environmental Research Letters*, *14*(8), 084036.