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**Life and Earth Sciences Institute
University of Ibadan**



An Assessment of Mau Forest Cover, Climate Change and Impacts of Evictions on Livelihoods in Rift-Valley, Kenya

by

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PhD. Environmental Management

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PAN African University

**Life and Earth Sciences Institute
University of Ibadan**



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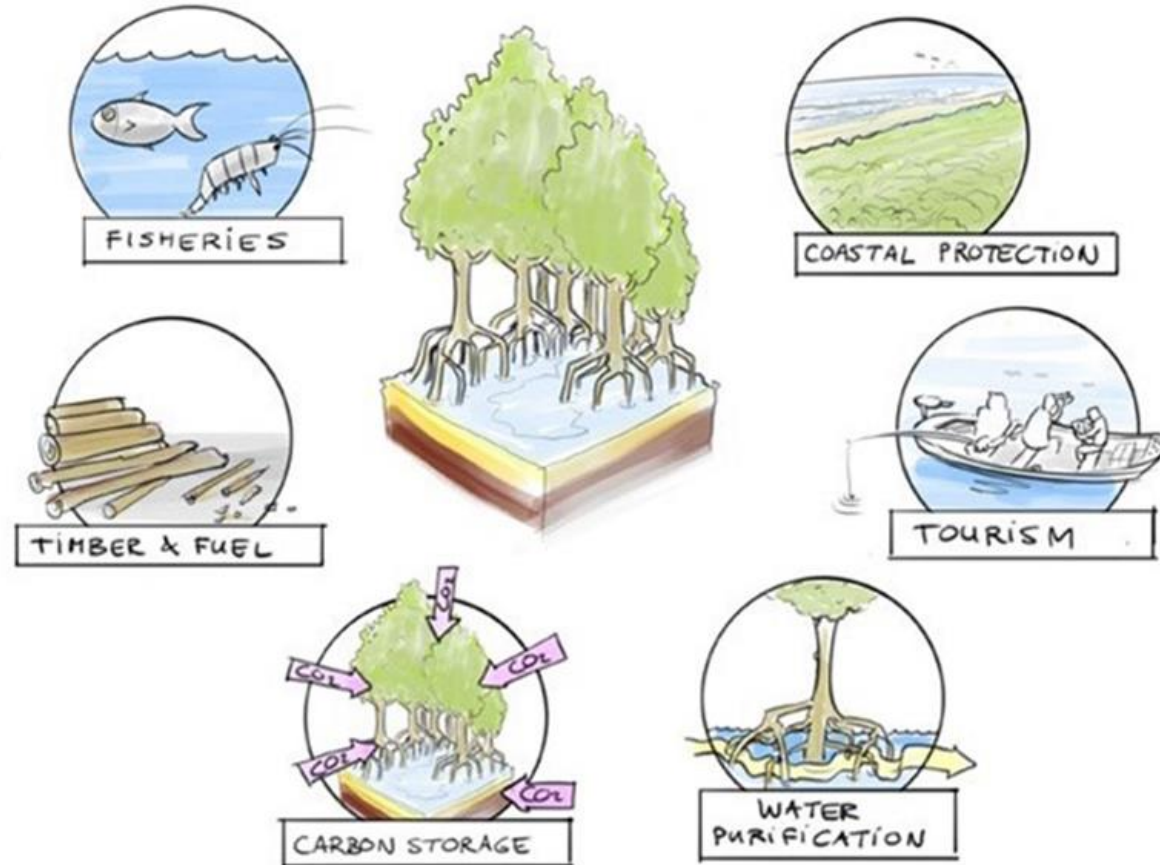
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1. Introduction

