FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Photo: Apollo Habtamu

Irrigated fodder in Ethiopia: Suitability and potential

ILSSI/LSIL Webinar, December 02, 2020

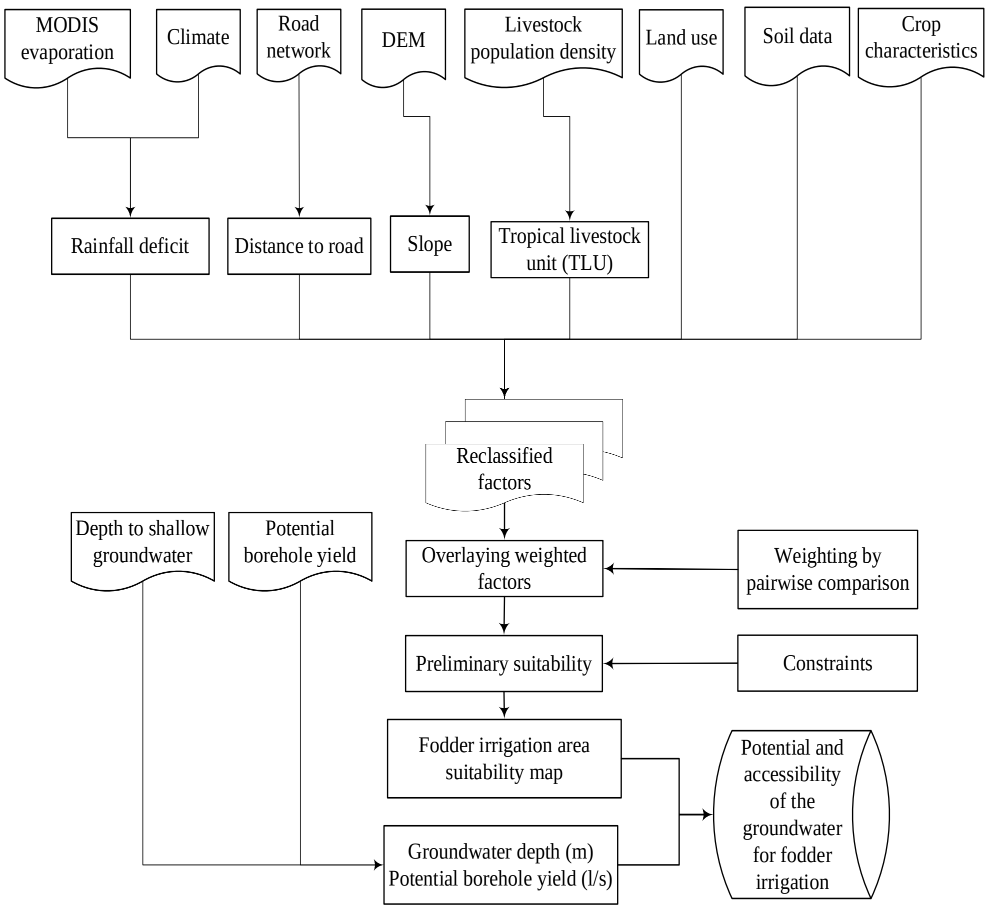
USAID FROM THE AMERICAN PEOPLE · The Borlaug Institute · Texas A&M AgriLife Research · The Texas A&M University System · IFPRI International Food Policy Research Institute · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS University of Florida

BACKGROUND

- Agriculture is one of the major drivers of the Ethiopian economy in which **livestock** is an integral part
- Ethiopia has the largest livestock population in Africa but with suboptimal productivity
- Improved fodder production systems can address bottlenecks in feed quantity and quality, and thereby contribute to poverty reduction
- ILSSI has been studying the potential for small scale irrigation to improve fodder production, e.g. *Napier (Pennisetum purpureum)*, alfalfa *(Medicago sativa)*, oats *(Avena sativa)*, vetch *(Vicia sativa)*, and desho (*Pennisetum pedicellatum*), for poverty reduction and sustainable development.

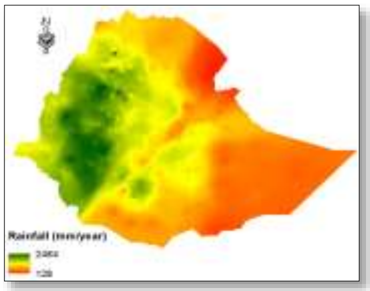
LAND SUITABILITY ANALYSIS

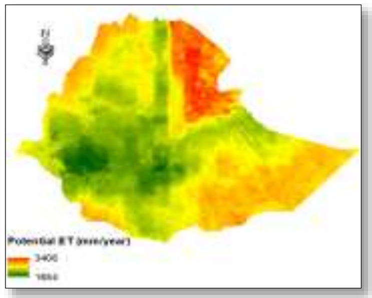
Data	Source	Spatial resolution (m)
Soil (texture, depth & pH)	Africa Soil Information Service (AfSIS), 2015	250
Rainfall (mm/year)	Ethiopian National Meteorological Agency (ENMA) from 1996 to 2010	--
MODIS potential evaporation (mm)	MOD16 Global Terrestrial Evapotranspiration Data Set (2000 – 2010)	1,000
Road network	Ethiopian Road Authority (ERA), 2010	--
Livestock population density	Ethiopian Central Statistical Agency (ECSA)	1,000
Digital Elevation Model (DEM)	Enhanced Shuttle Land Elevation Data from United States Geological Survey (USGS), 2000 released in 2015	30
Land use	Global Land Cover Datasets (GlobeLand30)	30
Groundwater depth (m)	British Geological Survey, 2012	5,000
Potential borehole yield (l/s)	British Geological Survey, 2012	5,000
Fodder crop characteristics	FAO-EcoCrop database	--

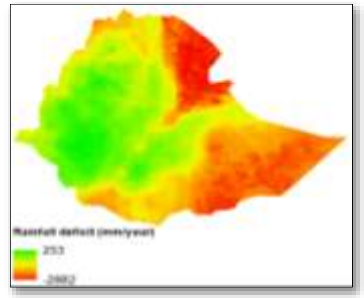


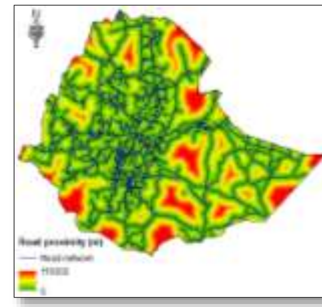
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

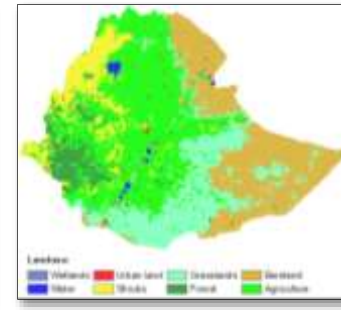
FACTORS CONSIDERED FOR SUITABILITY ANALYSIS

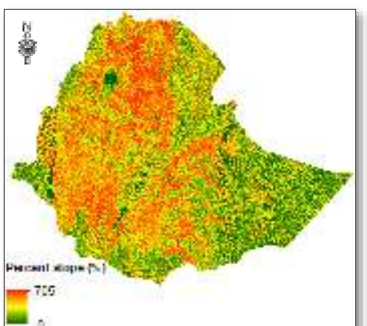

Annual rainfall (mm/year)

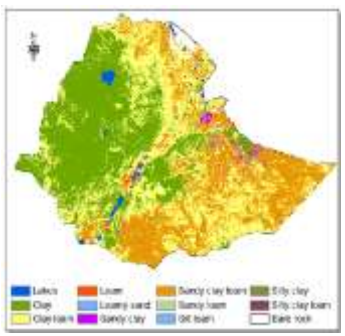

Potential ET (mm/year)

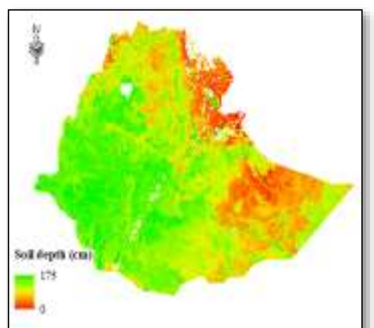

Rainfall deficit (mm/year)

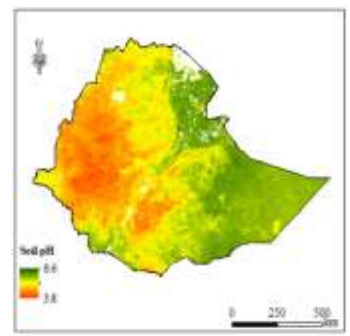

Road proximity

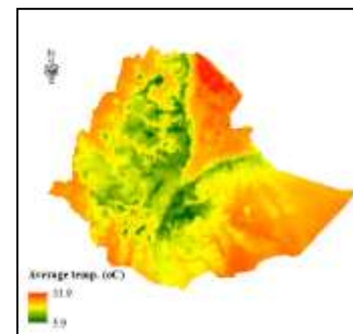

Land use


Percent slope


Soil texture


Soil depth (cm)


Soil pH

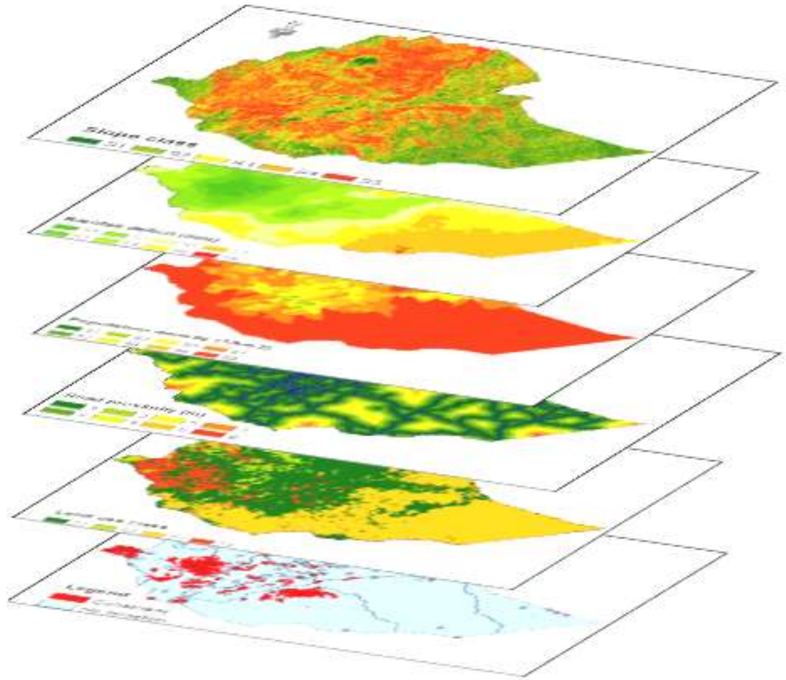

Average temperature (^oC)

