Effects of climate change and variability on forest dependent livelihoods: the case of Borana dry forest southern Ethiopia

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PRESENTATION OUTLINE

o **Introduction and rational for the study**
o **Objectives of the study**

o **Data collection methodology and analysis**
o **Results and discussion**

o **Conclusion and recommendations**

Introduction and rational for the study

- Tropical dry forests are one of the world's most vulnerable ecosystems (Ghose, 2020).

- In Africa, where 60% of rural populations are poor, dry forests make up an important resource base for subsistence and economic progress (Wubalem et al., 2020).

- Dry forest constitutes 80 percent (17,344,315 acres) of Ethiopia's total forest area (Atmadja et al., 2019).

- Borana dry forests are characterized by **a high diversity of plant species more than 377 species of plants** & home to 286 species of birds ;
the four endemic species *Ethiopian bushcrows, white-tailed swallows,*

  Prince Ruspoli's turacoes, & black-fronted spurfowls are endemic species found within the Borana forest (Teshome, 2015; Fenetahun and Fentahun , 2020).

Int cont.....

❖ Daniel (2010), forest cover of Borana decreased from 1.5% in 1986 to 1.2% in 2002, decreased by 6511 ha.

❖ *Juniperus procera* forests naturally found are currently declining due to extraction of wood for construction, fuel & drying up of patch of woodland tree species (Daniel, 2010, Mohammed, 2014; Sisay et al. 2020).

❖ As population increases in extremely changing climate nature, increment of livelihoods based on non-sustainable exploitation of natural resources especially the cutting down of woody species for charcoal production is being a worse for future of pastoral livelihoods in pastoral area leading to range land degradation (Doyo et al. 2018, Sara, 2020).

❖ Understanding of forest dependency & identifying alternative options for forest &tree resource dependent communities play a key role in sustainable management of forest resources under change climate. However, identifying alternative options for forest and tree resource dependent communities has received little attention.

Objectives of the study

A study was conducted with the aim of identifying and analyzing options for improving the livelihoods of forest dependent Borana pastoralists and agro-pastoralists in face of climate change and variability. Specifically:

- To investigate the effects of climate change on forest dependent livelihoods

- To assess the practices on livelihood options in response to climate change.

Study area Description

➢ The study was conducted in Yabello
& Arero districts of Borana Zone which
Lies between 4∘41′ – 5∘03′ N and 38∘ 17′ - 38∘ 33′ E.

➢ It is an arid & semi-arid area, with pockets of
sub-humid zones.

➢ Pastoralism & agro-pastoralism is the dominant
economic activity for the people.

➢ **It has four distinct seasons**: **spring**
(March to May)
is the main rainy season,

➢ **autumn:** (**September to November**),

➢ **winter** (**December to February**),
summer(June to August) are,
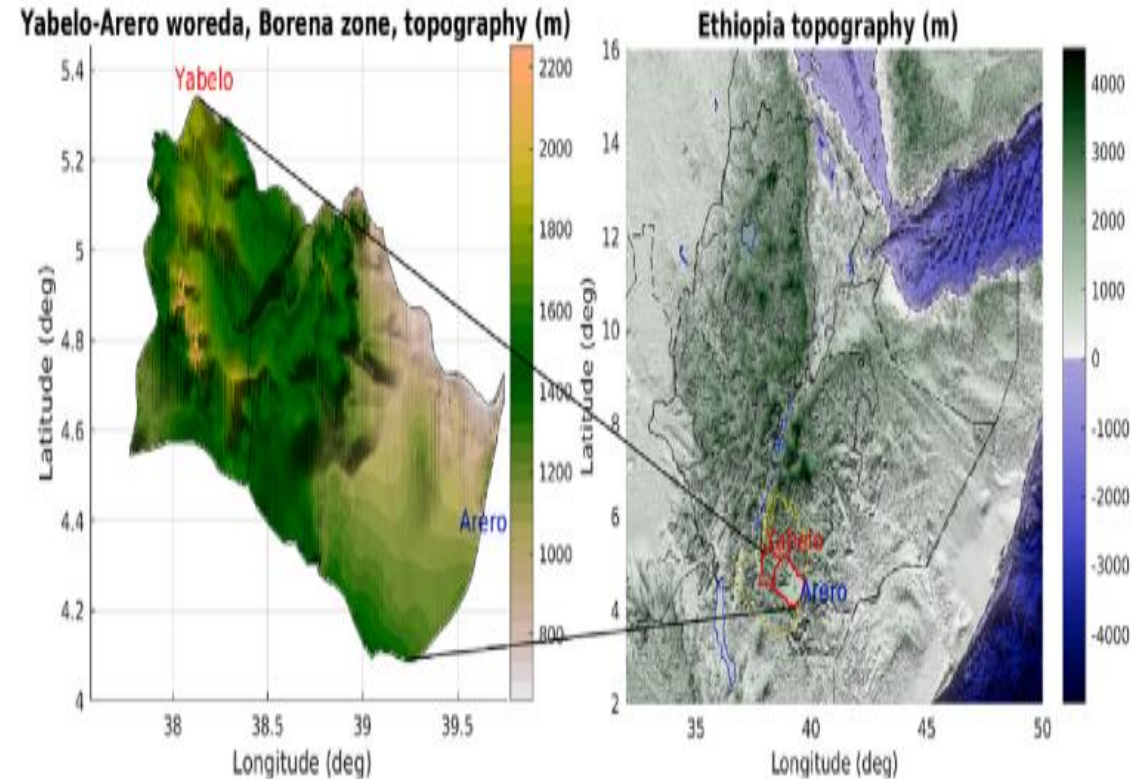cool dry, small rainy, and warm dry seaso
respectively.

