STRENGTHENING WATER RESOURCES MANAGEMENT IN AFGHANISTAN

The Strengthening Water Resources Management in Afghanistan

(SWaRMA) project is a two year collaboration between the governments of Afghanistan and Australia through the CSIRO.

eWater, in collaboration with the CSIRO has supported the initiative through:

- Developing a Kabul Basin Model.
- Developing a Whole-of-Afghanistan water availability model.
- Capacity building in water resource modelling with eWater Source.

Panjshir valley in Eastern Afghanistan (credit:mbrand85/AdobeStock)

Kabul Basin Model

The Kabul River Basin is located in Eastern Afghanistan. It joins the Indus River in neighbouring Pakistan. Most inflows are generated from snow melt in the sub-basins of the Panjsher and Konar rivers, which are located high in the Hindu-Kush mountains, with their heavy snowfalls and many glaciers. The catchment is largely undeveloped, with only 6%

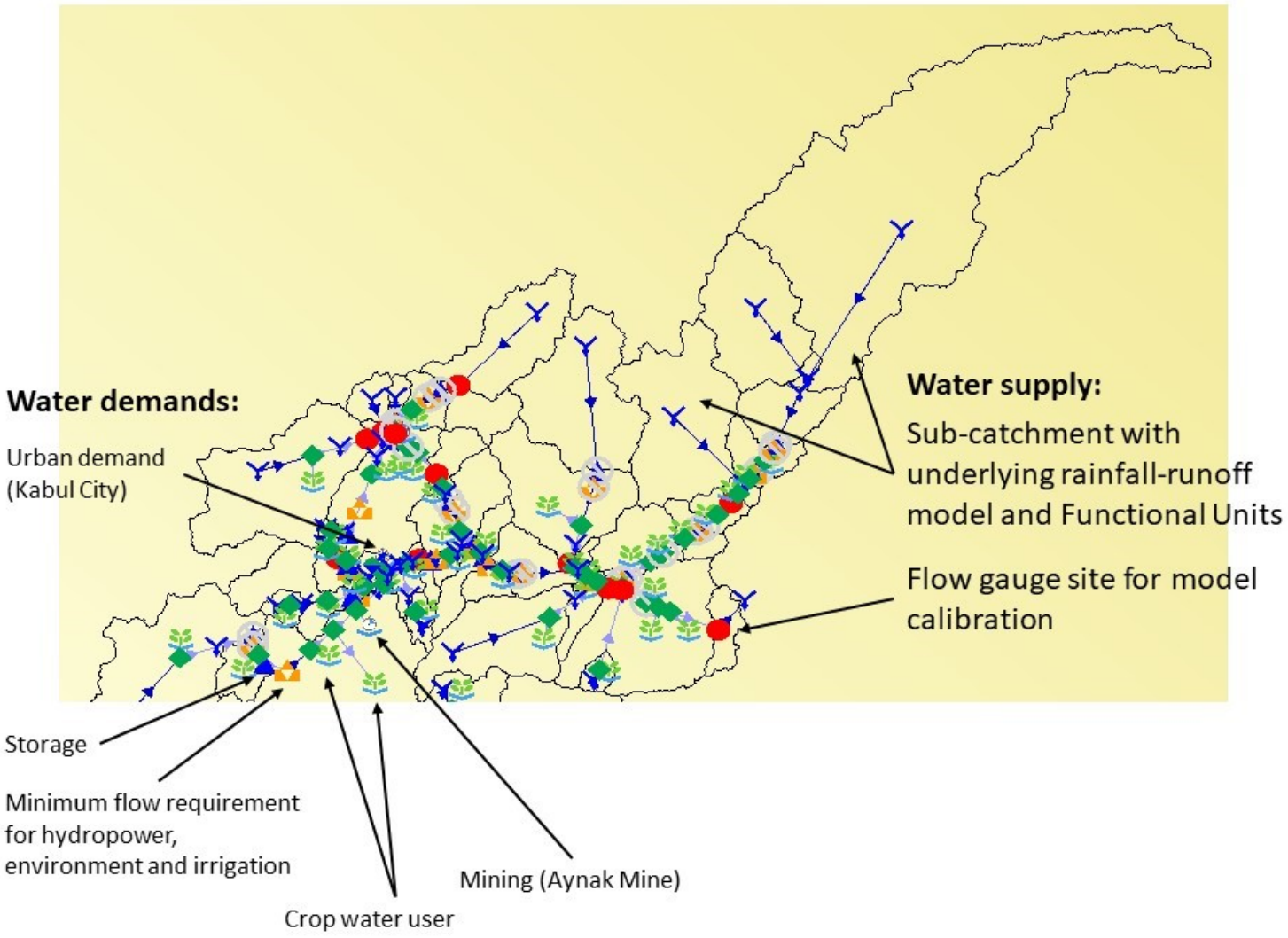
of land used for cropping (FAO, 2010) and 1% urban. Kabul City is the largest urban area with a population of 4 million.

