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KING'S WATER CENTRE

KING'S College LONDON

POLICY BRIEFS

Environmental Intelligence for Managing Dams and their Catchments

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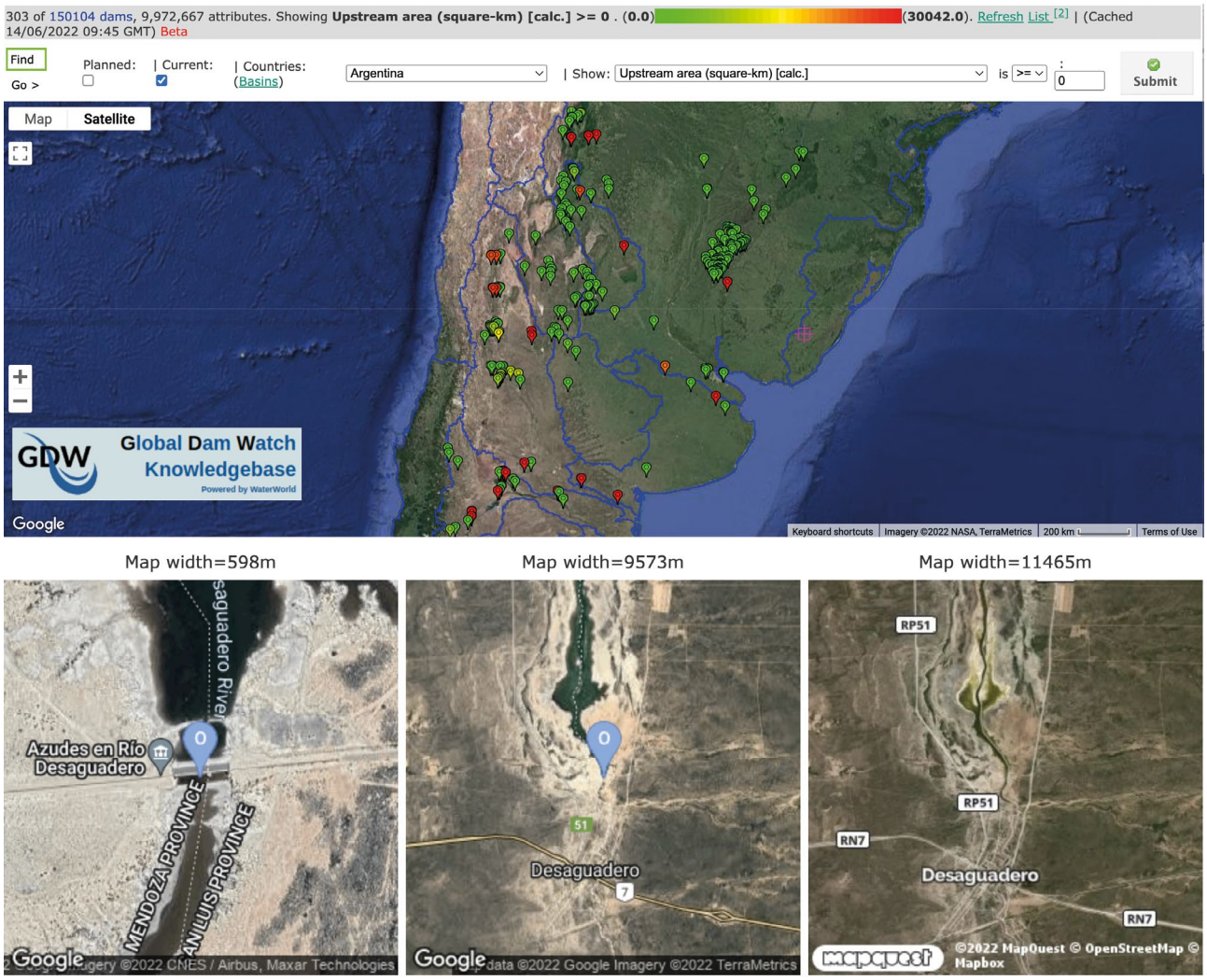
KEY MESSAGE

Dams continue to be, constructed worldwide in support of socioeconomic development. Despite providing wide-ranging benefits such as dry-season water for agriculture, industry and household use, and – in the case of hydropower dams – renewable energy, instream infrastructure like dams can negatively affect land and water ecosystems, as well as their dependent populations. Although social and environmental concerns associated with dams are widely acknowledged, research has been limited by a lack of consistent data and assessment tools, especially at transboundary and global scales.[1] To address this gap, we present, in partnership with the King's Water Centre[2] and *Global Dam Watch (GDW)*[3] partners around the world, *Global Dam Watch knowledge-base (GDWkb)*[1]: a collection of dam databases and associated tools for data curation, visualisation and analysis of dams and environment. *GDWkb* is freely available and enables users to curate, analyse and download comprehensive dam data and analyses at national and basin scales. *GDWkb* is a live and evolving set of data & tools focused on local rather than global applications, visualisation and analysis.

