IMPROVING MANGEMENT OF LIVESTOCK IN AWASH RIVER BASIN: A CHALLENGE TO ETHIOPIA

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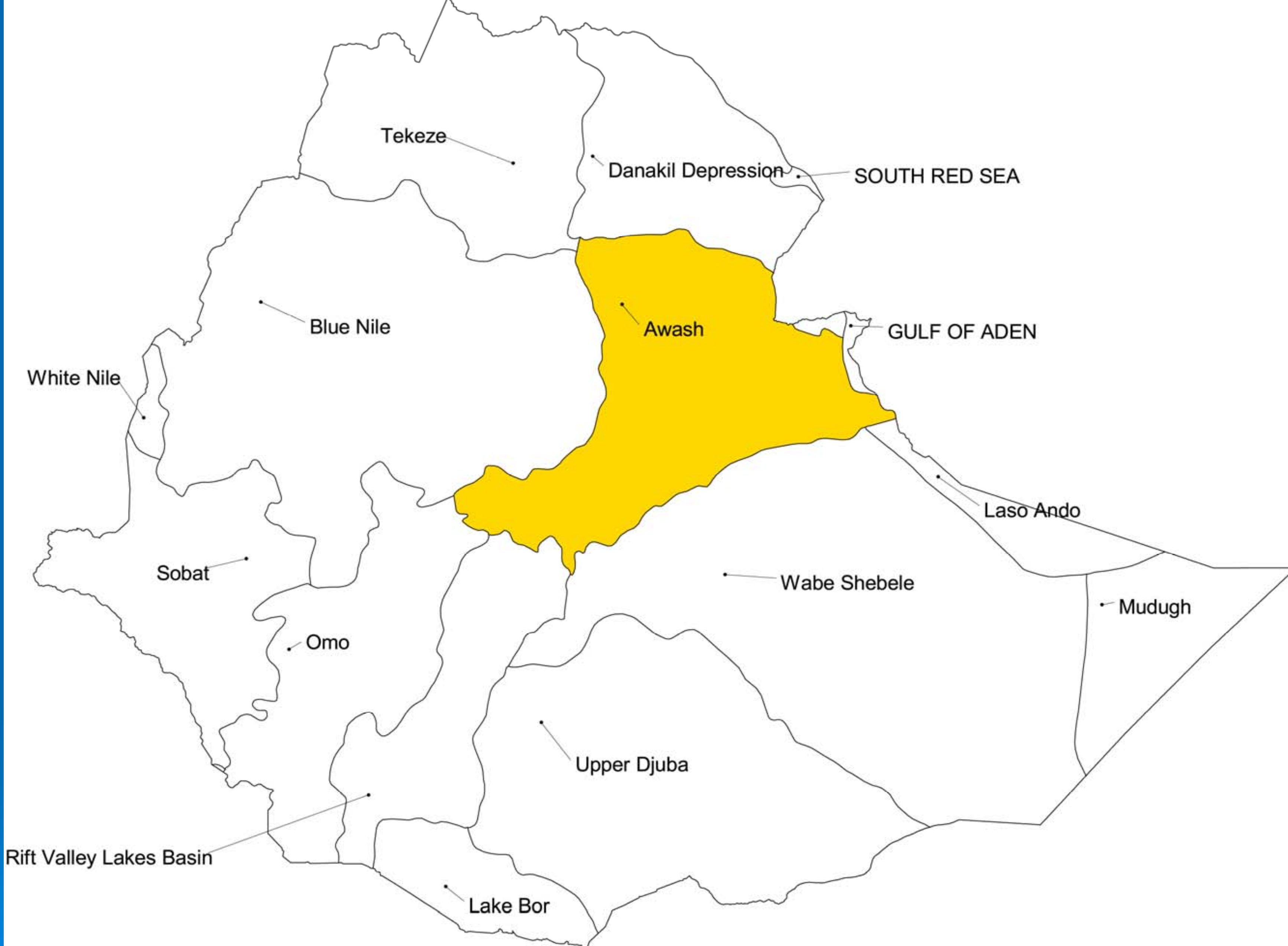


Figure 1. River Basins of Ethiopia.

Objectives

- To asses livestock water Demand in the Basin
- To asses livestock Feed demand
- To asses livestock grazing impact in the Basin
- To assess RUE
- To see land degradation and desertification

Methods

- Controlled grazing plots
- Biomass yield calculation from Climate
- GIS tool
- NDVI estimation from Satellite
- ***In Situ*** Photographs

Rainfall water Use Efficiency (RUE)

For calculating RUE (kg/ha/mm rainfall)

The following formula was used

RUE = Crop Yield T/ha x 1000/GSR-Ev

- The calculation requires the actual yield received.
- **Effective rainfall** is the growing season rainfall minus an evaporation factor
- **GSR** is the growing season rainfall plus allowance for pre-season stored soil moisture
- **Ev** is the evaporation factor, which differs for each crop type and between regions

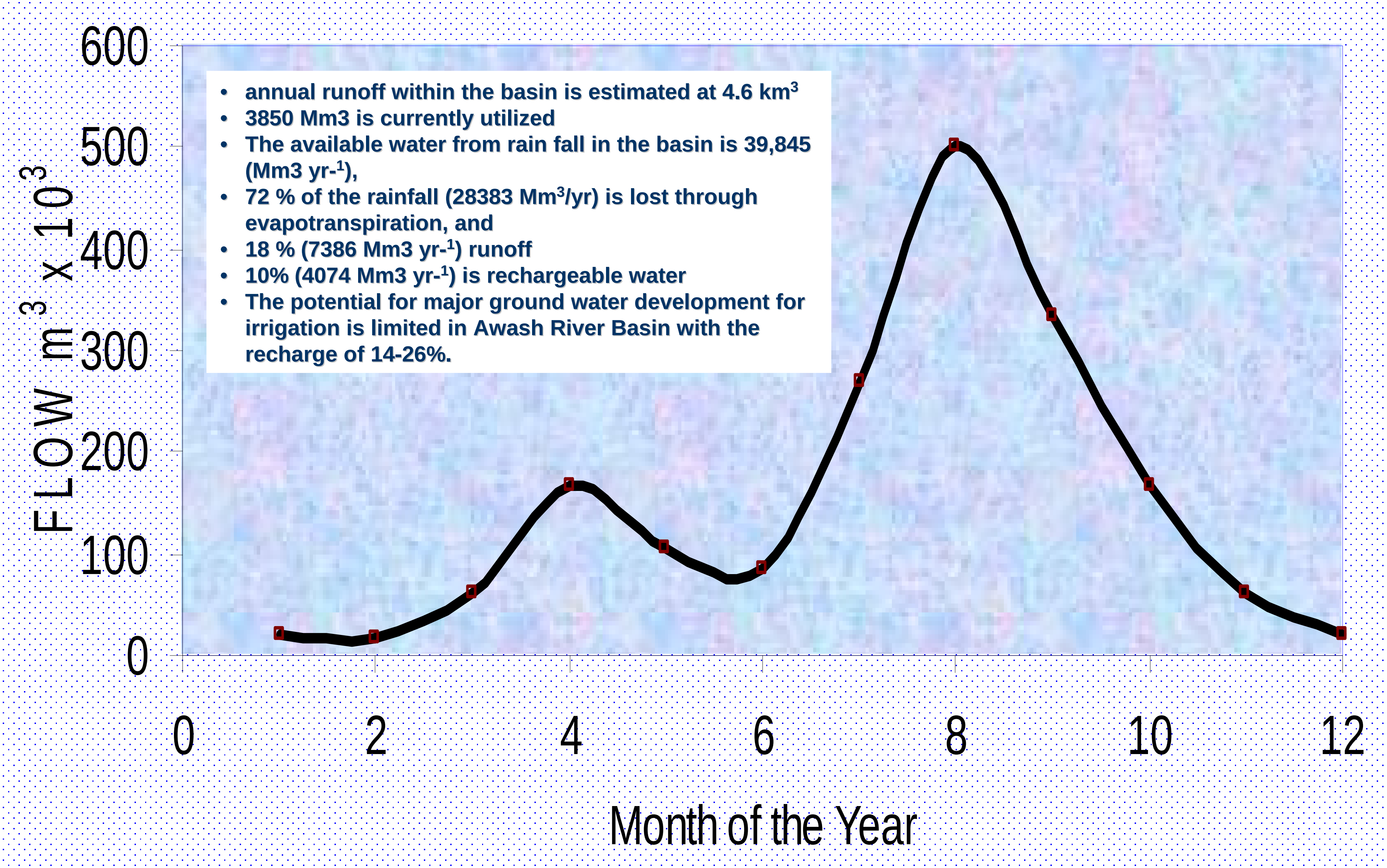


Figure 2. Monthly Awash River Flow.

Uplands land above >1500m.a.s.l & mean annual rainfall >800mm

- Eastern catchments
- Western catchments
- Upper Basin

Upper Valley land varies from 1000-1500m.a.s.l & mean annual rainfall varies from 600-800mm

Middle Valley land varies from 1000-1500m.a.s.l & annual mean rainfall varies from 200-600 mm

- Melka werer –Awash to Hertale
- Gewane-Hertale to Gedebassa outlet
- Mille- Gedebassa outlet to mile confluence

Lower Plains land from 200-500m.a.s.l & mean annual rainfall is < 200mm

Eastern catchment is closed sub-basin from 1000-2500m.a.s.l

- Pediment slopes- between 1000-1500m.a.s.l limited rainfed agriculture is practiced
- Plains below 1000m the inhabitants are Issas and the resource base is ground water & seasonal surface water flows.

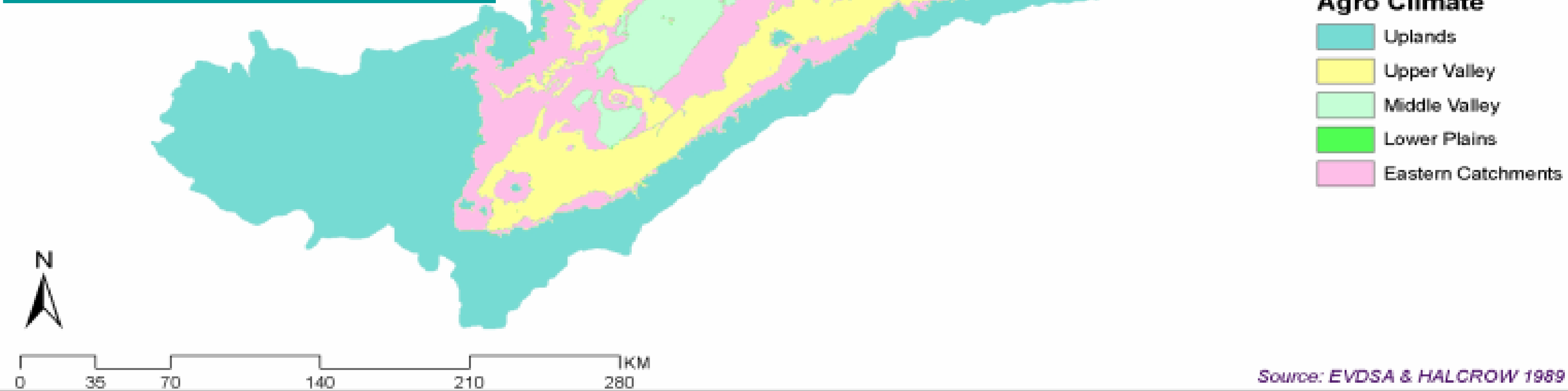


Figure 3. Agro-ecological zones of Awash River Basin.