The model includes water demands for irrigated cropping, urban water, hydropower and the expected water demand from the Aynak mine. Minimum flow requirements are included to meet environmental needs. Urban demands are only modelled for Kabul City, as it is the only urban demand large enough to have an impact on downstream water supply. After consultation with the Ministry of Energy And Water (MEW), demands for Kabul were estimated as 120 L per person per day. Water demand on groundwater is factored into water use for Kabul City, since it is known that over time the reliance on groundwater for Kabul City will change to using surface water from the proposed Shatoot and/or Gulbahar dams. The model is conceptualised to provide for this change in the future.

The Source model for the Kabul Basin provides a broad scale representation of the Kabul River basin and its key water demand and supply elements. It serves as a tool for capacity building, including demonstrating the use of models to assess different water management scenarios. The model is

not currently intended to be applied as an operational model of the system. However, it has been conceptualised to provide a framework representing the key features which can be extended with further information regarding management rules and requirements.

This model has been handed over to the Ministry of Energy and Water, so they can continue to develop the model and use it to more detailed analysis and water resource planning and management.



Integrated Source model for the Kabul River Basin

Rapid assessment of whole of Afghanistan water availability

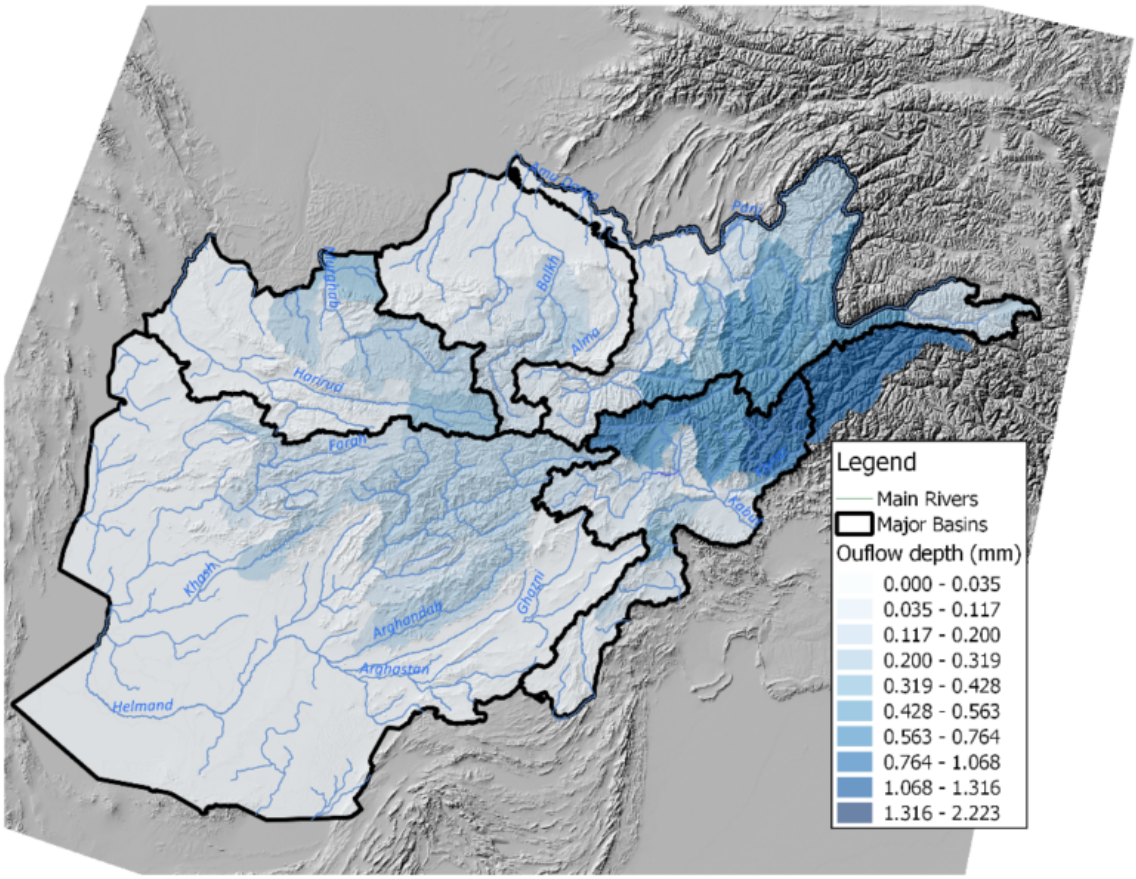
The Source platform makes it possible to explore water availability across multiple scales, from the scale of sub-catchment tributary to major river basin scale to the whole country. A whole of Afghanistan Source model was built to undertake a rapid assessment of water availability in Afghanistan’s five major river basins. Due to limited historical data, the assessments were based on daily global data inputs for the period 2006-2016 and long-term monthly average flows from pre-1980.