Building on the 'geowiki' approach used to develop our GlObal geOreferenced Database of Dams (GOODD),[4] *GDWkb* includes tools to help grow, manage and convert dam data into open-access and actionable national- and basin-scale intelligence on dams, globally. Currently comprising more than 150,000 georeferenced records, *GDWkb* aims to provide easy-to-use online tools for better understanding the benefits, costs and risks associated with dams, including impacts of climate change and land use change on the operation of dams. A particular focus is on the risks of nature loss to dam operation, and the risks of dam operation to nature loss.

Figure 1: *The interface of GDWkb showing dam data for Argentina.*



Source: M. Mulligan.

THE IMPORTANCE OF DAMS

Water management infrastructure, including dams and their reservoirs, have an important role to play in economic and social development worldwide by helping meet dry-season water demands and by generating renewable energy.[4] Dams are one of the most pervasive geo-engineering accomplishments globally, with the largest dams totalling around 58,000 worldwide[5], the majority of which have been built within the last 60 years.

Approximately 50% of large dams worldwide were built primarily for irrigation[4], supporting 12–16% of global food production[6]; additionally, dams contribute ~70% of the world's renewable energy production through hydropower.[7] With global food and energy demands expected to rise by 70% by 2050[8] and by 56% between 2010 and 2040[9], respectively, it is predicted that more and larger dams will be built in the coming years. Such demands are particularly pertinent in low-income countries where fewer dams have been built to date, resulting in increased planning and construction of dams in such regions.[9]

Underpinning and embedded within the UN's Sustainable Development Goals (SDGs) is an aim to restore ecosystems and their functions to ensure that they continue to provide important ecosystem services for current and future generations.[10] Despite delivering many benefits, dams can negatively affect land and water ecosystems, and the species and societies that depend upon them. On the other hand, dams underpin important developmental goals, including for water, food and energy, as embedded in a number of the SDGs – including SDG6 (clean water and sanitation), SDG7 (affordable and clean energy) and SDG2 (zero hunger) – on both global and local scales[11], as well as the UN convention on biological diversity[12] and the Paris climate accord.[13]

Three of the Global Goals for Sustainable Development

To better monitor and manage the risks of environmental change to dams and the risks of dams to the environment, comprehensive, open-access, curated and easily used data on the location and characteristics of dams and their catchments is needed. A number of global, regional and local dam inventories exist; however, they vary widely in scope, scale and design. In consequence, information regarding the characteristics and location of dams is often highly localised, fragmented or difficult to access.[14]

KING'S WATER CENTRE CONTRIBUTIONS TO *GLOBAL DAM WATCH*

To address this gap and better support research, decision-making and management, a partnership of universities, non-governmental organisations (NGOs) and international organisations has come together to produce Global Dam Watch (GDW)[3] a collective focused on developing an open-access one-stop-shop for dam information, data and tools.

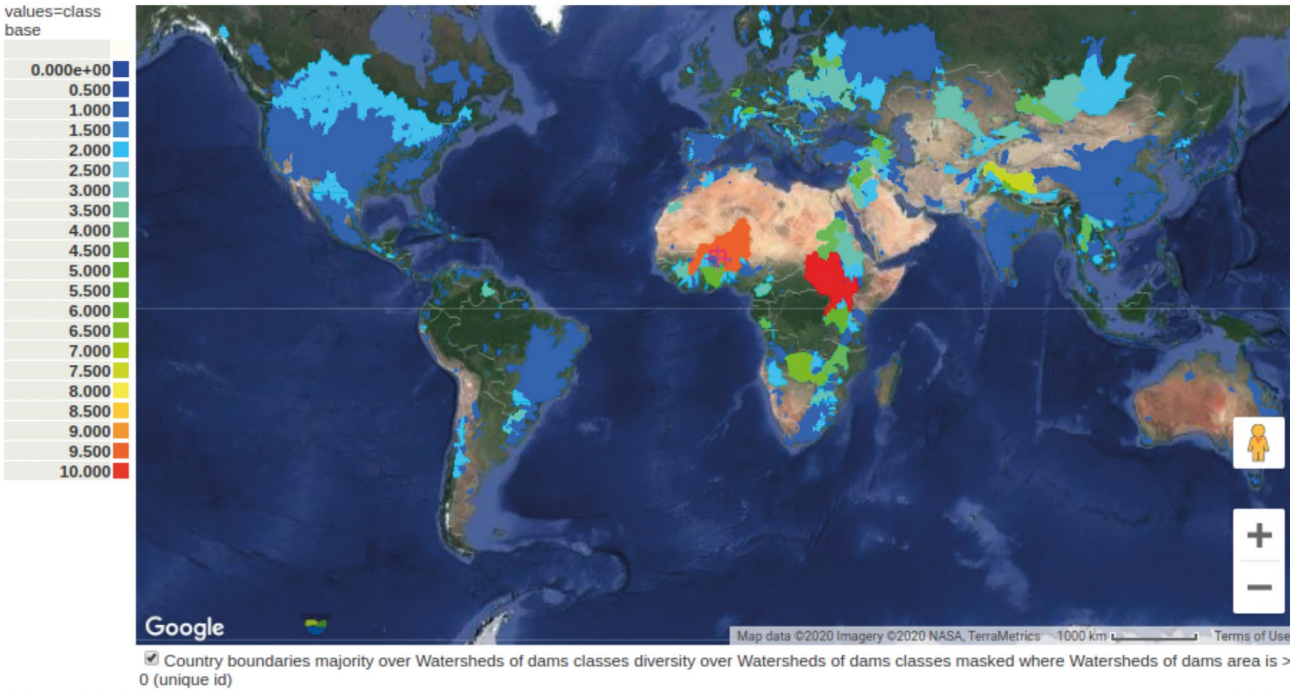
GDW's objectives are:

