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Where Aims Become Achievements

The impact of Climate Variability on Livestock resources and Pastoralist adaptation responses in Dollo Addo Woreda, Ethio Somali National Regional State

BY: Degu Zewdu

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Presentation Outline

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2. Objectives
3. The Study Area Characteristics
4. Methodology (Material & Methods)
5. Result & Discussion/Findings on:
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   2. Impacts of climate variability on livestock resources in Dollo Ado
   3. Adaptation response by pastoralists in Dollo Ado
   4. Factors affecting pastoralists Adaptation responses in Dollo Ado
6. Conclusion & Recommendations

1. Background

- **Although climate variability has many definitions, it can be best described as the way climate elements are *depart* from the average value with in different time period. It can be in a month, seasons, years or decades (IPCC, 2014).**

- **The most common variables that are mostly used by meteorologists to measure climate phenomena are temperature and rainfall** (Block 2008).

- Global climate variability has become one of the most common environmental concerns and also one of the most serious challenge of 21st century.

- **The problem of climate variability is more serious in developing countries specifically in East Africa. This is because of its location, poverty and food security status.**

- **Climate variability is also common in Ethiopia. Over the last decades, Ethiopia has experienced climatic variability. The rainfall condition of the country is strongly irregular, average temperature is increasing, the number of 'hot days' and 'hot nights' are also increasing, *drought and flood are also the common phenomena of the country*** (Woldeamlak, 2003)

- **In Ethiopia Pastoralism practiced on more than 60% of the national land.**

- **Pastoralists in Ethiopia are mainly found in Somali, Afar, Oromia, Gambella and Benishangul regions.**

- **It is estimated that the Somali pastoralists are the highest with 53 % of the total pastoral population of the country followed by the Afar 29 % (PFE, 2006).**

- **However, extreme climatic events like that of drought-caused livestock mortality, food insecurity, and poverty are putting huge effects on the economy of the pastoralists in Ethiopia.**

- **In the study area (Dollo Ado) Pastoralism is the main sources of income for the communities & majority of the population are depending on livestock production.**

- The study area Dollo Ado is located at the border of Ethiopia, Somalia & Kenya along with Dawa and Genale rivers.

2. Objectives of the study

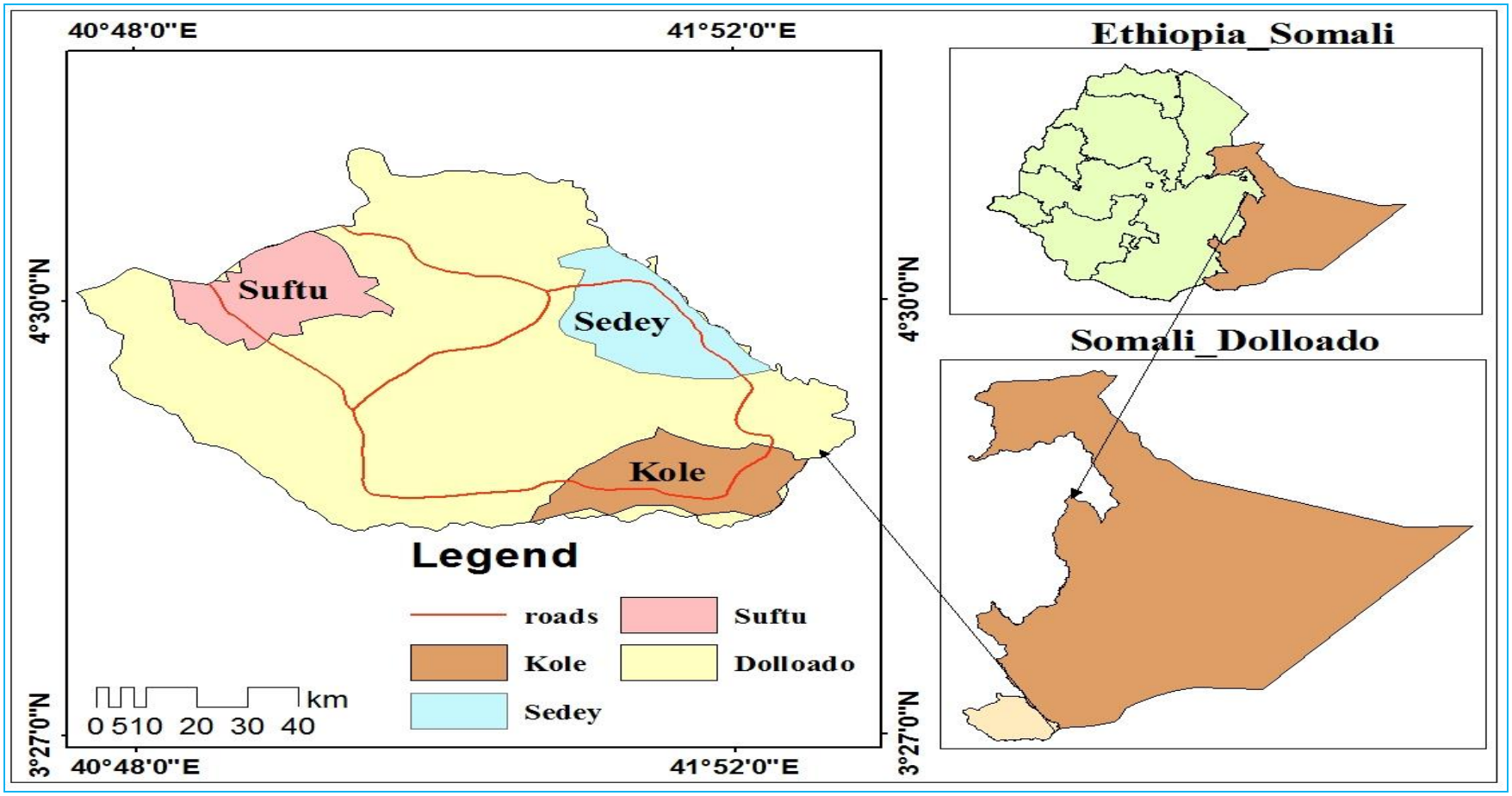
- The main objective of the study was to understand the impact of climate variability on livestock resources & pastoralists adaptation response in Dollo Ado
- Four specific objectives were also identified.

