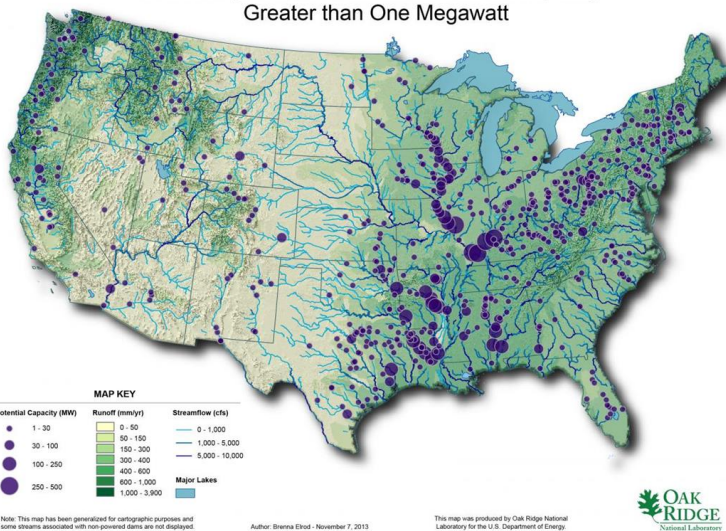


# Advancing understanding of non-powered dams through flexible, stakeholder-driven classification

## The need for classification

**Large population of dams.** There are over 90,000 documented dams and related structures in the United States<sup>1</sup>, 95% of which do not yet generate electricity<sup>2</sup>. These existing structures are an attractive target for hydropower development. While each dam is unique, breaking the diverse population of dams into smaller, more manageable groups of similar dams facilitates analysis and evaluation of development opportunities.

U.S. Non-powered Dams with Potential Capacity Greater than One Megawatt



**Limited classification.** Dams are generally grouped based on a single characteristic (size, material, purpose) or with respect to a narrow objective (e.g. hazard classifications used for assessing infrastructure/safety). These types of classifications have limited utility for other objectives, including hydropower development.

**Diverse stakeholders.** Development of hydropower involves a wide variety of stakeholders - from dam owners to utilities, water resource agencies, technology developers, and environmental groups. This diverse group may also be interested classifying dams for other analytical applications such as water system planning/management, safety, or dam removal/rehabilitation. Each of these stakeholders has unique objectives and different characteristics of interest.

## A Flexible Taxonomy Framework

A framework for creating stakeholder-specific taxonomies of non-powered dams is an alternative to a “one-size-fits-all” categorization. It addresses the challenge of classification through four general steps:

**1) Define building blocks.** These fundamental pieces are the characteristics that define the dams, suggested thresholds or values used to

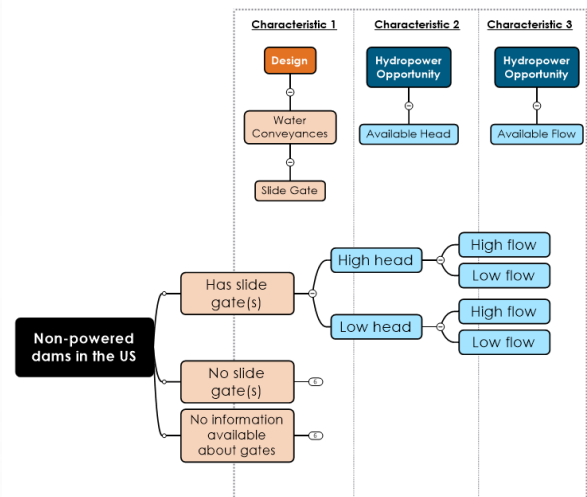
define classes, and the data sources that inform the values for each dam.

**2) Incorporate stakeholder preferences and assumptions.** An individual stakeholder imposes their own priorities and preferences for how the classification system is organized, how to define classes for each characteristic, and which data sources are used.

**3) Form the taxonomical structure.** With categories and classes of characteristics defined, the actual structure of the taxonomy can be envisioned.

**4) Apply data.** Available data is mapped onto the taxonomy. Ultimately, this framework produces classes of dams that can be visualized in a number of ways: geographic locations on a map, tabular summaries, or visual representations of distributions for selected characteristics. This approach to classification:

- **Produces results tailored** to individual priorities and objectives
- **Identifies data gaps**, highlighting which characteristics lack supporting datasets
- **Addresses uncertainty** by incorporating multiple data sources and relaxing/constraining definitions of classes
- **Provides context** by comparing classes with respect to other dams or classes of dams in the larger population



*Example taxonomy for a turbine developer with specific design constraints. Classes (e.g. high head vs. low head) can be defined by an individual so that the taxonomy reflects their specific needs.*

## Stakeholder Engagement

Feedback is essential to ensuring that the building blocks (i.e. supporting data, characteristics, and suggested classes) and the flexible taxonomy framework approach are effectively responding to stakeholder needs. Iterative development is ongoing through collaboration with researchers at universities, industry, and national labs, and a workshop/webinar series.

<sup>1</sup>National Inventory of Dams. 2020. <https://nid.usace.army.mil/>

<sup>2</sup>Hadjerioua, B., Wei, Y. and Kao, S.C., 2012. An Assessment of Energy Potential at Non-Powered Dams in the United States.

smh.ornl.gov

ORNL is managed by UT-Battelle for the US Department of Energy