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

RECLASSIFYING AND OVERLAYING OF FACTORS

- The factors were reclassified into different labels of suitability classes according to FAO framework.
- Weighting of factors: pairwise comparison (Saaty 1977) and
- Overlayed to identify the irrigated fodder suitable area

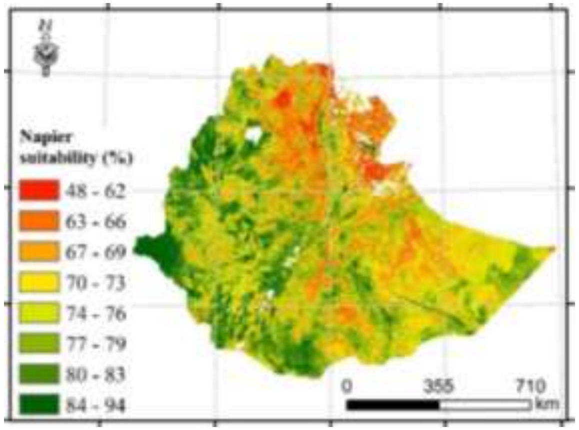


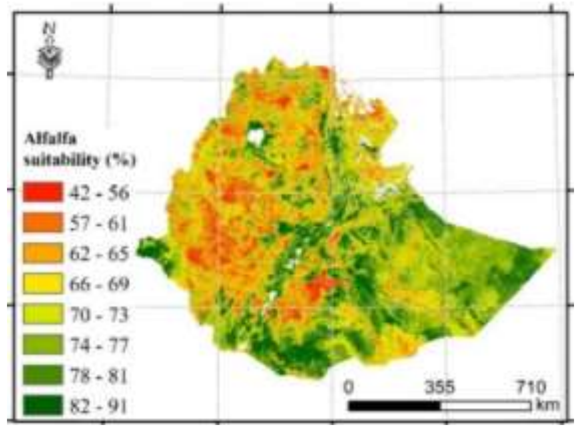
USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

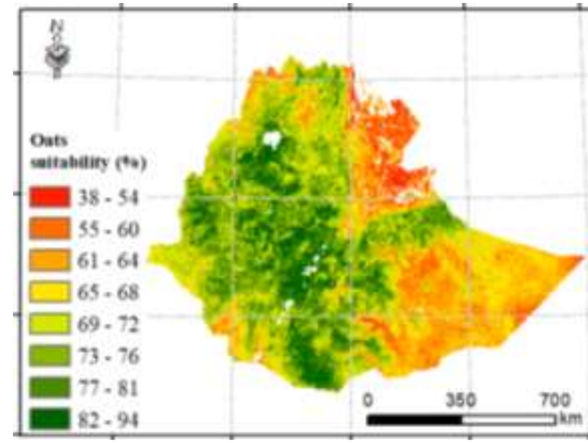
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

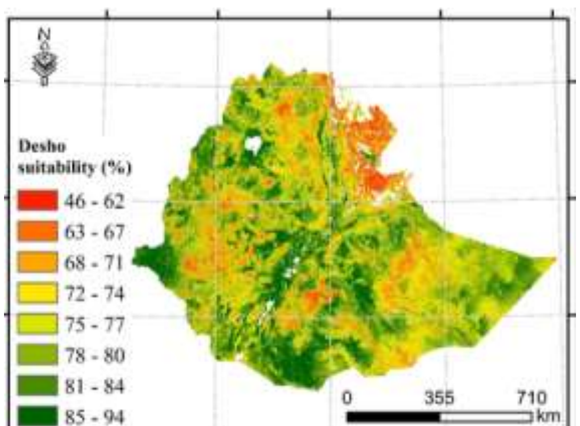
SUITABLE LAND FOR IRRIGATED FODDER PRODUCTION

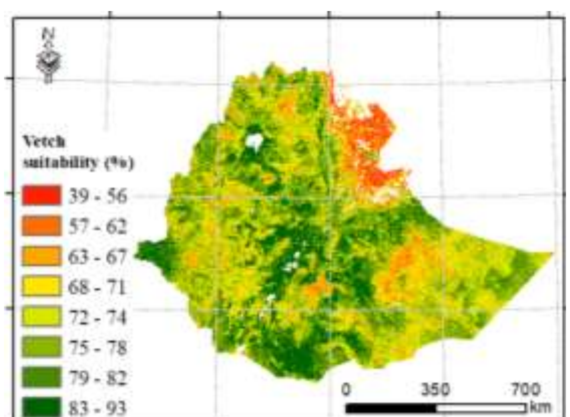
- Nearly 20% of the land is suitable for fodder (80% threshold)

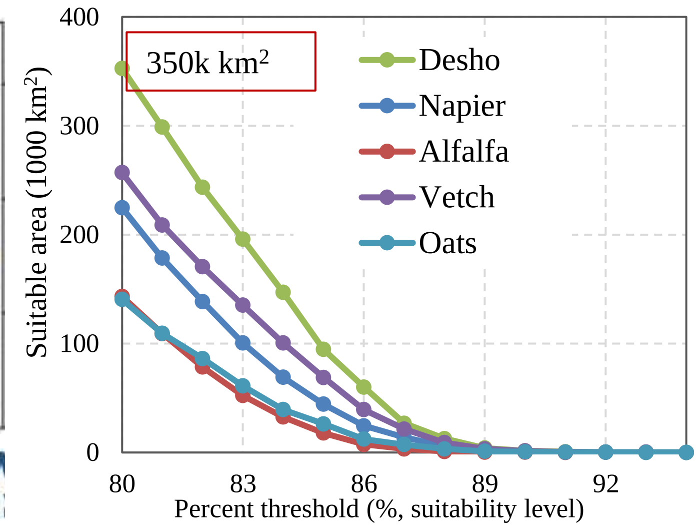










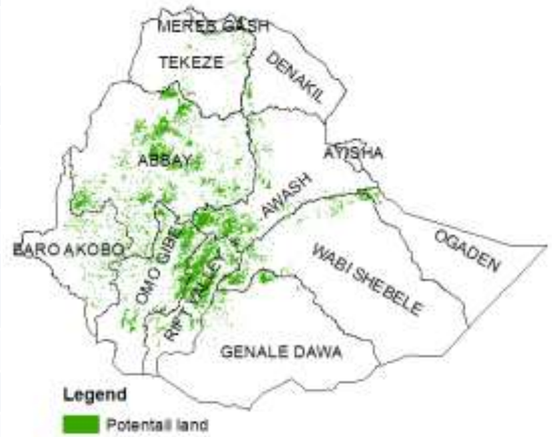


USAID FROM THE AMERICAN PEOPLE
THE BORLAUG INSTITUTE
TEXAS A&M AGRILIFE RESEARCH
THE TEXAS A&M UNIVERSITY SYSTEM
IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IWMI International Water Management Institute

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

SUITABLE FODDER PRODUCTION LAND BY BASIN

		Potential growing site (km^2)					
River basin	Basin area (km^2)	Napier	Alfalfa	Vetch	Oats	Desho	Total
Abbay	198,891	**60,720**	9,856	47,897	**48,377**	66,065	**431,806**
Awash	110,439	14,547	18,813	22,470	10,362	29,377	206,008
Aysha	4321	-	7	2	-	80	4,410
Baro-Akobo	76,203	35,542	6,662	18,958	7,572	31,199	176,136
Afar/Denakil	63,853	1,898	2,889	2,703	346	4,067	75,756
Genale-Dawa	172,133	40,067	**43,551**	**66,648**	25,851	**77,400**	425,650
Mereb	5965	226	215	1,105	509	1,275	9,295
Ogaden	80,009	3,665	14,172	5,636	597	21,887	125,966
Omo-Ghibe	78,189	25,938	6,050	18,168	15,744	24,687	168,776
Rift Valley	51,989	18,937	10,878	23,853	16,946	26,171	148,774
Tekeze	86,455	8,408	3,506	13,440	3,675	19,829	135,313
Wabi-Shebelle	202,219	14,333	26,298	35,517	10,454	49,870	338,691
Total	1,130,666	224,281	142,897	256,397	140,433	351,907	--
Percent		**20**	**13**	**23**	**12**	**31**	**--**



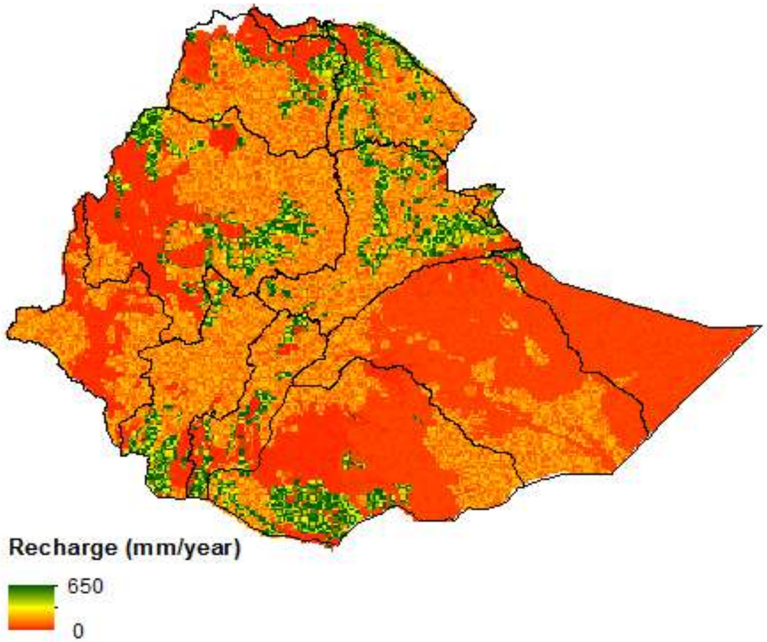
- Abbay River Basin has the largest Napier and Oats production site;
- Genale-Dawa River Basin has the largest Alfalfa, Vetch and Desho production site;

GROUNDWATER IRRIGATION POTENTIAL

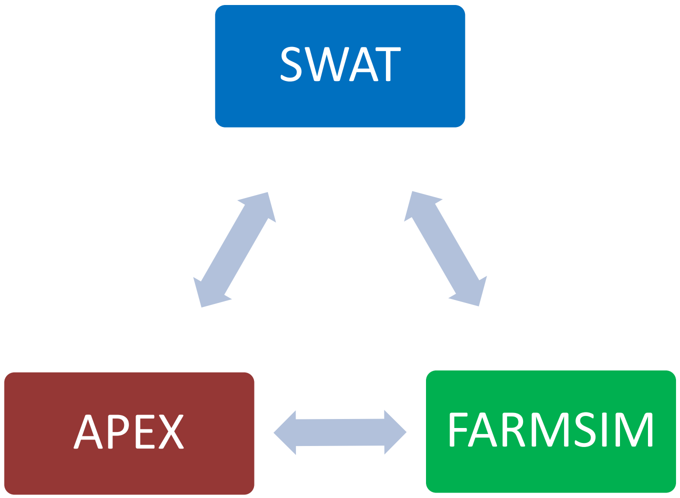
- Groundwater data from the British Geological Survey was used to evaluate the groundwater potential.
- In large part of the country, the shallow groundwater is accessible using simple water lifting technologies.

