Livestock water productivity of four community-based small-scale irrigation schemes in the Upper Awash River Basin of Ethiopia

By

Wagnew Ayalneh, Abiye Astatke, Kai Sonder,
Ranjitha Puskur, Don Peden and Girma Tadese

Why irrigation development?

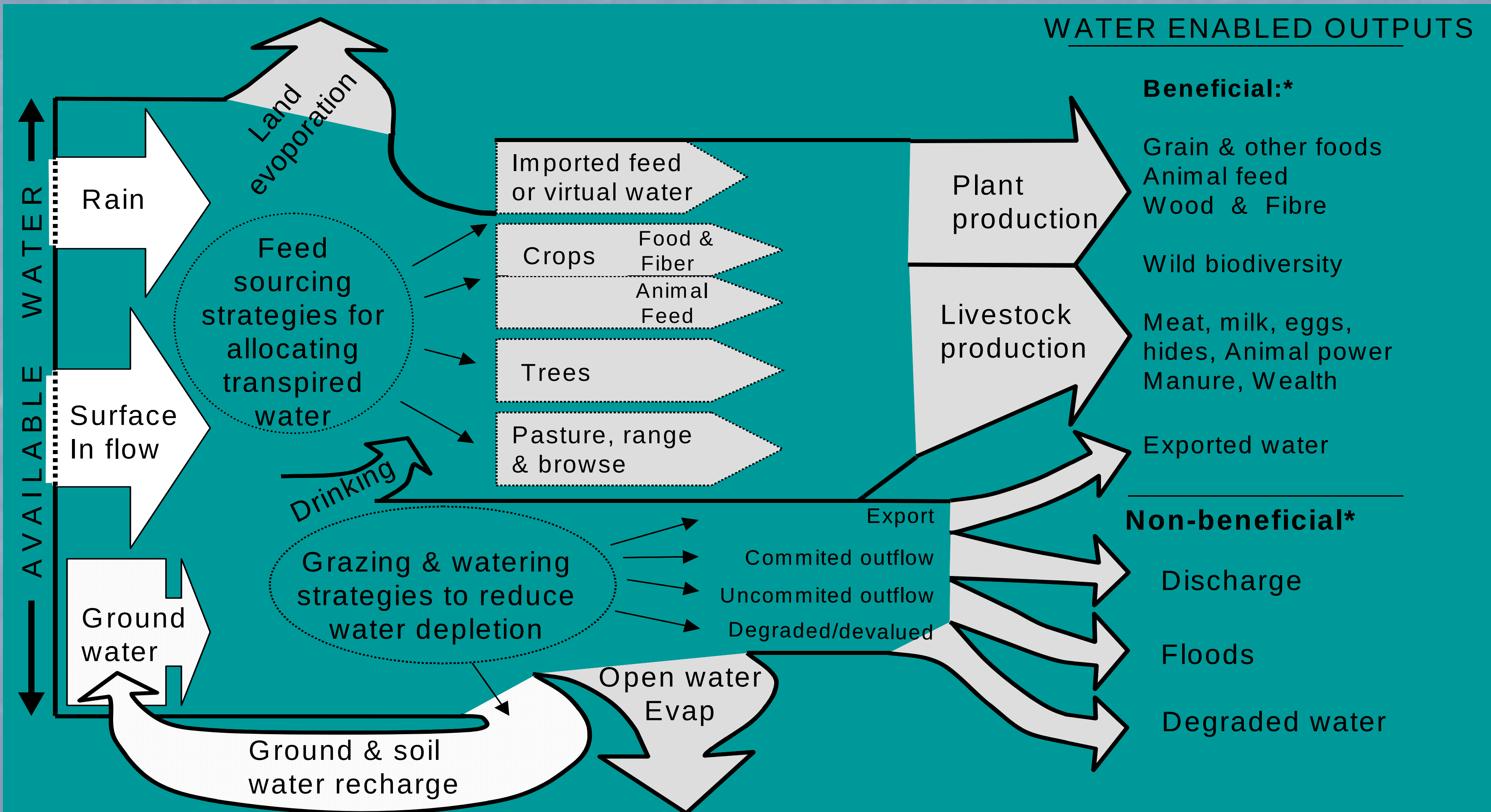
- Rapid population growth has created a vicious cycle of declining soil fertility, erosion, feed shortages thus leading to greater land degradation and food insecurity
- Rainfed agricultural production of the small holder farmers declined by about 3 per cent annually (Hurni,1989)
- Declining productivity in rain fed agriculture necessitates doubling food production over the next two decades
- Ethiopia has an estimated irrigable land of about 3.5 million hectares of which only about 5% has developed to date

