

Sediment sampling in Large Rivers; Experiences from the Kasai River in the Congo Basin

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Abstract

Land use change due to population growth and an increase in anthropogenic activities such as logging and mining (mostly illegal) have led to an increase in the sediment load of the Kasai River in the Congo River Basin. However, even with recent developments in technologies such as remote sensing and improvements in erosion prediction models to study sediment transport in water bodies; this phenomenon has been little studied in this poorly gauged catchment and the wider Congo River Basin due to lack of field-based sediment concentration measurements required to calibrate the results of such studies. The present study describes recently concluded field excursions to set up a high frequent sediment sampling station on one of the major tributaries of Congo River, the Kasai River. The station is fitted with an ISCO 6712 automatic pumping sampler to enable high frequency sampling. The ISCO is coupled with an OBS 501 turbidity sensor to collect even higher frequent sediment concentration data. The site is also fitted with other instruments to measure other hydrologic and climatic variables such as a manual staff gauge and an automatic water levels logger. The preliminary sampling efforts have been designed to guide a comprehensive sediment sampling programme which is part of a wider study to build a sediment yield model for the Congo River Basin in order to study the impacts of sedimentation on hydropower planning.

Introduction

- Land use change due to population growth and an increase in anthropogenic activities (logging & mining)
- Increased sediment load in the Kasai River
- Downstream impacts on hydropower and navigation
- Lack of field-based sediment concentration measurements to calibrate/validate erosion prediction models