Groundwater depth and potential borehole yield evaluated for the most suitable land

Fodder crop	Average depth to groundwater (m)	Potential borehole yield (l/s)
Napier	17.1	4.0
Alfalfa	22.3	5.8
Desho	27.4	4.3
Vetch	13.8	4.5
Oats	19.6	3.7



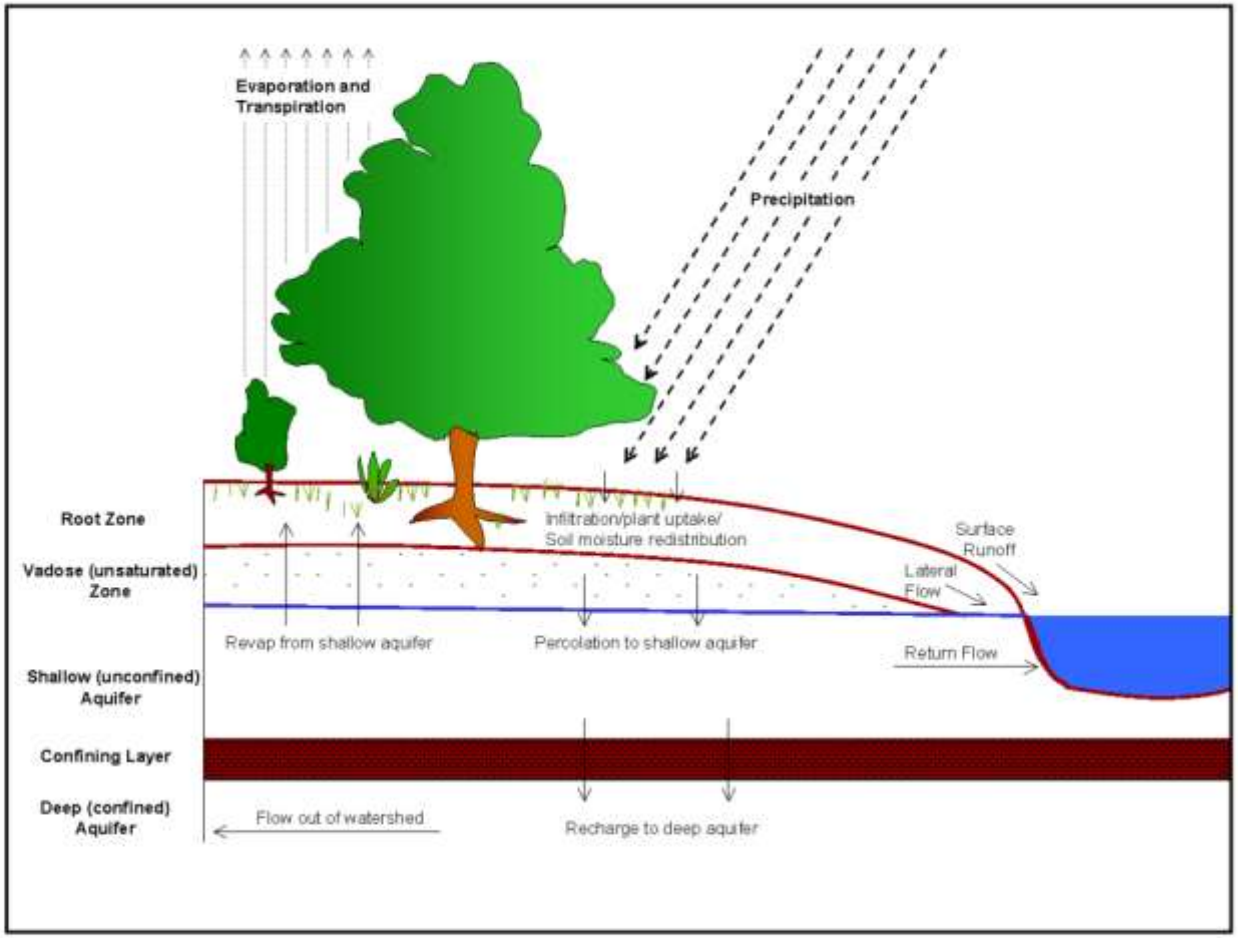
INTEGRATED DECISION SUPPORT SYSTEM (IDSS) FRAMEWORK



Clarke et al., 2016; Worqlul et al., 2017

- SWAT model to analyze the biophysical impacts of intensification of the interventions at the watershed scale
- APEX model to analyze cropping systems and to quantify benefits on crop yields
- FARMSIM to assess economic & nutrition impacts of agricultural technologies

BIOPHYSICAL MODELING

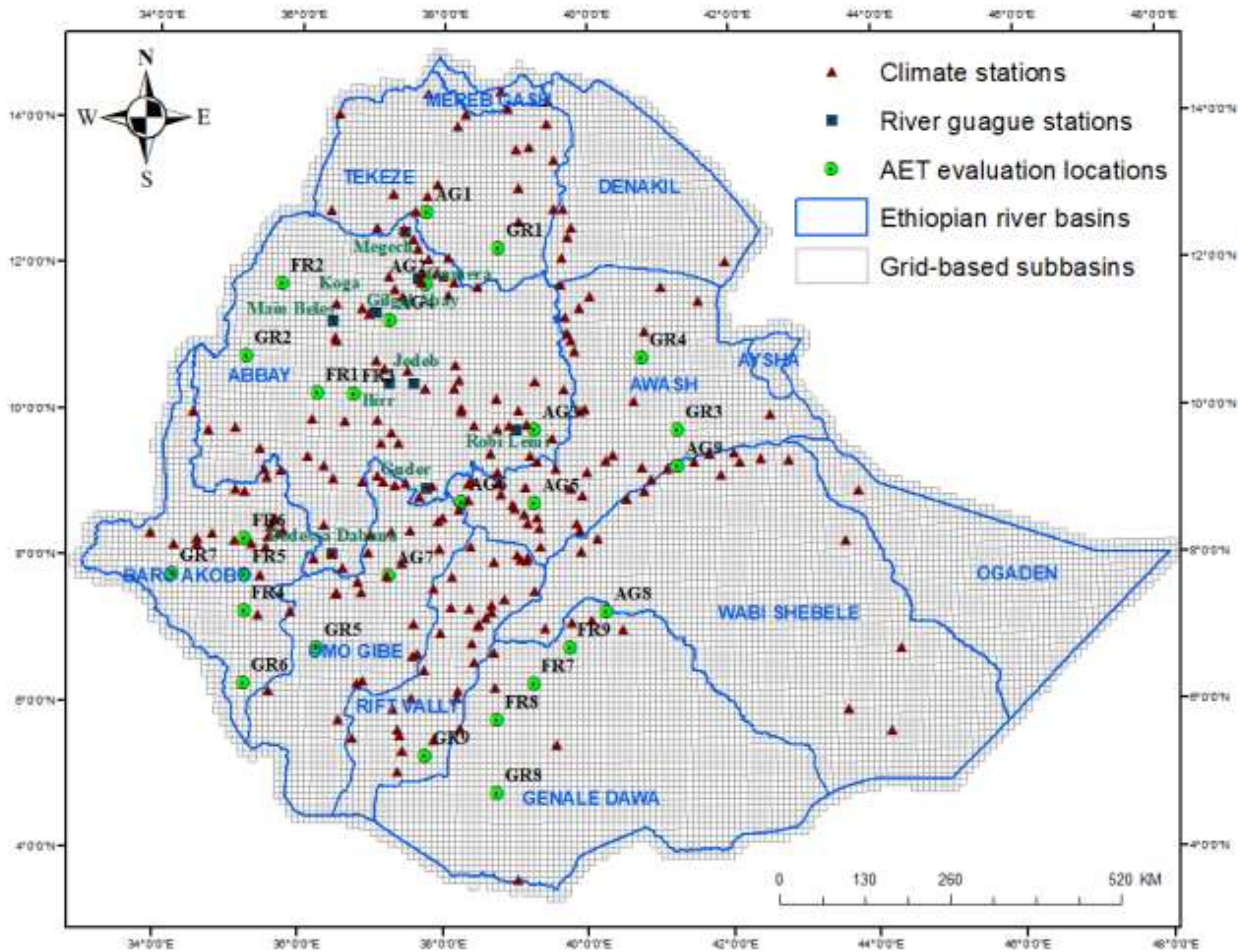


Biophysical models estimate:

- Water balance
- Water quality
- Crop production
- Impacts of changes in land management and climate

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

SWAT MODELING



- A 10 km grid-based SWAT model with 14,314 subbasins
- Daily rainfall and temperature data from 240 and 140 stations, respectively
- Fine resolution land use and soil data
- Locally collected field crop management data and data from EIAR, FAO, and partner organizations.

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

MODEL PERFORMANCE EVALUATION

- Model evaluation during calibration and validation periods based on observed stream flow in multiple stations provided satisfactory model performance.

Goodness-of-fit evaluation between averages monthly simulated and observed streamflow using Nash and Sutcliffe Efficiency (NSE), Kling-Gupta Efficiency (KGE), and Coefficient of Determination (R2) during the model calibration and validation periods.

