Mapping Feed Demand and Supply

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2018 Global Nutrition Symposium, January 2018, Addis Ababa, Ethiopia





Rational

- Understanding current levels of livestock production and productivity
- Opportunities and limitations for increasing livestock production and productivity
- Targeting and prioritizing feed interventions
- Essential input for mapping business opportunities around feed production and transaction



Topics

- Conceptional architecture of feed supply-demand tool (FEEDBASE)
- Use of secondary data sets and conversion factor
- Demonstration of the pilot tool for Ethiopia
- From stationary feed supply-demand tool to interactive decision making tool
- Feed supply and demand, resource demand and environmental foot prints



Schematic representation of FEEDBASE



Assumptions and constants to estimate feed supply from cropping

Сгор	Crop residue	Bran/husk	Grains	Сгор	Oilcake
Paddy	1.3	0.08	0.02	Groundnut	0.60
Wheat	1	0.08	0.02	Sesame	0.60
Sorghum	2.5		0.05	Rape & Mustard	0.67
Bajra	2.5		0.05	Linseed	0.67
Barley	1.3		0.10	Niger	0.72
Maize	2.5		0.40	Sunflower	0.70
Finger millet	2.0		0.05	Safflower	0.70
Small millets	2.5		0.10	Soybean	0.73
Other cereals	2.0		0.10	Coconut	0.0625
Pulses	1.7	0.03		Cotton	0.0499
Groundnut	2.0				
Soybean	0.17				

Assumptions and factors to estimate feed supply from greens

Source	Area	Productivity/annum
Cultivated fodder	5% of the total cropped area	40 tons/hectare
Forests	50% of the area accessible for Fodder	3 tons/hectare
Permanent pastures and grazing lands	Total area	5 tons/hectare
Miscellaneous tree crops	Total area	1 ton/hectare
Cultivable waste lands	Total area	1 ton/hectare
Current fallows	Total area	1 ton/hectare
Other fallows	Total area	1 ton/hectare

Assumptions and factors to estimate feed demand from livestock census

Species	Factors
Cattle - Cross bred	Adult body weight- 350 kg Growth potential- 400 g/d Milk production - state specific values as provided by Department of Animal Husbandry, Government of India
Cattle Indigenous	Adult body weight- 250 kg Growth potential- 200 g/d Milk production- state specific values as provided by Department of Animal Husbandry, Government of India
Sheep & goat	 90% of the population under extensive system with no concentrate supplementation 10% of the population under semi intensive system with 25% concentrate supplementation. Dry matter requirement - 3% of the body weight.
Poultry Only	Only commercial broilers and layers have been considered based on the feed conversion ration and assuming 3.5 and 4.0 kg of feed per broiler and layer respectively.
Equines, mules, Horses, donkeys, Camels	2% dry matter intake

Demonstrate Pilot Tool



🚽 Feedbase_Main



Data Management Data Entry Analysis Help

FEEDBASE - Ethiopia

Database and an analysis tool for assessing supply and demand of animal feeds red viable decision support system for planning and decision-making in livestock product concept of developing Feed Supply-Demand scenarios from available data was a interest by the Ethiopian Agricultural Transformation Agency (ATA) and a collad between Indian Council of Agricultural Research(ICAR) and the International Liveste (ILRI) to adopt, and develop, the concept for an Ethiopian Feed Supply-Demand Ethiopia). The concept of development of database and tool based on feed sup cropping and land use pattern and feed demand from livestock census and nutrient recategories of livestock based on their body maintenance, production and reproduction in the second second

The Feedbase-Ethiopia module has been developed using user friendly graphical use accessing the information by user defined query. Thematic maps module has been source GIS software for digitization, store and generate spatial data. Which is provid the quantitative and qualitative availability of different feed resources for individual d and land use patters statistics and the requirement in terms of dry matter for standunit based on livestock census data. Besides adopting the tool to Ethi conceptionaldevelopment was decided to customize the tool with interactive features compare and prioritize feed and animal interventions for effect and impact. The feed animal and feed resources of Ethiopia would be an important tool and aid for sho planning by policy makers, researchers etc. in improving the livestock productivity in 3-10, 6-19-10,6-6-6, 8-12-3, 8-4-2, 9-1-4, 9-2-6