The objectives:

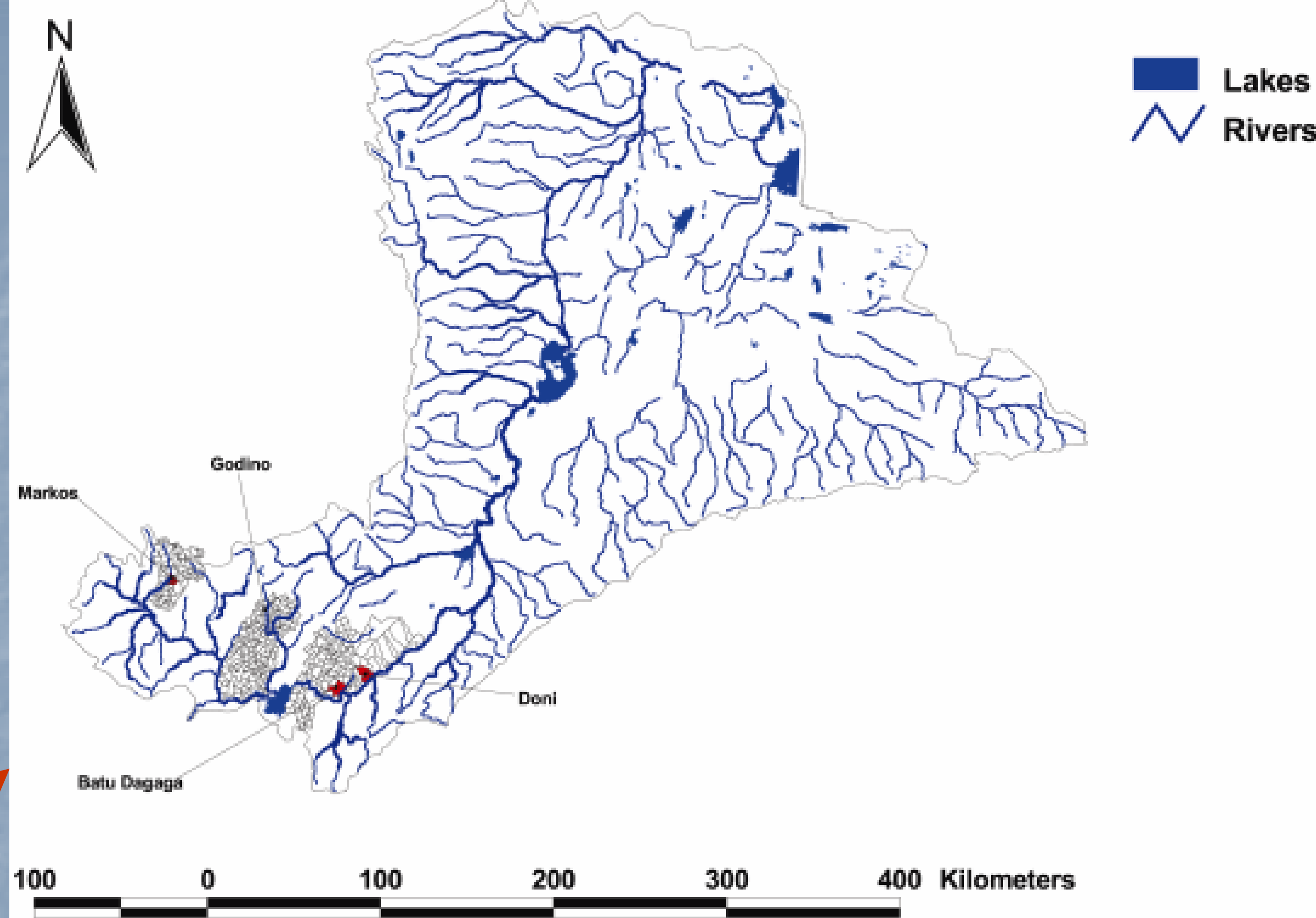
- To come up with livestock water productivity values using the already developed livestock water productivity framework
- Identify data sets required in conducting the livestock water productivity assessment at household level.