Afghanistan is a land locked country and shares its river basins with its neighbouring countries. The use of global input sets helped overcome potential issues of sourcing this data from these other countries. However, a lack of available observed flow sites within these countries meant that

neighbouring flow contributions could not be calibrated.

Due to lack of observed flows, it was only possible to calibrate against historical average monthly flows. As such the model can only be considered to represent long-term average conditions across Afghanistan and can only give an indicative assessment of water availability. In time, the model can be further developed as data and knowledge improve.

The rapid assessment provides a much needed baseline tool and information source for water managers. The figure below is an example of the outputs available from the model, it shows the area-weighted outflow per sub-catchment, providing an indication of the distribution of water availability across Afghanistan. It shows that the higher mountain areas are the main source of flows, particularly the Hindu Kush mountains, which receives significant snow in winter.



Area weighted outflows per sub-catchment in Afghanistan

References

FAO (2010) Land cover of the Islamic Republic of Afghanistan. Food and Agriculture Organization of the United Nations. https://dwms.fao.org/~draft/lc_2010_en.asp (accessed 12/12/2018)

Learn more about SWaRMA here

INTEGRATED WATER RESOURCES MANAGEMENT IN LAO PDR

> Water is essential to life and culture in the

People’s Democratic Republic of Lao. More than third of GDP and 75% of employment comes from subsistence agriculture, which is heavily dependent on

rainfall and Lao’s rivers.

Traditionally, the People’s Democratic Republic of Lao (Lao PDR) was considered a water rich country, but increasing demand for water, especially in the dry season is putting pressure on water resources. Climate change is also affecting the region, with water quality impacted by rising temperatures and water infrastructure at risk from increased flash flooding.

In response, the Government of Lao PDR is implementing a series of water reforms, including developing a National Water Resources Strategy and Action Plan 2016-2020 and major amendments to the Water and Resources Law were approved in 2017. The new law focuses on better protection of water resources and sustainable use to support national economic development.