Fig. 1. Map of the study area

o A mixed quantitative & qualitative research design involving various data collection tools was employed.

o Sample household size was determined following model of Yamane (2001) which assumes 50% (p= 0.5) variability & 95% confidence level with ±5% precision error.

$$\underline{N} /$$
$$1 + N(e)2$$

Meteorological data were analyzed using descriptive & econometric methods
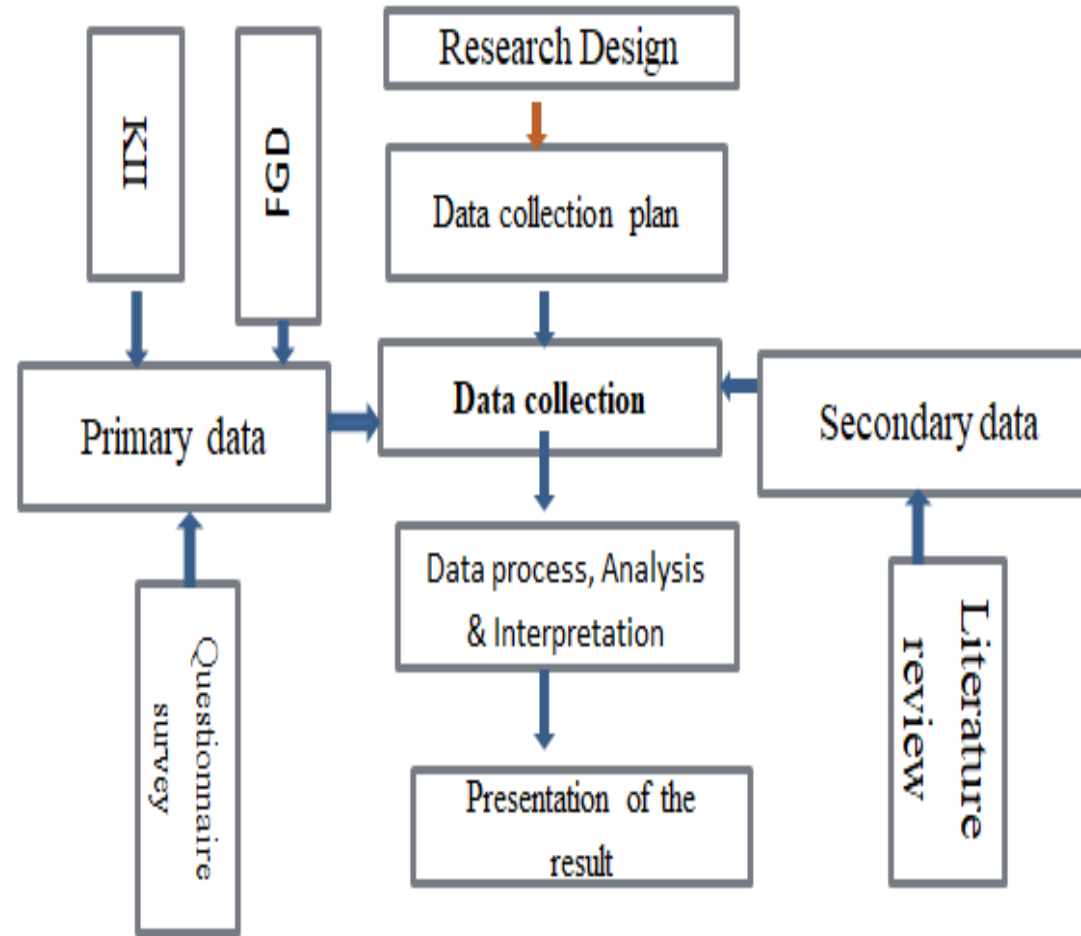