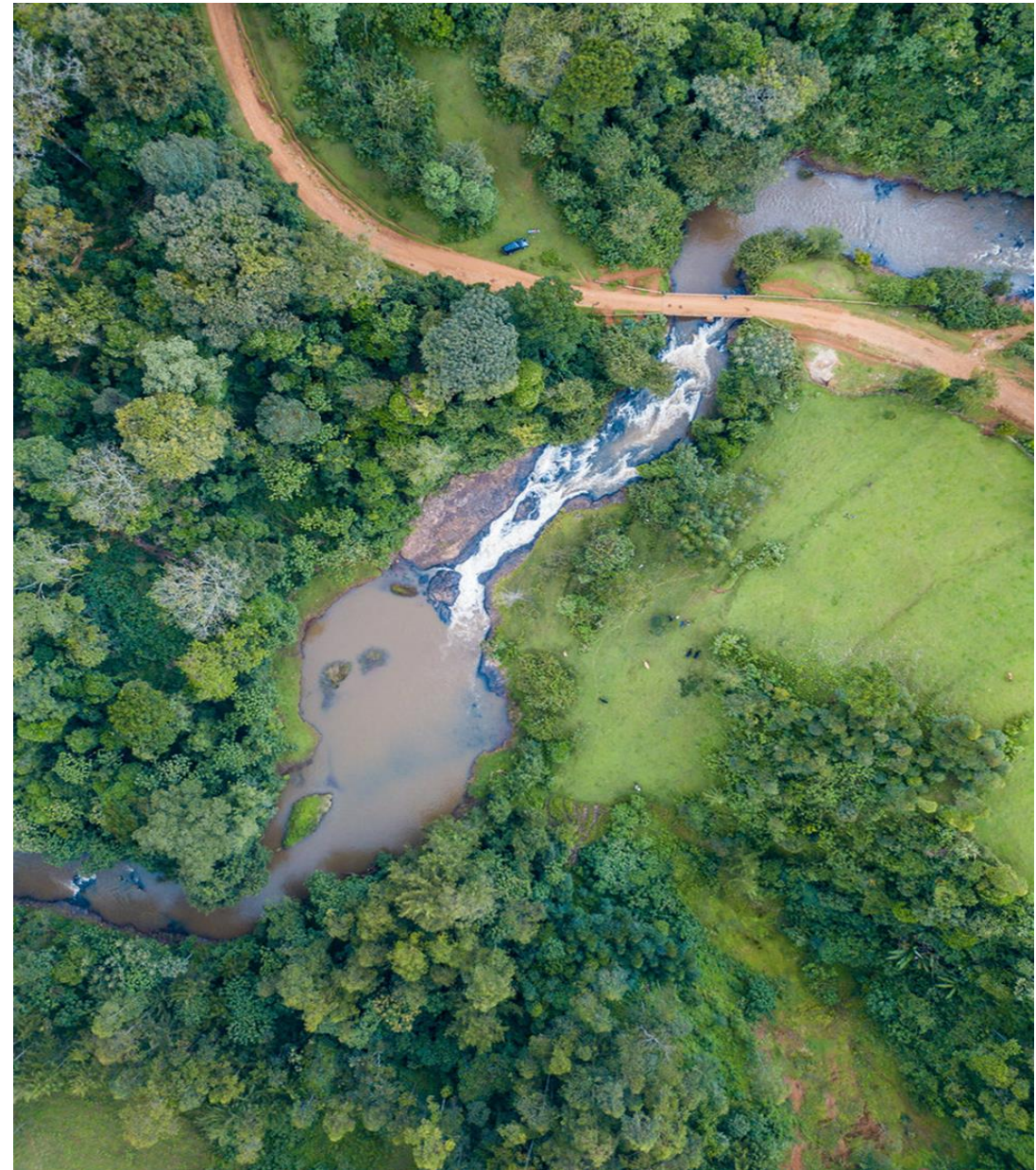
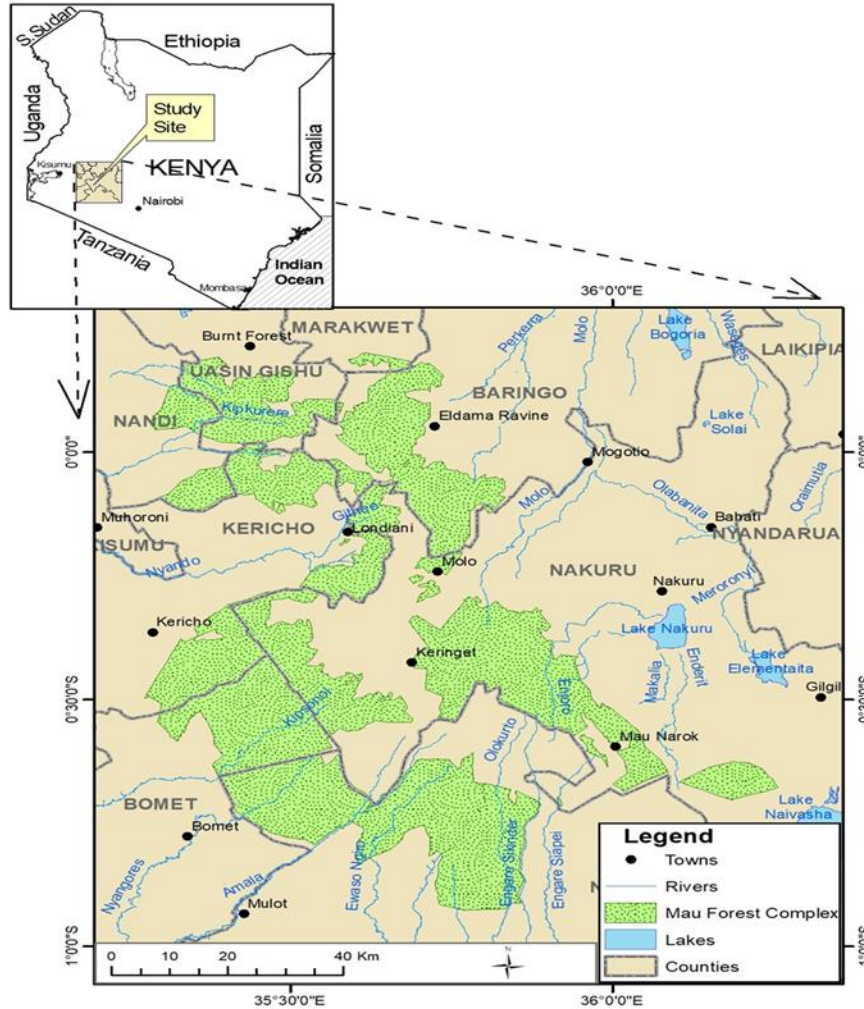
- Forests play a major role environmentally, economically and socially
- Despite this role, forests face deforestation and degradation