These were :-

1. Assess the current climate variability and identify climate related hazards in Dollo Ado Woreda
2. Examine the impact of climate variability on livestock resources
3. Assess pastoralists' adaptation response to the impact of climate variability
4. Analyse factors that affect pastoralists' decision to implement various adaptation strategies to the impact of climate variability

3.The Study Area/Dollo Ado

- Found in Ethio- Somali National Regional State, Liben Zone
- The elevation is b/n 200-1000 meters above sea level. It is 987 km far away from Addis Ababa. Pastorlism is the most dominant livelihood system
- Few Agro pastoralist are also found near to Dawa & Genale rivers.



4. Research methods (Material & Methods)

4.1. Research design

- **Sequential explanatory mixed method research design** was used by making a sequential stage of :
- Quantitative + Qualitative data collect=Quantitative + Qualitative data Analysis

4.2. Input data types and sources

- **Daily** and **monthly** temperature & rainfall data for 34 years period (***1983-2016)*** were obtained from the **Ethiopian National Meteorological Agency/Satellite data**

- **Stations** data were also included for **Dollo Ado** & **Filtu station**
- **Five dominant Livestock population data** from annual survey were collected from Dollo Ado Woreda Agricultural and NGOs office.

- **Qualitative data**
  - **Socio economic data, communities experience on drought, flood,& livestock diseases, level of damage caused by climate related hazards & *adaptation* responses were collected from sample households.**

4.3. Sampling techniques and sample size

- A **multi-stage sampling** technique was used to select the study site and sample households in the study area. In the **first stage**, Dollo Ado Woreda was selected purposively based on the researcher experience and accessibility to manage the study.

- In the **second stage**, three sample kebeles were selected by **randomly**. In the **third stage**, **five representative villages** were selected by ***random sampling technique*** from three sampled kebeles.

Suftu=Kajama&Fikow
Kolo= Kobe and Washakber
Sedey=Rama

- In the fourth stage **systematic sampling technique** was used to distribute the questionnaire for **150** sample respondents in each villages.

4.4. Methods of Data collection

❖ The data collection methods for this study were

- **Household questionnaires for150** people
- **Key Informant Interview (seven in numbers)**
- **FGD : three (one in each kebeles)**
- **Field observation and photograph**
- **Document review**
- **Government and NGO report review**

→ Key Informant Interview (KII)

4.5. Methods of data analysis & Software used =SPSS & Arc GIS

- **For temperature and rainfall variability**: **PCI, CV Mean and SD were used**
- ✓ **SRA was used to identify rainfall related hazards**
- ✓ **16 Rainfall & temperature indices were calculated**
- ✓ **To examine the impact of climate variability** on livestock **correlation and multiple linear regression** model were applied .

- ✓ **To analyze factors affecting pastoralists' decision to implement various adaptation strategies MNLR model was conducted.**

5. Result & Discussion/findings on:

1. Climate variability in Dollo Ado

1.1. Monthly rainfall and temperature variability

- Base on the result obtained from **CV** and **PCI**, there was monthly rainfall and temperature variability for **34** years period.
- **This was confirmed by the result obtained from CV for monthly rainfall** (5.83 - 0.30) and **PCI** value ranges from **10.85** to **20** which means **irregular** to **strongly irregular** rainfall distribution.
- The result for monthly temperature variability indicates that **CV** value was between **0.05** and **0.38**

- The maximum monthly rainfall occurred in December at Kole (235), in January (199 mm) at Suftu and 194 mm at Sedey

- March and April were the driest months at Suftu (0.5 & 0.44mm) and at Sedey (0.00mm)

❖***The highest temperature variability observed in December and July (0.05) at Suftu, in August (0.38) at Sedey, and (0.07) at Kole*.**