Figure 2. Schematic diagram of the study

RESULTS AND DISCUSSION

Trends of Climate Change and Variability

Trends of minimum and maximum temperature

- Persistently rise seasonal mean temperature was observed in spring by 0.047 (p = 0.0025), autumn by 0.047 (p = 0.0025), summer by 0.071 (p = 0000), and winter by 0.046 (0.0030) 0 c per year. The mean seasonal temperature increased statistically significantly. The summer mean seasonal temperature was increased faster than all seasons.

- The cold dry season (winter) proceeded by a high rate of main rainy season (spring) temperature increment could facilitate the loss of the rangeland moisture, pasture availability and palatability.

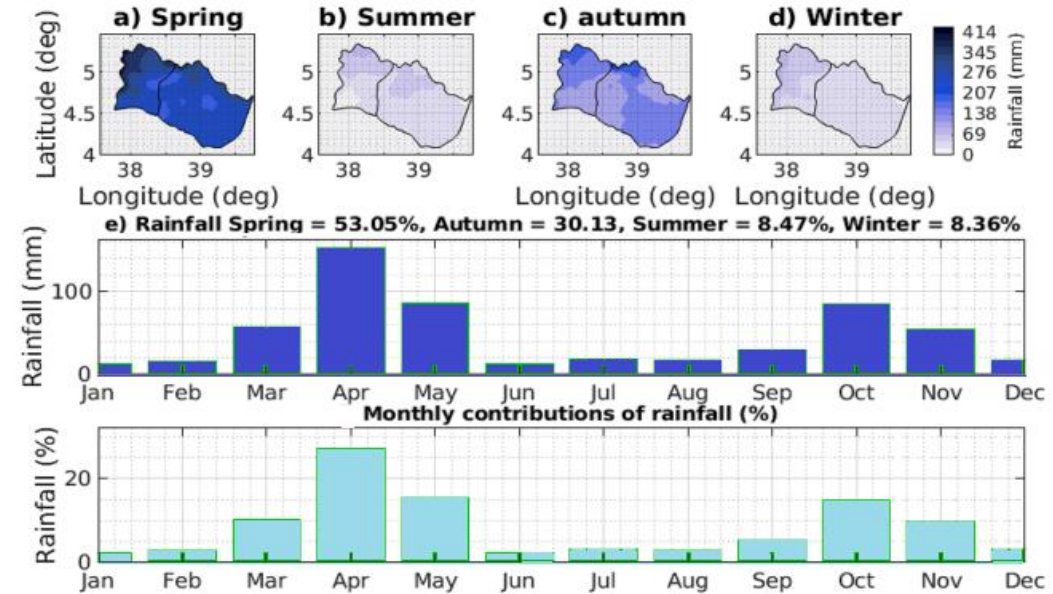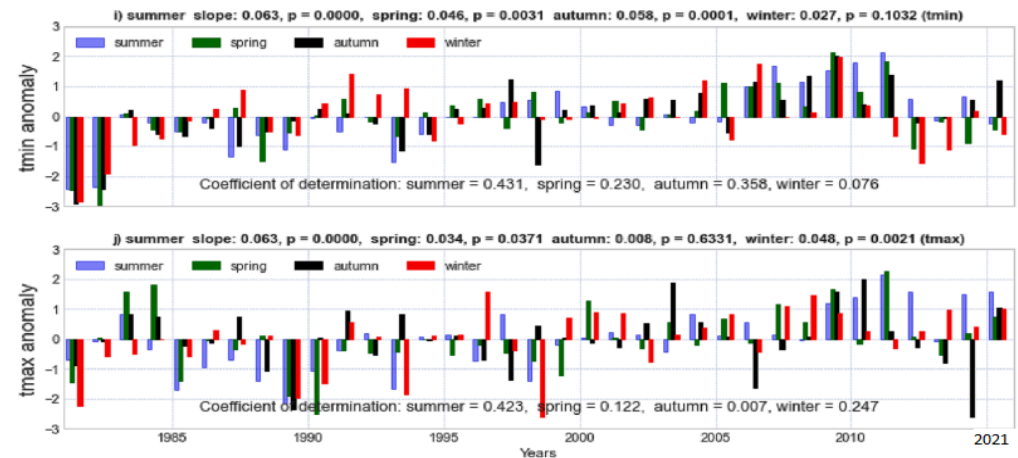- The maximum and minimum temperatures of Yabello and Arero districts were increasing significantly at p > 0.05 level