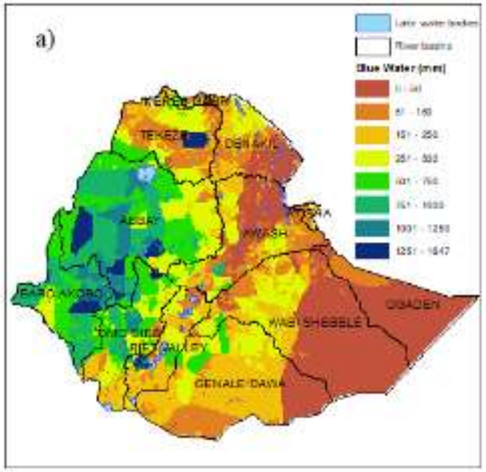
Station	Area upstream of gauge (km^2)	Calibration				Validation			
		Period	NSE	KGE	R^2	Period	NSE	KGE	R^2
Gilgel Abay	1700	1983–2000	0.686	0.573	0.767	2001–2008	0.67	0.589	0.396
Koga	200	1993–2000	0.215 (0.577)[a]	0.212 (0.721)	0.213 (0.551)	2001–2012	0.404	0.619	0.474
Gumera	1400	1983–2000	0.677	0.739	0.69	2001–2013	0.722	0.765	0.67
Megech	500	1983–2000	0.499	0.638	0.514	2001–2007	0.522	0.712	0.554
Jedeb	300	1983–2000	0.634	0.534	0.593	2001–2002	0.812	0.588	0.446
Main Beles	3400	1983–2000	0.653	0.66	0.691	2001–2002	0.679	0.659	0.697
Guder	500	1983–2000	0.753	0.687	0.799	2001–2002	0.463	0.456	0.76
Durra	1000	1983–2000	0.664	0.611	0.401	2001–2002	0.81	0.823	0.802
Robi Lemi Jemma	900	1984–2000	0.638	0.487	0.674	2001–2002	0.624	0.163	0.847
Dedessa Dabana nr Dembi	1800	1985–2000	0.731	0.773	0.508	2001–2002	0.347	0.237	0.904

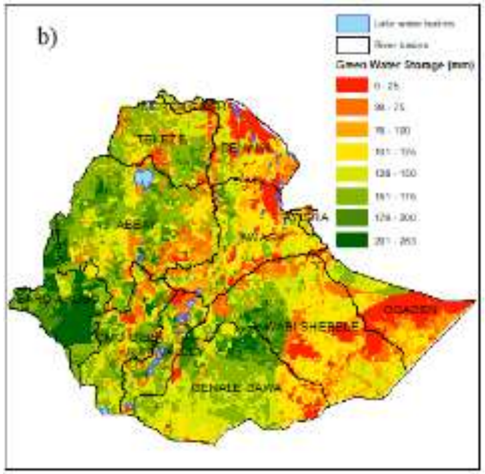
Dile et al., 2020

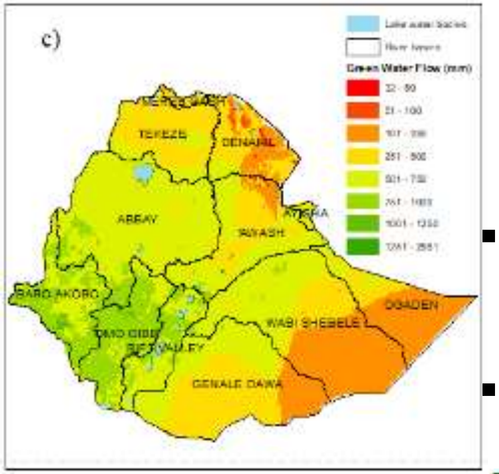
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

BLUE-GREEN WATER RESOURCES

- High variability in the **blue water** resource
- Highest blue water in the **Upper Blue Nile, Baro-Akobo and Omo-Gibe** basins
- About 25% of the country has long-term average annual **blue water** resource >500 mm.





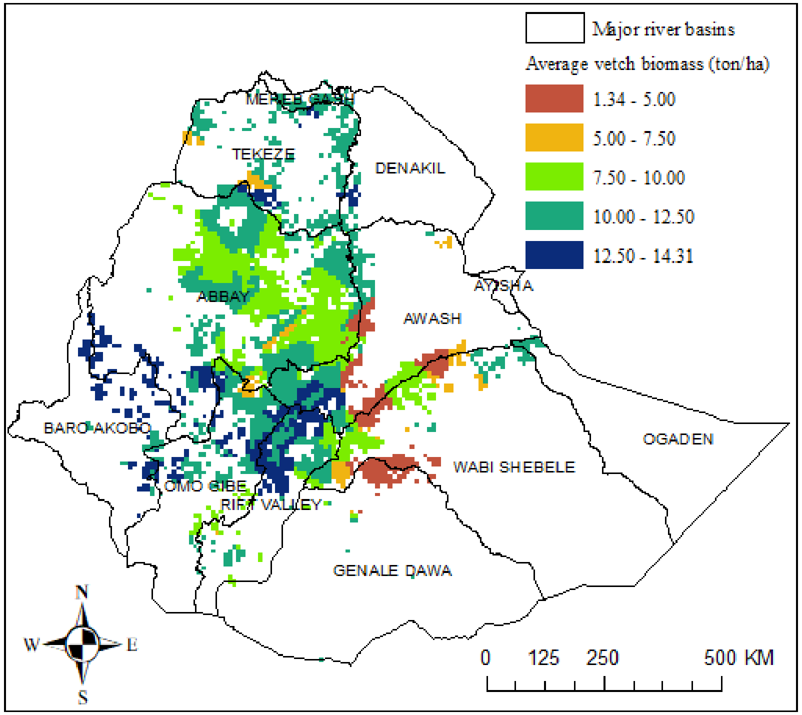


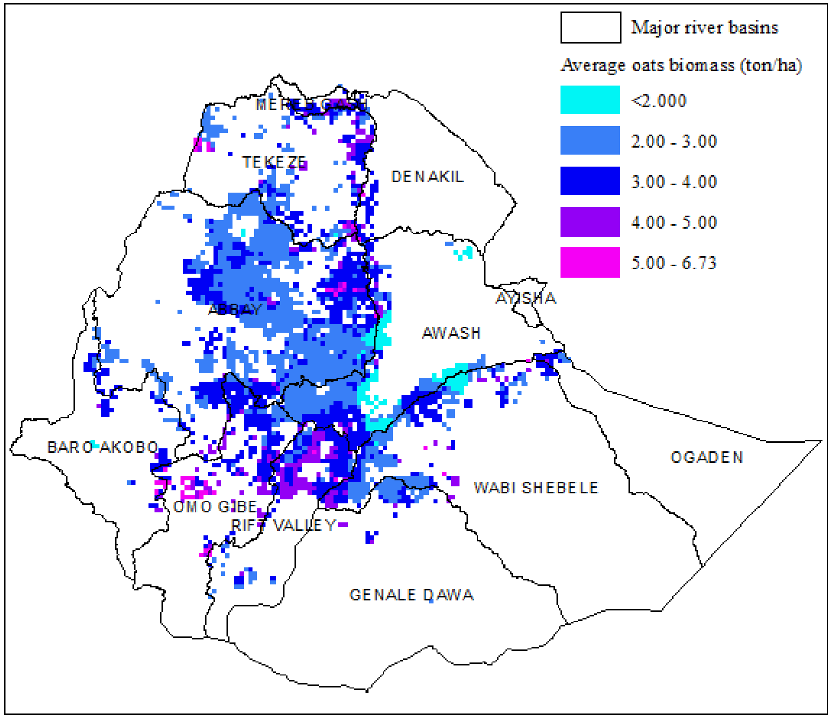
- Less spatial variability in the **green water storage**
- Highest green water storage in Baro Akobo, Upper Blue Nile, upper part of Genale and upper part of Wabi Shebele
- About 55% of the country has long-term average annual **green water storage** of >125 mm.

- Highest long-term average **annual green water flow** in the lower part of the Upper Blue Nile, Baro Akobo, Omo-Gibe and Rift Valley basins.
- About 57% of the country has **green water flow** of >500 mm.