WATA Agricultural Transformation Agency (ATA), Addis Ababa, Ethiopia



International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia

GIS Map

Table form

Graph

Indian Coucilof Agricultural Research, New Delhi, India

🚽 Table

Feed Available in thousand tonnes

	Dists	Year	Source	FineStraw	CoarseStraw	LeguminousStraw	Grains	Cake	Bran	Chunni	Greens	
▶ 1	Gonder zuriya	2016-17	MAIZE	0.000	27066.200	0.000	541.324	0.000	0.000	0.000	0.000	
2	Gonder zuriya	2016-17	WHEAT	22355.700	0.000	0.000	596.152	0.000	1192.304	0.000	0.000	
3	Gonder zuriya	2016-17	BARLEY	0.000	12596.100	0.000	335.896	0.000	0.000	0.000	0.000	1
4	Gonder zuriya	2016-17	TEFF	0.000	38778.075	0.000	1034.082	0.000	0.000	0.000	0.000	Ē
5	Gonder zuriya	2016-17	SORGHUM	0.000	12373.050	0.000	329.948	0.000	0.000	0.000	0.000	
6	Gonder zuriya	2016-17	RICE	13155.900	0.000	0.000	350.824	0.000	877.060	0.000	0.000	1
7	Gonder zuriya	2016-17	OATS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
8	Gonder zuriya	2016-17	MILLET	0.000	363.840	0.000	12.128	0.000	0.000	0.000	0.000	1
9	Gonder zuriya	2016-17	FABA BEAN	0.000	0.000	9138.000	228.450	0.000	0.000	0.000	0.000	
10	Gonder zuriya	2016-17	PEA	0.000	0.000	596.040	14.901	0.000	0.000	9.934	0.000	
	Gonder zuriya	2016-17	HAROCOAT BEEN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
12	Gonder zuriya	2016-17	GRASS PEA	0.000	0.000	23773.440	594.336	0.000	0.000	0.000	0.000	1
10	Gonder zuriya	2016-17	CHICKPEA	0.000	0.000	20026.800	500.670	0.000	0.000	333.780	0.000	
	Gonder zuriya	2016-17	LENTILS	0.000	0.000	374.400	9.360	0.000	0.000	6.240	0.000	1
15	Gonder zuriya	2016-17	COMMON VETCH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1
10	Gonder zuriya	2016-17	NUGE	0.000	0.000	4787.200	0.000	1555.840	0.000	0.000	0.000	1
17	Gonder zuriya	2016-17	LINSEED	0.000	0.000	156.000	0.000	101.400	0.000	0.000	0.000	T
10	Gonder zuriya	2016-17	RAPESEED	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1
10	Gonder zuriya	2016-17	SOYABEAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
20	Gonder zuriya	2016-17	SESAME	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1
- 21	Gonder zuriya	2016-17	GROUNDNUT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
22	Gonder zuriya	2016-17	COTTON SEED	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1
	Gonder zuriya	2016-17	SUNFLOWER	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Gonder zuriya	2016-17	SWEET POTATO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Gonder zuriva	2016-17	POTATO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3297.360	

