Number of High-Hazard Potential Dams

This EnviroAtlas national map depicts the number of dams that are classified as having high hazard potential within each 12-digit hydrologic unit (HUC) in the U.S.

Why is the number of high-hazard potential dams important?

The U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), has developed a classification system for the nation's ~84,000 dams.[1] Dams are classified by potential impacts (e.g., loss of human life or destruction of property) resulting from dam failure or faulty operation (e.g., an unscheduled release of water). A dam's hazard potential classification does not imply that any hazards are affecting the present condition of the dam. The hazard potential classification does not cover design criteria or operation procedures; these elements are the responsibility of individual regulating agencies.[1] Since dams may be owned and operated by federal, state, or private entities, the classification process helps to standardize the definition of hazards and possible responses to threatened public safety.

The 3 FEMA dam hazard classification levels are low, significant, and high hazard in order of increasing negative consequences and responses should a threatened dam failure or faulty operation occur.[1] The failure or faulty operation of a low hazard potential dam is likely to result in little economic and environmental loss and no loss of human life. Significant hazard implies likely economic or environmental damage, but no loss of human life. A high hazard potential classification indicates that failure or faulty operation may result in the loss of one or more human lives, whether or not economic or environmental losses occur.[1] According to the Army Corps of Engineers' National Inventory of Dams (NID), there are 15,498 dams in the U.S. classified as high-hazard potential. Of these, 10,636 dams have an official emergency action plan.[2] The need for preparedness became clear in February 2017 when the Oroville (California) dam, the tallest dam in the U.S. at 770 feet, experienced spillway damage and overtopping of the dam after an extended period of heavy rain and snowmelt, requiring the evacuation of 188,000 people for several days.

Human societies worldwide enjoy the benefits of dams that provide drinking water, electric power, irrigation, flood control, and recreation. Dams in arid regions in the U.S. have been instrumental in allowing agricultural production

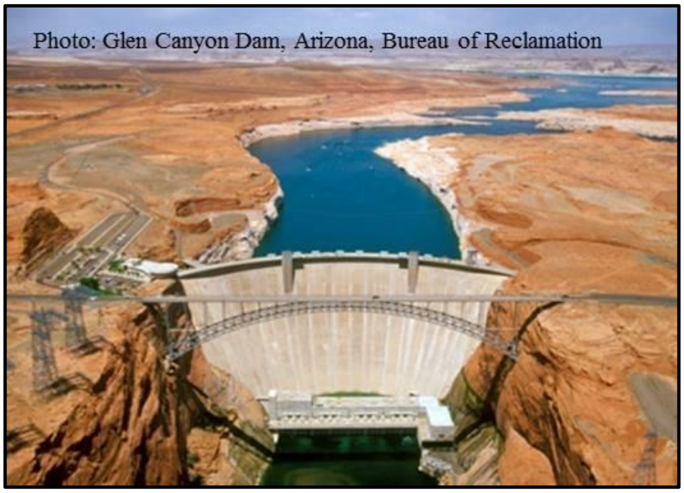
Photo: Glen Canyon Dam, Arizona, Bureau of Reclamation

and providing residential and industrial water supplies for major population increases in the Southwest. However, these benefits come at a price, which is the loss of riverine and stream ecosystem quality, function, and services. Post-dam habitat changes are dramatic for aquatic and semiaquatic wildlife: the change from flowing water to still water; reduction in riparian habitats, vegetation, and groundwater recharge; retention of sediment; blockage of fish passage; and downstream changes in seasonality of flood and low flow affecting wildlife feeding and reproduction and native plant succession.[3-6] Dams are a major factor in declining native fishery and riparian bird populations.[3,4,5] Physical changes to rivers from damming are more dramatic in the drier regions of the country (the Great Plains and intermountain areas of the West) than in the East and Pacific Northwest where higher rainfall and runoff preserve some of the regulated river's former characteristics.[4]

How can I use this information?

This map allows users to evaluate the number of high-hazard potential dams in each 12-digit HUC across the U.S. The map provides an indication of the amount of surface water storage available within each HUC for drinking water, irrigation, flood control, and recreation. This indicator is most useful for drawing attention to regional patterns of high-hazard potential dams within HUCs. The popup that appears when clicking on the HUC will reveal the number of high-hazard potential dams in the HUC. Users can identify hydrologic units with few or no dams as areas likely to have more free-flowing streams and rivers. A companion map, Water Supply from NID Reservoirs, provides total

CONTINUED ON BACK ▶

maximum storage capacity behind dams in millions of gallons for each HUC.

An area can be more thoroughly investigated by adding data for streams and water bodies (NHDPlus, found under the boundaries icon) to the base map. Increasing the transparency and examining the base map gives a view of the drainage network and the potential locations of reservoirs. One may also compare the EnviroAtlas data and base imagery with the interactive map on the NID website for dam locations.

How were the data for this map created?

The data for this map were acquired from the 2009 National Inventory of Dams (NID) maintained by the U.S. Army Corps of Engineers. The number of high-hazard potential dams were noted for each 12-digit hydrologic unit (HUC) and compiled for the entire U.S. The data were summarized by 12-digit HUC boundaries taken from the National Hydrography Dataset Plus (NHDPlus) V2 WBD Snapshot. For more details, see the metadata**.**

What are the limitations of these data?

The mapped information does not represent a complete accounting of all dams within HUCs. It is an inventory of the largest reservoirs that store the greatest volume of water and have the most influence in interrupting the free flow of water in rivers and streams within the HUCs. Summarizing and estimating various metrics across HUCs may create misleading results. Dams may be concentrated along a major river or scattered along minor tributaries across a broad rural area in the HUC; the locations of specific dams are not mapped within individual HUCs. The hazard classification does not consider every possible hazard. For example, incidents like accidental loss of life by recreational users are not considered. No allowances are made for crisis evacuation plans or emergency procedures as they should not substitute for the appropriate design and construction of dams.[1]

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Summary data on dams for the nation and individual states as well as an interactive map and report may be obtained at the Army Corps of Engineers National Inventory of Dams (NID) website. Non-government users can query the database using the interactive report and map functions.

Where can I get more information?

A selection of resources on dams, dam safety planning, and dam effects on environmental quality is listed below. For additional information on data creation, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

Megan Mehaffey, EPA, developed the map. The data fact sheet was created by Sandra Bryce, Innovate!, Inc.

Selected Publications

1. Interagency Committee on Dam Safety. 2004. Federal guidelines for dam safety: Hazard potential classification system for dams. U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), Washington, D.C. Update of 1998 report, 21 p.

2. U.S. Army Corps of Engineers. National Inventory of Dams (NID). Accessed March 2017.

3. Nilsson, C., and K. Berggren. 2000. Alterations of riparian ecosystems caused by river regulation: Dam operations have caused global-scale ecological changes in riparian ecosystems. *BioScience* 50(9):783–792.

4. Graf, W.L. 2006. Downstream hydrologic and geomorphic effects of large dams on American rivers. *Geomorphology* 79(3-4): 336–360.

5. Bunn, S.E., and A.H. Arthington. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. *Environmental Management* 30(4): 492–507.

6. Power, M.E., W.E. Dietrich, and J.C. Finlay. 1996. Dams and downstream aquatic biodiversity: Potential food web consequences of hydrologic and geomorphic change. *Ecosystem Management* 20(6): 887–895.

Poff, N.L., and D.D. Hart. 2002. How dams vary and why it matters for an emerging science of dam removal. *BioScience* 52(8): 659–668.