Crop water productivity modeling: Demand and impact at a field level

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Nile BDC Symposium on Modeling in the Blue Nile Basin

Addis Ababa, 12 November 2012

Example: On-site Impacts- Water Demand and Water Productivity

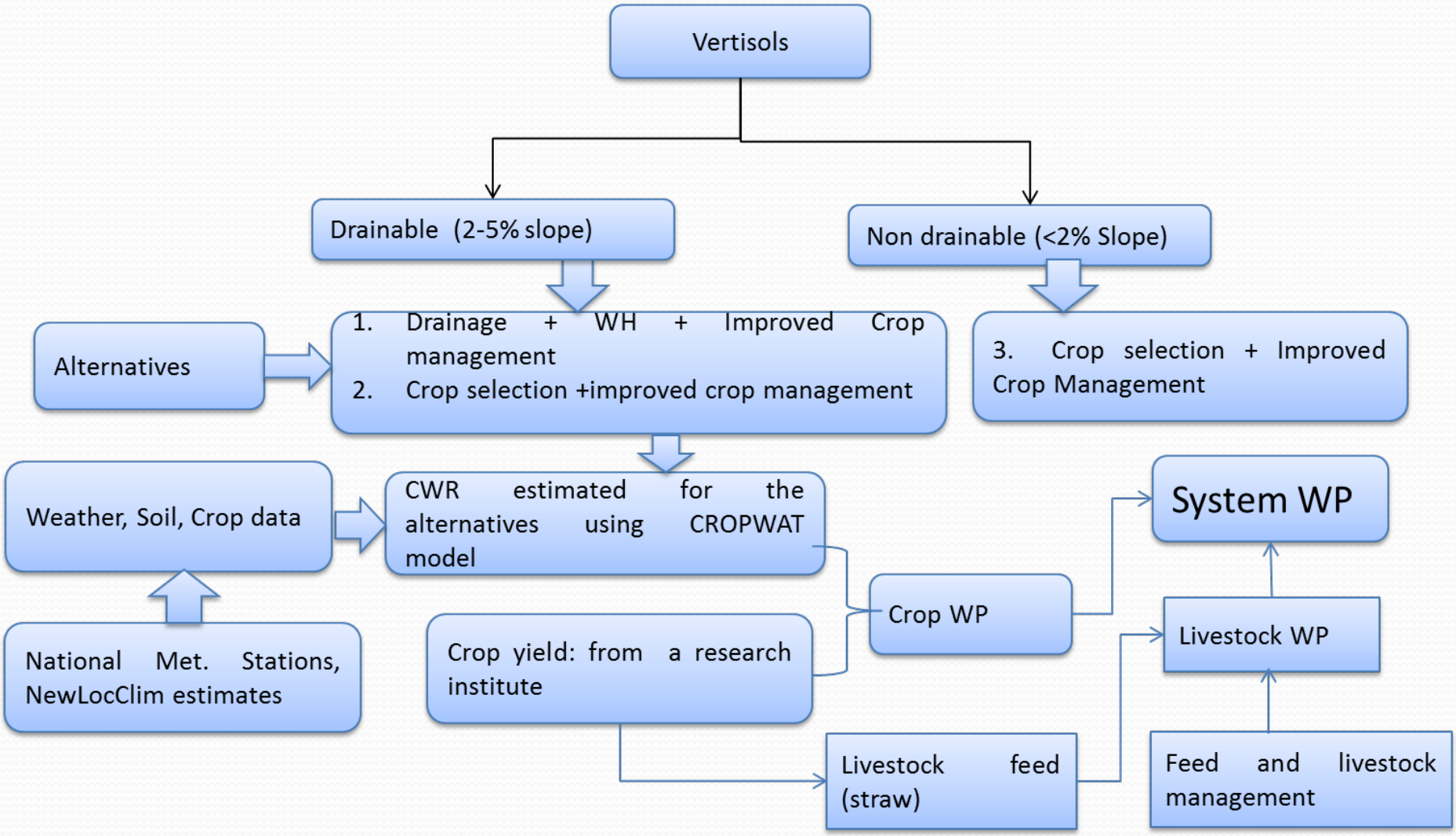
Activities	Model Used
• Estimate WR and consumption of crops grown under different soils Climates:	• CROPWAT (vr. 8) • AquaCrop (Vr. 4)

- Current Vs alternative AWM scenarios

$$\text{WP with respect to evapotranspiration } (WP_{ETa}) = \frac{\text{Crop yield (kg) or its value}}{\text{Actual evapotranspiration } (M^3)} \quad \text{..... } Eq.1$$

$$\text{WP with respect to rainfall } (WP_{eff}) = \frac{\text{Crop yield (kg) or its value}}{\text{Eff. rainfall during the growing period } (M^3)} \quad \text{..... } Eq.2$$