R.station	Data typ	Statis	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Suftu	Tem	Mean	34.6	32.6	32	32.8	35.4	34.4	33.4	34.5	36.3	37.7	37.5	34.7
		CV	0.04	0.03	0.03	0.02	0.02	0.04	0.05	0.04	0.02	0.02	0.04	0.05
	Rainfall	Mean	58	4.59	**0.5**	**0.44**	3.3	45	41	5.6	0.59	2.56	20.6	88.3
		CV	0.7	1.8	5.1	5.8	2.45	0.85	1.13	1.28	4.15	2.12	1.31	0.44
Sedey	Tem	Mean	32.5	32.5	31.7	33.2	35.8	33.9	32.5	34.4	36.2	37.2	36.6	33.5
		CV	0.03	0.03	0.03	0.02	0.02	0.04	0.04	0.38	0.02	0.02	0.04	0.04
	Rainfall	Mean	54.2	4.8	**0.00**	**0.00**	2.56	36.7	42.4	4.44	3.65	3.35	17.94	86.9
		CV	0.81	2.04	0.00	0.00	2.75	0.98	1.14	1.58	4.14	2.30	1.29	0.57
Kole	Temp	Mean	30.6	29.5	28.9	30.0	31.5	31.7	30.3	31.2	33.0	33.8	32.6	30.9
		CV	0.04	0.05	0.05	0.05	0.04	0.04	0.06	0.07	0.05	0.05	0.06	0.05
	Rainfall	Mean	63.0	10.2	22.9	17.8	21.8	58.2	62.0	33.9	21.2	24.5	73.15	**112**
		CV	0.54	1.33	0.92	1.12	0.93	0.65	0.76	1.04	0.81	0.89	0.53	0.30

1.2. Seasonal rainfall variability in Dollo Ado

❖ There was also seasonal rainfall variability in **four seasons**

✓ **In the main rainy season locally known as *Dayr*** (October, November and December). The value of **CV** was between **: 1.38 and 0.57**

✓ **During short rainy** season known as ***GuGa*** *(*April, May and June) =

CV value was 3.04 & 0.90 which was the highest

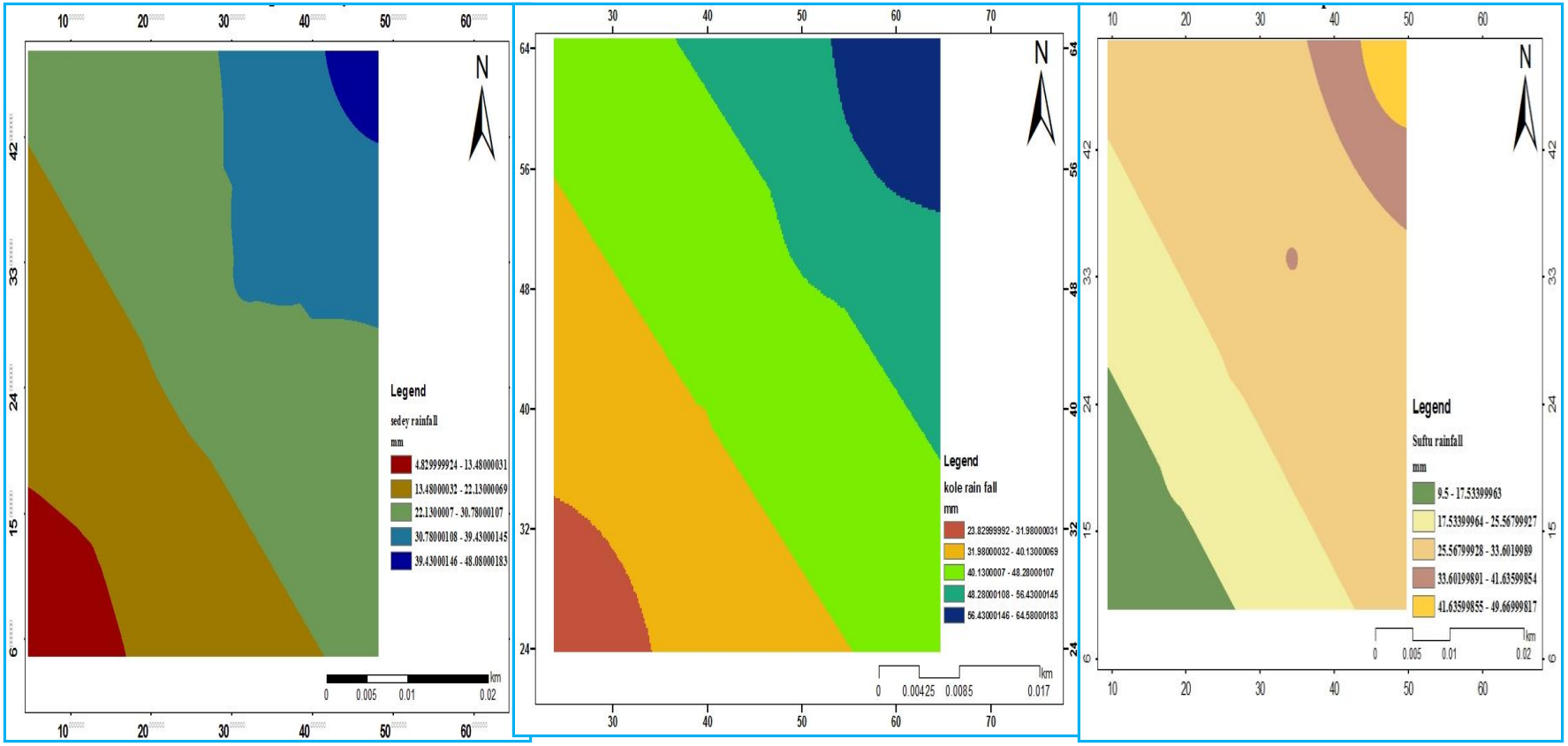
✓**Dry season *Hagaa*** *(* July, August and September), **CV=2.7 and 2.18**