1. Area 110000km^2
2. Starts from Ginchi highlands 2700masl & terminates in Lake Abe
3. Total length is 1200km

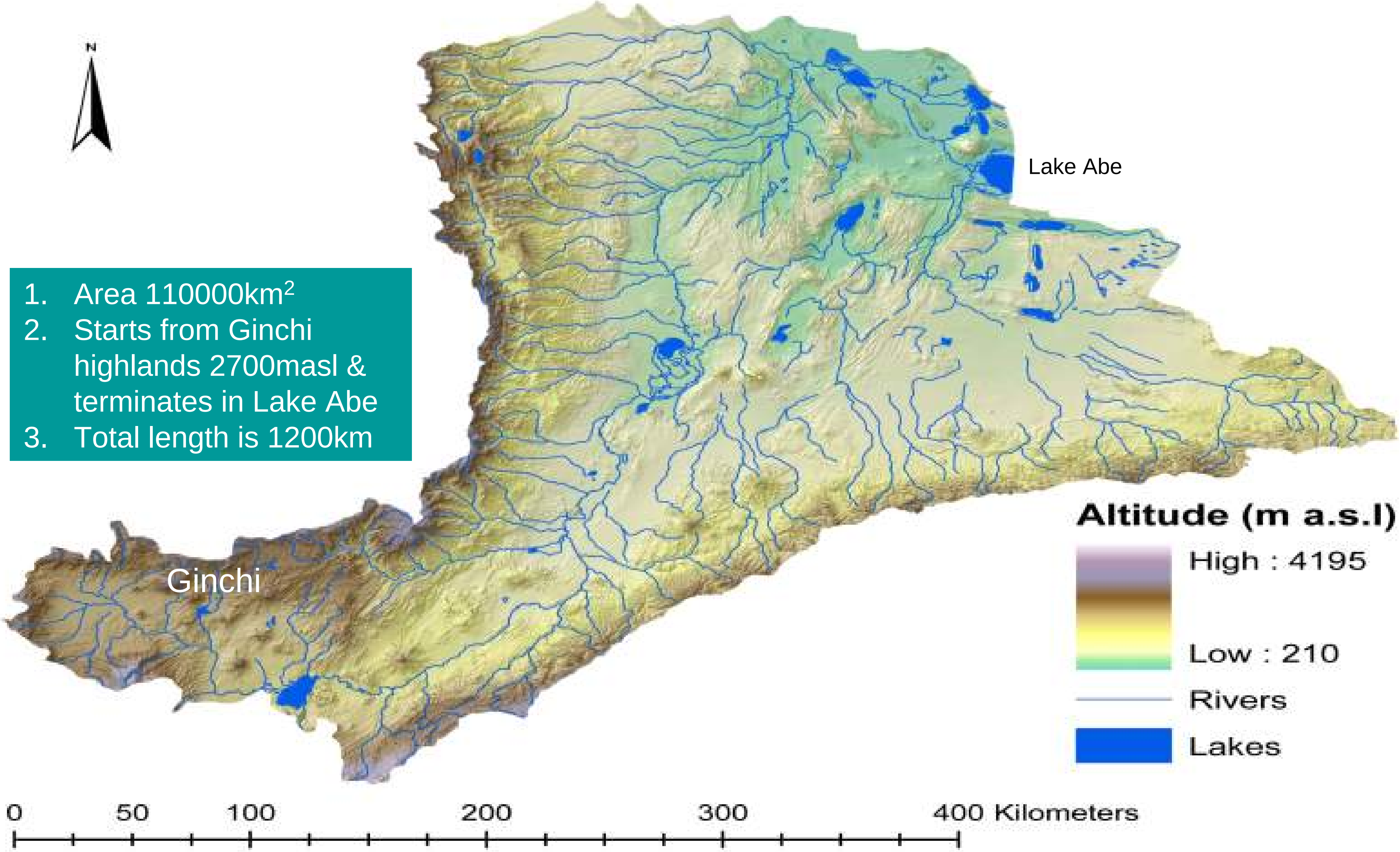
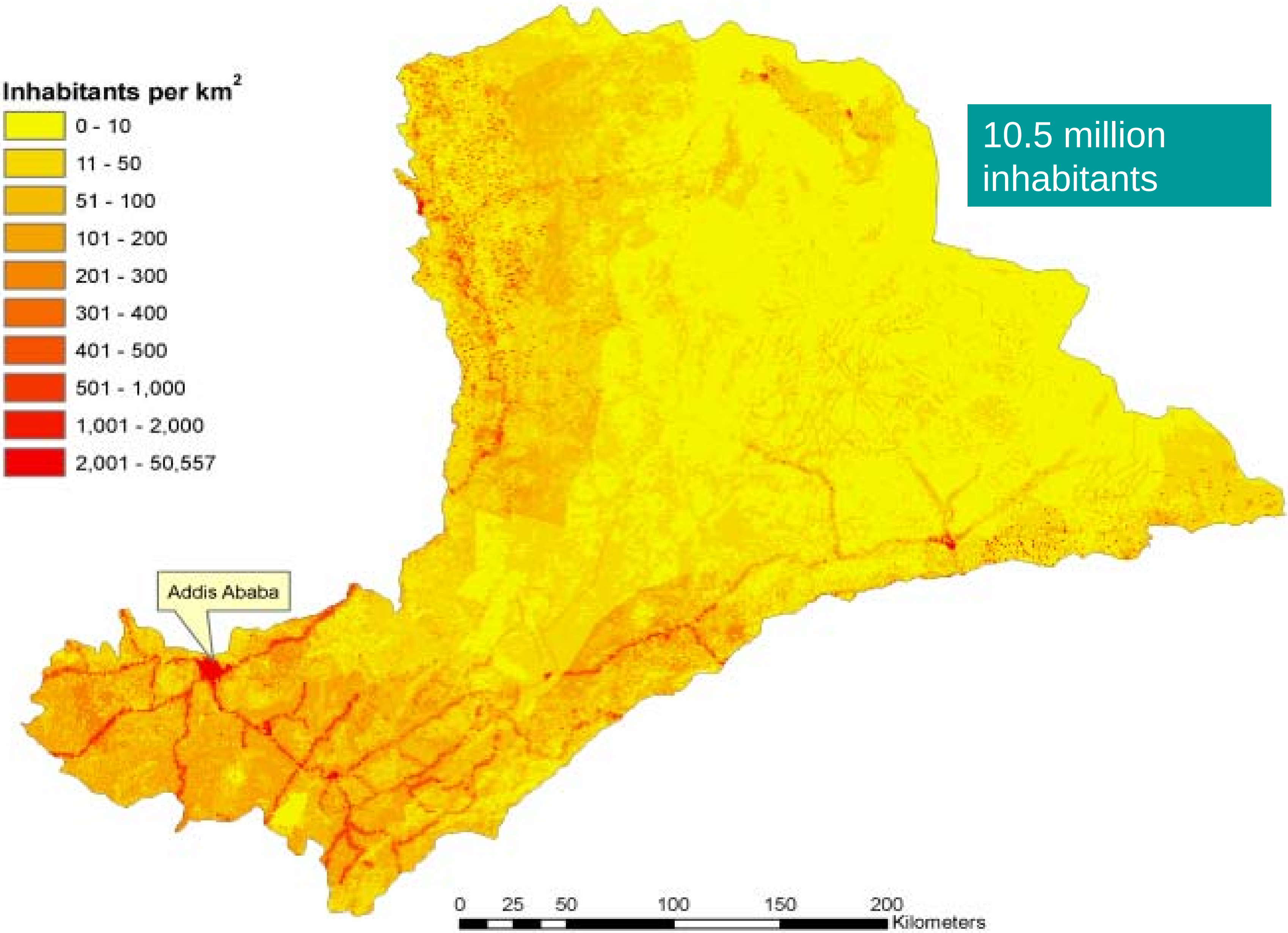


Figure 4. Altitudinal ranges of Awash River Basin.



10.5 million inhabitants

Figure 5. Human population density in Awash River Basin.

Livestock water requirements

Livestock water consumption depends on a number of physiological and environmental conditions such as (King 1983):

- Type and size of animal
- Physiological state (lactating, pregnant or growing)
- Activity level
- Type of diet-dry hay, silage or lush pasture
- Temperature-hot summer days above 25 ^{0}C can sometimes double the water consumption of animals rose outside.
- Water quality - palatability and salt content

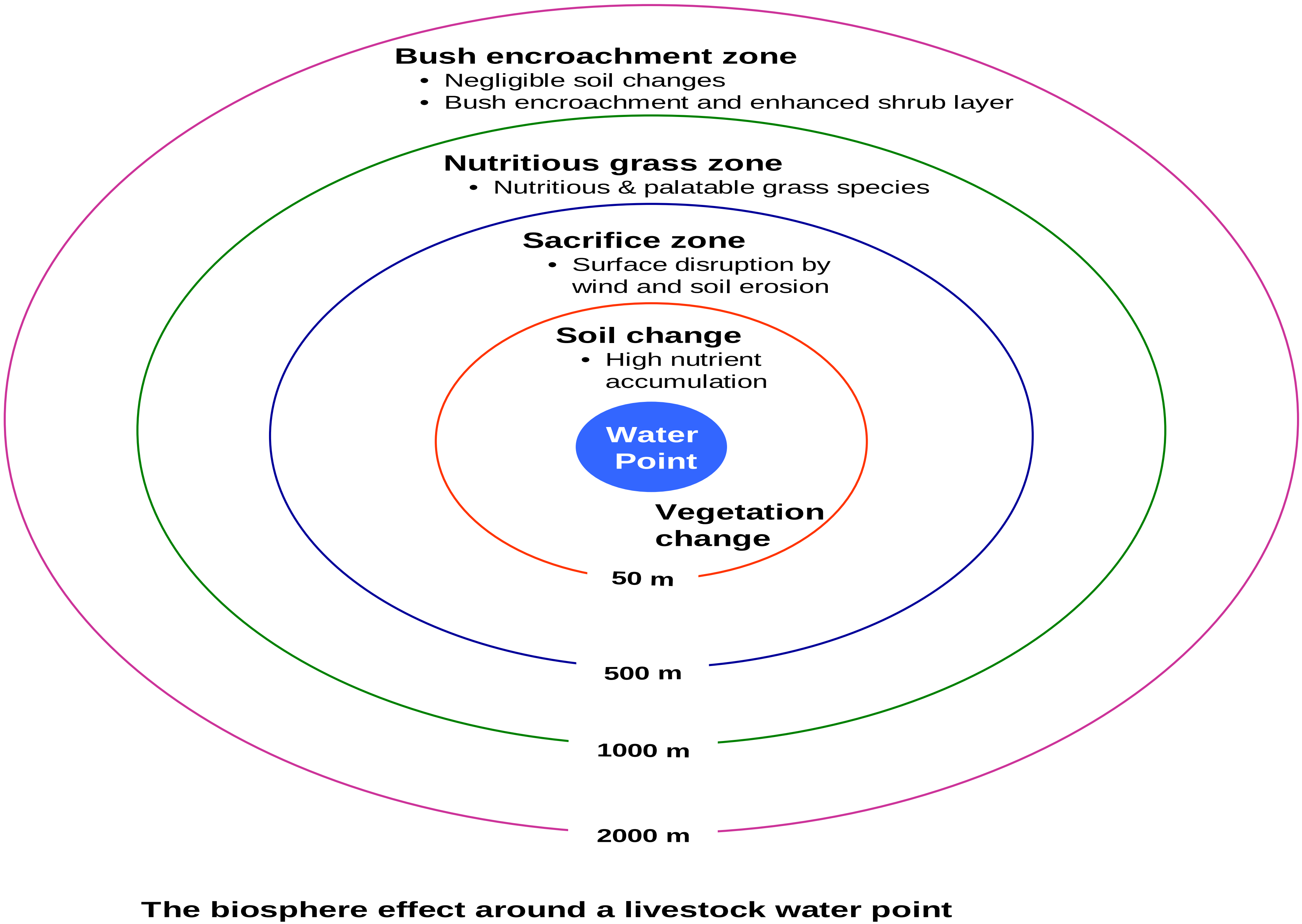


Figure 6. The Biosphere around a livestock water point.