Graph

GISMap

🖳 Table

Population in actuals and feed requirement (Dry Matter) in tonnes

	Dists	Year	Animal	Category	Population	DM	СР	ME	Dry	Concentrate	Greens
▶ 1	Gonder zuriya	2016-17	CATTLE	Male<1Yr	18796	28471.241	3018.638	60859.850	2067.560	14472.920	4135.120
2	Gonder zuriya	2016-17	CATTLE	Male : 1-3 Yrs	52129	101794.905	9133.001	205188.085	34405.140	28670.950	51607.710
3	Gonder zuriya	2016-17	CATTLE	Male > 3 yrs	61068	143769.339	10699.114	230120.102	103815.600	14656.320	29923.320
4	Gonder zuriya	2016-17	CATTLE	Femal<1Yr	13476	20412.771	2164.246	39222.033	1482.360	10376.520	2964.720
5	Gonder zuriya	2016-17	CATTLE	Femal: 1-3 Yrs	15318	29912.225	2683.714	52064.044	10109.880	8424.900	15164.820
6	Gonder zuriya	2016-17	CATTLE	Femal > 3 yrs	52129	122724.698	9133.001	167095.860	34405.140	28670.950	51607.710
7	Gonder zuriya	2016-17	CATTLE	IND:Female:in mil	130	360.620	32.266	568.166	148.200	41.600	98.800
8	Gonder zuriya	2016-17	CATTLE	IND:Femal:In milk	7890	21454.883	1814.306	30180.828	9389.100	2603.700	6233.100
9	Gonder zuriya	2016-17	CATTLE	IND:Femal:Dry:1	321	773.289	62.097	1203.988	381.990	57.780	147.660
10	Gonder zuriya	2016-17	CATTLE	IND:Femal:Dry:>	7344	17289.612	1286.669	23540.678	8739.360	1321.920	3378.240
	Gonder zuriya	2016-17	CATTLE	CB:Femal:In milk:	41	192.300	20.502	321.149	46.740	13.120	31.160
10	Gonder zuriya	2016-17	CATTLE	CB:Femal:In milk:	826	3783.700	382.892	5719.265	941.640	264.320	627.760
10	Gonder zuriya	2016-17	CATTLE	CB:Femal:Dry:1-3	201	678.626	51.356	993.215	341.700	48.240	98.490
	Gonder zuriya	2016-17	CATTLE	CB:Femal:Dry: >3	103	336.475	22.557	415.350	175.100	24.720	50.470
15	Gonder zuriya	2016-17	SHEEP	Shee CB:Femal:Dry	r: >3 yrs 22203	3241.638	607.807	7674.578	437.399	59.948	1931.661
10	Gonder zuriya	2016-17	SHEEP	Sheep 1-2 yrs	4753	1387.876	161.341	2055.791	192.497	26.142	822.269
17	Gonder zuriya	2016-17	SHEEP	Sheep >2 yrs	28970	8459.240	983.387	17447.183	1173.285	1593.350	5011.810
10	Gonder zuriya	2016-17	GOATS	Goat < 1 yr	39511	5768.606	1081.614	23074.424	7783.667	106.680	3437.457
10	Gonder zuriya	2016-17	GOATS	Goat 1-2 yrs	3712	812.928	88.067	2709.760	150.336	20.416	642.176
	Gonder zuriya	2016-17	GOATS	Goat:> 2 yrs	41455	9078.645	983.520	35104.094	1678.928	228.003	7171.715
1	Gonder zuriya	2016-17	HORSE	Horse: All	1611	1764.045	370.449	5762.547	882.023	0.000	2058.053
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Gonder zuriya	2016-17	MULES	Mules: All	358	392.010	82.322	1084.561	156.804	0.000	358.716
	Gonder zuriya	2016-17	DONKEY	Donkey: All	22701	24857.595	5220.095	55515.296	9943.038	0.000	22746.402
	Gonder zuriya	2016-17	CAMAL	Camel: All	00	0.000	0.000	0.000	0.000	0.000	0.000
05	Gonder zuriya	2016-17	POULTRY	Poultry Birds	309691	11303.722	1808.595	113037.215	0.000	12387.640	0.000

Graph

GISMap

🖳 FormBal

_	Balance Sheet										Units in tonnes					
		Dists.Dists	YEAR	Total Dry Available	Total Dry Required	Total Dry Balance	Total Concentrate Available	Total Concentrate Required	Total Concentrate Balance	Total Greens Available	Total Greens Required	Total Greens Balance	Total DM Available	Total DM Required	Total DM Balance	To Ava
	► 1	Gonder zuriya	2016-17	185540.75	228847.49	-43306.74	8624.63	124070.14	-115445.51	70876.73	210249.34	-139372.60	192468.02	559020.99	-366552.97	
	* Tot			185540.75	228847.49	-43306.74	8624.63	124070.14	-115445.51	70876.73	210249.34	-139372.60	192468.02	559020.99	-366552.97	

# Ongoing/further work at Ethiopian pilot feed – supply - demand tool feed

- Data collected from more than 20 districts
- Plausibility and sensitivity checks, triangulations and ground-truthing
- □ Refinements of feed and animal factors (intake etc)
- □ Capture seasonality, feed import-export

From stationary feed supply – demand information to interactive decision making tool

Predict responses to changes in feed quantity and quality

Predict responses to changes in animal species, breed and performance: feed demand is relative and context-specific

Predict environmental foot prints

# Feed at the interface where positive and negative effects from livestock are negotiated

□ Water for feed production the very major taker of water in livestock production

□ Can we extend the "secondary data use" approach to:

- o estimate water requirement for feed production
- o greenhouse gas emission from feeding

# Match feed data bases with water requirements

•Often more data sets available than people are aware of

- Climate change work
   Lack of awareness, different ministries, departments, agencies
   Locate, fill gaps where required and match
- Information required for allocating water requirement to biomass production

ET₀:reference evapo-transpiration calculated from temperature, wind speed, humidity, rainfall

- $\succ$  K_c: crop specific coefficient derived from crop phenology
- LGP: length of growing period