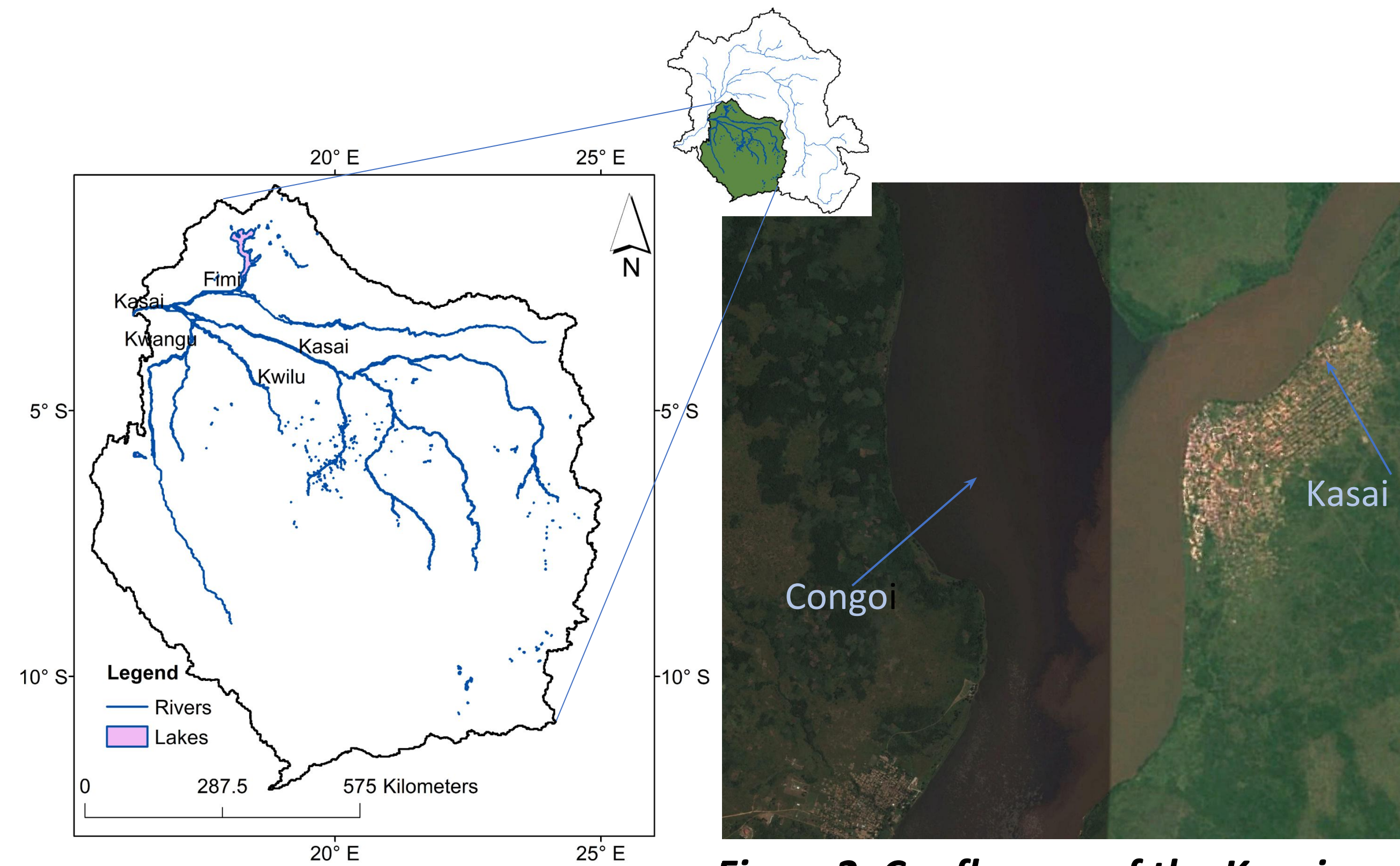


Figure1: Location and coverage of the Kasai basin

Figure2: Confluence of the Kasai and main stem Congo River

- Study design is an upscale of similar study in Pangani River Basin in Tanzania.
- Aimed to guide a comprehensive sediment sampling programme ; for the Congo River Basin to study the impacts of sedimentation on hydropower planning.