Plate 1. Livestock around Batu Degaga irrigation schemes are gathering at the river bank of Awash; to drink water, to cool their body and to drop their wastes in the river (*Photo Courtesy : Yusuf Kedir 2004*).

1. Upland has high livestock heads
2. Middle & Lower Basin have low livestock heads

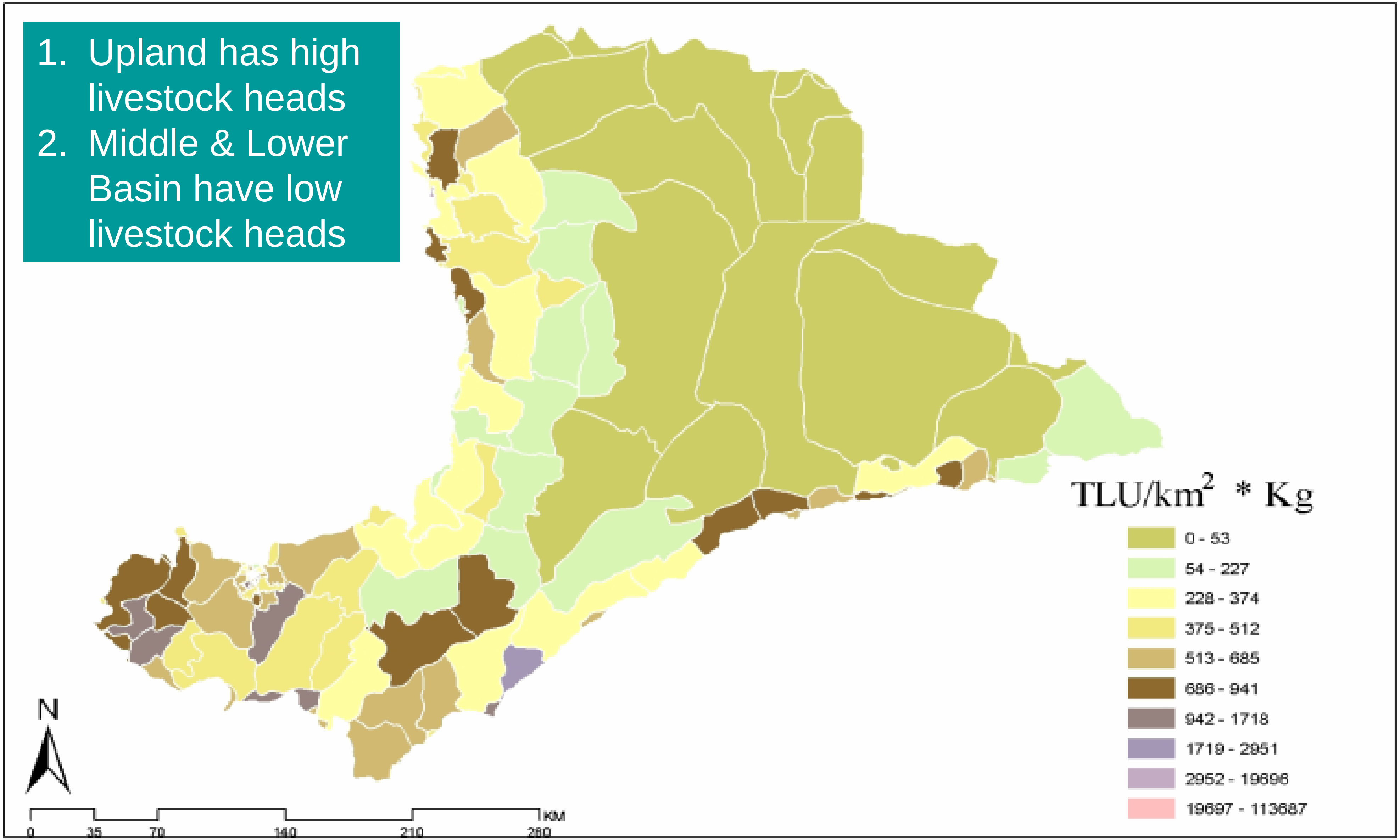


Figure 7. Estimated livestock (cattle, sheep & goat) daily dry matter intake.

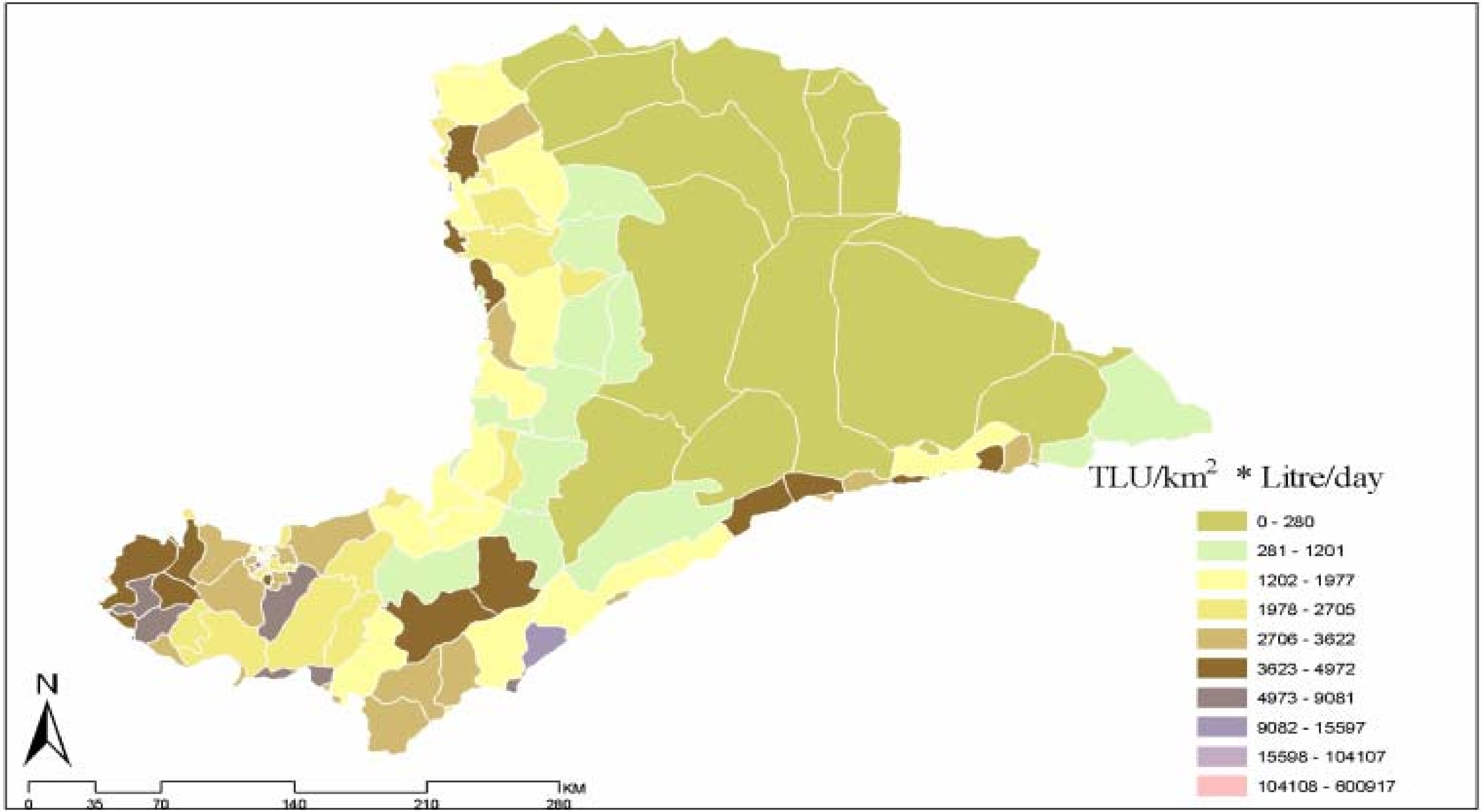
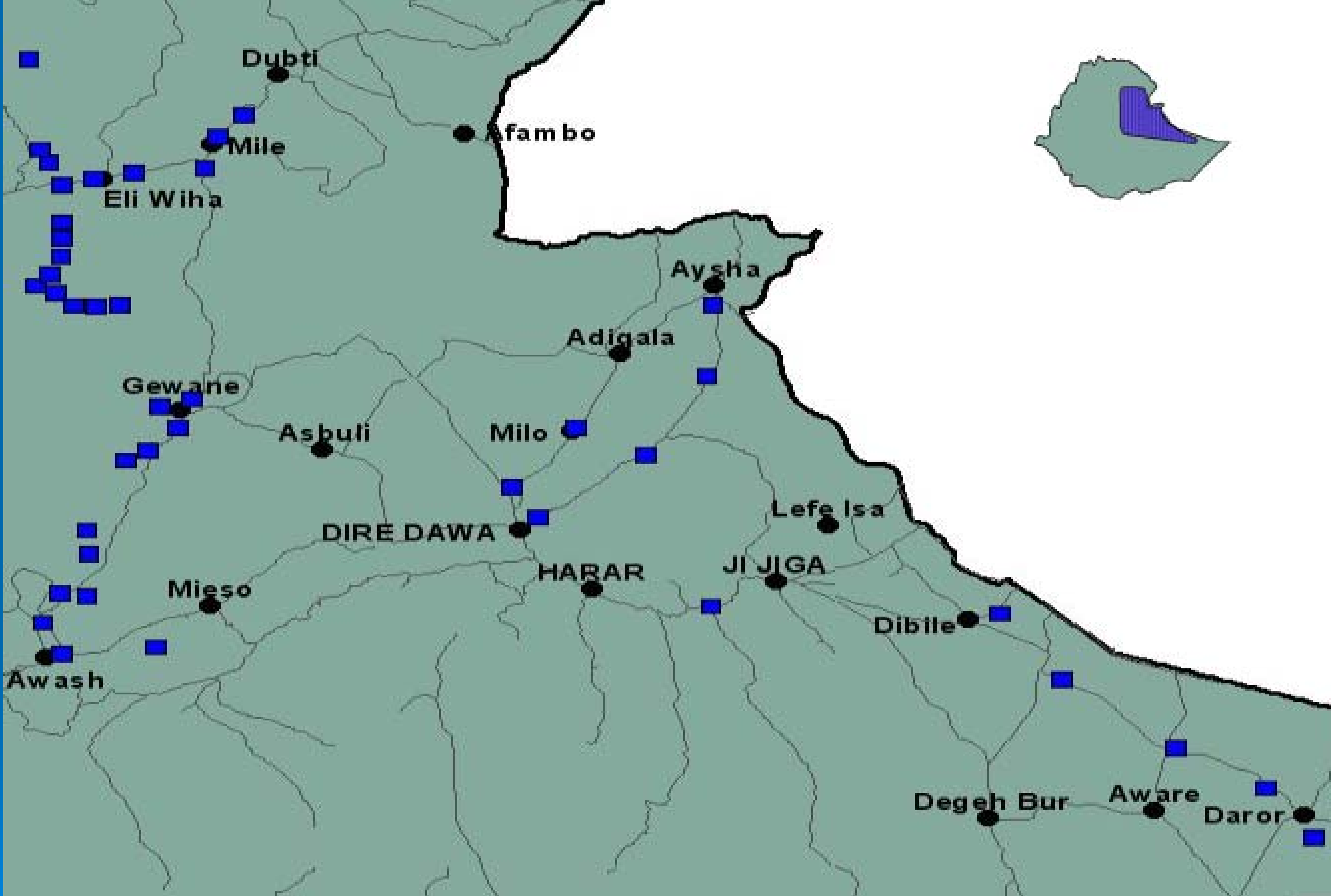


Figure 8. Livestock water requirement (cattle, sheep & goat) at dry hot air temperature season (27°C).

