

WISE-UP TO CLIMATE

In the Upper East region of Ghana, natural water infrastructure benefits provide Pwalugu communities with an average annual income of 1,360 USD per household. Baseflow and natural irrigation by seasonal flooding supports a range of livelihood activities corresponding to 53% of total household annual income. The proposed Pwalugu multi-purpose dam will impact natural infrastructure benefits downstream. However, this could be positive or negative and at different magnitudes depending on which dam operating rules are adopted.

Livelihood activities based on seasonal river flow regime

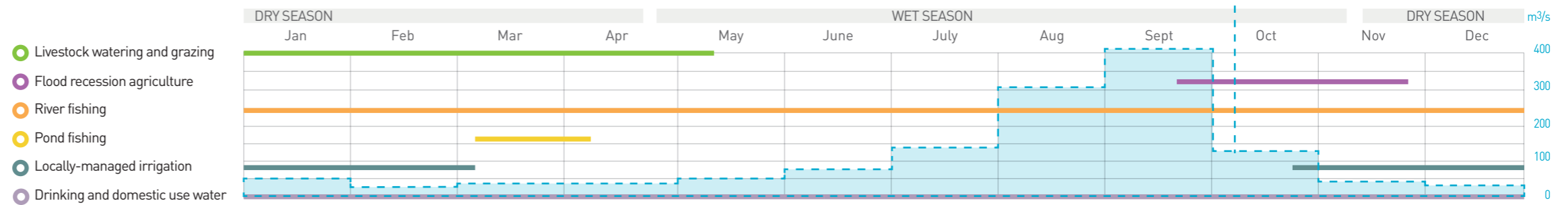
Pwalugu communities rely heavily on the seasonal flooding regime of the White Volta River. Flooding peaks

in August/early September during the wet season. Production and retrieval of any benefits is not simultaneous. This calendar of livelihood activities mapped to river flow shows

the way in which the Pwalugu area benefits from natural infrastructure (seasonal flooding and fertile floodplains) as well as built infrastructure benefits from the upstream

Bagré dam (in Burkina Faso), which regulates flow to reduce extreme flooding and provide baseflow during the dry season.

RIVER DISCHARGE
 The total volume of water flowing through a river channel at any given moment affected by seasonal fluctuations.



LIVESTOCK WATERING AND GRAZING
 In the dry season livestock graze and water freely around the riparian ponds and on the floodplain. In the wet season the livestock grazes near houses and water is collected from the ponds

FLOOD RECEPTION AGRICULTURE
 Farmers depend on the residual soil moisture from the floodwater that deposits fertile sediments, to farm crops on the floodplain

RIVER FISHING
 Some fish migrate upstream to breed and spawn. Year round constant flow in the river allows the households who own a canoe to fish on the river.

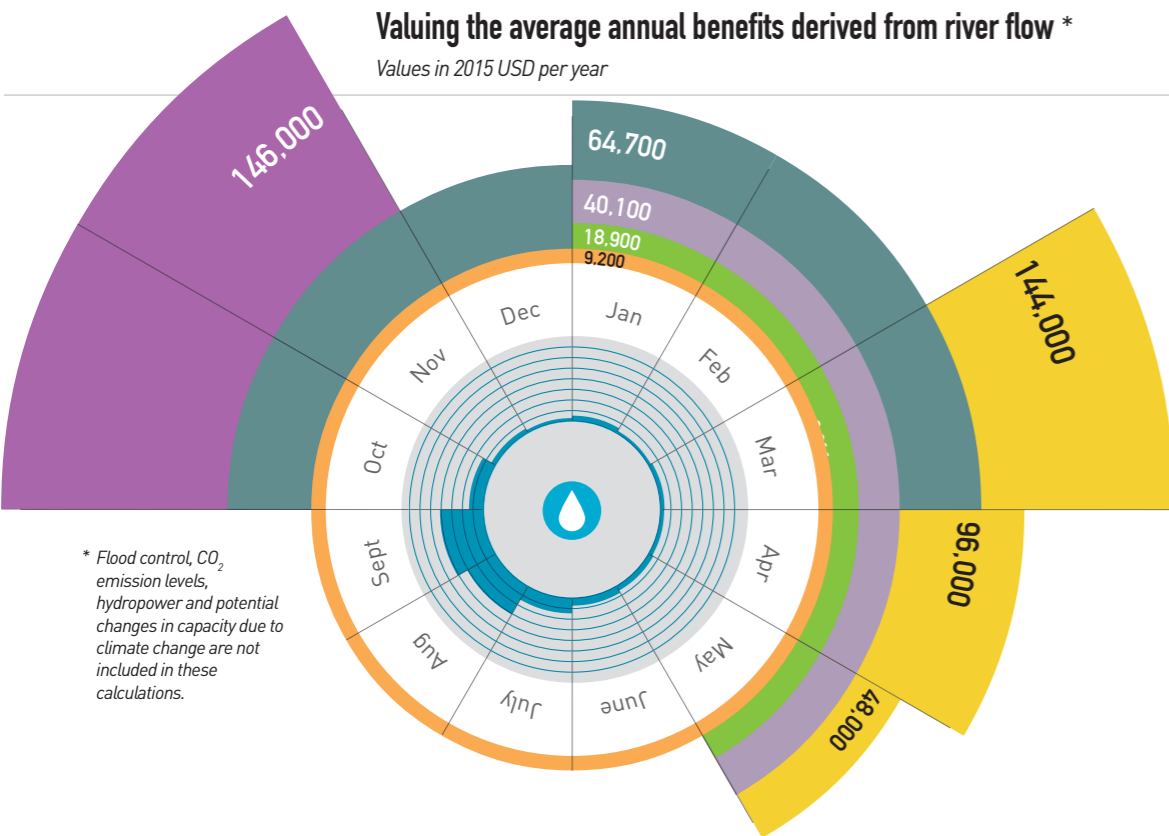
POND FISHING
 Fishing is dependent on the filling of the ponds through annual flooding. Local by-laws ban fishing between September and March. This helps to sustain the fish population.