✓ **Hot dry season *Koreheed*** *(* January, February and March) ***CV2.56 &0.93***

Recording station	Oct, Nov and Dec		Apr, May and Jun		Jul, Aug and Sep		Jan, Feb and Mar	
	Total amount	CV	Total amo	CV	Total am	CV	Total amou	CV
Suftu	37.17	1.29	16.32	3.04	15.56	2.18	21.02	2.56
Kole	70.14	0.57	32.61	0.90	39.08	2.7	32.07	0.93
Sedey	36.04	1.38	23.08	1.24	16.83	2.28	19.64	0.95

1.3. Annual rainfall and temperature variability

- There were spatial and temporal annual rainfall and temperature variability for the 34 years period as it was confirmed by rainfall CV: 1.76 –096 and temperature CV between 0.64 and 0.06



The spatial patterns of rainfall variability at Sedey, Kole and Suftu respectively

1.4. Households Perceptions/*local knowledge* on climate variability

❖ Majority (90.7%) of the surveyed households believed that there is climate variability in Dollo Ado based on their local experiences.

❖ Respondents also used **several rainfall variability indicators**

- **Households rainfall variability indicators**
  - Increased **water insecurity** (61.3%)
  - **Irregular rainfall start and ending times** (23.4%)
  - Increased **drought and flood frequencies** (12%)
  - Decreased biodiversity (2.7%)
  - Declined indigenous tree species (2.0%)
  - Decreased grazing period (1.3%)

2. Findings on Climate related Hazards in Dollo Ado

❖**The result of standardized rainfall anomalies** (SRA), indicated that there were **20 years negative** and **14** year's positive rainfall anomalies for 34 years study period.

- **Negative rainfall anomalies means below the long term mean /drought**
- Positive rainfall anomalies means above the long term mean /flood categories
- **There was no any single normal year period in the area for the last 34 years.**

➡ 16,15 &12 years positive rainfall anomalies (**Flood years**) at Suftu,Sedey &Kole station

➢22, 19, 18 years negative rainfall anomalies at Kole, Sedey and Suftu were observed.

❖The drought severity classes are extreme drought (S<-1.65), severe drought (-1.28 > S > -1.65), moderate drought (-0.84 > S> -1.28) (Bewket, 2007).

Years	Drought category	Station
1999 and 2000	Extreme drought	Kole
1984 and 2001	Extreme drought	Sedey
1984 and 2001	Severe drought	Suftu
1997	Extreme wettest	at Suftu, Sedey and Kole
2006, 2007 and 2011	Wet rainfall	Kole