Ethiopia: Northeastern Zone (Feb 28, 2005)				Forage Available			
				Actual	Deviation		%
Location	Local Name	Site ID	Status	Value (kg/ha)	Value	Trend	Rank
Awashishit	Awashishit	ET-NE-AMI-01	Normal	1357	5.5		84.0
Aysha	Aysha	ET-NE-AYS-01	Normal	315	16.8		76.0
Daror	Daror	ET-NE-DAR-01	Normal	549	19.4		76.0
Fafan	Fafan	ET-NE-FAF-01	Above Normal	1345	37.9		88.0
Faraha	Faraha	ET-NE-FAR-01	Above Normal	1404	35.8		76.0
Gaad	Gaad	ET-NE-GAD-01	Normal	819	9.4		76.0
Gashan	Gashan	ET-NE-GAS-01	Above Normal	769	20.4		88.0
Gayani	Gayani	ET-NE-MIL-28	Normal	896	8.7		96.0
Geleila Dora	Geleila Dora	ET-NE-GEW-11	Watch	1893	-4.4		40.0
Goba	Goba	ET-NE-GOB-01	Above Normal	1037	66.2		100.0
Lanqerta	Lanqerta	ET-NE-LAN-01	Normal	856	18.9		72.0
Lasdere	Lasdere	ET-NE-LAS-01	Normal	451	12.5		80.0
Milo	Milo	ET-NE-MIL-01	Normal	586	6.0		76.0
Shabele	Shabele	ET-NE-SHA-01	Normal	712	6.7		60.0
Surur Bahir	Surur Bahir	ET-NE-DUB-29	Warn	504	-20.9		0.0
Ugaas	Ugaas	ET-NE-ULD-01	Above Normal	538	21.2		80.0
Wandede	Wandede	ET-NE-DAW-13	Watch	1663	-5.2		48.0

Table1. Forage availability in Middle and Lower Awash River Basin. Source:http://cnrit.tamu.edu/maps/map_init.html

Ethiopia: Northeastern Zone (Mar 10, 2005)				Forage Available					NDVI=nir-red/nir-red		
				Actual		Deviation		%	Deviation		%
District	Location	Local Name	Site ID	Status	Value (kg/ha)	Value	Trend	Rank	Value	Trend	Rank
Amibara	Awashishit	Awashishit	ET-NE-AMI-01	Normal	1357	5.5		84.0	-100.0		0.0
Aysha	Aysha	Aysha	ET-NE-AYS-01	Normal	315	16.8		76.0	-100.0		0.0
Shinille	Gaad	Gaad	ET-NE-GAD-01	Normal	819	9.4		76.0	-100.0		0.0
Aware	Gashan	Gashan	ET-NE-GAS-01	Above Normal	769	20.4		88.0	-100.0		0.0
Mille	Gayani	Gayani	ET-NE-MIL-28	Normal	896	8.7		96.0	-100.0		0.0
Gewane	Geleila Dora	Geleila Dora	ET-NE-GEW-11	Watch	1893	-4.4		40.0	-100.0		0.0
Shinille	Goba	Goba	ET-NE-GOB-01	Above Normal	1037	66.2		100.0	-100.0		0.0
Aware	Lanqerta	Lanqerta	ET-NE-LAN-01	Normal	856	18.9		72.0	-100.0		0.0
DireDawa	Lasdere	Lasdere	ET-NE-LAS-01	Normal	451	12.5		80.0	-100.0		0.0
Shinille	Milo	Milo	ET-NE-MIL-01	Normal	586	6.0		76.0	-100.0		0.0
Dubit	Surur Bahir	Surur Bahir	ET-NE-DUB-29	Warn	504	-20.9		0.0	-100.0		0.0
Aysha	Ugaas	Ugaas	ET-NE-ULD-01	Above Normal	538	21.2		80.0	-100.0		0.0



Map of Greater Horn (Hot Spot)

Source:http://cnrit.tamu.edu/maps/map_init.html

Figure 9. Pathways of integrated conservation based crop/livestock production, human health and well fare

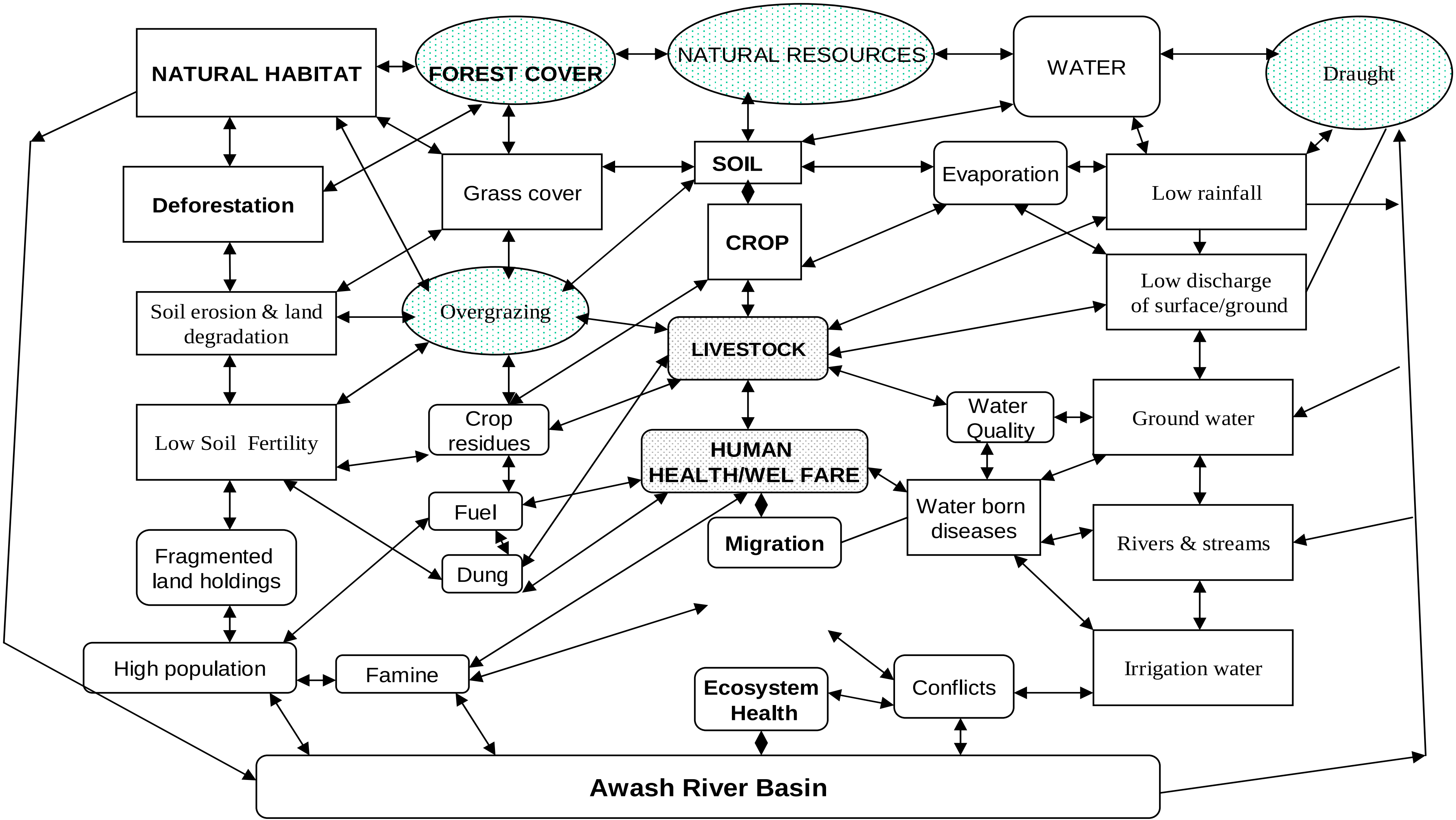


Table 2. Typical crop residue yield and water content of the Ethiopian farmer.

Type of feed	Yield (kg/year)	% Water in 100 kg	Water kg/year
Teff straw	427	14	59.8
What straw	171.2	16	27.4
Rough pea straw	92.6	16	14.8
Chick pea straw	22.6	14	3.2
Maize stover	1970.6	65	1281.0
Corn-cob	302.4	34	102.8
Teff aftermath	127.5	49	62.5
Wheat aftermath	76.2	29	22.1
Hay	179.3	9	16.1
Grazing natural pasture	3506.7	65	2279.4
Browse	2.7	65	1.8

Source: Getachew Eshete, 2002

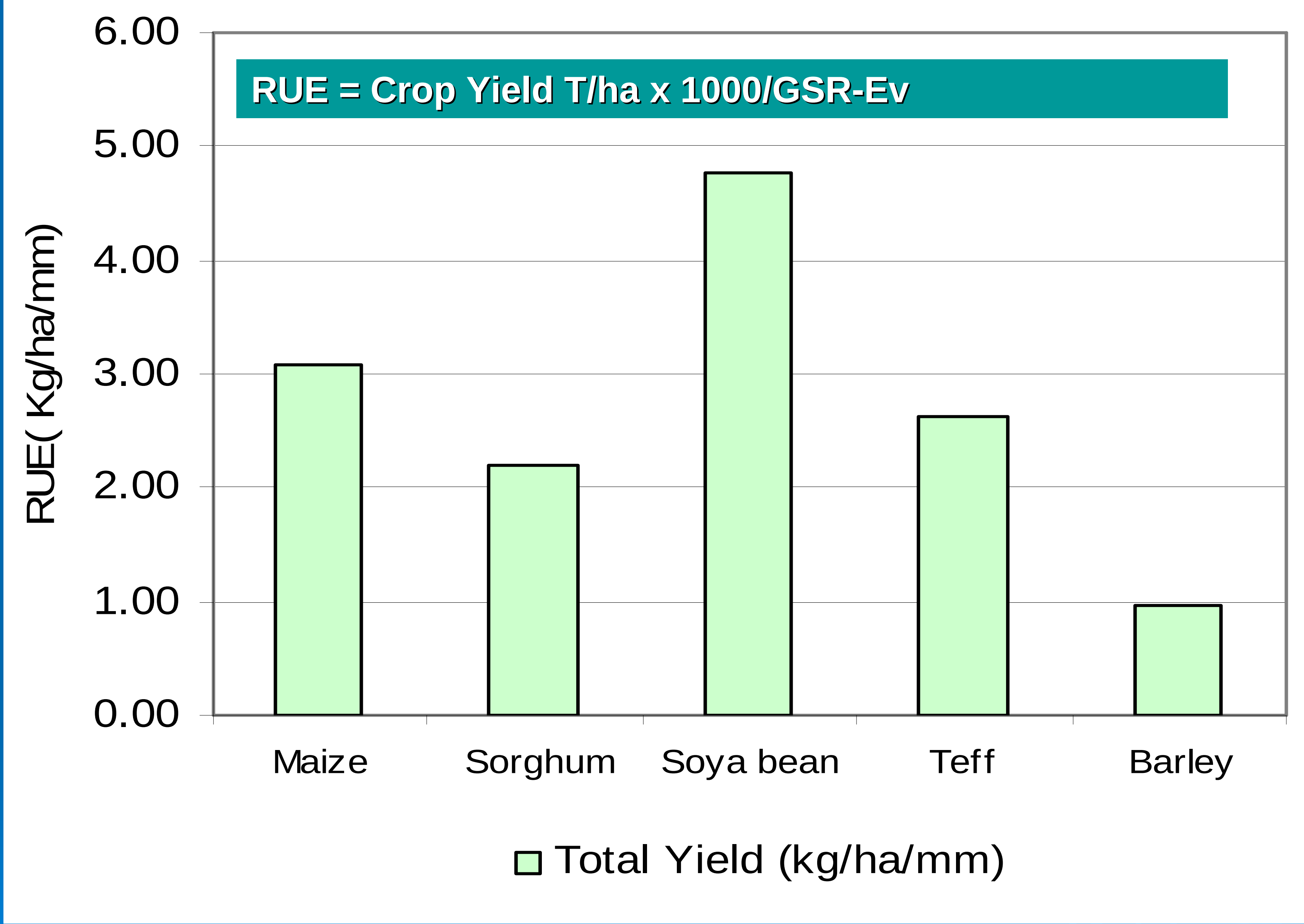


Figure 10a. Rainfall Use Efficiency (RUE) at Doni irrigation Scheme (Yusuf et al.,2005)