LOCALLY-MANAGED IRRIGATION
 During the dry season, the farmers who can rent a pump and buy diesel practice informal irrigation, this activity is highly dependent on dry season flows (provided for by Bagré Dam).

DRINKING AND DOMESTIC USE WATER
 During the wet season boreholes are the main source of water for drinking and domestic purposes. In the dry season water is collected directly from the White Volta River.

Valuing the average annual benefits derived from river flow *

Values in 2015 USD per year



* Flood control, CO₂ emission levels, hydropower and potential changes in capacity due to climate change are not included in these calculations.

CURRENT FLOW REGIME (after the Bagré dam)

The operation of the Bagré dam provides additional dry season flows supporting year-round river fishing and drinking water supply as well as water for small scale informal irrigation. Current operation of the Bagré dam still enables the livelihood activities derived from natural infrastructure. Cumulatively, over a year Pwalugu communities earn up to 1,37 million USD.

1,373,600 USD
 the contribution per year to the Pwalugu communities *

River discharge at Pwalugu for period 1996-2010 in m³ per second.

ECOSYSTEM SERVICES

- Livestock grazing and watering
- Flood recession agriculture
- River fishing
- Pond fishing
- Locally-managed irrigation
- Drinking water

POSSIBLE FUTURE flow regime after the Pwalugu dam

Maximising energy production and large scale irrigated farming will reduce seasonal flooding and in turn the income generated from flood-associated livelihood activities. Cumulatively, over a year this scenario would reduce Pwalugu communities income by 286,000 USD.

1,087,300 USD
 the contribution per year to the Pwalugu communities *

River discharge at Pwalugu estimated based on optimising hydropower and irrigation in m³ per second.

ECOSYSTEM SERVICES

- Livestock grazing and watering
- Flood recession agriculture
- River fishing
- Pond fishing
- Locally-managed irrigation
- Drinking water

Possible future operating options for Pwalugu dam

Values in 2015 USD per year

	MIXED PORTFOLIO (balanced built and natural benefits)	MAXIMIZING ENERGY AND IRRIGATION BENEFITS
NATURAL INFRASTRUCTURE BENEFITS *		
Livestock grazing and watering	94,500	0
Flood recession agriculture	292,000	0
River fishing	110,400	110,400
Pond fishing	288,000	0
Locally-managed irrigation	388,200	776,400
Drinking water	200,500	200,500
TOTAL (USD)	1,373,600	1,087,300

+ Only ecosystem service-based activities that rely on the river flow have been considered and valued. When activities rely on other water sources (i.e. rainfall replenishing wetlands) other than the river flow during the year, under economic terms and assumptions the values of these activities would be zero.

BUILT INFRASTRUCTURE BENEFITS		
Hydropower	7,600,000 131 GWh	10,610,000 183 GWh
Irrigation	101,120,000 14,500 ha	139,480,000 20,000 ha
Reservoir Fishing	7,200,000 1,343 tons	8,520,000 1,590 tons

The hydropower value is calculated using the Volta River Authority tariffs of 0.24 GhC kWh-1 (Oct, 2015). The irrigation value is based on a crop mix of 25% maize and 75% rice with an average yield of 5 ton ha-1. Market prices of the crops are set at 884 and 1,565 USD ton-1 respectively. Fish catch is based on the market prices of 5,362 USD ton-1.

*represents three communities, i.e. approximately 1,000 households.