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

DRY SEASON IRRIGATED VETCH & OATS BIOMASS



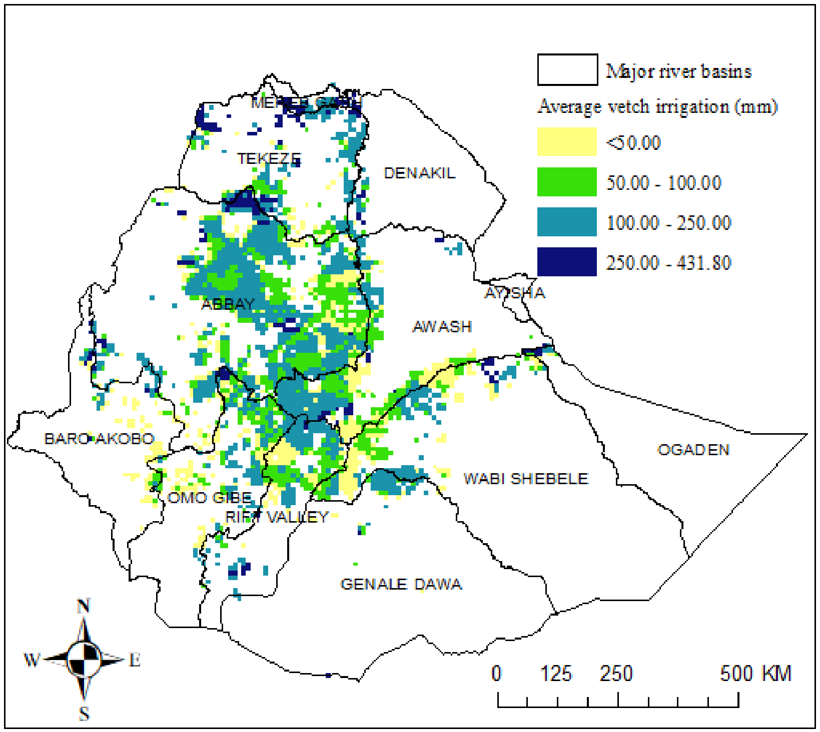


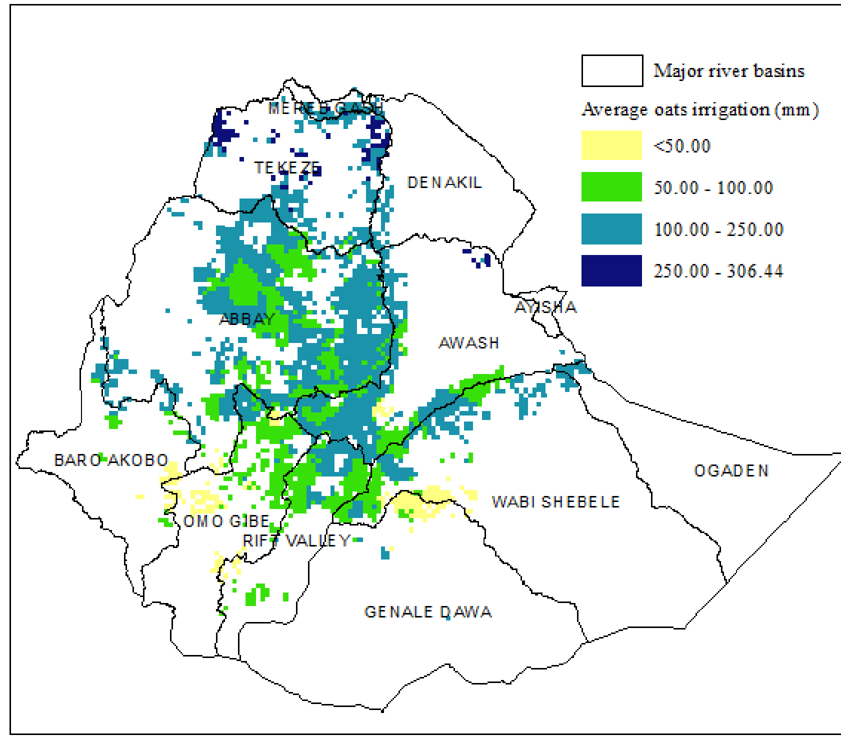
- Significant production in the Lake Tana, Omo Gibe and Rift Valley basins
- About 87% **of the rainfed land** can produce >7.5 ton/ha **irrigated vetch biomass**

- Highest producing areas are in Upper Blue Nile, Omo Gibe and rift valley basins
- About 48% **of the rainfed land** can produce >3 ton/ha **irrigated oats biomass**

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

VETCH & OATS IRRIGATION





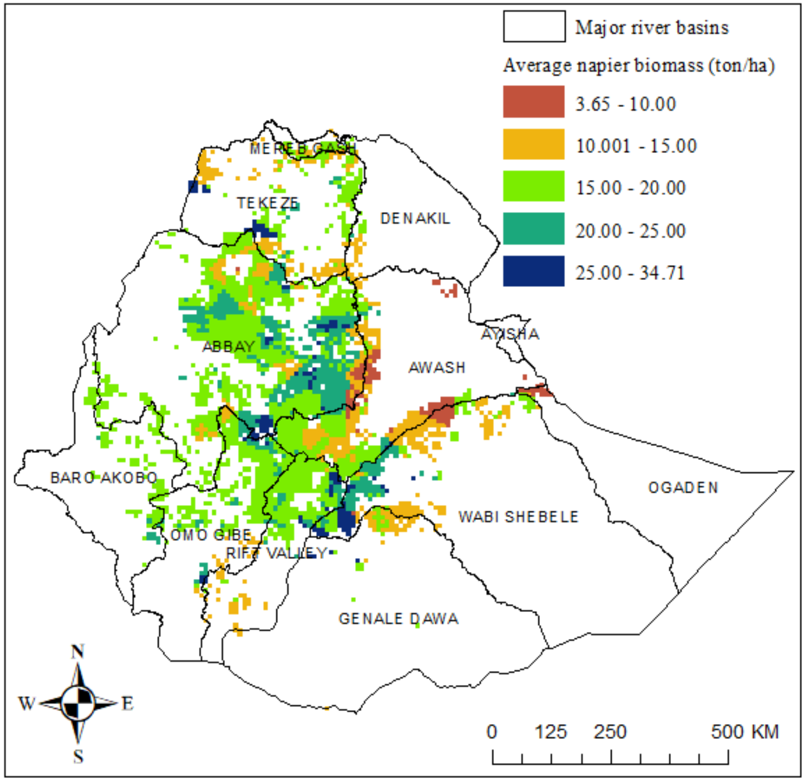
- Modest amount of irrigation to produce vetch during the dry season
- About 15% **of the rainfed agricultural land** required <100 mm of irrigation

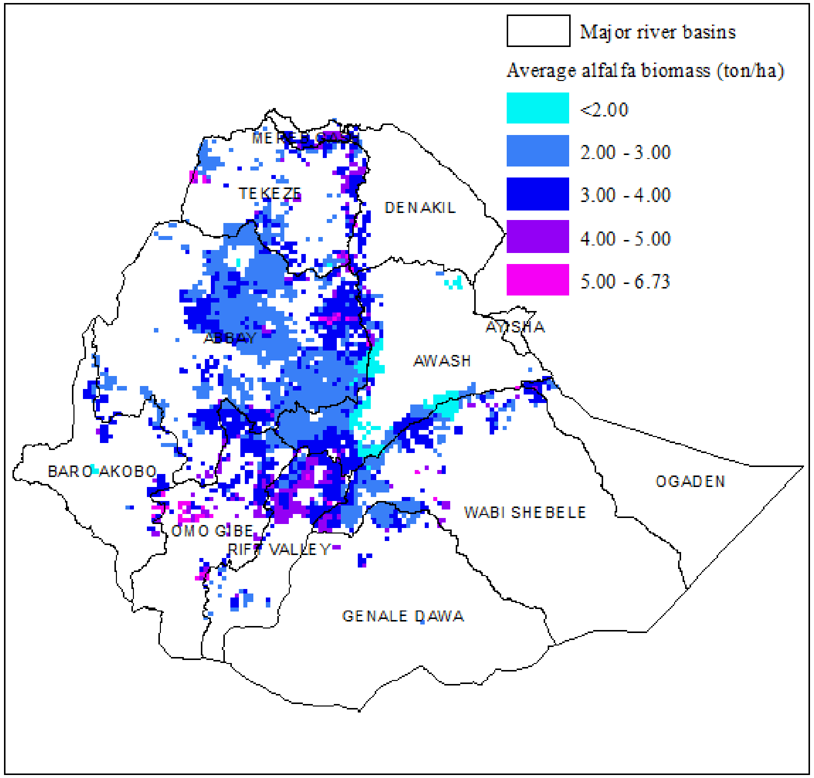
- Less amount of irrigation (<307 mm) is required to produce oats
- About 38% of the **rainfed agricultural land** required <100 mm of irrigation

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

PERENNIAL FODDER: IRRIGATED NAPIER & ALFALFA





- With dry season irrigation and rainfall, up to 34 ton/ha Napier can be produced over the year
- About 75% **of the rainfed agricultural land** can produce >15 ton/ha Napier

- With **maintenance irrigation** during the dry season, up to **6.7 ton/ha** alfalfa can be produced over the year
- About 48% **of the rainfed agricultural land** can produce >3 ton/ha alfalfa

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

BIOPHYSICAL POTENTIALS REMARKS

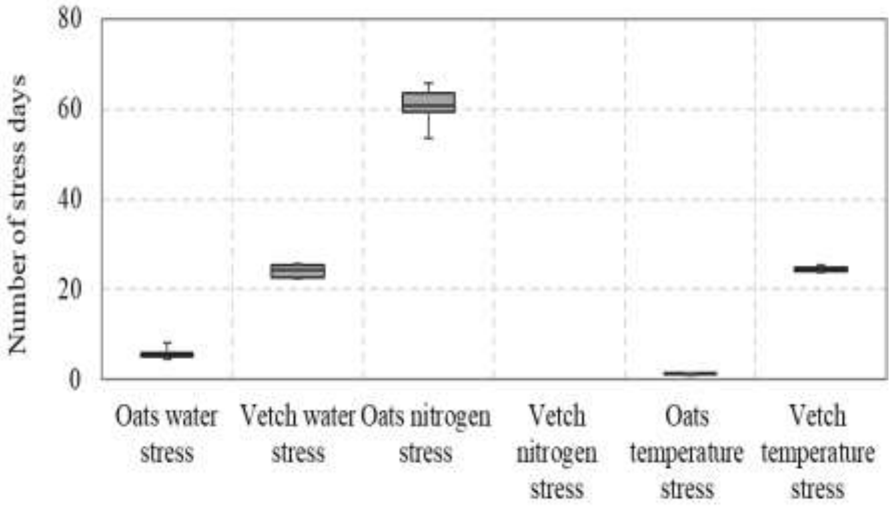
- About 20% of Ethiopia's land is suitable for fodder production using surface irrigation
- Substantial amount of water resources available for irrigation in a sustainable way
- Modest amounts of fodder can be produced across the country using reasonable amount of irrigation
- The irrigation water requirement is well below the available blue-green water resources in the grids

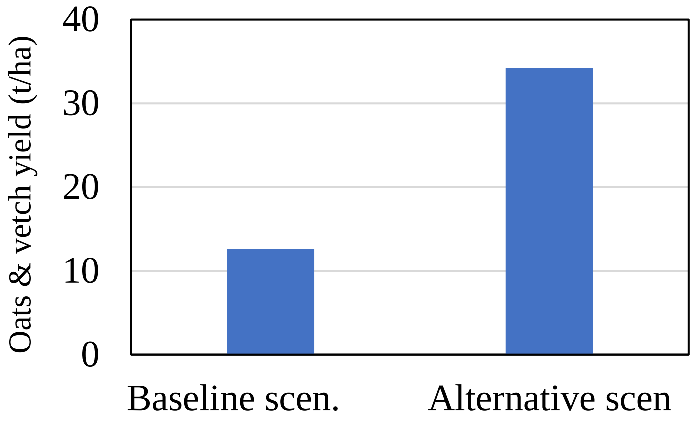
Q & A

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

FIELD SCALE FODDER YIELD SIMULATION

- Multiple fodder production sites were established to cultivate fodder crops
- Field data collected was used to setup APEX model to predict fodder yield
- The APEX model was used to evaluate the gaps and constraints of fodder production