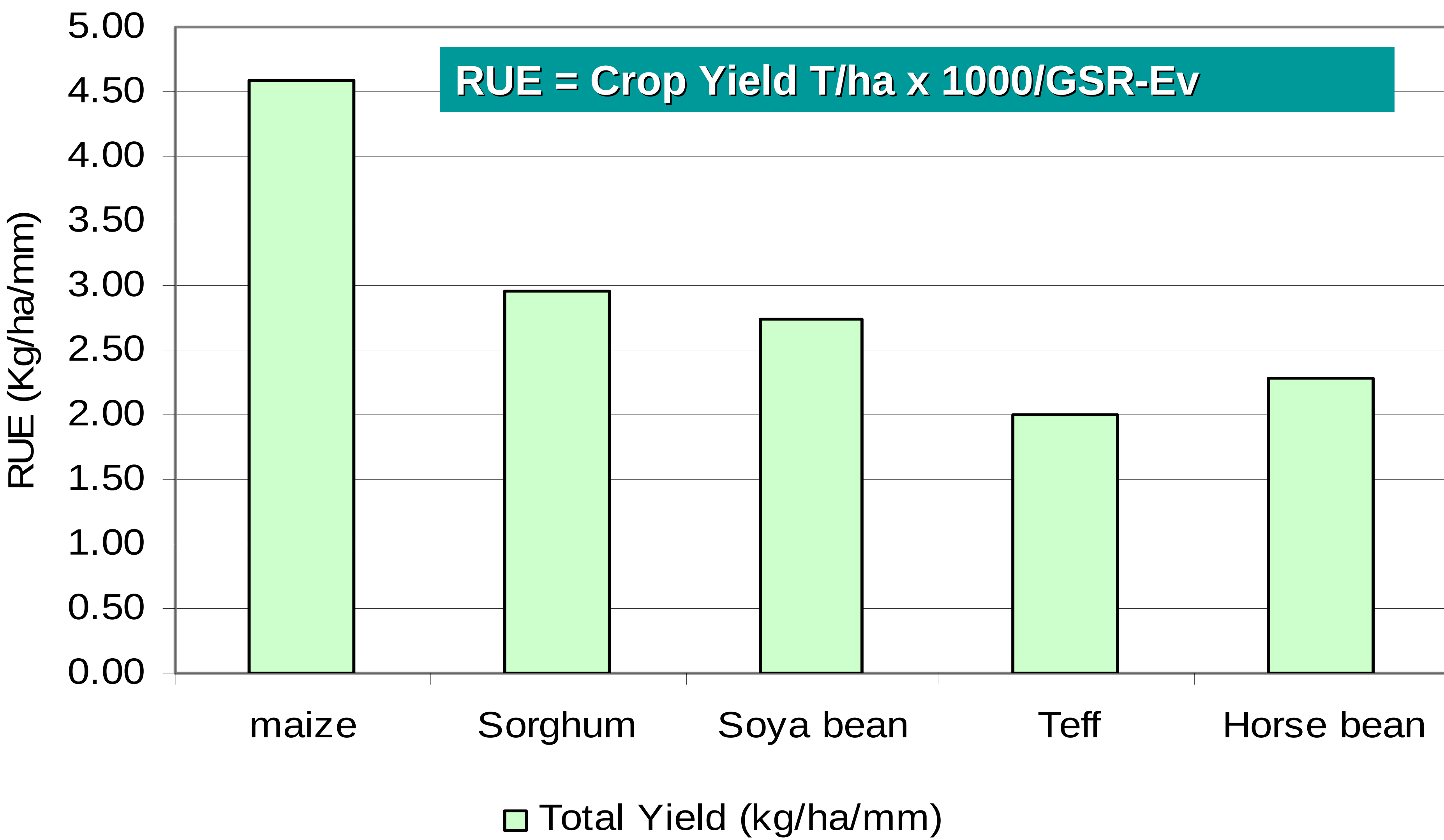


Figure 10b. Rainfall Use Efficiency (RUE) at Batu Degaga irrigation scheme (Yusuf et al.,2005).

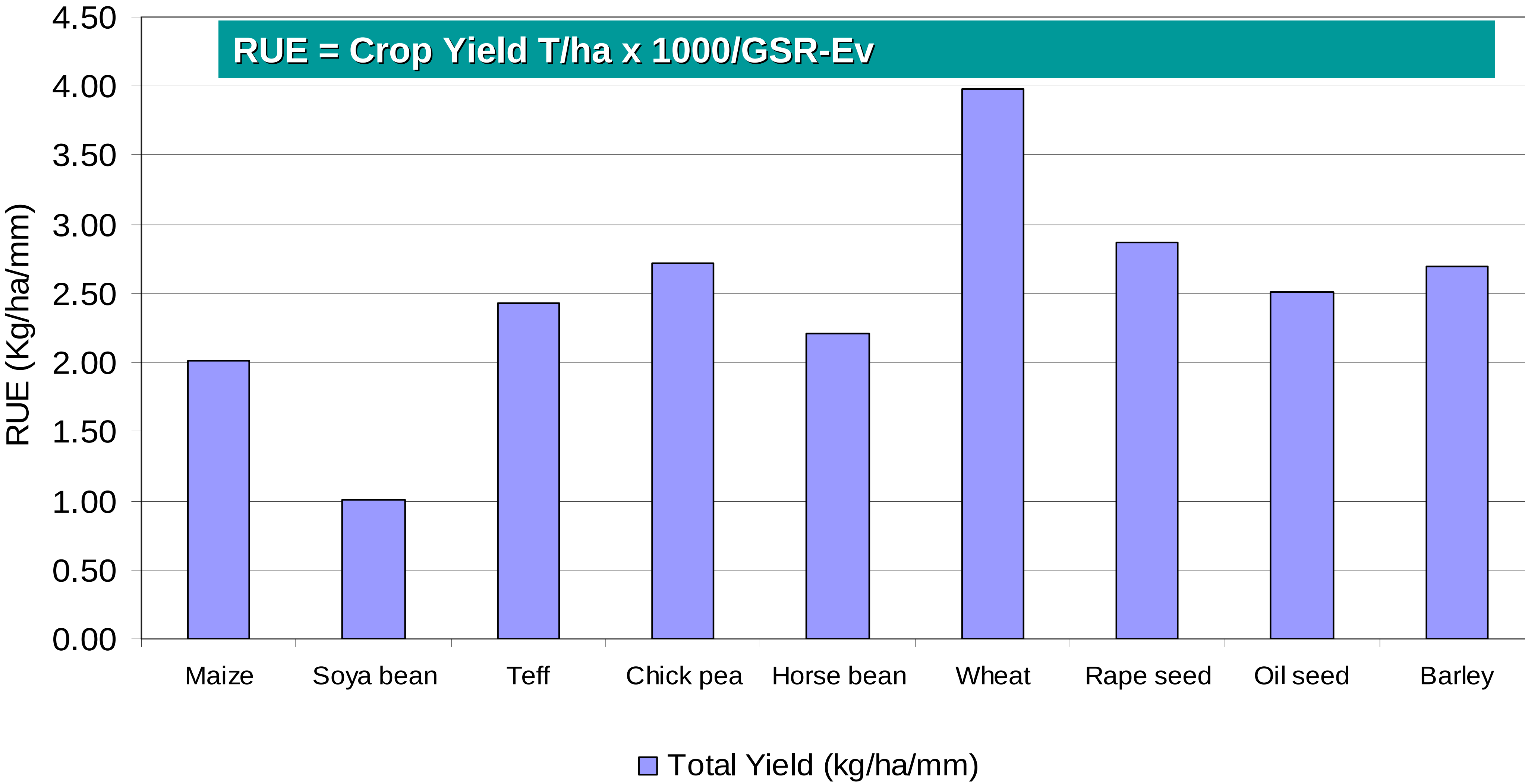


Figure 10c. Rainfall Water Use Efficiency (RUE) at Godino irrigation Scheme (Yusuf et al.,2005)

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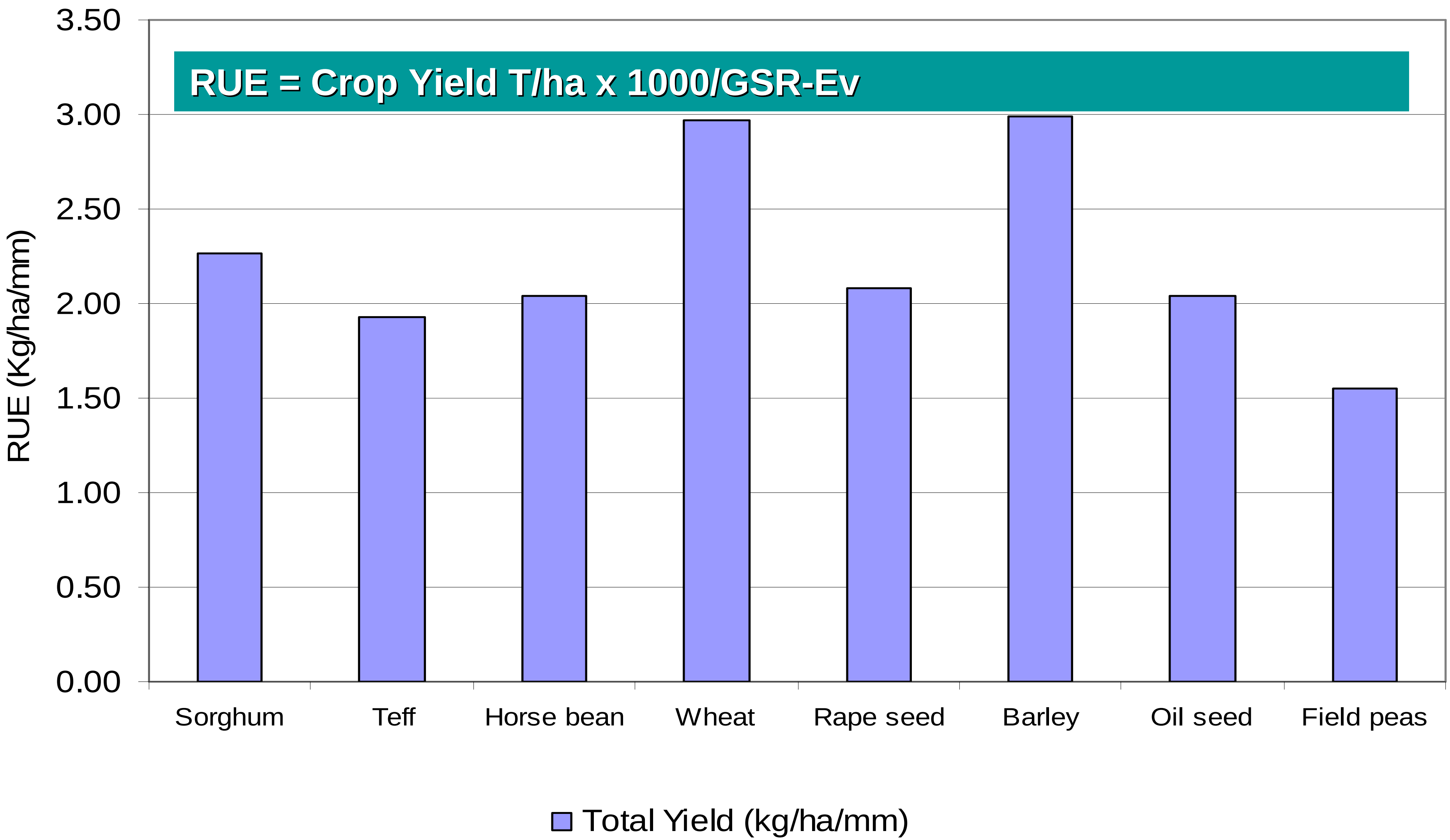