Figure 3. seasonal and annual cycles and percentile contribution of mean monthly rainfall of Yabello-Arero districts.

districts

- The trend shows statistically insignificant at $P > 0.05$ during all seasons.
- the study site has been experiencing a mix of increasing &decreasing seasonal rainfall trends in the study period.
- Spring &winter seasons' rainfall showed a decreasing trend,
- summer & autumn season rainfall was increasing for the last 40 years.
- The decline of main rainy season rainfall particularly coupled with rising temperature & rangeland degradation could be the causes of water & pasture scarcity.
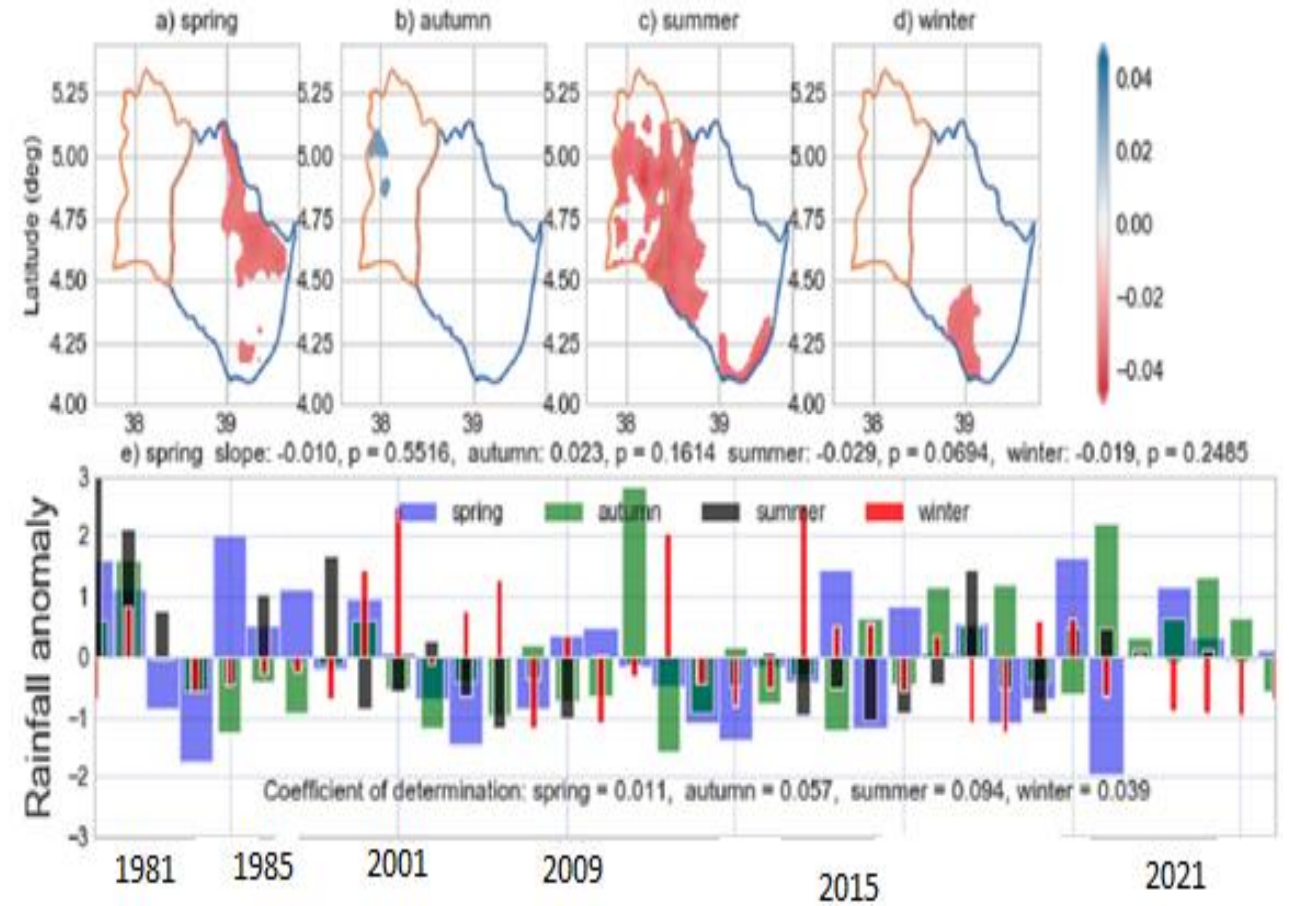

