

Evaluation of Water and Bioenergy Nexus in Wami Ruvu River Basin, Tanzania

Supplementary Material

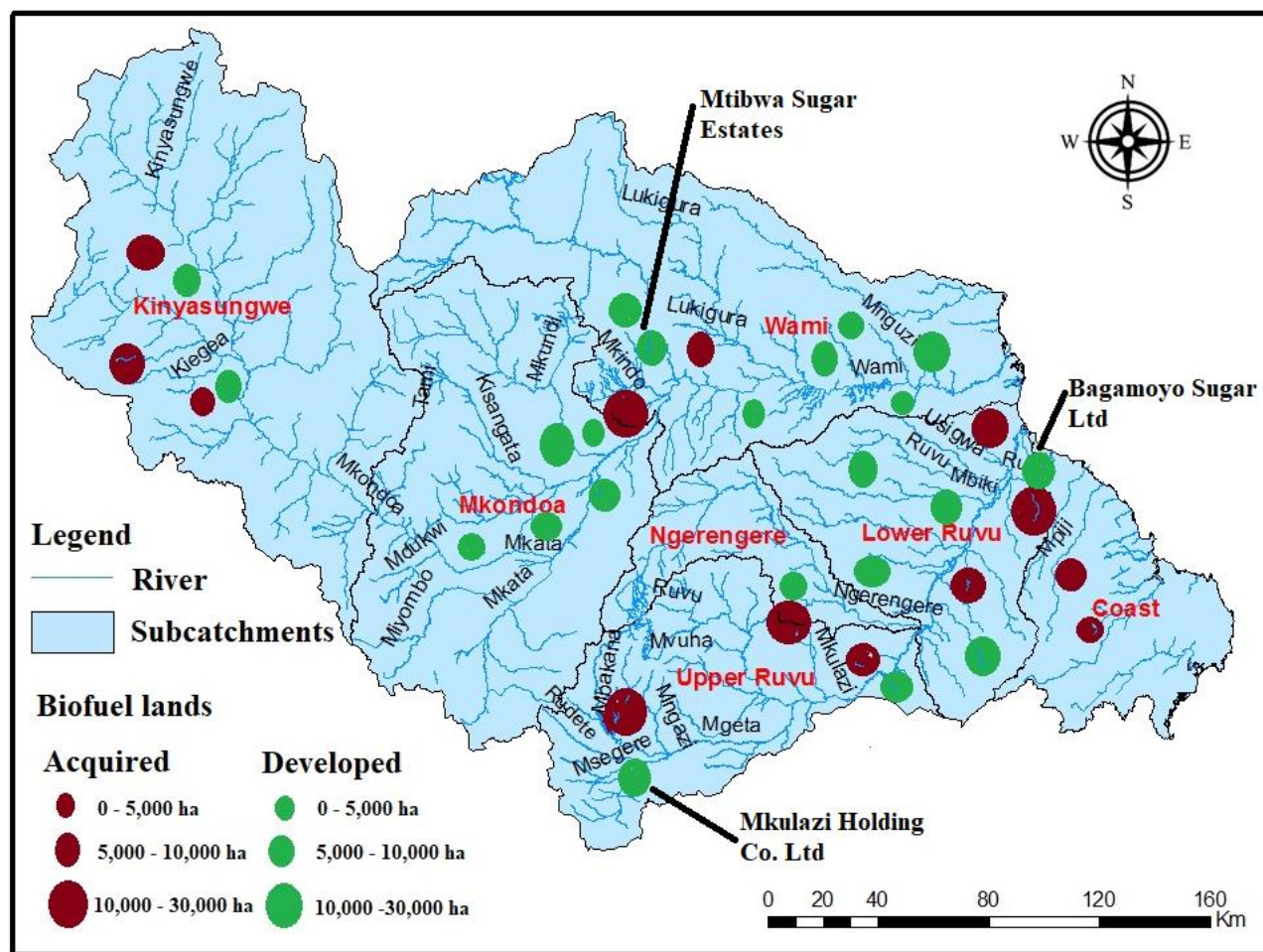
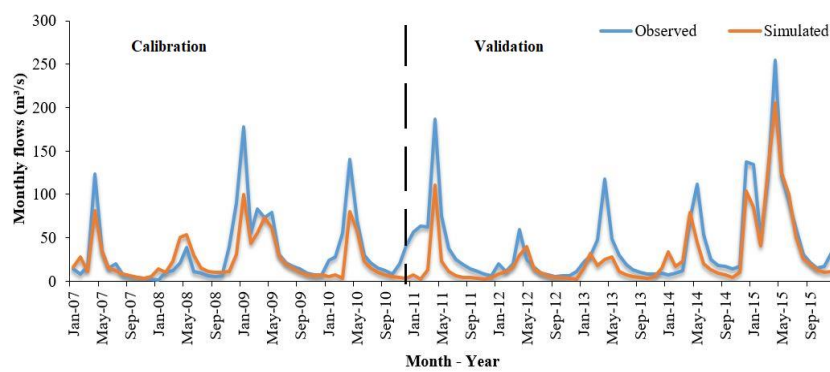
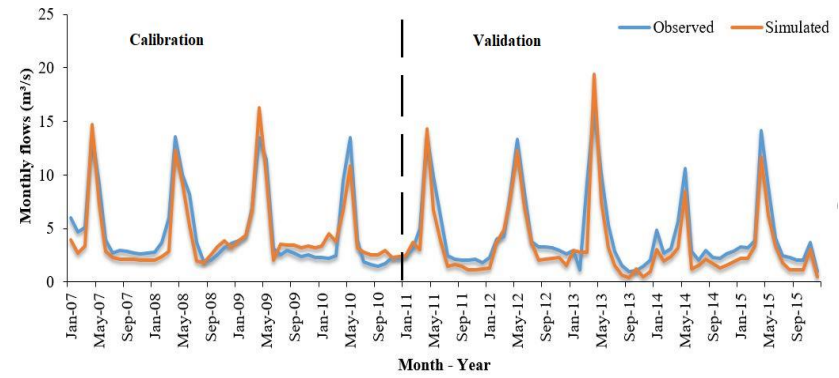