Figure 10d. Rainfall Use Efficiency (RUE) at Markos irrigation Scheme (Ysuf et al.,2005)

Livestock grazing

- Heavy grazing pressure is deleterious effect on natural resources
- Heavy stocking rate can compete with meager water and land resources

- **Grazing system** A defined, integrated combination of animal, plant, soil, and other environmental components and the grazing method(s) by which the system is managed to achieve specific results or goals.
- **Stocking density** Relationship between the number of animals and the specific unit of land being grazed at any one point in time (animal units at a specific time/area of land).
- **Stocking rate** Relationship between the number of animals and the grazing management unit utilized over a specified time period (animal units over a described time period/area of land).

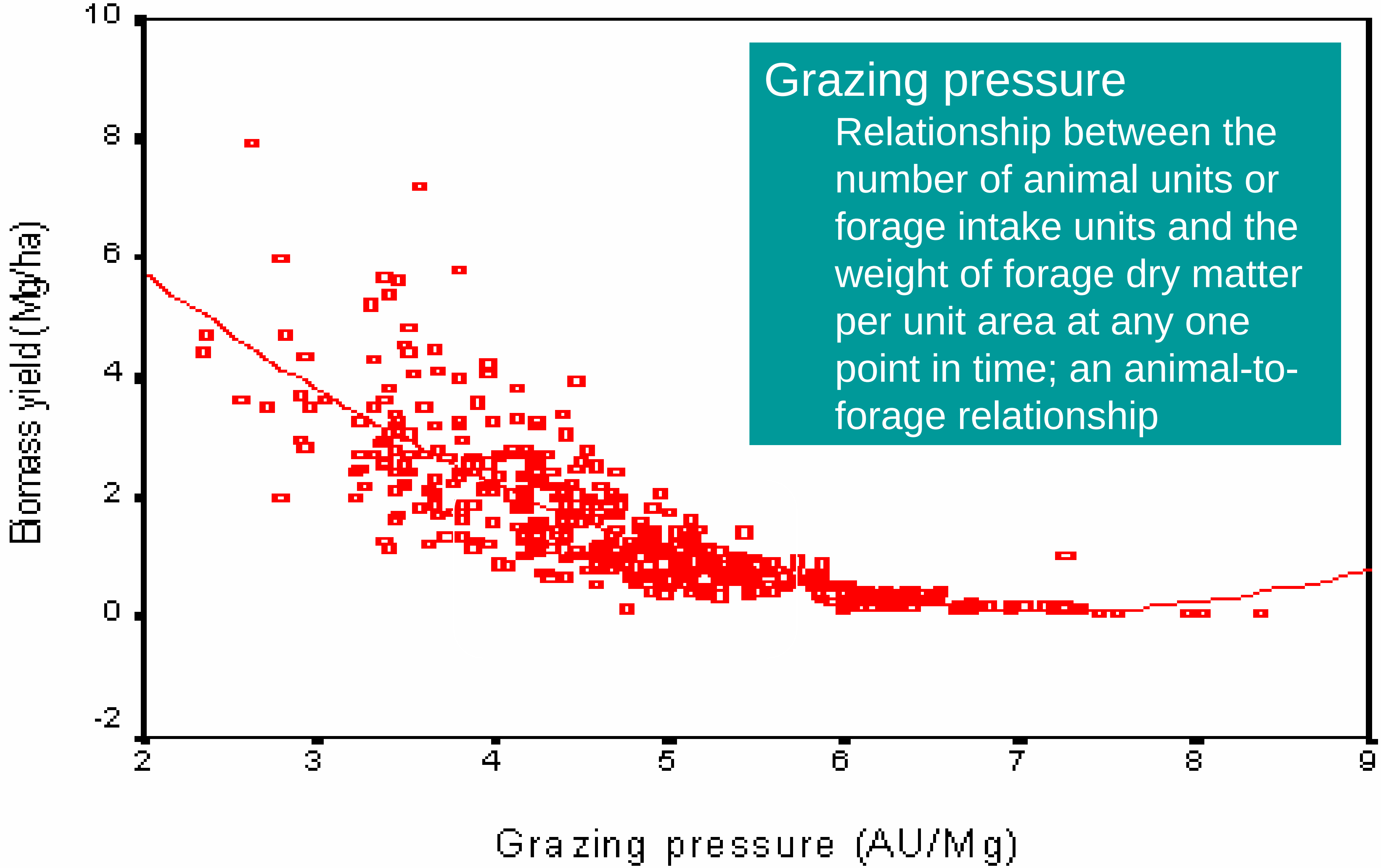
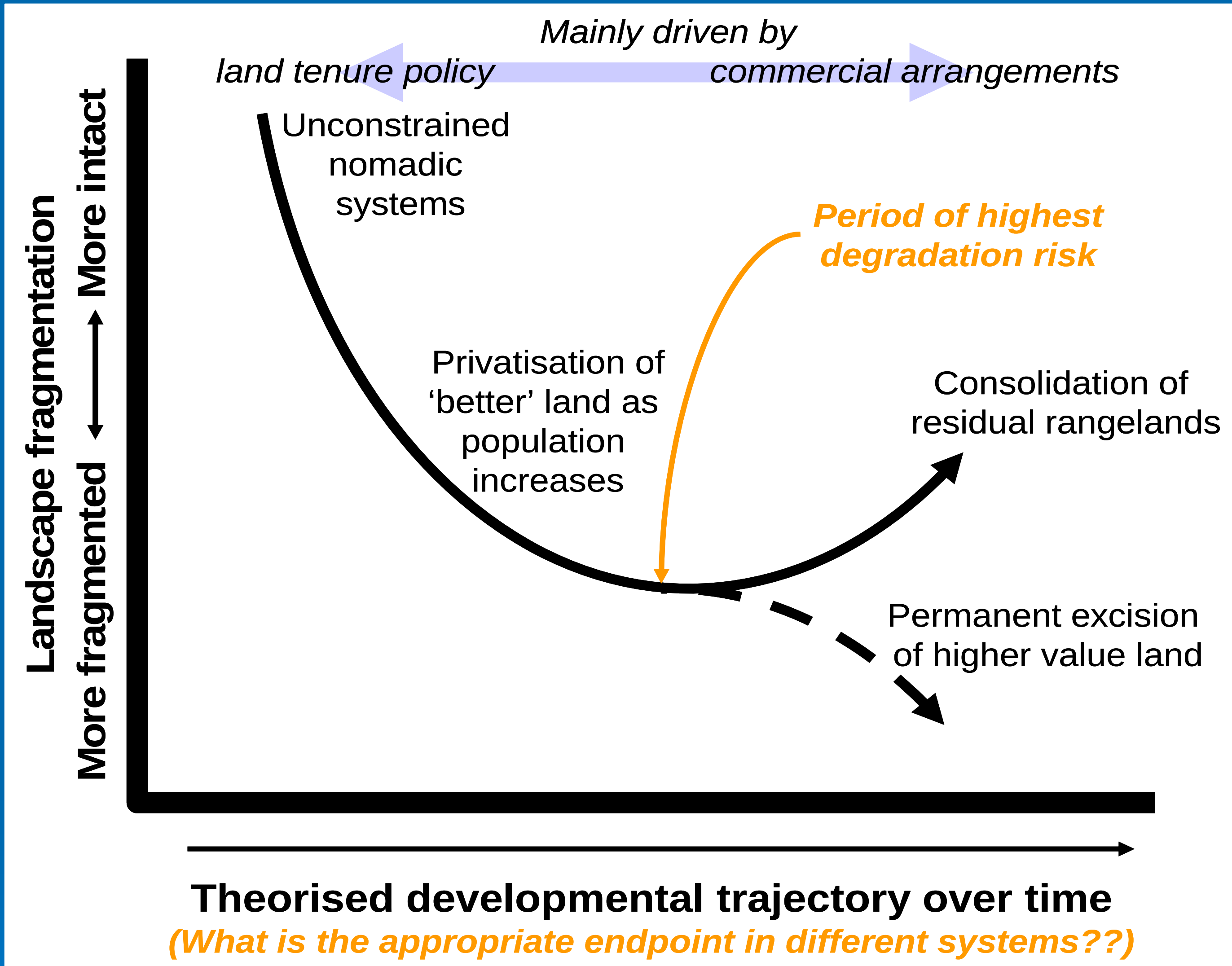


Figure 11a. Relationships between stocking rate (AUM/ha and biomass production (source: Girma Taddese et al., 2001).



Land use intensification throughout the rangelands is fragmenting landscapes into simpler, discrete units. The result is a reduction in the scale of landscape-animal-human interactions. At the higher quality resources (waters, grazing, cropping lands, etc) could be reduces

Figure 11b. Hypothesised process of fragmentation and reduction in scale in rangelands (Andrew Ash et al., 2005).

http://www.nrel.colostate.edu/projects/scale/IRC%20Scale%20Paper%20Ash.doc

If there is a significant difference in the nature of these stocking rate – animal performance relationships at different spatial scales then it is important to take into account in the context of landscape intensification. For example smaller, homogenous paddocks may provide the opportunity to increase stock numbers because of better water distribution.