1. Introduction

- In East Africa, forested mountains are frequently referred to as 'water towers.'
- The Mau Forest Complex, the largest montane forest in East Africa, is one of such water towers





1. Introduction

To save the ecosystem from further destruction and collapse, evictions were carried out the between 2002 and 2006 and also in 2018

- There is limited information in Kenya on the impacts of sudden land alienation on settlers evicted from forests.





2. Objectives

The aim of this thesis research was to assess the trends of Mau Forest cover, local climate change and the impacts of evictions on livelihoods in Rift Valley Kenya.

The specific objectives were to:

1. Assess the trend and land use land cover changes that have taken place between 1984 and 2020 in Mau Forest
2. Assess the trend in local climate in terms of rainfall and temperature patterns from 1984 to 2020 in the study area
3. Establish the relationship between the changes in Mau Forest cover and local climate
4. Investigate the factors that led to people settling in the Mau Forest, Kenya
5. Assess the impacts of the evictions on the livelihoods in Rift Valley, Kenya



Rationale

- Evaluating the status of the forest and livelihoods acts as a measure on whether the country is heading in the right direction so far as regards to SDG 1; of ending poverty, SDG 3 on good health and wellbeing and SDG15; protecting and promoting sustainable use of terrestrial ecosystems including forests.
- It will contribute to the realization of Vision 2030; Kenya's long-term planning blueprint which pursues the conservation of water towers as a flagship project
- The research findings will be useful to forest managers in Kenya as they will contribute to policy and regulations development and reviews. The empirical evidence from this study will show the state of the forest as well as livelihood before and after eviction, therefore, bringing important reflections of progress that has been made so far in striking a balance between environmental conservation and wellbeing.