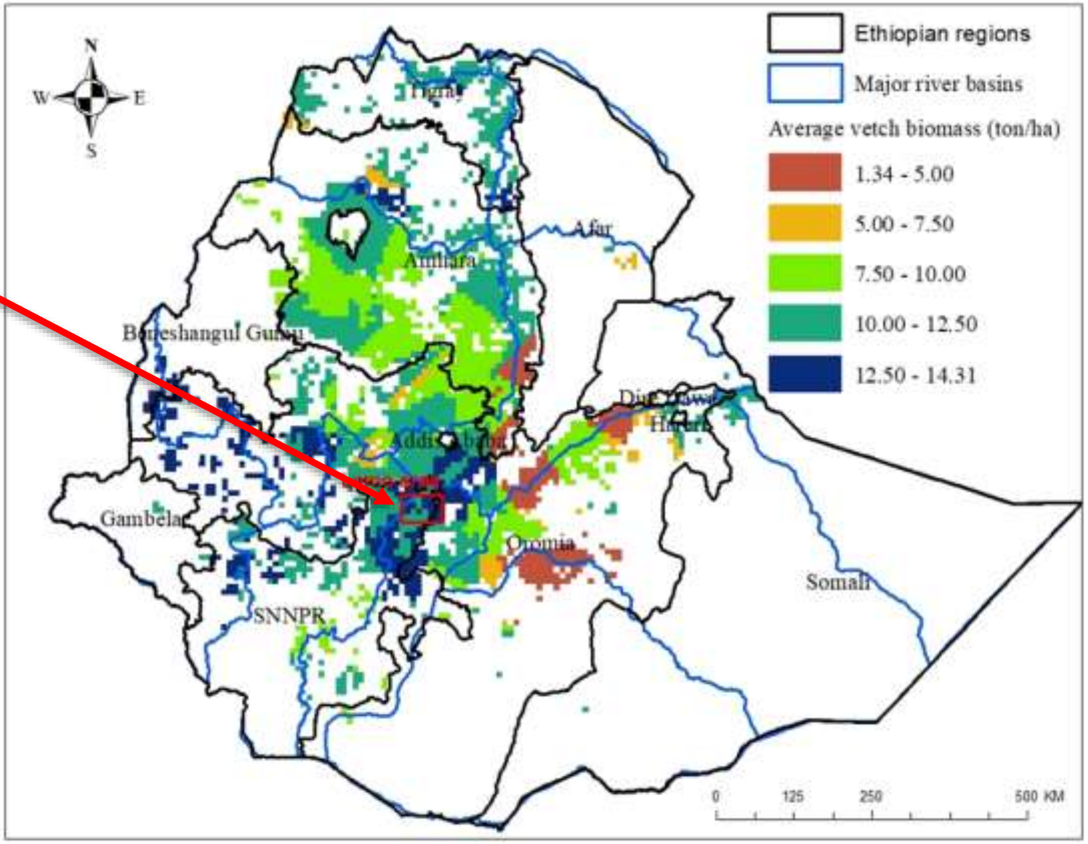


USAID FROM THE AMERICAN PEOPLE | THE BORLAUG INSTITUTE | TEXAS A&M AGRILIFE RESEARCH | THE TEXAS A&M UNIVERSITY SYSTEM | IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE | IWMI International Water Management Institute | ILRI | World Vegetable Center | UF IFAS UNIVERSITY of FLORIDA

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

IRRIGATED FODDER: IMPACTS ON ECONOMIC AND HUMAN NUTRITION

- Site: Upper Gana kebele (village) in Lemo woreda (district), SNNP region of Ethiopia
- Socio-economic household surveys (IFPRI: 2015; 2017)
- Field studies with local farmers led by Africa RISING, ILRI & IWMI: 2015-2018



USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

INCOME & HUMAN NUTRITION MODELING: FARMSIM

- FARMSIM: Monte Carlo farm economic and nutritional simulation model
- Simulate and forecast for 5 years current and alternative farming technologies/scenarios
- Incorporate risk for production and costs to simulate economic and nutritional viability of smallholder farms
- Not an optimization, but a simulation of "What could be if" technology is adopted at different rates
- Key output variables (KOVs): net profit, cost benefit ratio, daily nutrition intake / adult equivalent of calories, fat, proteins, calcium, iron and vitamin A

SCENARIO ANALYSIS

- Baseline: Rain-fed crops + no or minimal irrigation; no supplemental fodder feeding to native cows
- Alt.1--R&W-P_N: Rain-fed crops + Rope & Washer pump used in optimally irrigated systems + Supplemental fodder feeding to native cows
- Alt.2--Solar-P_N: Rain-fed crops + Solar pump used in optimally irrigated systems + Supplemental fodder feeding to native cows
- Alt.3--Solar-P_CB: Rain-fed crops + Solar pump used in optimally irrigated systems + Supplemental fodder feeding to dairy crossbred cows

INPUT VARIABLES & LIVESTOCK TECHNOLOGIES

	Baseline	Alt. 1--R&W-P_N	Alt. 2--Solar-P_N	Alt. 3--Solar-P_CB
Irrigated fodder				
Crop area (ha/household)	0.03	0.13	0.13	**0.23**
Yield (t/ha)	12.6	34.1	34.1	34.1
Cows / village or kebele				
Native	1102	1102	1102	**0**
Improved	37	37	37	**796**
Milk (L) per cow/year	237	640	640	1200
Live weight /bull (gains)	160	212 (52)	212 (52)	212 (52)
ASF Consumption/family	**Percent (%)**			
Milk by family	70	70	70	70
Milk made into butter	30	30	30	30
Butter consumed	44	34	34	34
Sheep / village or kebele	240	240	240	240
Live weight (kg)/sheep (gains)	34	60 (26)	60 (26)	60 (26)
Fraction consumed/family	0.09	0.09	0.09	0.09

KEY ECONOMIC IMPACTS

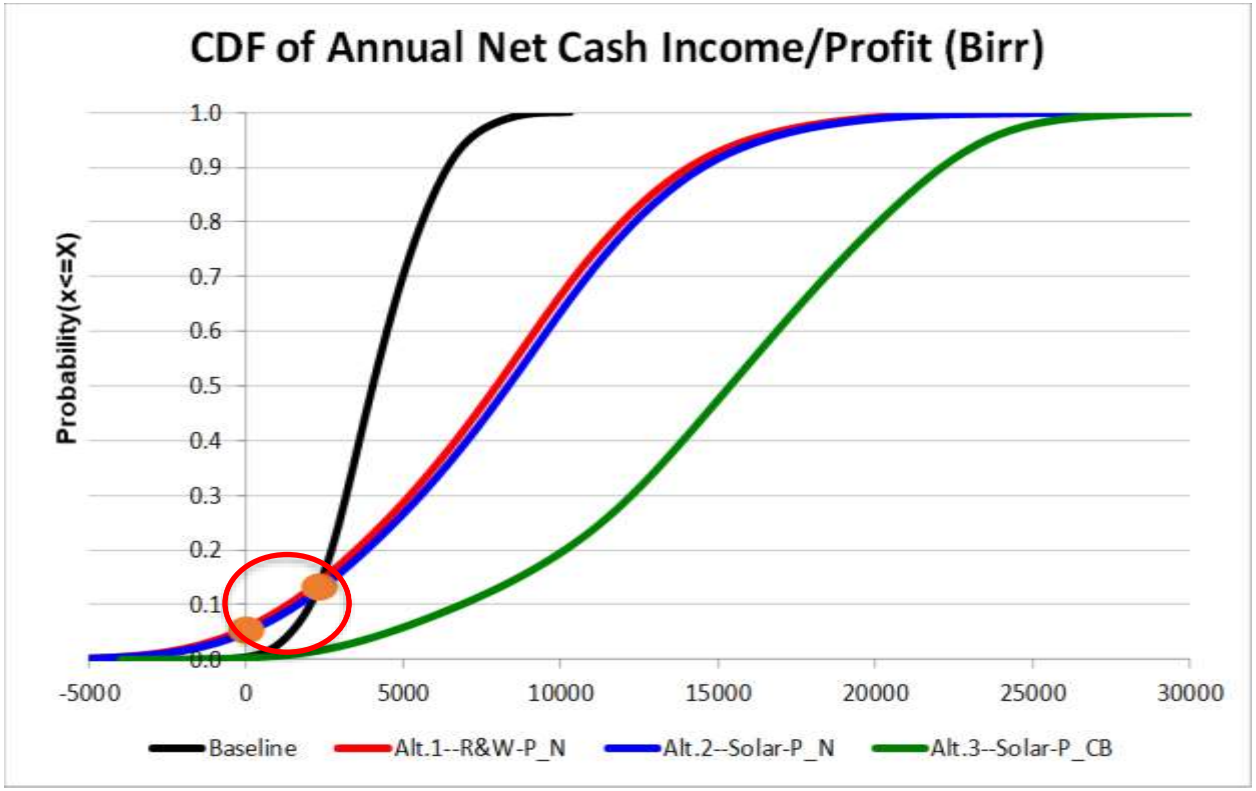
Economic impacts of adopting livestock technologies in Lemo, SNNP region - Ethiopia

	Baseline	Alt. 1-R&W_N	Alt. 2-Solar_N	Alt. 3-Solar_CB
Economics:	Averages values in Birr /family in year 5			
Net present value (5yrs)	119,429	160,237	152,340	140,750
Tot avg. net profit	4,139	7,863	8,233	15,009
% change profit: Alt./Baseline		**90%**	**99%**	**263%**
Benefit-Cost Ratio: Alt/Base		**1.9**	**1**	**1.2**
IRR		0.5	0.1	0.2
Prob BCR> 1 (%)		97	50	88
Prob IRR> 0.1 (%)		97.5	50.8	88
Avg. Livestock net profit	3,134	2,833	2,833	3,089

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

KEY ECONOMIC IMPACTS: RISK?