Example: WR and Consumption of crops grown on Vertisols under current and alternative AWM scenarios



CROPWAT - Session: untitled

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Climate/ETo

Rain

Crop

Soil

CWR

Schedule

Crop Water Requirements

ETo station: Fogera

Rain station: Fogera

Crop: Rice Demo

Planting date: 06/06

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			coeff	mm/day	mm/dec	mm/dec	mm/dec
Jun	1	Init	1.05	3.68	18.4	21.0	0.0
Jun	2	Init	1.05	3.37	33.7	50.8	0.0
Jun	3	Init	1.05	3.07	30.7	51.6	0.0
Jul	1	Deve	1.05	2.78	27.8	51.9	0.0
Jul	2	Deve	1.08	2.54	25.4	53.8	0.0
Jul	3	Deve	1.12	2.62	28.8	53.6	0.0
Aug	1	Mid	1.14	2.61	26.1	53.6	0.0
Aug	2	Mid	1.15	2.59	25.9	53.8	0.0
Aug	3	Mid	1.15	2.99	32.9	52.2	0.0
Sep	1	Mid	1.15	3.43	34.3	52.2	0.0
Sep	2	Mid	1.15	3.79	37.9	51.7	0.0
Sep	3	Mid	1.15	3.88	38.8	43.1	0.0
Oct	1	Late	1.02	3.52	35.2	32.1	3.1
Oct	2	Late	0.74	2.60	26.0	23.7	2.4
Oct	3	Late	0.44	1.53	16.9	22.1	0.0
					438.8	**667.3**	**5.5**

Example 1: WR, Consumption and WP of wheat grown on BBF and Flat seedbeds

Location and year	Growing season eff. rainfall (m^3 ha^{-1})	Actual ETc (m^3 ha^{-1})		Grain WP with respect to eff. rainfall (kg m^{-3})			WP with respect to actual ETc (kg m^{-3})	
		BBF	Flat	BBF	Flat	% increase due to BBF	BBF	Flat
Enewari 1986	4770	3005	1086	0.23	0.22	5	0.37	0.99
Dogollo 1986	5740	3161	2582	0.32	0.22	45	0.58	0.49
Dejen 1987	5640	3000	1200	0.22	0.16	38	0.42	0.77
Bahir Dar 2007	7570	2804	2429	0.34	0.26	31	0.93	0.82
Merawi 2007	5720	3135	1206	0.30	0.10	200	0.54	0.50
Bichena 1997	4770	3005	1086	0.34	0.19	79	0.53	0.83
Average	5876	3040	1669	0.33	0.24	57	0.66	0.89

BBF and Flat beds planted on June 10 and August 15, respectively

Example 2: WR, Consumption and WP of rice, grass-pea and extensively grazed grass grown on flat areas

Location	Yield (kg ha^{-1})		Average eff. rain (m^3 ha^{-1})	Actual ETc (m^3 ha^{-1})	Grain WP (kg m^{-3}) with respect to		Biomass WP with respect to eff. rain
	Grain	Straw			Eff. rain	Actual ETc	
Crop type: Rice							
Fogera 2007	3510	4467	6330	5259	0.55	0.67	1.3
Fogera 2011	3744	4765	6330	4233	0.59	0.88	1.3
	3627	4616	6330	4746	0.57	0.78	1.3
Pawe 2007	3644	4638	7900	4953	0.46	0.74	1.0
Pawe 2008	3547	4514	7900	5857	0.45	0.61	1.0
Average	3596	4576	7900	5405	0.46	0.68	1.0
Crop type: Grass -pea							
Fogera 2007			6330	3130			
Fogera 2011			6330	3130			
Average			6330	3130			
Pawe 2007			7900	4930			
Pawe 2008			7900	4860			
Average	4662	9558	7900	4895	0.59	0.95	1.8
Crop type: Pasture (extensive grazing)							
Fogera 2011*	Biomass (kg ha^{-1})		Eff. rain (m^3 ha^{-1})	CWR (m^3 ha^{-1})	Biomass WP (kg m^{-3}) with respect to Actual ETc		
	2793		6330	1940	1.44		0.44

Impacts

- Use of BBF increased water demand, but reduced evaporation loss
- BBF increased WP with respect to effective rainfall
- Growing rice instead of grass-pea or grazing increased water demand, but reduced evaporation
- Use of BBF on drainable and rice on flat land increased **Economic Water Productivity**

Thank you