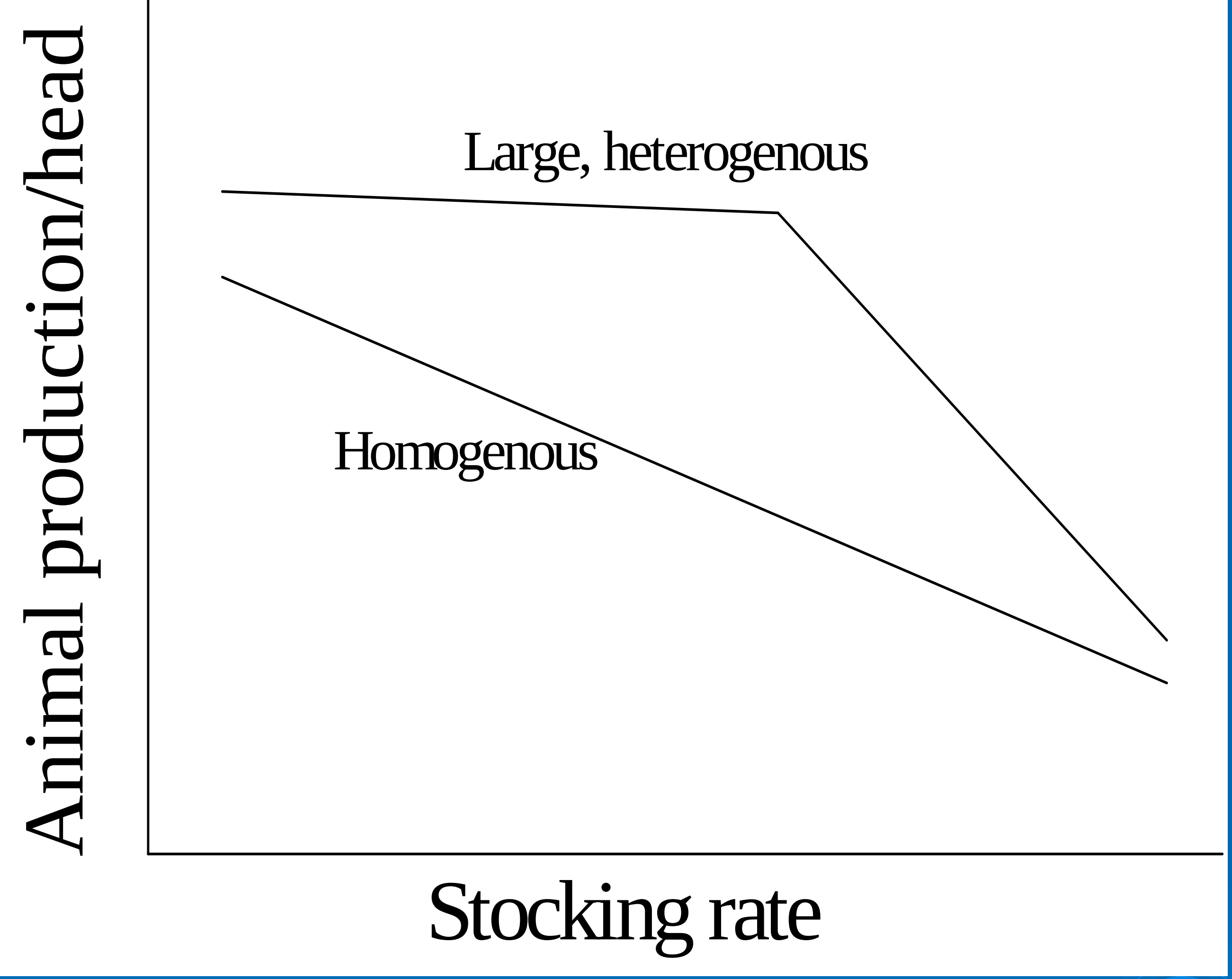


Figure 11c. Stocking rate – animal production relationship in relation to scale and landscape complexity

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Biomass production depends on adequate rainfall and other factors

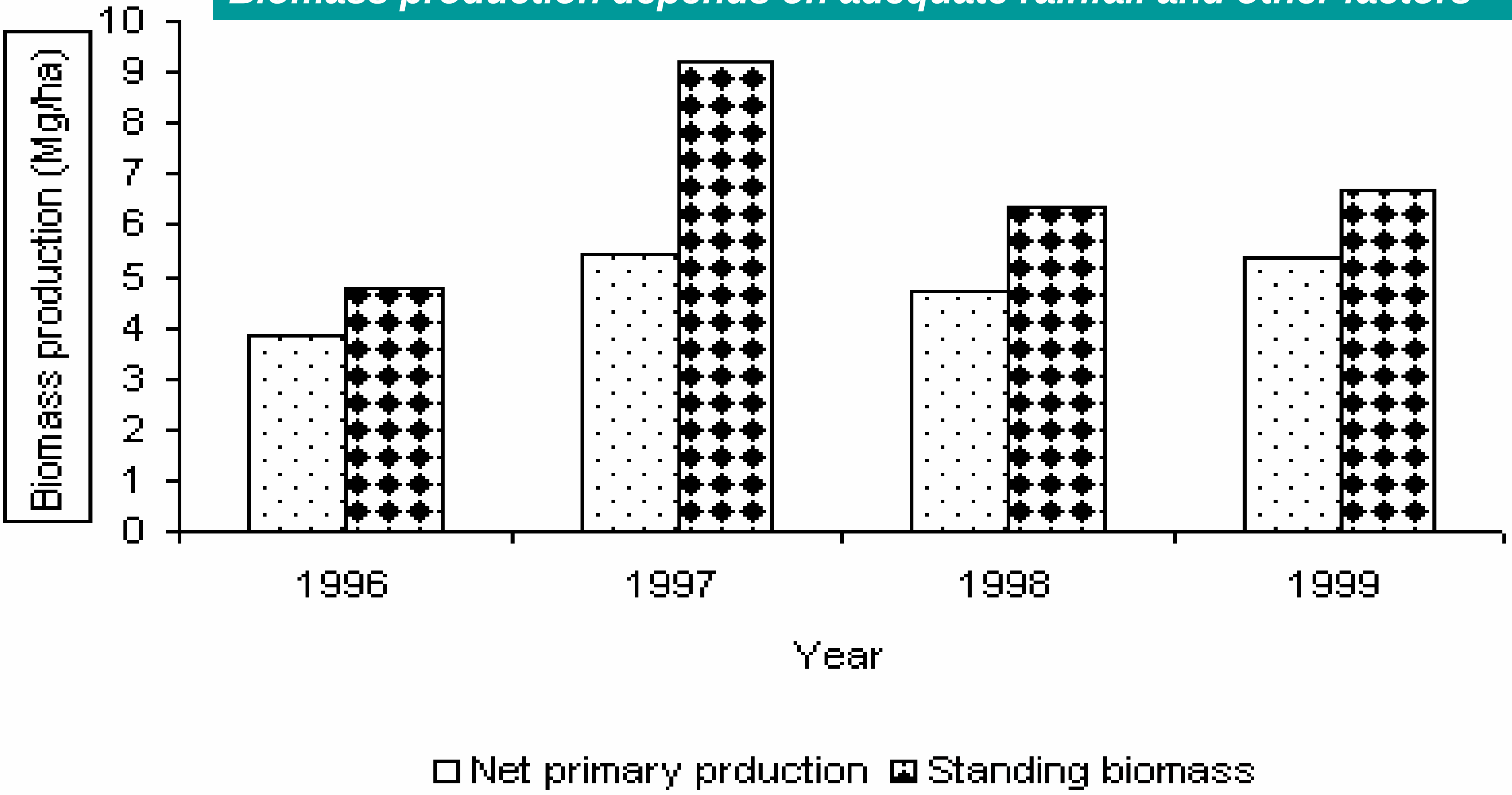
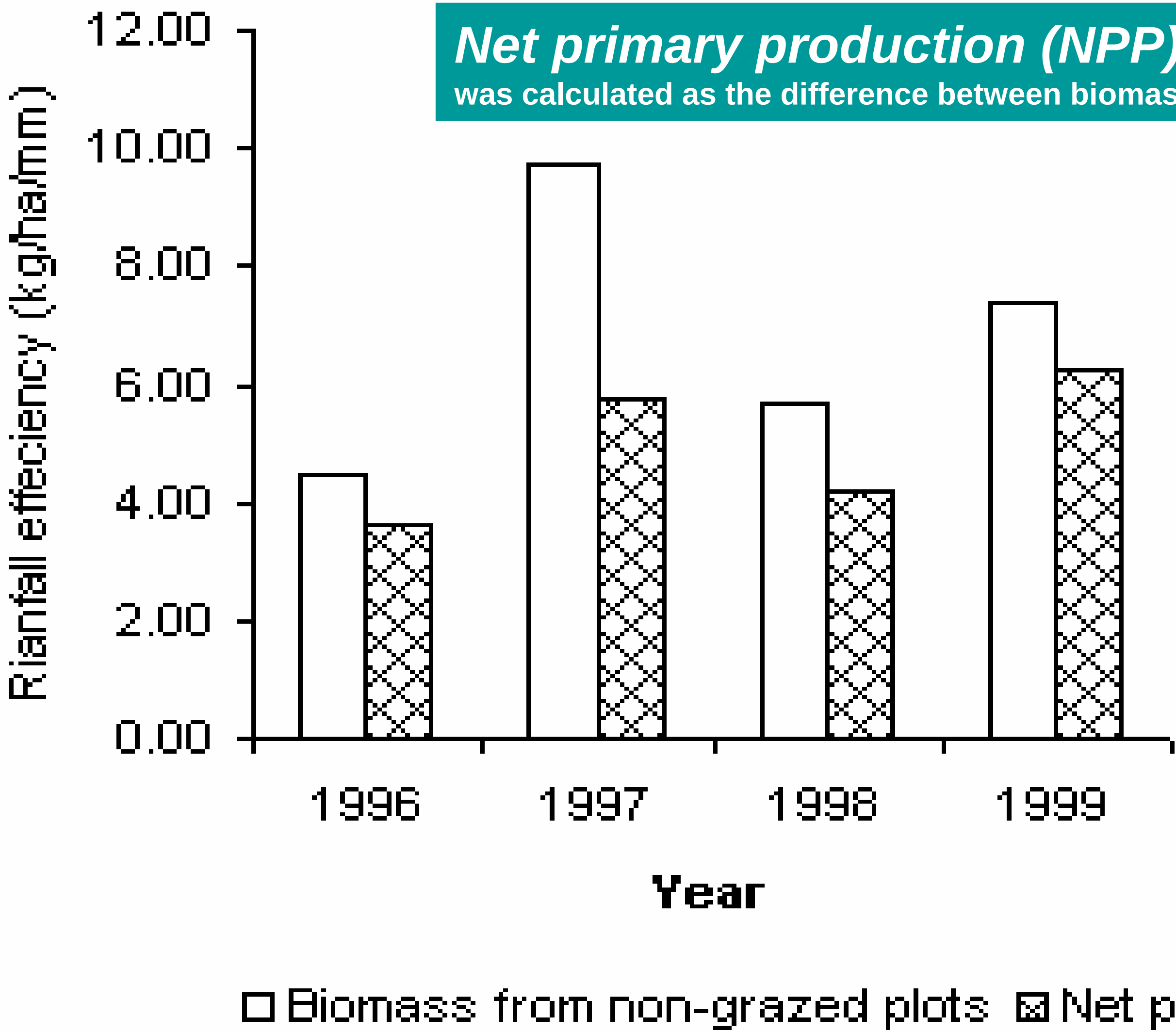


Figure 12a. Effect of grazing pressure on yearly net primary production of plant biomass (Mg/ha) ***source: Girma Taddese et al., 2001***