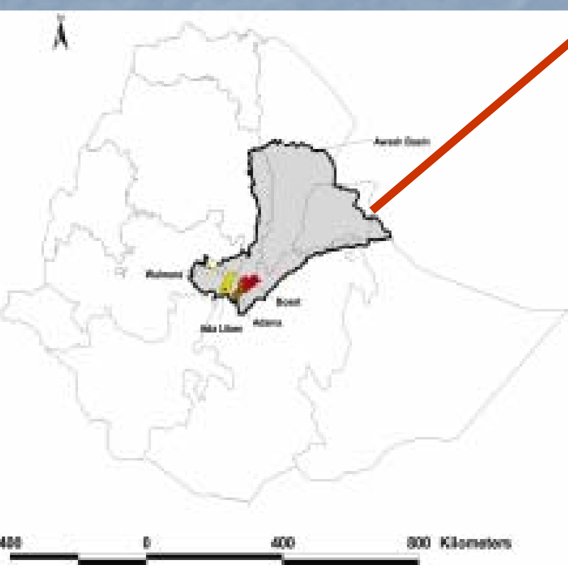
Livestock water productivity framework

(Sonder et al, 2004)



Study schemes





Methodology

- Thirty irrigators and 30 non-irrigator farmers were selected randomly from each scheme
- Household survey was conducted covering demographic characteristics, socio-economic factors, livestock holding, feed sources, water management practices, cropping patterns, agricultural input and yields at plot level, and marketing.
- Time spent by livestock on services for transport and threshing of cereals and pulses had to be estimated .
- 10 percent of the gross income from cereals and pulses was assumed to be the threshing value when livestock were used for the purpose.

Methodology (cont'd)

- Dry manure production estimated per TLU (Leegwater and Schiere, 1999) and changed to monetary value
- Except for maize residue (1:3), the ratio of crop residue (DM) to grain for all other crops taken as 1:1.
- From onion fields, residue samples were taken and 200 kg dry matter per ha estimated for vegetable residue.
- The amount of dry matter feed required for the maintenance of a TLU is assumed as 5 kg d^{-1} and depleted water at household level calculated on this basis.
- Livestock water productivity monetary value is the ratio of beneficial outputs to water utilized.

Dry season feed availability for livestock of irrigator and non-irrigator households at Godino,

Results

Average Livestock holding in TLU, feed requirement and crop residue availability per household

Animal type	Doni		Batu Degaga		Godino		Markos		Mean	Sig.	S.E.
	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator			
Cattle	2.75	1.45	3.46	2.44	2.18	2.01	1.70	4.14	2.51	*	0.89
Draft oxen	1.37	1.17	1.83	1.40	2.73	2.47	1.60	2.33	1.89	***	0.41
Sheep	0.24	0.13	0.66	0.35	0.18	0.09	0.20	0.23	0.26	NS	-
Goat	0.19	0.41	1.60	0.65	0.08	0.19	0.16	0.03	0.41	***	0.29
Horse	0.00	0.09	0.00	0.14	0.00	0.00	0.07	0.09	0.04	NS	-
Donkey	0.30	0.49	0.81	0.61	0.85	0.98	0.49	0.41	0.61	**	0.19
Mule	0.02	0.11	0.05	0.02	0.02	0.05	0.00	0.07	0.04	NS	-
Poultry	0.06	0.04	0.16	0.10	0.17	0.15	0.09	0.12	0.11	*	0.05
Total TLU#	4.93	3.89	8.57	5.71	6.21	5.94	4.31	7.42	5.87	**	0.16

Average Livestock holding in TLU (Contd.)

Animal type*	Doni		Batu Degaga		Godino		Markos		Mean	Sig.	S.E.
	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator			
Total TLU#	4.93	3.89	8.57	5.71	6.21	5.94	4.31	7.42	5.87	**	0.16
Required feed (kg/year)	8960	7080	15620	10420	11350	10300	7870	13540	10643	**	292
Crop residue (cereals & pulses)	1960	2330	3500	3420	4970	7460	4970	7120			
Maize stover	1630	1630	1630	1630	-	-	-	-			
Vegetable residue	200	-	200	-	200	-	200	-			
Total crop residue	3790	3960	5330	5050	5170	7460	5170	7120			
% of feed requirements met by residue	42	56	34	48	46	72	66	53			
Feed from hay & pasture	5170	3120	10290	5370	6180	2840	2700	6420			

Significant level: * at 5%; ** at 1%; *** at 0.1% ;

Source: # - Campbell, K.L.I., Hodgson, N.H. and Gill, M. (eds) (1999).