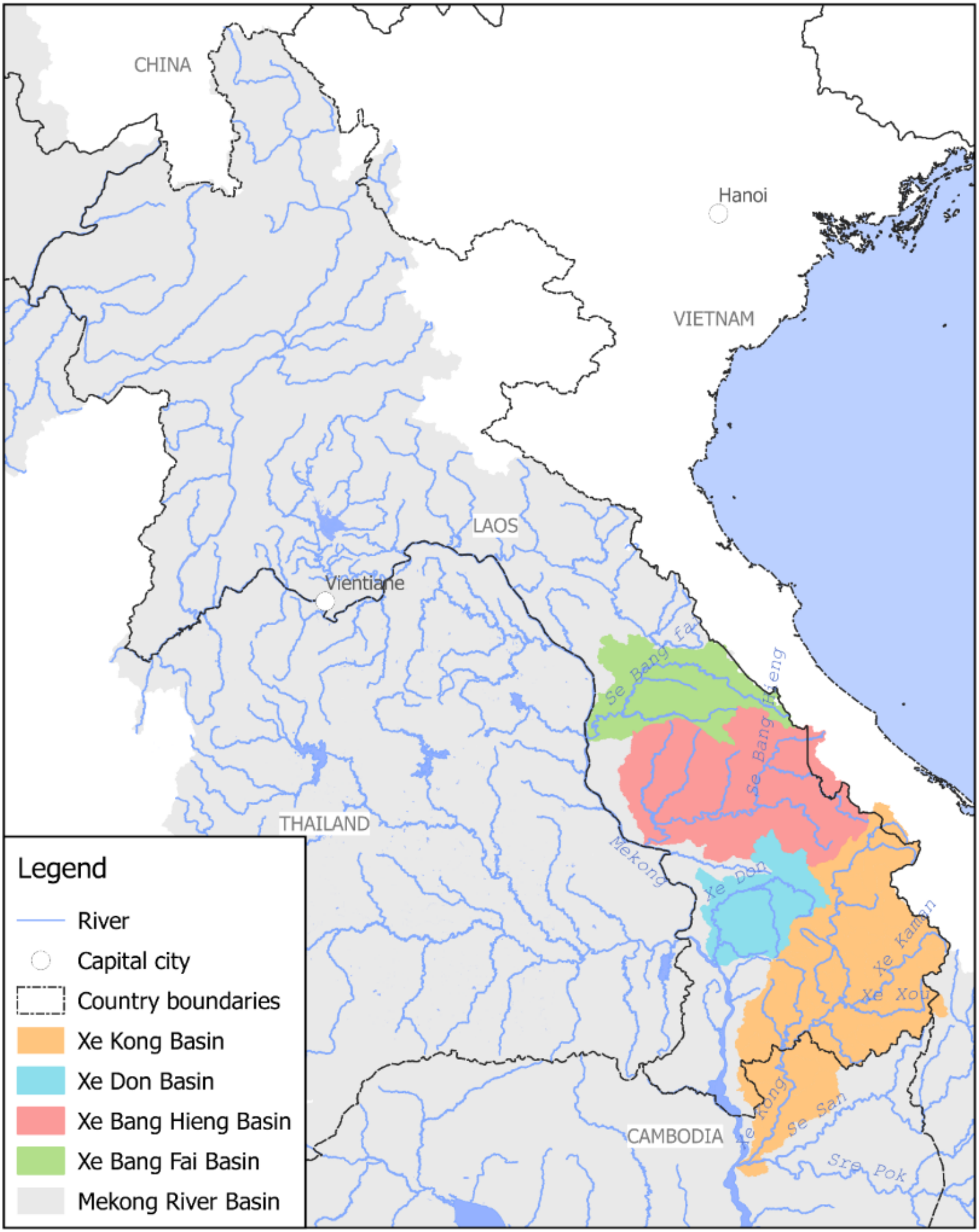
Supporting these reforms is the World Bank funded Mekong Integrated Water Resource Management (MIWRM) program, which seeks to establish good examples of integrated water resources management practice at the local, regional and river basin scales.

Landscape view over Xe Don river in Pakse, Laos (credit: Marek/AdobeStock)

The project

eWater was engaged under the MIWRM program to support the Lao PDR Natural Resources and Environment Research Institute (NRERI) Hydrological Modelling Unit to build its capability to develop and apply water models for water resource assessment, sustainable water management and to support policy and investment decision making.