1. Alt. 1& 2-Native:
   Risk for loss: 4-6%
2. Alt. 3- Crossbred:
   Risk for loss: 0.2%
3. 12% prob. :profit
   Baseline > Alt.1&2



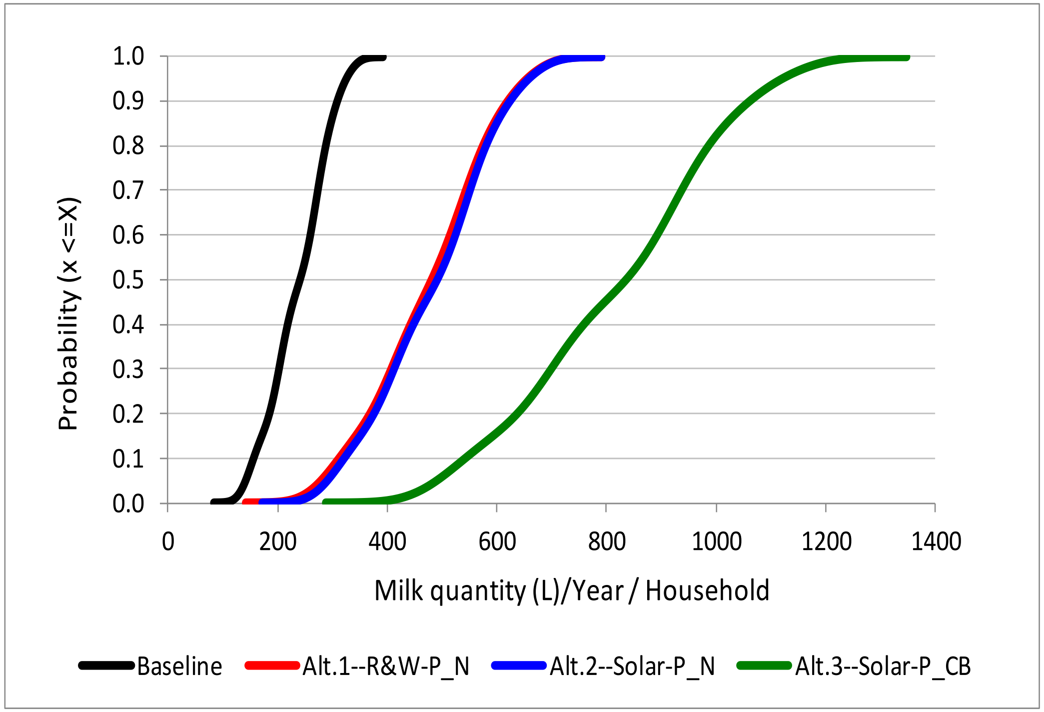
USAID FROM THE AMERICAN PEOPLE | THE BORLAUG INSTITUTE | TEXAS A&M AGRILIFE RESEARCH | THE TEXAS A&M UNIVERSITY SYSTEM | IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE | IWMI International Water Management Institute | ILRI | World Vegetable Center | UF IFAS UNIVERSITY of FLORIDA

KEY HUMAN NUTRITION IMPACTS: MILK PRODUCTION

1. Feeding native / Baseline: Increase in milk cons (x0.8)

2. Feeding crossbred / Baseline: Increase in milk cons (x3.0)

3. Increase in Ca intake due to milk: 73-84% under Alt. scenarios



KEY HUMAN NUTRITION IMPACTS: NUTRIENTS

Human nutrition impacts of adopting livestock technologies in Lemo, SNNP region - Ethiopia

		Baseline	Alt. 1--R&W-P_N	Alt. 2--Solar-P_N	Alt. 3--Solar-P_CB	**% Change in Nutrient: Base/Alt**	
Nutrients:	Min req.	Average daily nutrients in year 5				***Base/Alt2***	***Base/Alt3***
Energy (calories/AE)	**2,353**	2,437	2,608	2,576	2,752	**6**	**13**
Proteins (grs/AE)	**41.2**	69	78	77	80	**12**	**16**
Fat (grs/AE)	**51**	23	31	28	**51**	**24**	**122**
Calcium (grs/AE)	**1**	0.38	0.67	0.66	0.71	**73**	**84**
Iron (grs/AE)	**0.009**	0.016	0.017	0.017	0.016	**5**	**0**
Vitamin A (µg RAE/AE)	**600**	825	1,000	961	1,080	**17**	**31**

Unit for vitamin A = µg RAE/ AE (RAE: Retinol Activity Equivalent)

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

SOCIO-ECONOMIC MODELLING REMARKS

- Livestock sector in Ethiopia faces many challenges: low productivity
- Crop and livestock scenarios under alternative farming systems led to improvement in profit and human nutrition compared to the current practices
- Scenario under crossbred cows showed complete alleviation of fat deficit and substantial reduction in available calcium deficit
- Use of improved feed resources and breed (irrigated fodder and crossbred cows) can alleviate some of the production constraints while improving income and human nutrition at household in Lemo

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

Q & A

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

APPROACH FOLLOWED: R4D

- Project sites – districts in Amhara and SNNPR states (Bahir Dar zuria, Dangla, Lemo, Angacha)
- Farmer had different levels of SSI experience solely for vegetable and Khat production
- But no prior experience of irrigated fodder

DEMONSTRATION TRIALS

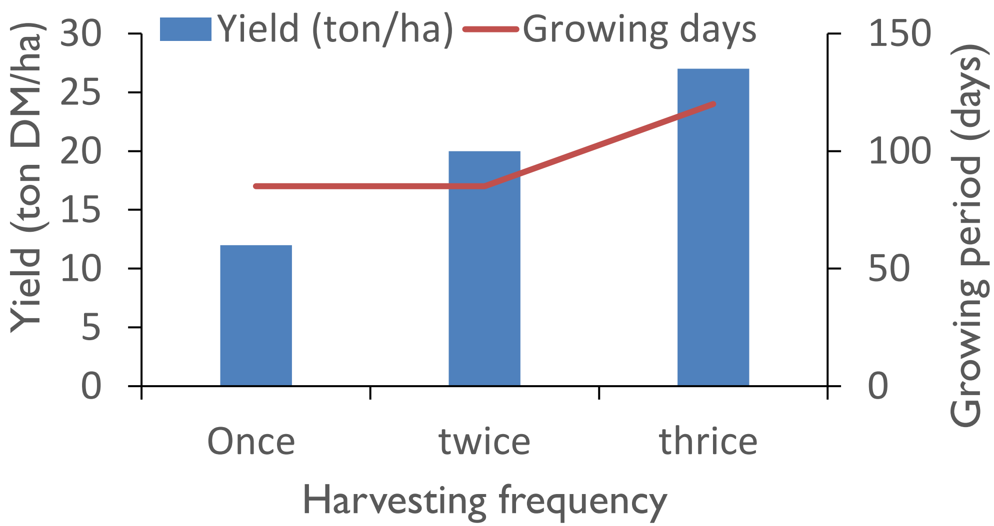
- Initially, involved few farmers (17) willing to allocate land (100 m^2) for on-farm trials
- Annual (oat-vetch) and perennial (Napier, Desho, Brachiaria, Desmodium and pigeon pea) forages
- Shallow wells as main source of water
- Pulleys, rope and washer pumps, and solar pumps for water lifting technology.



DEMONSTRATION TRIALS

- Production of high forage biomass of good nutritional quality from small plots

Multi-cut oat-vetch forage



DEMONSTRATION TRIALS

Irrigated Napier forage intercropped with legumes - multiple benefits

- Napier – Pigeon pea and Napier-Desmodium combinations produced good results
- Added biomass and quality advantages
- Pigeon pea grains for human consumption

DEMONSTRATION TRIALS

Irrigated Napier intercropped with Pigeon pea (PP)

Forage	Average yield (t/ha/1st cut)	Crude protein (%)	IVOMD (%)
Napier sole	3.27	8.3	49.1
Napier + PP 1 (early maturing)	4.88	12.5	51.2
Napier + PP 2 (late maturing)	4.34	11.5	51.3

- Yields and protein up by about 40% with Napier pigeon pea combinations
- Improvement in the physical soil structure and fertility

EVIDENCE FROM ON-FARM TRIALS

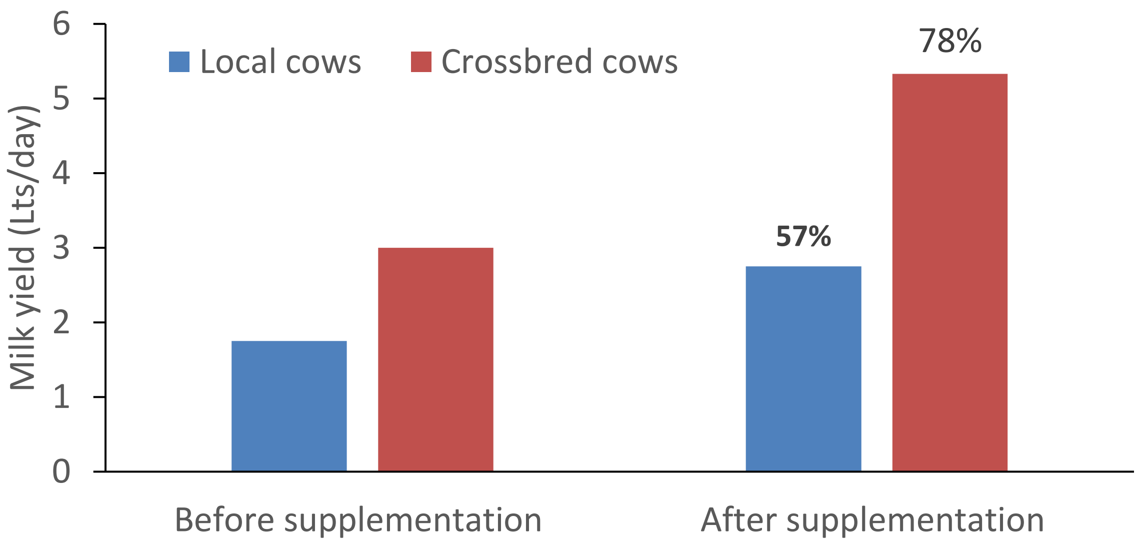
Irrigated Napier income potentials

- Napier could be harvested 6 to 9 times in 12 months
- In a 12-month growing period, a minimum yield of 18 t/ha and a maximum of 23 t/ha dry matter were recorded
- Gross value at ~150k to 200k ETB per ha at fodder markets

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

EVIDENCE FROM ON-FARM TRIALS

Effect of supplementation of 2 kg oat-vetch hay to lactating local and crossbred cows