1. To advance recent efforts to develop a single, globally consistent dam and instream barrier data product for global-scale analyses (the *GDW* database);
2. To bring together the increasingly numerous global, regional and local dam and instream barrier datasets in a directory of databases (the *GDW* directory);
3. To build tools for the visualisation of dam and instream barrier data and for analyses in support of policy and decision-making (the *GDWkb*); and
4. To advance earth observation and geographical information system techniques to map a wider range of instream structures and their properties.

King's Water Centre is a leading partner in *GDW*, working particularly on objectives (3) and (4). The realisation of these objectives would advance the development of sustainable solutions at the environment–food–energy–water nexus and enable new and improved analyses of the impact of dams on society and the environment, and the impact that environmental changes – such as land use and climate change – on the operation of dams and their reservoirs.

GDWkb provides tools for managing dam data, visualising dam attributes (Fig. 1) and facilitating various analyses and downloadable data at national and basin scales. *GDWkb* connects to our very widely used hydrological policy support system: WaterWorld[15], which provides open access to a wide range of analytical functionality on water, climate change and land use for every country and basin in the world (Fig. 2).

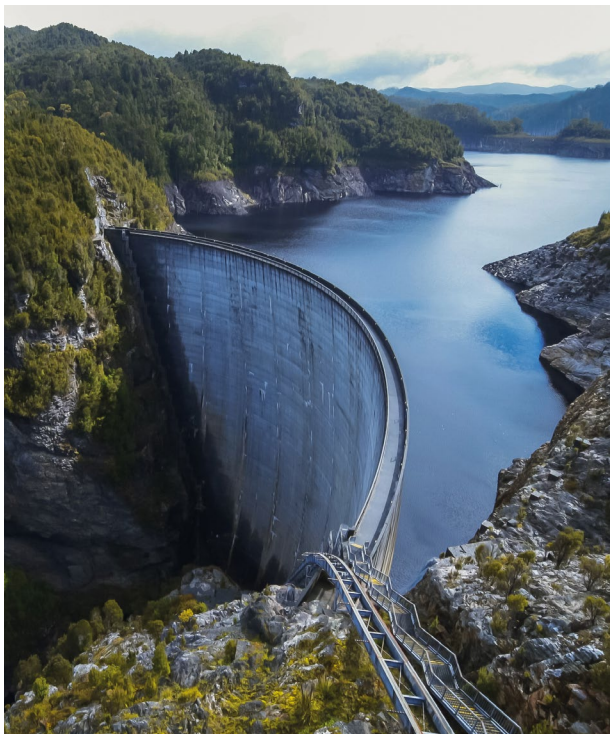
Figure 2: *Transboundary dam watersheds: number of countries in the watershed of dams as calculated by WaterWorld, linked to GDWkb.*



Source: M. Mulligan.

INVITATION FOR COLLABORATION

To better understand interrelations between dam development and other global changes (such as land use and climate change) and thus advance sustainable solutions at the environment–food–energy–water nexus, we envision a broad suite of tools becoming part of *GDWkb*. We invite input and partnerships from policy makers, industry, NGOs, research institutions and governments to strengthen both *GDW* and *GDWkb*'s utility and relevance to different communities worldwide, help define *GDWkb*'s tools and content, better understand domain-specific applications and provide analytical expertise.



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ABOUT KING'S WATER CENTRE

King's Water Centre works to incubate, elevate, and empower the best science and innovation to tackle the world's water problems. We are curiosity-driven, interdisciplinary, and solutions-focused. Based in the heart of London, King's Water Centre brings together scholars and practitioners for a just and sustainable water future.

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