Surface water resource models for four basins; Xe Bang Fai, Xe Bang Hieng, Xe Don and Xe Kong were built and calibrated using the eWater Source platform. The models were used to evaluate:


CHINA
Hanoi
VIETNAM
LAOS
Vientiane
THAILAND
CAMBODIA
Se Bang Fai
Se Bang Hieng
Mekong
Xe Don
Xe Kaman
Xe Xou
Xe Kong
Se San
Sre Pok
Legend
River
Capital city
Country boundaries
Xe Kong Basin
Xe Don Basin
Xe Bang Hieng Basin
Xe Bang Fai Basin
Mekong River Basin

- total water availability from surface runoff
- inter-basin water transfers
- water demands and consumption for domestic, industrial and agriculture users
- hydropower operations and production.

Water supply and demand were summarised on a monthly basis and the impacts of water resource development on natural flow patterns were evaluated.

In addition, to understand the relative impacts of different water resources development options in the Xe Kong basin, four development scenarios were assessed:

1. current (2017) conditions
2. hydropower development
3. irrigation development
4. combined development.

Each scenario was evaluated under historical climate conditions and a climate change scenario. This initial

assessment seeks to demonstrate the power modelling can bring to the decision-making process and inform the development of a later detailed scenario assessment.

Overcoming data constraints

Traditionally, good water modelling relies on high-quality, measured data. However, such data is often uncommon in countries such as Lao PDR. To address this, much of the data used in the modelling came from global, remotely sensed data sets, calibrated against the limited measured data.

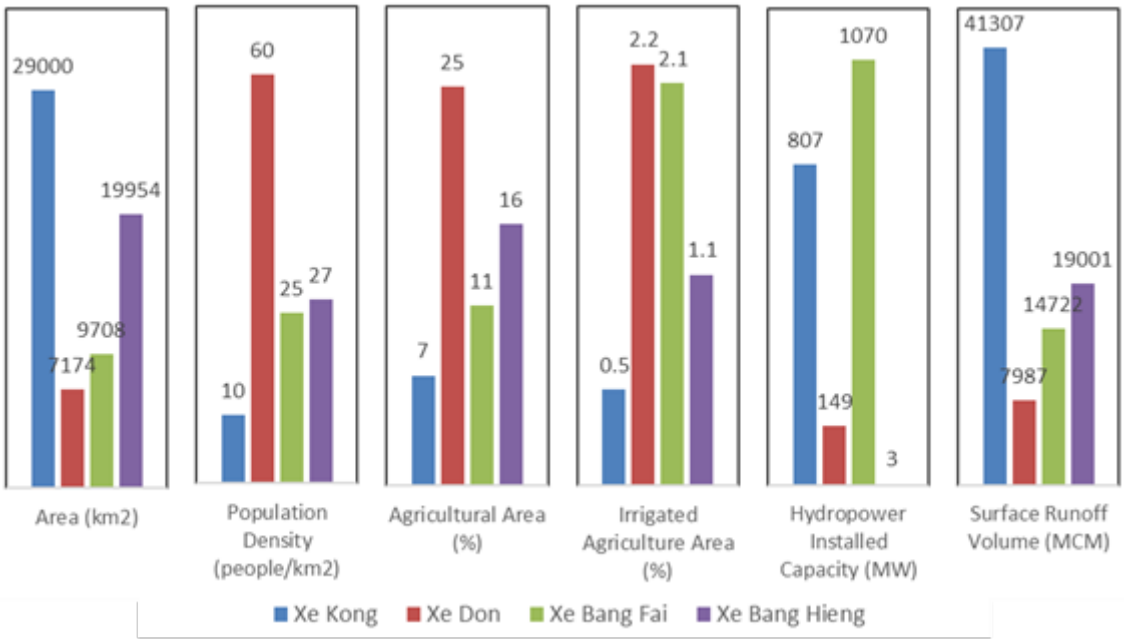
Despite the limited measured data, good calibration was achieved in all four basins, demonstrating that the Source model platform is an effective tool for low-data environments. Importantly, Source has the ability to incorporate additional data as it becomes available, progressively increasing reliability and accuracy over time.