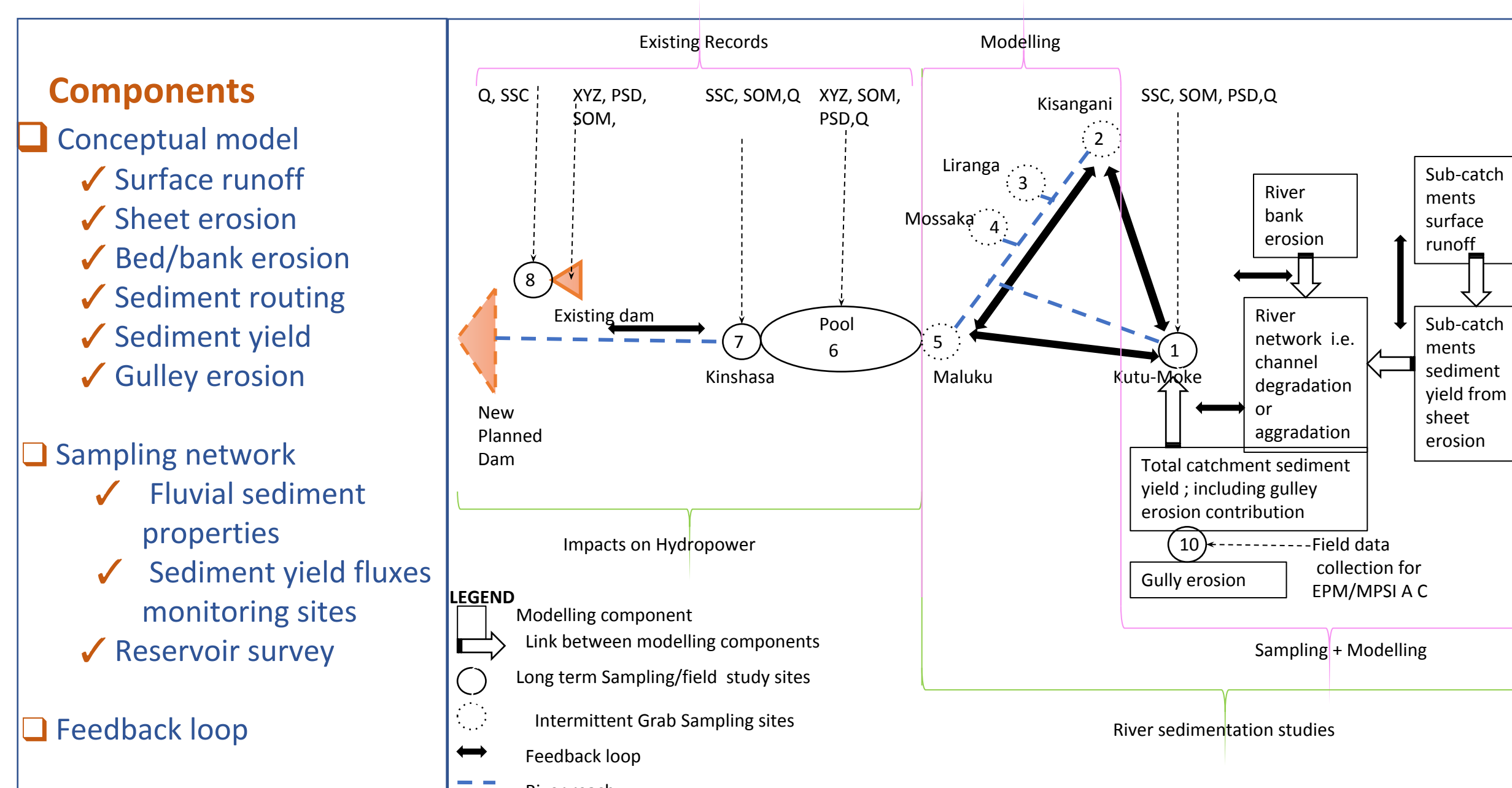


Figure 3: The Conceptual framework for the study based on the Pangani River Basin study in Tanzania

Methods

Sampling Programme design

Sediment sources and erosion processes mapping for the whole Congo Basin

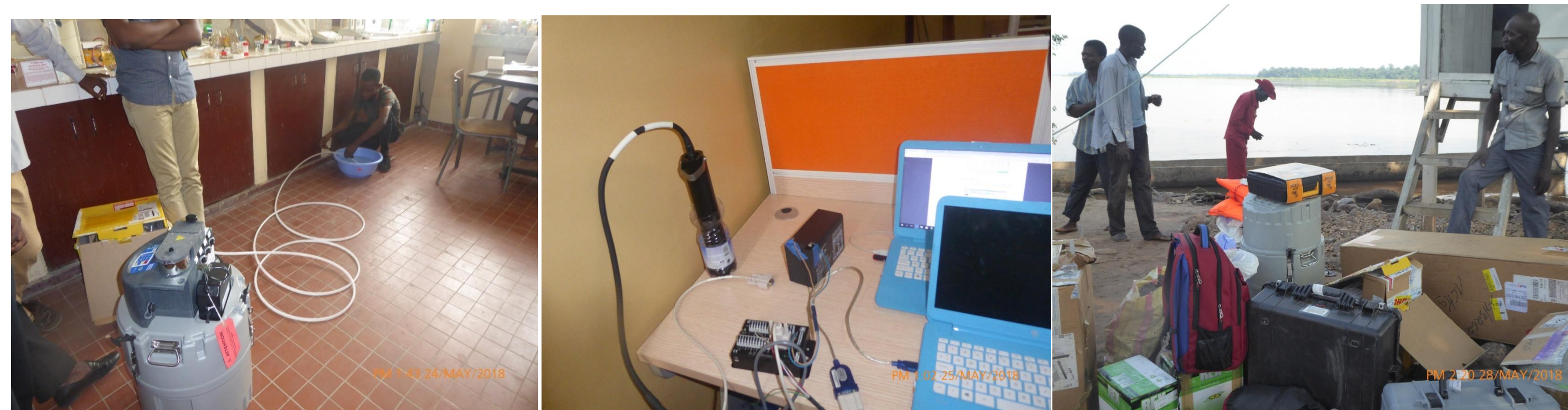
Sampling Site selection



Construction and set up of sampling station



Equipment installation



Sediment sampling and monitoring



Results

- Station is fitted with an ISCO 6712 automatic pumping sampler
- ISCO 6712 is coupled with an OBS 501 turbidity sensor
- site is also fitted with manual staff gauge and automatic water levels logger.