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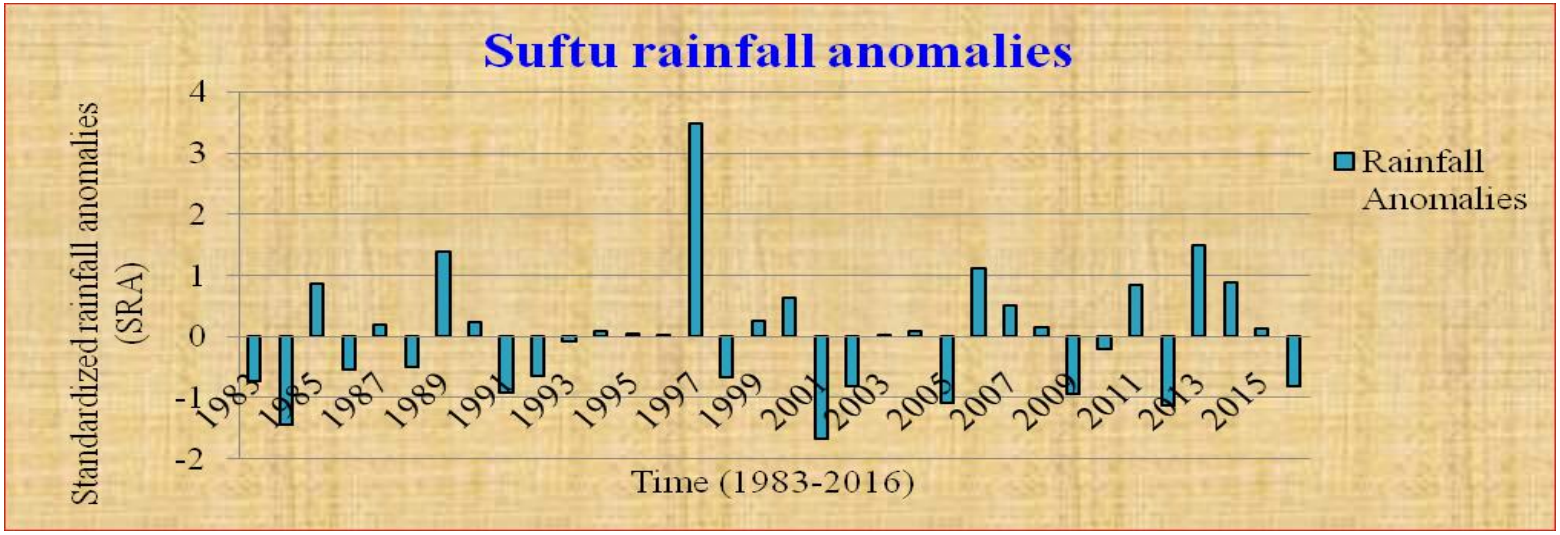
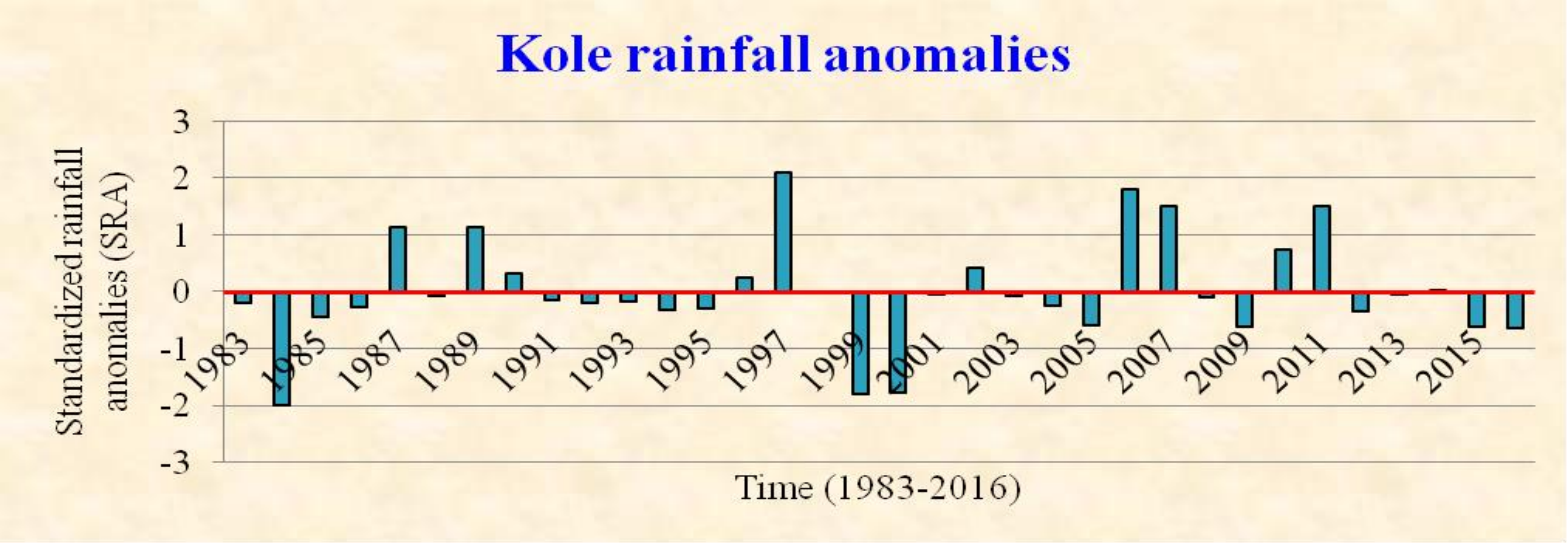
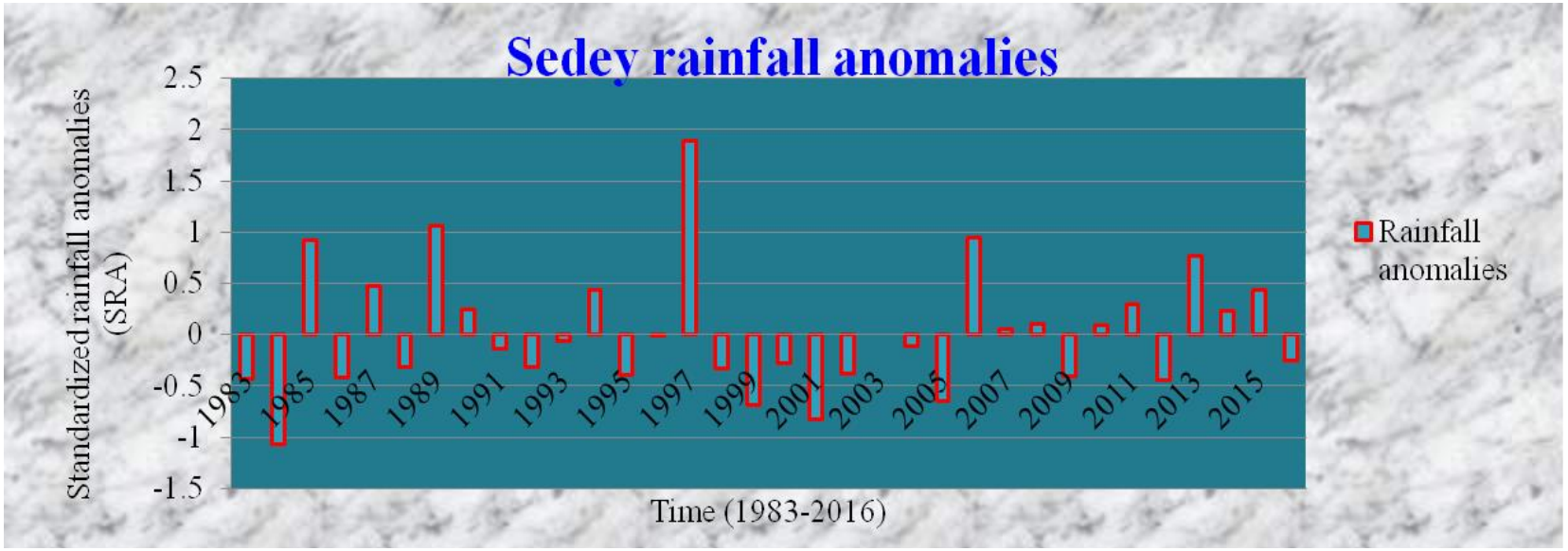