Figure S1. Spatial distribution of biofuel projects in the basin

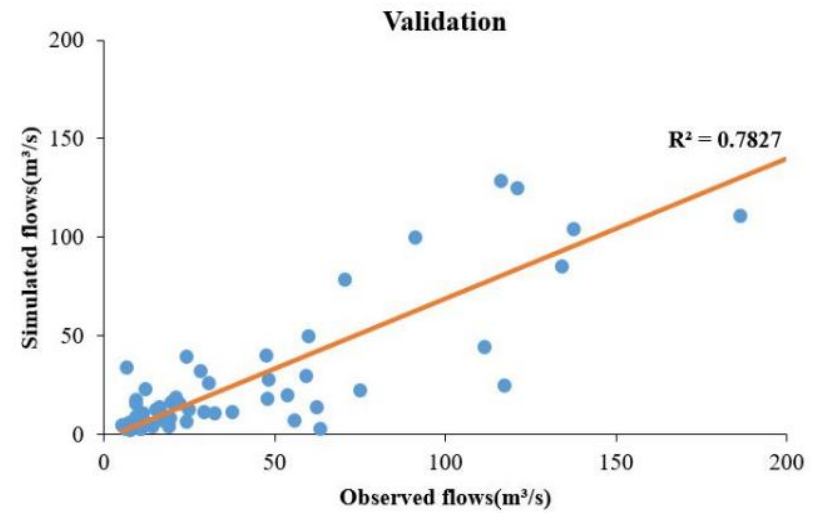
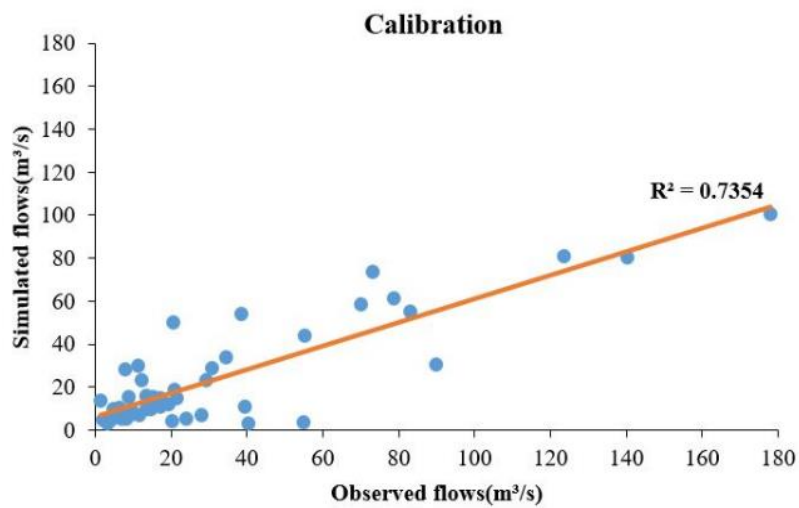