## A simplified framework to combine feed resources data base and water input requirement estimates



# Estimates for water requirements to produce specific feed resources in 4 districts in India

District	Liters of water required to produce 1 kg of feed						
	Crop residues	Concentrates	Greens				
Bijapur	1303	2300	3427				
Tumkur	1177	1589	3291				
Raichur	1825	2108	3770				
Chikmangalore	633	1140	3235				

(Blümmel et al., 2014)

## Conclusions

- Concept of structured feed supply demand scenario accepted by key players in Ethiopia (and Vietnam, Malawi and Mali)
- Pilot tool exists that will allow plausibility testing and ground-trothing
- If tool passes these tests multiple addition options will become open and feasible
- Effective CG NARES South to South collaboration

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### Main screen of FEEDBASE – Feed distribution

### Feed Available in thousand tonnes

	Year	Source	FineStraw	CoarseStraw	LeguminousStraw	Total	Crop Residues DM	Total DM
	2011-12	RICE	403.390	0.000	0.000	403.390	363.051	363.051
	2011-12	WHEAT	547.600	0.000	0.000	547.600	492.840	492.840
	2011-12	SORGHUM	0.000	3.250	0.000	3.250	2.925	2.925
	2011-12	BAJRA	0.000	57.500	0.000	57.500	51.750	51.750
	2011-12	MAIZE	0.000	0.500	0.000	0.500	0.450	0.450
	2011-12	BLACK GRAM	0.000	0.000	1.360	1.360	1.224	1.224
	2011-12	GREEN GRAM	0.000	0.000	2.380	2.380	2.142	2.142
	2011-12	OTHER PULSES	0.000	0.000	5.100	5.100	4.590	4.590
	2011-12	GROUND NUT	0.000	0.000	0.200	0.200	0.180	0.180
	2011-12	BENGAL GRAM	0.000	0.000	5.610	5.610	5.049	5.049
	2011-12	RED GRAM	0.000	0.000	1.870	1.870	1.683	1.683
	2011-12	WHEAT	208.200	0.000	0.000	208.200	187.380	187.380
	2011-12	SORGHUM	0.000	3.250	0.000	3.250	2.925	2.925
	2011-12	BAJRA	0.000	48.250	0.000	48.250	43.425	43.425
	2011-12	MAIZE	0.000	10.250	0.000	10.250	9.225	9.225
	2011-12	BLACK GRAM	0.000	0.000	2.380	2.380	2.142	2.142
	2011-12	GREEN GRAM	0.000	0.000	4.420	4.420	3.978	3.978
	2011-12	OTHER PULSES	0.000	0.000	1.190	1.190	1.071	1.071
	2011-12	GROUND NUT	0.000	0.000	765.000	765.000	688.500	688.500
	2011-12	BENGAL GRAM	0.000	0.000	5.950	5.950	5.355	5.355
	2011-12	RED GRAM	0.000	0.000	1.190	1.190	1.071	1.071
	2011-12	RICE	246.090	0.000	0.000	246.090	221.481	221.481
	2011-12	WHEAT	156.100	0.000	0.000	156.100	140.490	140.490
	2011-12	SORGHUM	0.000	1.250	0.000	1.250	1.125	1.125
	2011-12	BAJRA	0.000	388.250	0.000	388.250	349.425	349.425
_	2011-12	MAIZE	0.000	10.000	0.000	10.000	10,000	10,000

### Feed availability information in tabular form

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Animal distribution – species and category wise



### Feed availability information in spatial (GISMap) form



Feed requirement in dependency of per dairy animal productivity: the Indian scenario (Blümmel et al. 2016c)