Suftu rainfall anomalies
Standardized rainfall anomalies (SRA)
4
3
2
1
0
-1
-2
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Time (1983-2016)
Rainfall Anomalies


Kole rainfall anomalies
Standardized rainfall anomalies (SRA)
3
2
1
0
-1
-2
-3
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Time (1983-2016)

Cont.....



2.1 Households experience on climate-related hazard

- ✓ Drought was the main climatic related hazard as (93.34%) households reported
- ✓ Livestock diseases is the second reported by 73.34% of households
- ✓ Flood was rated by 58 % of households

- HHs displaced by flood at Dollo Ado/few of them

- During the filed work the researcher witnessed very poor situation of the displaced peoples (28 houses destroyed, 277 chickens & 66 goats died & 88 toilets were destroyed at Suftu Kebele, by 2018)

2.2. Climate related indices (extreme rainfall & temperature indices)

■ Rainfall indices used for the study

Station	R days	Rx1day	Rx5 days	CDD	CWD	Rainfall TOT	R10 mm	R20 mm	R95p	R99p
	rainy d's	Mx1day rainfall	Mx 5 day rainfall	Con dry	Con rai	Aual T r d	heavy r	VHR	Very high rain days	extremely high rain
Suftu	22.52 days	32 mm	41mm	30 days	11days	5736 mm	6.44	2.8	22.21	40.471
Sedey	17.42 days	34 mm	61mm	30 days	12days	4732 mm	5.23	1.8	19.81	37.934
Kole	41.85 days	35 mm	35mm	30 days	18days	15758mm	16.41	2.82	49.55	77.827

■ Temperature indices used for the study

Stations	SU25	TR20	TX10p	TX90p	TN10p	TN90p
	Summer d's	Tropical nights	Cool days	Warm days	Cool nights	Warm nights
Suftu	359.96	28.53	2.833	2.41	2.58	2.19
Sedey	359.96	28.05	2.5	2.56	2.08	2.45
Kole	359.96	2.88	2.75	2.59	1.58	2.16

3. Résulte on the impacts of climate variability on livestock resources

❖ Based on the **Livestock population and Climate data (rainfall+temperature)** correlation and regression analysis were conducted.

Livestock's		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standard. Coefficient. Beta	Sig.	95.0% Confidence Interval for B lower Bound	95.0% Confidence Interval for B upper bound	Correlation Partial
Goat	(Constant)	762.2	28.52		0.819	-13.51	11.12	
	Rainfall	841.2	76.34	0.992	0.008	51.74	16.72	**0.992**
	Temperature	132.1	85.96	0.014	0.891	-35.25	38.41	0.109
Sheep	(Constant)	8094.9	13.066		0.617	52.88	67.71	
	Rainfall	776.9	36.89	0.996	0.002	61.16	93.66	**0.998**
	Temperature	-594.2	412.702	-0.068	0.287	-26.87	11.55	**-0.713(strong &N)**
Donkey	(Constant)	-15.74	441.34		0.975	-19.70	18.22	
	Rainfall	8.11	1.180	0.975	0.021	3.03	13.18	0.979
	Temperature	8.63	13.196	0.093	0.580	-48.14	65.41	0.420
Cattle	(Constant)	-129.8	23.04		0.996	-10.48	10.89	
	Rainfall	222.23	62.68	0.929	0.071	-47.48	49.94	0.929
	Temperature	-10.12	701.17	-0.004	0.990	-32.01	30.76	**-0.010(weak &N)**
Camel	(Constant)	1206.53	464.66		0.819	-18.61	21.66	
	Rainfall	162.78	12.04	0.680	0.320	37.93	69.47	0.680
	Temperature	2.065	13.466	0.001	0.999	-59.72	59.85	0.001

- ***Sheep and cattle population were had strong negatively correlation with temperature.***
- ***Majority of livestock population had positive correlation with rainfall.***

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- Regression analysis was also generated to determine the degree to which annual temperature and rainfall at the station explained livestock numbers.