(a)

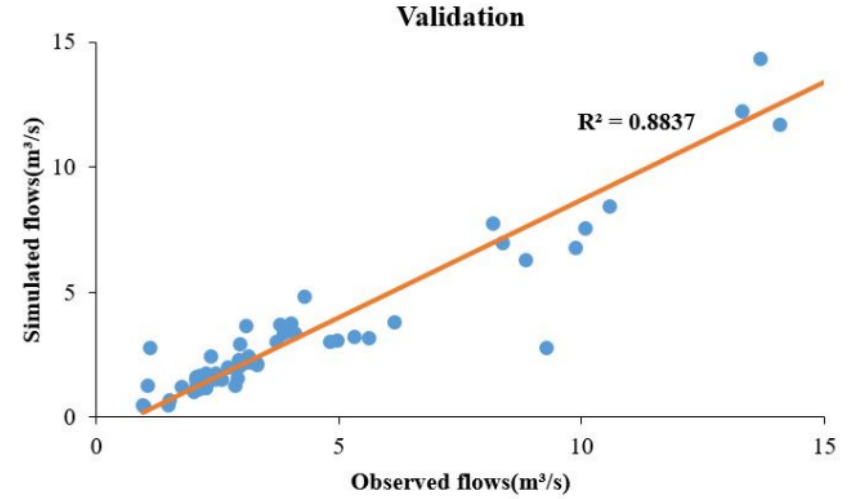
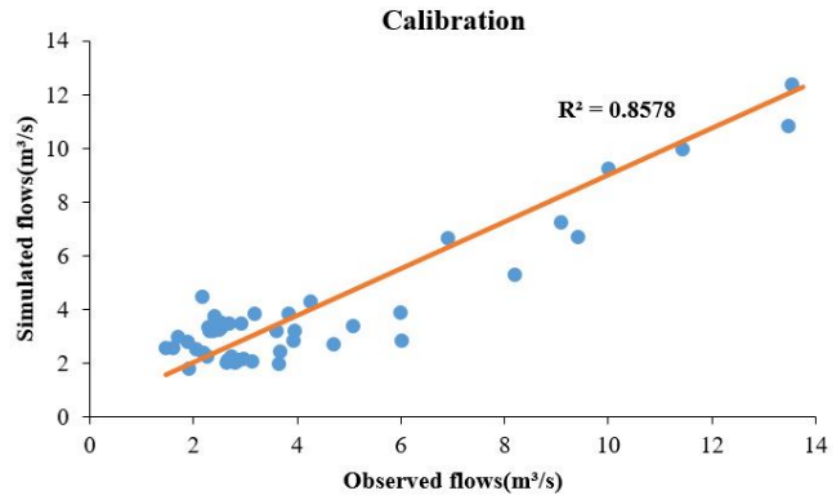