🖶 Table

### Population in actuals and feed requirement (Dry Matter) in tonnes

	Dists	Year	Animal	Category	Population	Crop Residues	Concentrate	Greens	Total
▶ 1	Ahmadabad	2010-11	CATTLE	CB:Male<1 Yr	2525	276,493	1935.450	552.986	2764.929
2	Ahmadabad	2010-11	CATTLE	CB:Male : 1-3 Yrs	1971	1295.114	1079.262	1942.671	4317.047
3	Ahmadabad	2010-11	CATTLE	CB:Male for Bree	860	1460.913	208.702	417.404	2087.019
4	Ahmadabad	2010-11	CATTLE	CB:Male for Agri	391	663.518	94.788	189.576	947.882
5	Ahmadabad	2010-11	CATTLE	CB:Male for Bullo	310	526,503	75.215	150.429	752.147
6	Ahmadabad	2010-11	CATTLE	CB:Male Others	218	370.916	52.988	105.976	529.880
7	Ahmadabad	2010-11	CATTLE	CB:Female <1 yr	4593	502.898	3520.287	1005.796	5028.981
8	Ahmadabad	2010-11	CATTLE	CB:Female:1-3 Yrs	5328	3500.507	2917.089	5250.761	11668.357
9	Ahmadabad	2010-11	CATTLE	CB:Dry	3205	5444.750	777.821	1555.643	7778.214
40	Ahmadabad	2010-11	CATTLE	CB:Not calved	1785	3032.814	433.259	866.518	4332.592
	Ahmadabad	2010-11	CATTLE	CB:Female Other	415	704.697	100.671	201.342	1006.709
10	Ahmadabad	2010-11	CATTLE	IND:Male<1 Yr	18108	2354.076	8329.806	3965.712	14649.594
40	Ahmadabad	2010-11	CATTLE	IND:Male : 1-3 Yrs	10184	4175.591	3462.686	10036.696	17674.973
	Ahmadabad	2010-11	CATTLE	IND:Male for Bre	2990	3557.689	538.138	1451.328	5547.155
46	Ahmadabad	2010-11	CATTLE	IND:Male for Agri	10279	12232.089	1850.232	4989.973	19072.294
40	Ahmadabad	2010-11	CATTLE	IND:Male for Bull	5960	7092.467	1072.810	2893.309	11058.586
47	Ahmadabad	2010-11	CATTLE	IND:Male Others	785	933.702	141.232	51.550	1126.484
40	Ahmadabad	2010-11	CATTLE	IND:Female <1 yr	31044	4035.687	14280.123	6798.580	25114.390
40	Ahmadabad	2010-11	CATTLE	IND:Female:1-3 Yrs	28474	11674.368	9681.184	28061.195	49416.747
0	Ahmadabad	2010-11	CATTLE	IND:Dry	27475	32694.698	4945.417	12638.287	50278.401
1	Ahmadabad	2010-11	CATTLE	IND:Not Calved	7127	8481.130	1282.860	3278.420	13042.410
	Ahmadabad	2010-11	CATTLE	IND:Female Other	2769	3295.110	498.420	1273.740	5067.270
	Ahmadabad	2010-11	Cattle	CB:In milk	7765	12847.432	8551.237	9170.858	30569.527
	Ahmadabad	2010-11	Cattle	IND:In milk	53800	54973.101	24258.535	50131.078	129362.713
05	Amreli	2010-11	CATTLE	CB:Male<1 Yr	453	49.567	346.969	99.134	495.670
	0li	2010.11	CATTLE	CD-Male - 1 2 Ver	1000	1007.040	1000 000	1011.022	4000 400

### Animal –Population and feed requirement information in tabular form

# Pitfall of oversimplified feed supply – demand calculations

Mediated by voluntary feed intake as interface

Feed supply: Metabolizable energy

Feed demand: Metabolizable energy for: Maintenance and Production



## Feed-dependent variations in voluntary feed intake observed in ILRI and partner work

Feed	Species	Mean Intake (g/kg LW)	Range Intake (g/kg LW)
Sorghum stover sole (24 cultivars)	Sheep	20.0	16.7 – 26.8
Maize stover sole (10 cultivars)	Sheep	23.2	17.1 - 30.6
Pearl millet cultivar sole (21 cultivars)	Sheep	23.2	17.5 – 28.3
Total mixed rations	Sheep	34.9	32.8 - 37.0
Sorghum stover supplemented	Sheep	28.9	27.7 – 29.9
Two total mixed rations ¹ Basal component of sorghum stover varied b	Dairy Buffalo	37.0	36.0 to 38.0

Summarized from two special issue on food-feed crops by ILRI and partners in 2010 and 2013

### Feed-dependent variations in voluntary feed intake observed in ILRI and partner work

- □ Single and multiple laboratory fodder quality traits could be identified that account for 80% and more of the variation in voluntary feed intake
- □ Is it worthwhile to identify laboratory fodder quality traits for Ethiopian feeds to predict voluntary feed intake rather than use constants for intake?

NDF? ADL ME? CP?

After all laboratory fodder quality traits are part of the feed supply – demand scenario

### Points for discussion

□ Complementation of "static" information tool?

- seasonality and related aspects
- Import export aspects
- Water aspects
- Move from constants to feed specific variables
- Several independent but nested tools
- ????

□ Information to decision making tool

- Which variables/inputs
- How many levels/tiers
- "Mother" files feed supply and feed demand ie livestock population/herds structure
- Several independent but nested tools?

## Thank you!