Model	R	R Square	Adjusted R^2	Std. Error of the Estimate
Goat	0.992[a]	**0.984**	0.968	892.48567
Sheep	0.998[a]	**0.996**	0.991	431.31588
Donkey	0.980[a]	**0.960**	0.920	13.79113
Cattle	0.929[a]	**0.863**	0.725	732.79419
Camel	0.680[a]	**0.463**	-0.075	1450.04503

- The result shows that 98.4%, 99.6%, 96%, 86.3% and 46.3% of total variability in goat, sheep, donkey, cattle and camel production can be explained as a result of the effect of the climatic elements (rainfall and temperature variability).

Thus, we can say that

1. **Sheep's are seriously affected (99.6%) in Dollo Ado**
2. **Goats are secondly affected (98.4%) in Dollo Ado**
3. **Donkeys are the thirdly affected (96.0%) in Dollo Ado**
4. **Cattles like cow fourth (86.3%) and Camels are relatively strong(46%).**

3.1.Household's response to the impact of climate variability on livestock

- Most Households (76.67 %) in the study area indicated that animal productivity in terms of milk and meat production has decreased.
- Increase animal mortality as it reported by 59.33% of the household's.

FGDs and interview results also indicated:

- **Livestock pasture and trees are disappearing in Dollo Ado**
- There is no life without trees – animals need the trees/pasture and we need the animals
- **We don't have any cash money to buy food for our livestock's during drought time**
- **Poor peoples who have small clan and few relatives are more vulnerable**
- Women's are also more vulnerable due to high responsibilities
- Many years ago up to now livestock foot and mouth disease are present and currently the frequency of these diseases are increasing
- **During the hot time our animals already suffer from different disease**
- The food security conditions of pastoral communities in Dollo Ado are also under critical condition due to animal mortality and frequent drought.

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➢**The result obtained from key informant interviews with milk sellers indicated**

1. Bad drought made the milk production hopeless
2. Poor marketing infrastructure leaves no option for the women to sell their milk product from their village to another areas
3. There is no permanent shop or market to sell livestock milk.
4. There is no other option without milk to buy other materials even salt since livestock is the major source of daily food & income/milk and meat is needed

4. Adaptation response used by pastoralists in Dollo Ado

- **Majority (93.3%) of the surveyed households were used adaptation strategies to overcome the impact of climate variability.**

Adaptation strategies during drought

- Livestock mobility/migration 53.3%
- Livestock diversification 36.7%
- Growing of pasture using irrigation 9%
- Small scale trade 7%

Adaptation responses during flood

- Receiving food aid 47.30%
- Income diversification 52.7%

Adaptation strategies to livestock disease

- Get veterinary service/livestock vacation 30.7%
- Animal health training 5.3%
- Shifting from pastoralist to agro pastoralist 57.3 %

Challenges of adaptation responses

- **Households were also reported their major challenge to implement several adaptation responses**

❖ Shortage of skills to implement adaptation strategies 41.3%
❖ Absences of climate related information and awareness creation 28.7%
❖ No sufficient financial resources 23.3%
❖ No sufficient manpower 4.7% and
❖ Shortage of land reported by 1.3% of the households

Factors affecting pastoralists' decision to implement various adaptation

- **The result of MNL model indicated: sex, education, livestock production experience, access to climate information, access to credit, access to market, access to livestock extension service and non livestock income** have showed significant and positive correlation with different adaptation strategies used by the pastoralists in Dollo Ado woreda

MNL model result *, **, *** significance at 10, 5 and 1%

Adaptation responses	independent variables	Coefficient (ß)	Exp (ß)	Sig (p value)
1. Livestock mobility	Sex	0.194	1.214	0.836
	Age	-0.138	0.871	0.882
	Education	-0.756	0.469	0.097*
	Marital status	-0.020	0.980	0.964
	Family size	0.439	1.552	0.430
	Experience	0.459	0.632	0.426
	Climate information	2.458	11.6	0.001***
	Access to credit	1.281	0.278	0.428
	Market access	2.729	15.323	0.041**
	Extension services	3.468	32.065	0.023**
	Non livestock income	3.468	32.083	0.008 ***
2. Livestock diversification	Sex	-3.199	0.041	0.000***
	Age	-0.163	0 .849	0.830
	Education	1.429	4.173	0.003***
	Marital status	0 .480	0 .619	0.36
	Family size	0.486	0.615	0.244
	Experience	0.242	1.273	0.589
	Climate information	0 .705	2.024	0.063*
	Access to credit	0.306	0.736	0.802
	Market access	1.971	7.179	0.082*
	Extension services	3.144	3.190	0.008***
	Non livestock income	4.509	90.787	0.001***
3. Receiving food aid	Sex	0.334	1.396	0.642
	Age	0.925	2.523	0.197
	Education	15.522	29.810	0.996
	Marital status	0.457	1.579	0.423
	Family size	0.131	1.140	0.851
	Experience	2.055	7.807	0.015**
	Climate information	-15.952	1.181	0.990
	Access to credit	-4.513	0.011	0.000***
	Market access	-14.921	3.310	0.991
	Extension services	2.763	15.846	0.999
	Non livestock income	- 0.191	0.826	0.930