Figure 1. Seasonal & annual rainfall variability & trend in Yabello and Arero districts.

Table 1. Perceptions of climate variability in the past 10 to2 0years

Climatic parameter	Respondent perception(Respondent opinion expressed as percentage				
	Increase	**decrease**	**No change**	**No idea**	**Total**
Temperature (summer)	85	10	2	3	100
Temperature(Winter)	56	34	4	6	100
Rainfall intensity	68	16	11	5	100
Rainfall frequency	16	70	10	4	100
Drought length and severity	84	12	4	0	100
Drought frequency	88	8	3	1	100

Perceived effects of climate variability

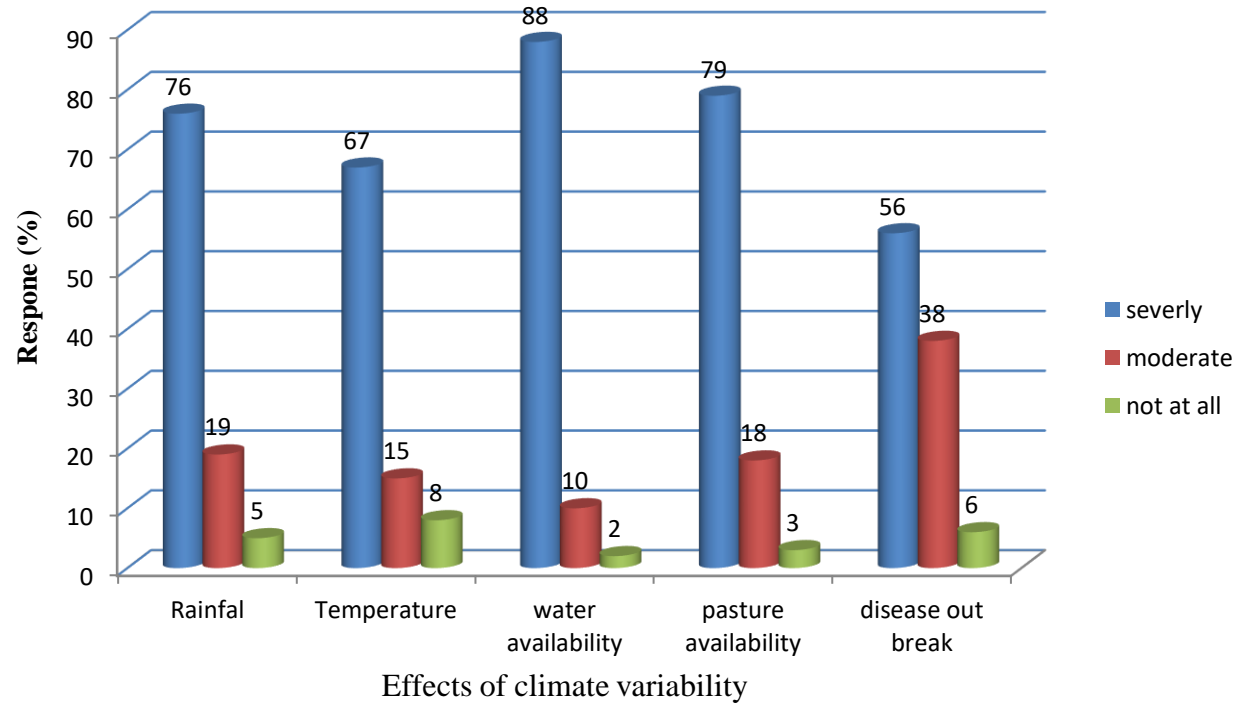**Figure 4. Level of effects of climate variability (Own survey result, 2023)**