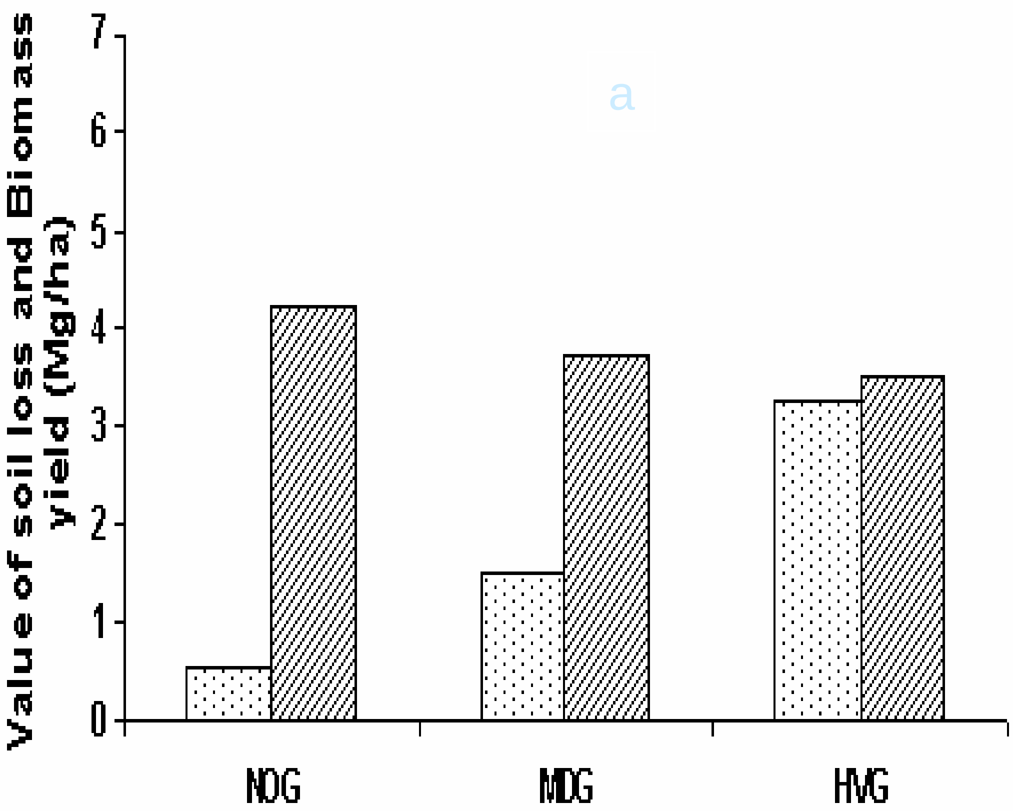
Net primary production (NPP)

was calculated as the difference between biomass of non-grazed and grazed plots



Plant growth is especially sensitive to two climatic variables, temperature and moisture. Both affect evapotranspiration, but to growing plants only actual evapotranspiration (AE) represents the true utility of water—its availability in necessary quantity and quality, at the correct phase, and during the correct season

Figure 12b. Influence of rainfall efficiency on plant biomass production (kg/ha/mm) *source: Girma Taddese et al., 2001*



Heavy grazing pressure reduces the vegetation cover and increases soil loss (MDG= 1.8AUM/ha & HVG- 4.2AUM/ha

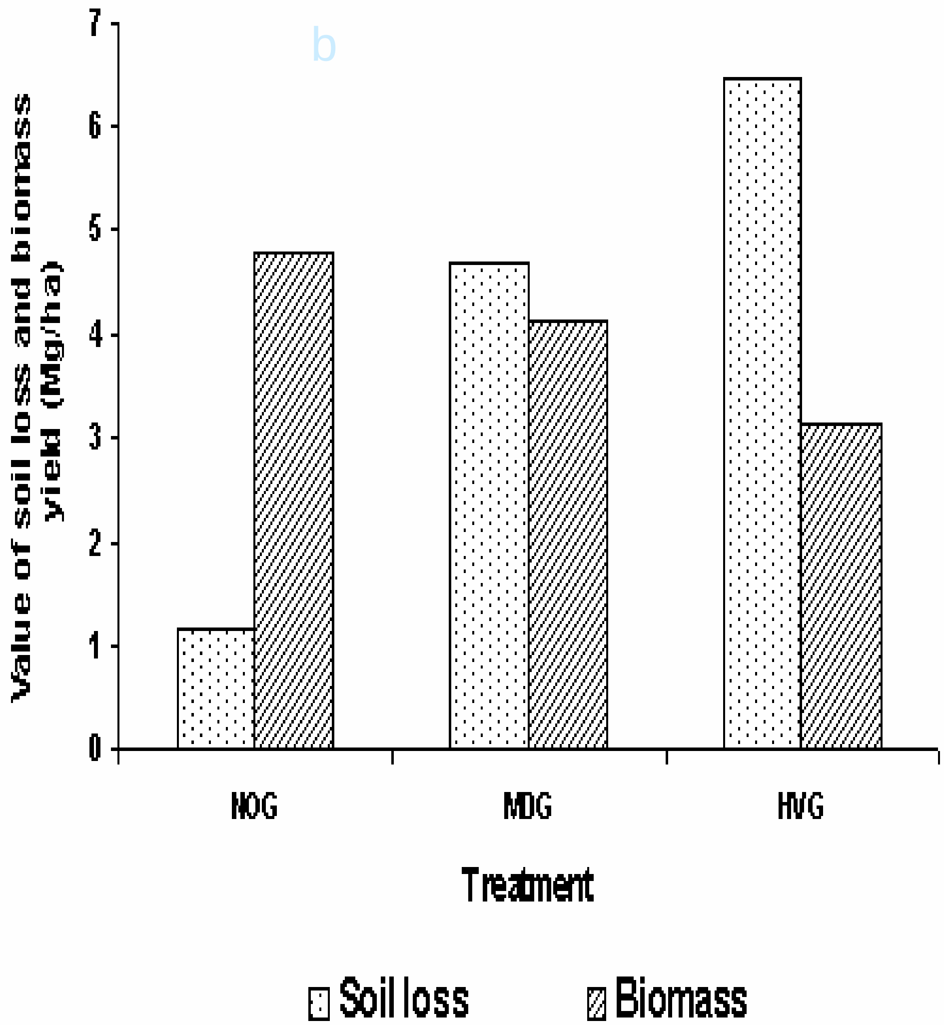


Figure 12c.Effect of grazing pressure on mean soil loss and biomass yield (t/ha), (a) 0-4 % slope and (b) 4-8 % slope

source: Girma Taddese et al., 2001.

1. Large irrigation has destabilized the pastoralist systems in the Lower Awash
2. Livestock were pushed from wet lands and riverside
3. Pressure has increased on surroundings forest and water resources
4. As more as more wetlands are put desertification has increased

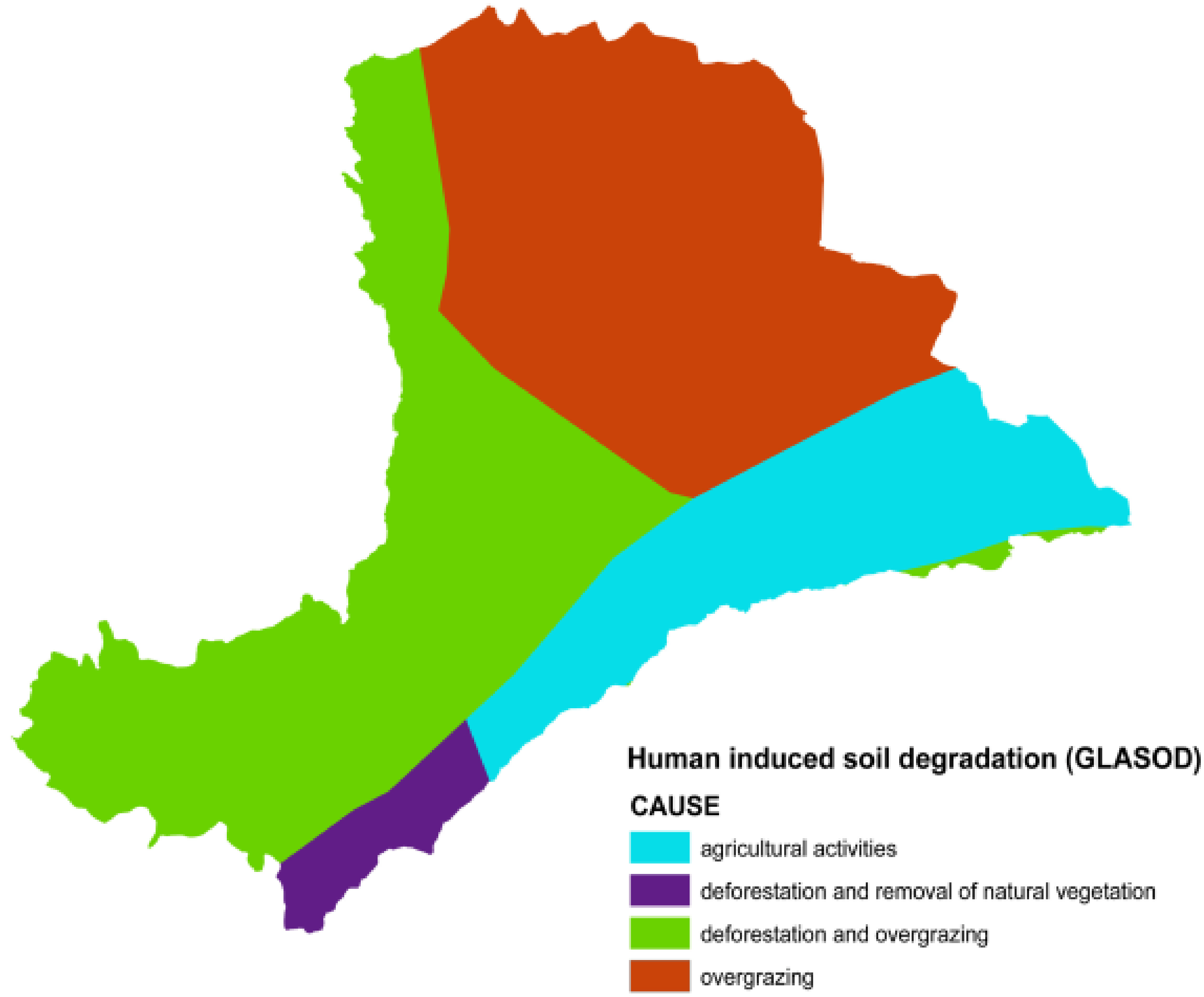


Figure 13a. Human induced soil degradation in the Awash basin (*Source ISRIC, UNEP GRID 1991*).

Figure 13b. Desertification in the Lower Awash River Basin.

Figure 13c. Sand Trickle in Lower Awash River Basin.

- This area was once a food plain grazing area for the pastoralist
- Large scale irrigation development has disrupted the grazing land
- Bush encroachment has intensified
- Salinity has increased

Figure 13d Prosopis Juliflora and Salt bush in Lower Awash River Basin
(Photo courtesy by Mulugeta Mammo 2001)

Figure 13e. Lower Awash Riverine

Conclusions

- The Awash River Basin is Located in the Greater Horn Region which is under severe environmental degradation and frequent draught
- So far developed Large, small and community irrigation schemes did not integrate livestock at initial planning stage
- Which resulted conflicts with surrounding farmers and pastoralists
- Land fragmentation and crop intensification has marginalized livestock from communal and private owned grazing areas
- Low rainfall has exhibited low vegetative production and Rain Use Efficiency
- Crop residues are important feed in the upland of the Bain

Continued Conclusions

- Community irrigations are easiy to manage by the farmers and environmentally healthy
- Farmers in the community based irrigation has managed to improve feed water availability for their livestock
- Livestock is forced to walk long distances from home stead for water drink.
- In the Middle and Lower Awash River Basin forage availability is below normal in most of the years.
- As more wet lands and flood plains are put to irrigated crops deforestation is expanding

Recommendations

- Community, small and irrigation should integrate livestock with crop production at initial planning of irrigation schemes
- Community irrigation should practice producing irrigated fodder and pasture
- Communities should stop using crop residues for fuel and selling the residues to urban areas
- More watering points for livestock should be designed in the community based irrigation.

Continued Recommendations

- In the lower Awash River Basin draught and salt tolerant feeds should be introduced
- Livestock water scarcity should be mapped frequently for the pastoralists
- Destocking in the feed water shortage areas could be one way of managing of livestock production for the hot spot areas. This could be done through different wealth accumulation strategy.
- Restocking in favorable areas of community based irrigation could be benefit the poor farmers

THANK YOU!!