Implementation

The project has helped to increase the capacity of water managers in Lao PDR to build and use water models. The four models build for the project give water managers vital information and new tools for responding to emerging water management challenges, such as:

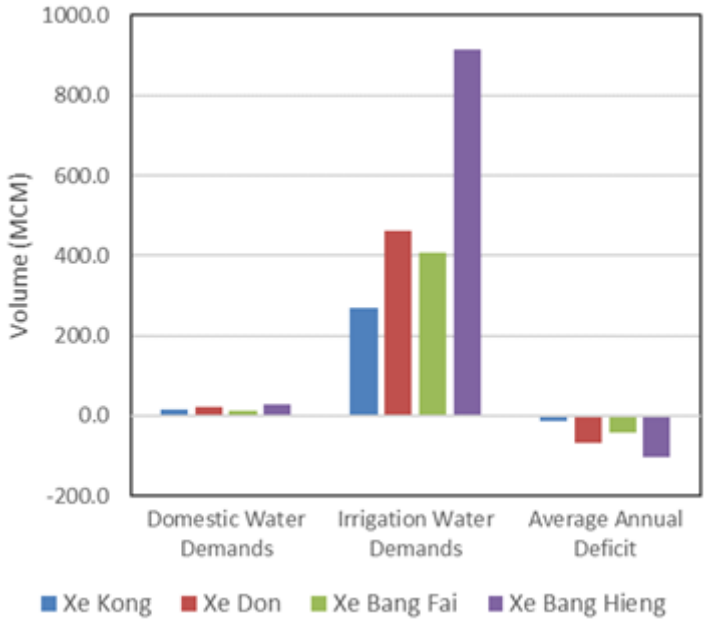
- annual and seasonal water availability
- annual and seasonal water flow patterns, and how these vary from natural conditions
- annual and seasonal water usage
- actual and potential water shortages
- hydropower demands and impacts on flow patterns and water balance

Example outputs from the model are shown in the figures below, they provide easy to understand, practical information to guide decision making.



Summary of basin characteristics.

NB: For Xe Bang Fai the installed capacity represents the NamTheun 2 hydropower project, which is located outside of the basin and diverts water into the basin.



Summary of average annual water demands and the deficit in supply (represented as negative values) for the four basins.

Capacity building

Building the capability of the NRERI Hydrological Modelling team was a core focus of the project. eWater provided tailored Source training and worked closely with the team in building the four models and developing the scenarios to be tested.

Back Row (L to R): Mr Daryl FIELDS (World Bank), Mr Chusit APIRUMANEKUL (World Bank), Mr. Somephone KHANPHANH (LNMC), Ms Phatthany KEOBOUNKHONG (DEPP), MR Khamphouay SIVONGXAY (Dept. of Water Resources), Ms Rachel BLAKERS (eWater), Mr Oulaphone ONGKEO (NRERI), Dr Thanapon PIMAN (Research Fellow), Dr Robert CARR (eWater), Mr Visanou METTHANY (Dept. of Meteorology & Hydrology), Mr Amphone CHOMXAITHONG (University of Laos), Mr Somphone KHONGSAP (Dept. of Planning & Cooperation), Mr Adnada BOULOM (Dept. of Transportation), Mr Phongsavath YINGYONG (NRERI)
Front Row (L to R): Mr Bounmy CHAYAVONG (NRERI), Mr Pankham SOUNDARA (NRERI), Mr Soulivanh LATHSAPHON (Dept. of Irrigation), Ms. Manysakhon CHITTHAPHONG (NRERI), Ms. Pakayphone YORDCHALEUN (NRERI), Ms. Nongnout PHANPHONGSA (NRERI), Ms. Souphada SENGVILAY (NRERI),

Participants at a workshop to develop scenarios for the Xe Kong basin. Attendees were from NRERI, other Lao PDR government agencies, the World Bank and eWater