Effects of climate change and variability on livelihoods options

Table 2. Effects of climate variability on crop production

Effects on crops	Percentage
Impacts of climate variability on crop production	
Reduced yields of common crops	65
Increased pests and disease attacks	35
Total	**100**
Degree of impacts of climate variability on crop yields	
High	78
moderate	17
Insignificant	5
Total	100
Most affected crops	
Maize	57
Haricoat beans	23
Teff	7
Wheat	13
Total	100
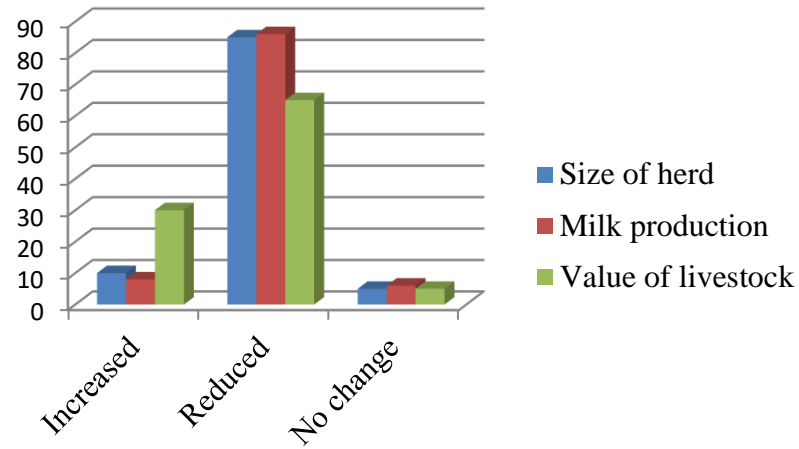
Figure.5 Effects of climate variability on livestock

According to a recent report, Borana pastoralist has completely lost their livestock to prolonged drought. **Above 2.3 million heads of livestock have** died due to prolonged drought, which left above 67,000 households with no livestock according to the Rapid Assessment report

Photo: Internal displacement of pastoralist& agro-pastoralist due to drought in 2023

about 68,866 households (372,193 individuals) were internally displaced & settled at different locations in the zone

Burchell's Zebra dead of hunger in Borana National park,2 023

Photo: Bodies of dead livestock collected and buried together,2023

Table 3. Level of awareness to climate change

Districts	High level	Moderate level	Low level	No idea
Arero	8.5%	31.2%	46.2%	14.1%
Yabello	11.8%	52%	33.9%	2.3%

Source of climate change information

- Government
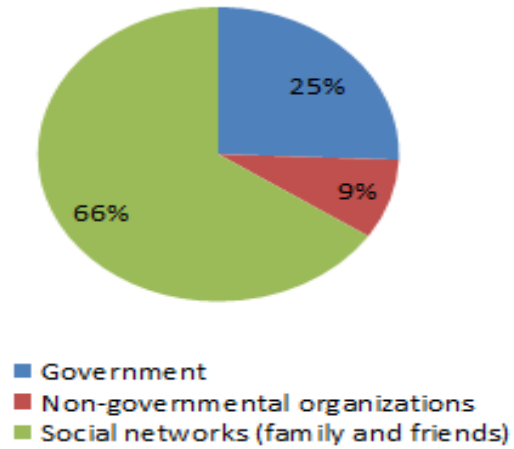- Non-governmental organizations
- Social networks (family and friends)

Figure 6. Source of climate change information (Own survey result,2023

Forest degradation and vulnerability

Table 4. Perceived causes of the decline and scarcity of forest resource

Causes	Percentage
Climatic causes	
Reduced/erratic rainfall	45
Prolonged drought	25
Invasive species	3
Anthropogenic causes	
Deforestation	22
Overgrazing	4
High population growth	6
Weakening of traditional governance	8
Expansion of cultivation and private enclosures (kalo)	3