3. Methodology

Research Design

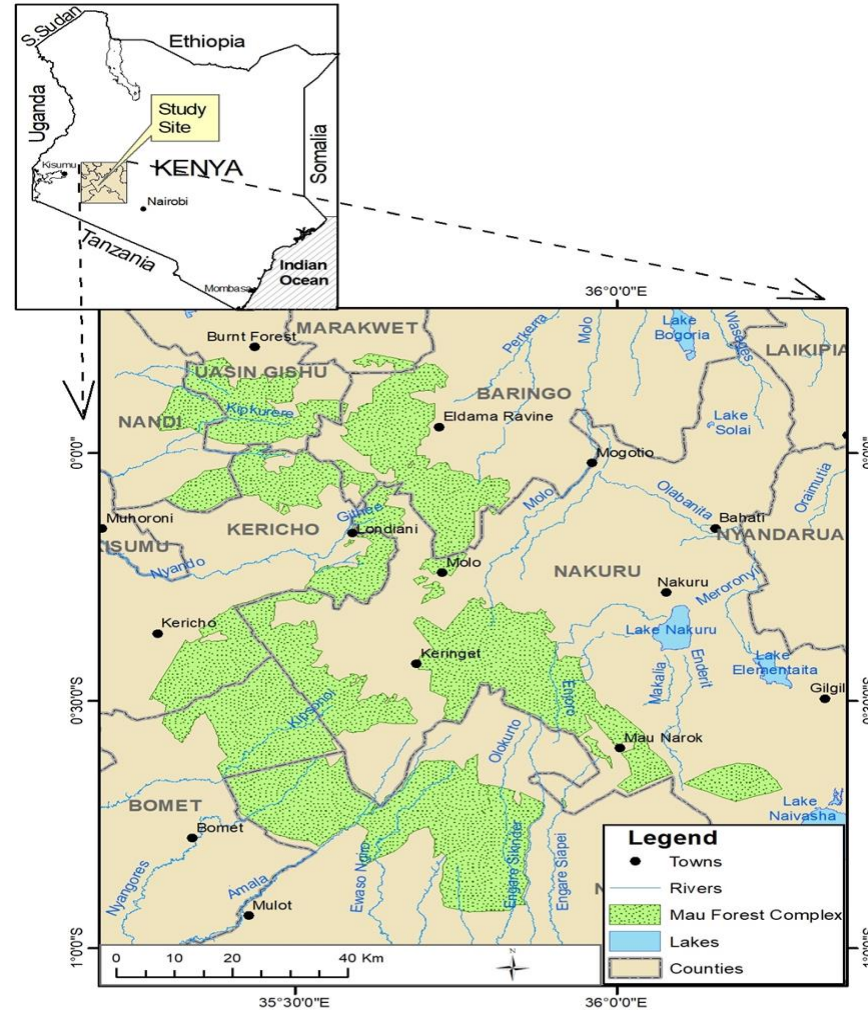
- Mixed methods research design was adopted for this study.
- The qualitative and quantitative data collection methods were used

Sampling Procedure

- Purposive and Snowball sampling. Purposive sampling was used to select the study areas as places where the evictees settled or were resettled.
- Snowball sampling was used to recruit participants into the study.
- A sample of 321 households, two focus group discussions and seven key informants were recruited into this study



Map of Study Area



Mau Forest Complex, Kenya



Data Collection

- i. Key informant interviews**
- ii. Household questionnaires**
- iii. Participant Observation**
- iv. Focus Group Discussions**
- v. Document Review**
- vi. Climate data**
- vii. Existing map of Mau Forest**