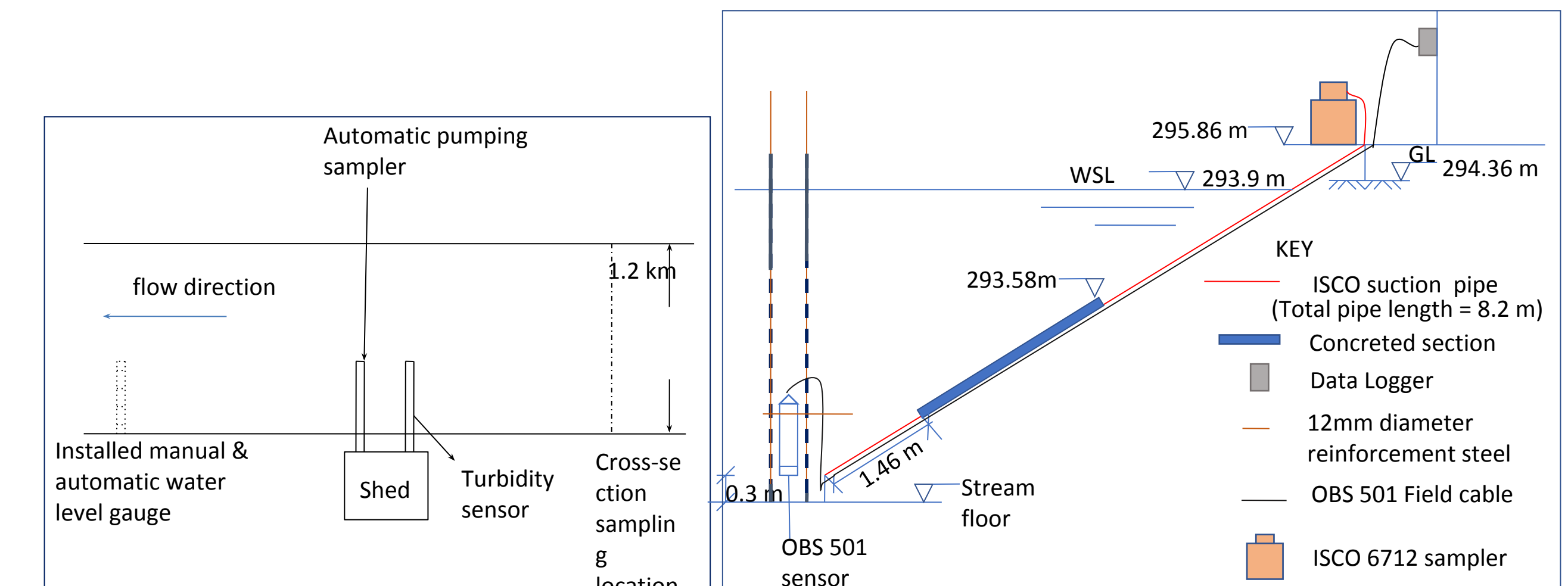


Figure 4: Map showing set up at Kutu-Moke sampling station

Figure 5: section of set up at Kutu-Moke sampling station

Status of data collection at the site

SN	Data type	frequency	from
1	Grab SS samples	daily	Sept 2017 to date
2	Grab SS samples	hourly	6-7 th sept 2017, 16-dec 2017
3	Cross section samples	8-12m intervals	5 th Sept 2017 (low flow) 1 st June 2018 (medium flow)
4	Water level readings	daily	Sept 2017 to date
5	Water level measurements	Hourly (automatic)	Sept 2017 to date
6	Grab bedload and bank soil samples	Intermittent	Sept and Dec 2017
7	Turbidity readings	hourly	June 2018 to date
7	ISCO Suspended sediment samples	daily	June 2018 to date

Conclusions and way forward

- Successful initial efforts to set up a high frequent sediment sampling station on the Kasai River.
- Sampling methods suitably coordinated with measurements of other hydrological variables.
- Sampling programme will run for one complete hydrologic year (from June 2018)
- Data from the sampling programme to calibrate the proposed sediment yield modelling component of the study and capture sediment delivery processes and dynamics.
- Programme designed to allow information sharing between sampling programme and hydrological modelling components (feedback loop).
- So far, the set up has proved to be robust in accommodating a range of flood magnitudes suggesting that data (to be) collected would represent long term sediment transport dynamics of the Kasai River as one of the major tributaries of the Congo River Basin.