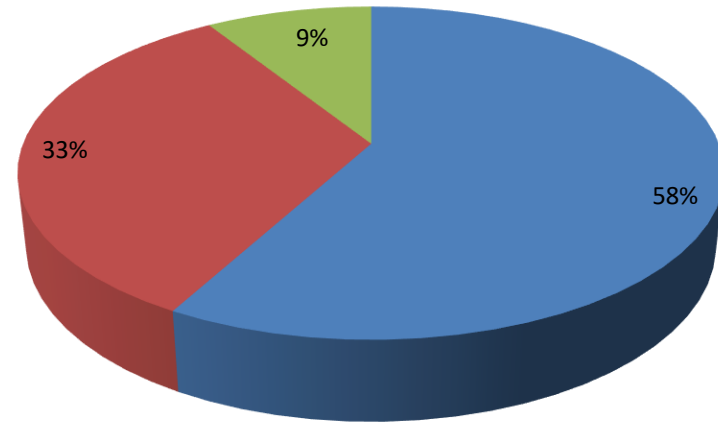**Observation on supply of forest resources**

■ Decreasing   ■ Increasing   ■ No change

Figure 7. Observations on supply of forest resources on past five years(Own survey,2023)

Forest-based livelihood dependency

- The pastoralist & agro-pastoral communities regularly use forest products for subsistence and income generation.

- Out of 286 interview households, 109 households (85.7%) were dependent and 41(14.3) were not dependent on forest and tree resources.

- In both study areas dry forest livelihood dependency was mostly for housed basic requirements such as fuel wood, fodder, charcoal and roof materials and as a source of household income through non-timber forest products.

- Dry forest contributes an average of 22.6% to household income.

- 70% fuel wood is the main source of cooking for the people who are close to the reserve forest (Adam & Tayeb, 2014; Rahman et al., 2017; Ali et al., 2020).
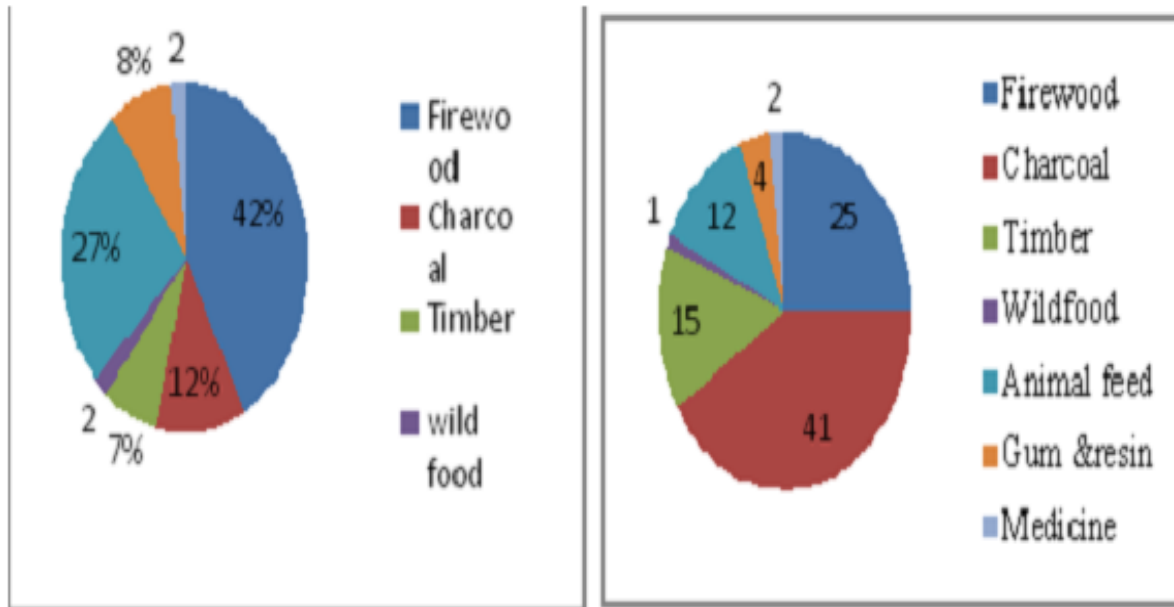
Figure 8 a. Arero district   b. Yabello districts