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4.Income diversification	Sex	0.818	2.266	0.278
	Age	0.526	1.693	0.472
	Education	15.649	9.139	0.996
	Marital status	0.202	1.224	0.731
	Family size	0.013	0.987	0.985
	Experience	2.256	9.544	0.009***
	Climate information	16.234	8.904	0.990
	Access to credit	3.887	0.021	0.000***
	Market access	14.441	5.352	0.991
	Extension services	1.327	3.770	0.000***
	Non livestock income	0.116	0 .890	0.958
5. Flood water management	Sex	18.238	6.59	0.000***
	Age	-1.420	0 .242	0.083*
	Education	42.387	0 .990	0 .000***
	Marital status	-43.463	1.331	0.978
	Family size	1.079	2.940	0.404
	Experience	0.934	2.545	0.487
	Climate information	38.761	1.467	0.992
	Access to credit	0.227	1.255	0.000***
	Market access	89.921	8.864	0.986
	Extension services	7.079	6.390	0.999
	Non livestock income	2.125	8.369	0.999
6. Religious belief and praying	Sex	1.584	4.875	0.234
	Age	-0.320	0.726	0.806
	Education	15.691	6.785	0.985
	Marital status	-0.177	0.838	0.484
	Family size	-0.670	0.512	0.356
	Experience	2.822	16.812	0.000***
	Climate information	0.256	0.774	0.810
	Access to credit	0.799	2.223	0.241
	Market access	0.193	0.825	0.803
	Extension services	-17.976	0.008	0.000***
	Non livestock income	0.462	1.587	0.605

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7. Growing of pasture by using irrigation	Sex	19.683	4.020	0.000***
	Age	0.186	1.205	0.916
	Education	19.612	4.899	0.982
	Marital status	-0.420	0.657	0.241
	Family size	-0.509	0.601	0.586
	Experience	1.9747	0.199	0.035
	Climate information	0.256	1.292	0.837
	Access to credit	0.342	1.408	0.744
	Market access	0.286	1.331	0.772
	Extension services	17.799	1.862	0.000***
	Non livestock income	0.173	0.841	0.871
8.Small scale trading	Sex	2.745	15.570	0.097*
	Age	0.010	1.010	0.995
	Education	19.731	4 .496	0.982
	Marital status	- 0.664	0.515	0.069*
	Family size	-0.389	0.678	0.656
	Experience	2.102	8.181	0.018**
	Climate information	15.278	8.684	0.985
	Access to credit	0.306	0.736	0.000***
	Market access	15.157	5.137	0.985
	Extension services	-19.887	2.307	0.000***
	Non livestock income	0.685	0.514	0.504
9. Get veterinary services	Sex	1.913	6.771	0.033**
	Age	-1.550	0.212	0.074
	Education	1.636	5.134	0.001***
	Marital status	-0.269	0.764	0.348
	Family size	-0.457	0.633	0.276
	Experience	0.542	1.702	0.241
	Climate information	3.196	0.041	0.002***
	Access to credit	16.939	9.487	0.990
	Market access	2.487	12.026	0.019**
	Extension services	-38.017	3.088	0.984
	Non livestock income	0.421	0 .656	0.674

Conclusion and Recommendations

- Based on 34 years climate data and calculation of (**CV, PCI, mean and SD**) it is proofed that there was monthly, seasonal and annual climate variability in the study area from the period **1983-2016**.
- The households were also believed that there is both temperature and rainfall variability in their localities based on their long term experience.
- The analysis of rainfall anomalies/SRA indicated that there were many extreme deviations above and below the mean annual totals **which are considered to be climate related hazards=drought +flood.**

- The household's in Dollo Ado believed that rainfall and temperature variability's are affecting their livestock production by reducing the amount and the quality of pasture and water.
- The result obtained from correlation and regression of livestock population with annual rainfall and temperature also indicated that **livestock numbers** are **decline during drought and extreme temperature**.

- Even if Pastoralist in the study area are implementing several adaptation responses ,there are also many factors that are affecting them. **Therefore,**

1. It is recommended that households should have to use most drought tolerant animals and it is better to diversify their income such as small scale irrigation with the two rivers (Dawa and Genalle).

2. Both the government and NGOs should better to invest on research & technology.

3. Climate information should be considered as resource and must be combined with other extensions services to reduce climate related risk
4. The government should have to develop locale scale climate forecasting
5. More effort also needed to support pastoralists on climate issues and how it impacts on their livestock production system and to ensure better adaptation options.
6. Livestock counts should be conducted within time periods less than a year or with in a year period.
7. The government should develop appropriate policy and strategies, and local scale adaptation response and water management based on the nature of impact

The end

Thank you !!!

Question?