(b)

Figure S2. Calibration and validation hydrographs at (a) 1G1, Wami River (b) 1HA8A, Ruvu River



(a)



(b)

Figure S3. Calibration and validation scatter plots at (a) 1G1, Wami River (b) 1HA8A, Ruvu River

Table S1. Sectorial water use per scenario

The results are summary of model outputs based on three scenarios (GDP growth 6%, GDP growth 8% and GDP growth 10%) formulated in the WEAP model (A brief description on how the model was used in simulating future scenario is given in Section 2.2 of the main text).

Sectors	Direct water supply (10^6 m^3)			Groundwater extraction (10^6 m^3)		
	GDP growth 6%	GDP 8% without biofuels	GDP 10% with biofuels	GDP growth 6%	GDP 8% without biofuels	GDP 10% with biofuels
Agriculture	569.3	678.7	1243.3	120	130.6	136.4
Domestic	68.4	103.5	230.9	97.8	206.5	238
Industry	35	172.7	528.5	25.6	12.6	15.3
Commerce	8.2	10.5	13.3	–	–	–
Livestock	2.8	3.7	4.812	–	–	–
Energy	190.6	200.7	220	104	208	312
Total	874.3	1169.8	2240.9	347.4	557.7	701.7

Table S2. Biofuel generation in Wami Ruvu Basin

The major sugar cane plantations in Wami and Coast sub-catchment focus mainly on sugar and ethanol production, while that of Upper Ruvu focus on sugar and energy.

*Items	Sub catchments							Total
	Kinyasungwe	Mkondoa	Wami	Upper Ruvu	Ngerengere	Lower Ruvu	Coast	
Area(ha)	500	5818	8933	3000	1214	9500	6200	35165
Ethanol produced (m³)	–	4986	7600	–	–	8000	6000	26586
Sugar (10³ tons)	5	–	150	50	200	125	100	630
Energy generated 2015 (10⁶kWh)	–	–	23.1	100	–	–	15	138.1
**Energy generated 2035(10⁶kWh)	–	–	110	150	–	–	30	290

*Sources, WRB inventory; reports such as AfDB (2015)[1], Biofuels in Tanzania[2], feasibility of large-scale bio-fuel production in Tanzania[3] Liquid Biofuels for Transportation in Tanzania [4] and Biofuel development initiatives in Tanzania[5]. The energy generated from bagasse at sugar factories is mainly used for meeting their own power requirements, and the heat is used as process steam in the manufacture of ethanol and sugar production process[1,4].

**If the planned capacity will be increased and new water permits will be acquired for three major plantations (in Wami, Upper Ruvu and Coast) then the plantations will operate at full capacity in 2035.

Reference

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2. Mshandete, A.M. *Biofuels in Tanzania : Small scale producers and sustainable environmental management*; 2013;
3. Mlinga, H.; Charlz, D.; Chijoriga, M.; Temu, A.; John, G.; Temu, R.P.C.; Maliondo, S.; Nchimbi-msola, S.; Mvena, Z.; Lupala, J. FEASIBILITY OF LARGE-SCALE BIO-FUEL PRODUCTION IN TANZANIA STUDY REPORT Sponsored by the Swedish Embassy in Tanzania The Study Team Sponsored by the Swedish Embassy in Tanzania. **2009**.
4. Janssen, R. Liquid Biofuels for Transportation in Tanzania: Potential and Implications for Sustainable Agriculture and Energy in the 21st Century. **2005**, 149.
5. Martin, M.; Mwakaje, A.G.; Eklund, M. Biofuel development initiatives in Tanzania: development activities, scales of production and conditions for implementation and utilization. *J. Clean. Prod.* **2009**, 17, S69–S76.