Purposes of Forest Resource Collection

Alternative options for reducing forest dependency

- According to the respondents perceptions (**68%) using alternative cooking system** could reduce forest resource dependency
- followed by economic support (65%),
- animal fattening (28%) and poultry production (22%) respectively.
- Generally, Supplementary feeding, and ecotourism were mentioned as an alternative options to reduce forest resource dependency.
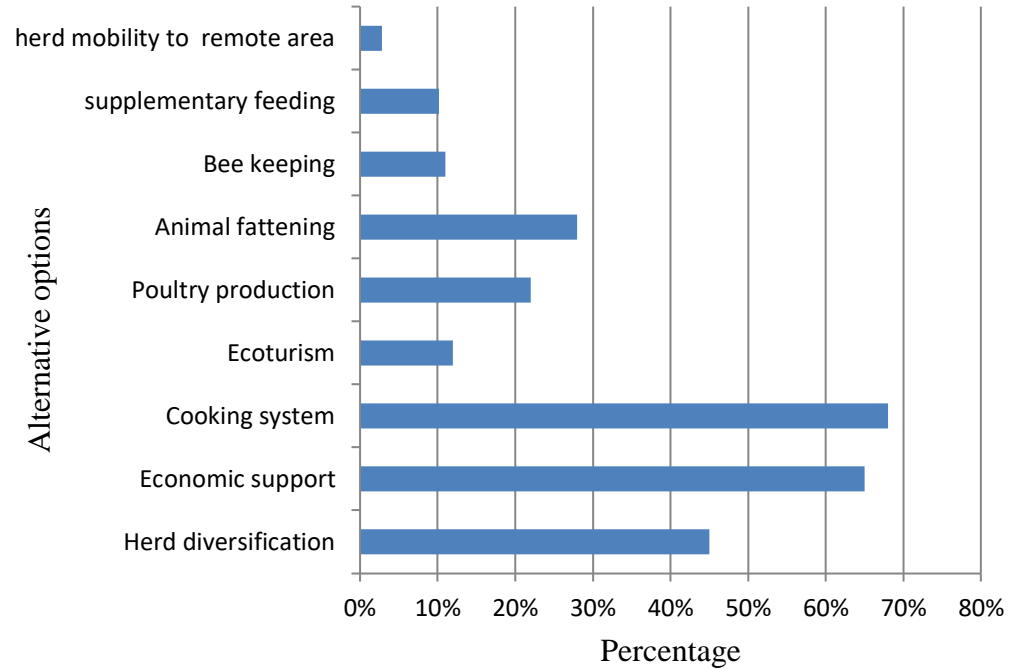

Figure 8. Alternative options, people's perception (Own survey result, 2023)

CONCLUSION AND RECOMMENDATIONS

➤ The study showed that pastoralists were shifted their livelihoods from poor pastoralism to mixed livelihood strategies to overcome the impacts of climate change.

➤ There is a high level of forest dependence on forest & tree resources by pastoralists & agro-pastoralist households.

➤ Dry forests are important to the livelihoods of pastoralist & agro-pastoralists household income.

➤ Forest resources in dry forest ecosystem contribute an average of 22.6 of the total annual household income.

- The livelihood of forest-dependent communities in many developing countries is very vulnerable to the impacts of climate change due to their high dependence on ecosystem services and their low capacity to reduce climate-related impacts.

- This study aims to identify and analyze alternative options to improve the livelihoods of forest dependent of Borana communities under changing climate.

- Increasing trend of climate change, particularly in temperature & erratic rainfall; Anthropogenic activities like deforestation could be the reasons for decrease in natural resources.

- Among the anthropogenic activities, illegal harvesting and over exploitation of forest and forest products, weakening of traditional governance & population growth are the main driving forces.

- Over dependency on forest resources, mainly for cooking, building houses, and food, is creating tremendous environmental impacts globally.
- The study shows some alternative options based on people's perception to reduce forest resource dependency within Borana community.

- Thus, to maintain and improve the livelihoods of people dependent on forest and tree resources the following strategies are suggested

o Involving the local communities in the rehabilitation(green legacy)programs within rehabilitation areas;

o Regulating the collection of non-timber forest products so that it would not threaten the ecological balance of the forests;

o Developing ecotourism; involving in the REDD+ program in dry forest of Borana;

o Strengthening community social capital (social organization) and sustainable forest management to generate additional income from forest products and services ;

o Capacity building & financial support to communities working to improve forest conservation,forest management &implementation of innovative forestry production techniques.

o Providing sufficient energy source which are environmental friendly

ACKNOWLEDGMENTS