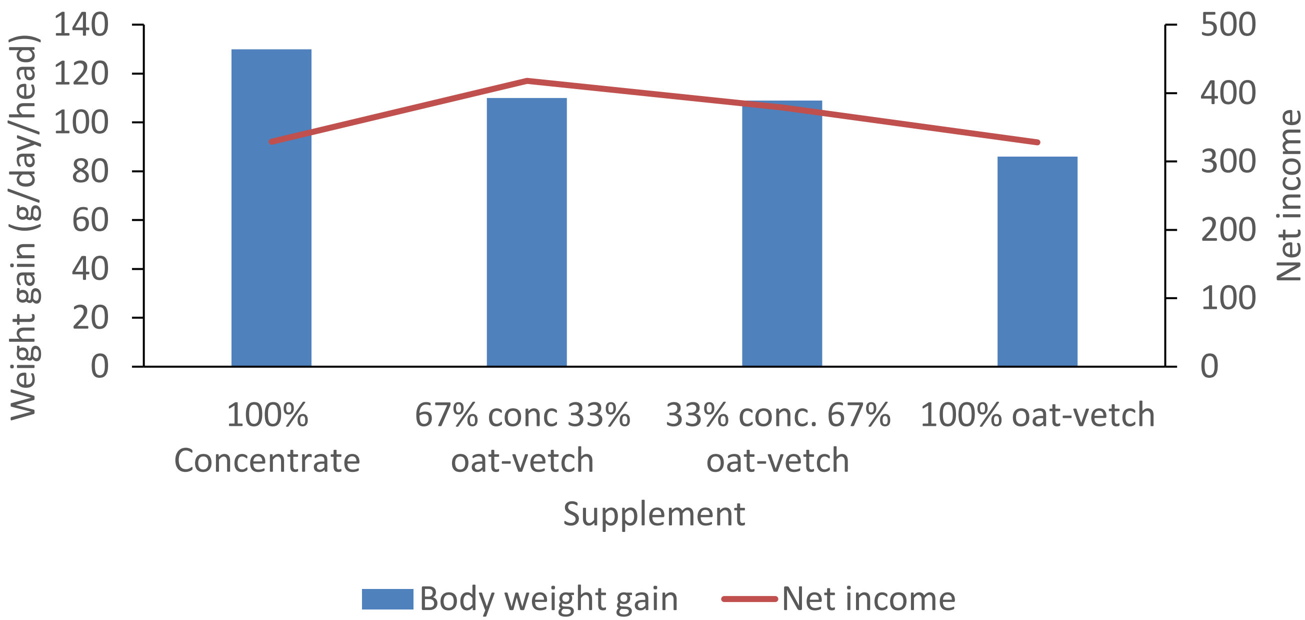


- Return from milk: **675-1500** birr/100m^2 oat-vetch

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

EFFECTS OF CONCENTRATES ON SHEEP WEIGHT

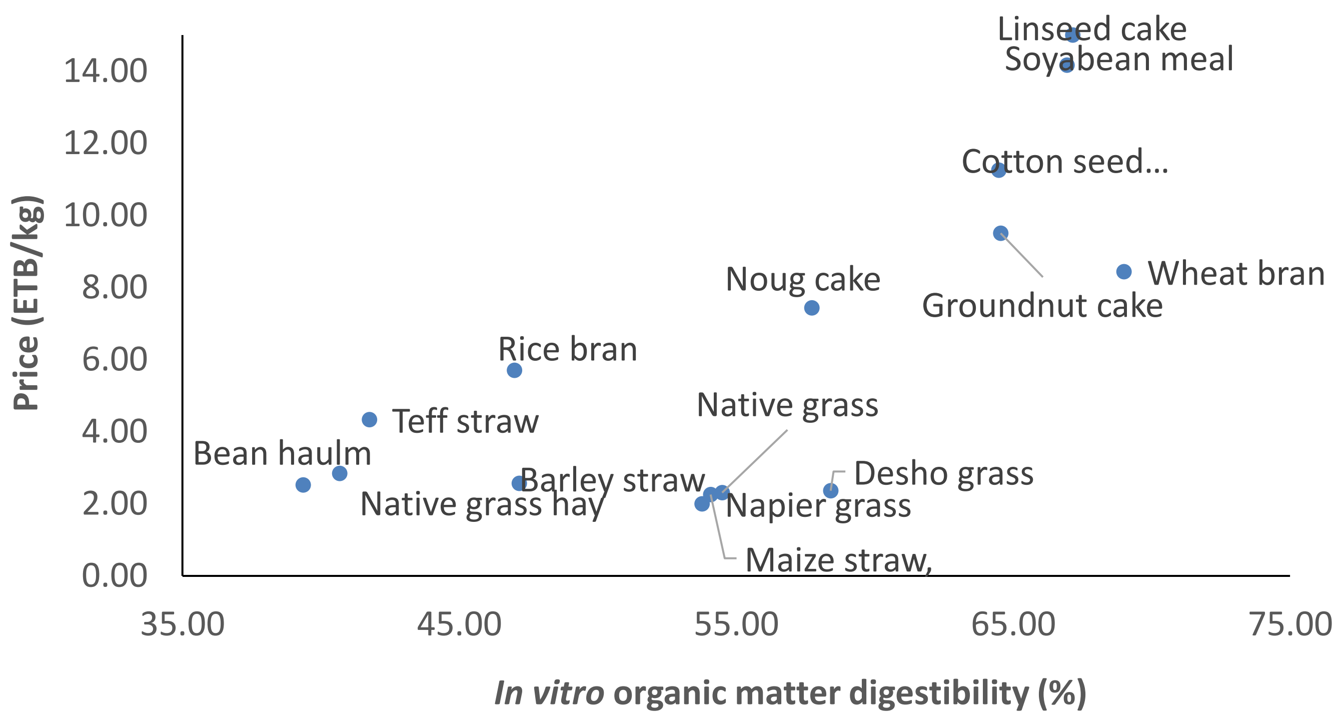
Effect of replacing concentrate mixes with oat-vetch forage on weight gain of sheep



FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

FODDER MARKET SURVEY

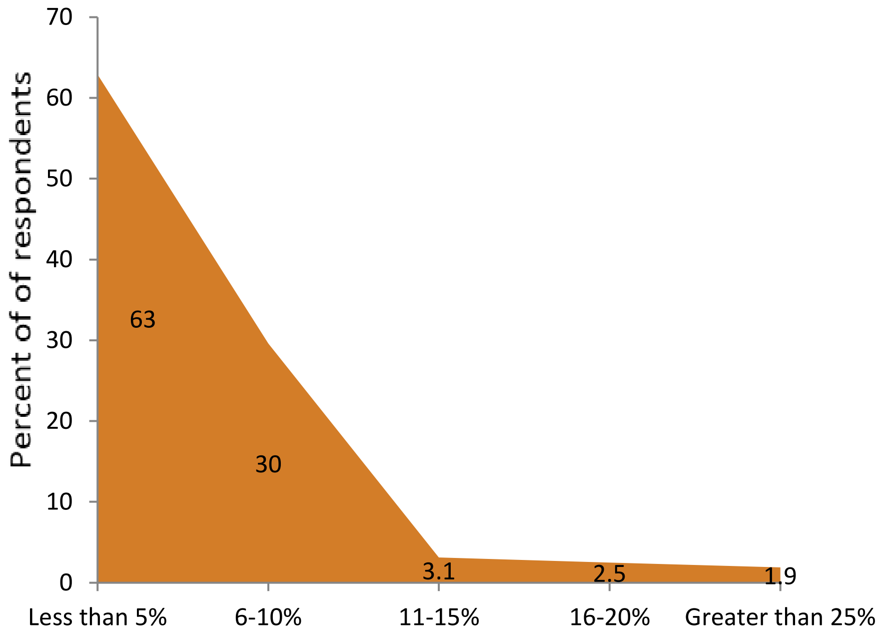
Price and quality relationships for a range of Ethiopian feeds

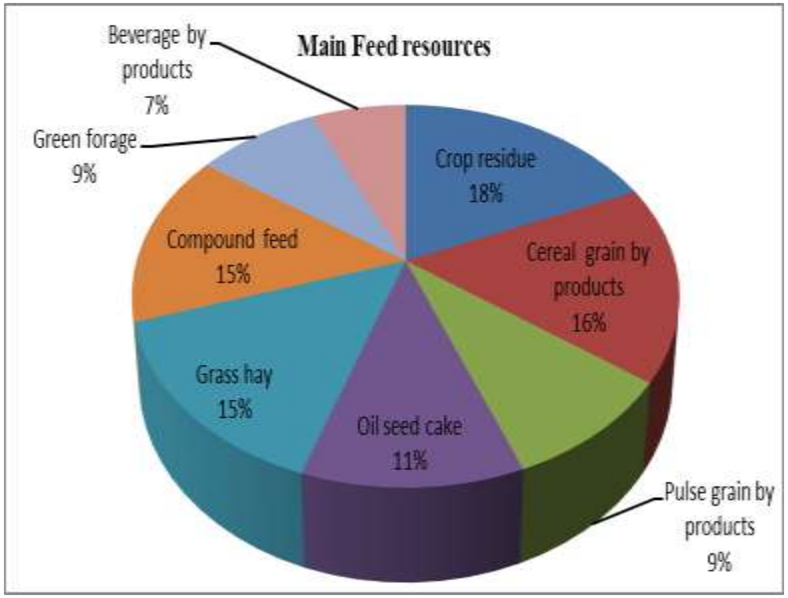


USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI International Water Management Institute · ILRI · World Vegetable Center · UF IFAS UNIVERSITY of FLORIDA

WILLINGNESS TO PAY AND FEEDS PURCHASED

Willingness to pay for better feed quality





ACHIEVEMENTS

- Awareness and interest in irrigated fodder increased
  - Number of farmers engaged
  - Demand for forage planting materials
  - Demand for irrigation technologies
- Improvement in milk production
  - Revival of dairy cooperatives (milk collection centers
- Irrigated fodder competing with cash crops

CHALLENGES AND THE WAY FORWARD

Challenges

- Dairy producers are primary beneficiaries, but limited access to improved breeds
- Access to forage seeds/planting materials
- Irrigation technologies, and market for farm produce

On-going activities

- Technology packaging
- Strengthening farmer cooperatives to play active roles
- Gender and climate resilience
- Capacity building

CONCLUDING REMARKS

- Allocating land and water exclusively for forage cultivation is a new development in Ethiopia with potential to improve income, nutrition for people and livestock
- Irrigated forage is a viable option and profitable for household level irrigators
- Government policy and incentives support the scaling of small-scale irrigation technologies and fodder is a high potential value chain

Q & A