Land holding and total amount of livestock time required for land preparation and transport service

Parameters	Doni		Batu Degaga		Godino		Markos	
	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator
Landholding per household (ha)	1.58	1.80	2.53	2.72	1.92	2.55	1.64	2.42
Land preparation & planting (oxen pair– days)	32.48	22.08	39.68	29.12	28.32	25.92	31.20	28.00
Transport (equine/day)	48.00	103.50	129.00	115.50	78.30	93.70	50.40	54.00

1. Even though irrigators have smaller landholdings, crop production on irrigated plots are twice or three times a year thus increasing the use of animal power.

Assumptions for estimating LWP

1. Draught power- 16 oxen days /ha and 20 Birr / oxen day
2. Transport – all equines included; for Doni and Batu Degaga 5 months of animal transport required due to water transport same for both irrigated and non-irrigated h households while for Godino and Markos 3 months of animal transport assumed; 10 Birr per day of work assumed per equine.
3. Price of Dung Cake taken Birr 0.25/piece at Godino and Markos while Birr 0.10/ piece at Doni and Batu Degaga due to market situation; 1 TLU produce 1000 kg dry matter dunk cake and 20% losses assumed in all cases (Campbell et al., 1999).
4. Threshing costs assumed to be10% of the gross income from cereals and pulse crops.
5. Amount of water calculated for feed – One TLU needs 5 kg /day of dry matter feed; to calculate the amount of water for feed reduce the amount of crop residue (CR) fed as it is already accounted for in crop water productivity; 300 l of water required to produce a kg of dry matter feed. Per annum TLU water for feed = (No. of TLUs *5 * 365 days minus total crop residue) * 0.3 m^3 of water/dry matter feed.
6. Animal product consumption estimated 20 kg of meat consumed /household; a kg of meat estimated as 10 Birr; Markos household without irrigation plots consume 1.5 l of milk /day; one liter of milk estimated as one Birr.

Livestock water productivity in terms of monetary value (Birr/m^3) for irrigated and non-irrigated households per year in the four irrigation schemes of Upper Awash Basin.

Parameters	Doni		Batu Degaga		Godino		Markos	
	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator	Irrigator	Non-irrigator
Draught (Birr)	650	442	794	582	567	518	624	560
Transport (Birr)	480	1035	1290	1155	783	927	504	540
Threshing (Birr)	392	466	699	684	994	1491	994	1423
Manure (Birr)	393	310	685	457	1244	1188	862	1484
Livestock & products sales (Birr)	200	-	-	228	700	-	125	300
Estimated value of livestock & livestock products consumed (Birr)	200	200	200	200	200	200	200	748
Total (Birr)	2315	2453	3668	3306	4488	4324	3309	5055
Amount of water required for livestock (m^3)	1551	936	3087	1611	1854	852	810	1926
Livestock water productivity (Birr/m^3)	1.50	2.62	1.20	2.05	2.40	5.08	4.10	2.62

Conclusion

- Livestock water productivity will depend on the livestock benefits derived to the amount of water depleted for production.
- The four schemes and two farm types within each scheme showed differences in livestock water productivity trends.
- The livestock water productivity of the highland schemes were higher than those in the lower altitudes
- The ratio of available crop residue to the total feed requirement of the non-irrigator households of the four schemes was 10% higher (57 %) than the irrigator households.

Conclusion (cont'd)

- The main benefits derived from livestock were livestock services in terms of draught power for land preparation, transport , threshing and dung cakes (dried manure).
- The potential for increasing the livestock water productivity in the mixed crop livestock traditional systems could be further improved through more efficient use of animal power and management (eg. Conservation tillage) and integration of food- feed crops in irrigated farms.
- It was clear that some data would be difficult to capture just through farmers interview and would require monitoring and measurements to come with more precise livestock water values.

Thank you