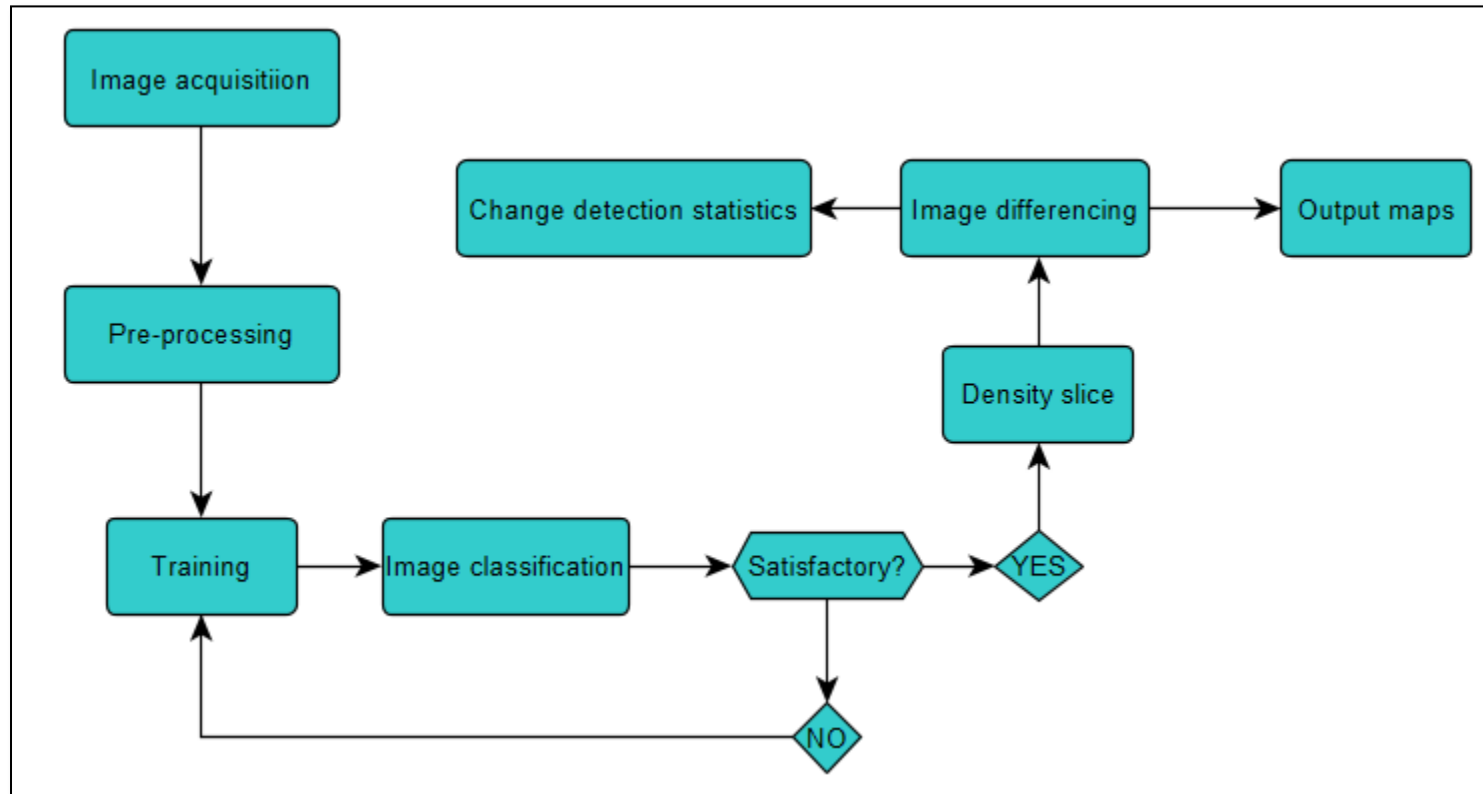
Data model	Data type	Data source	Date
Landsat 5 & 7	Raster	https://earthexplorer.usgs.gov/	1984, 1995 & 2008
Landsat 8	Raster	Google Earth Engine	2020
Mau forest boundary	Vector	KFS	2020
Climate data (rainfall and temperature)	Raster	Kenya Meteorological Department	1984-2020





Methods of Data Analysis

Objective 1: Assess the trend and land use land cover changes that have taken place between 1984 and 2020 in Mau Forest

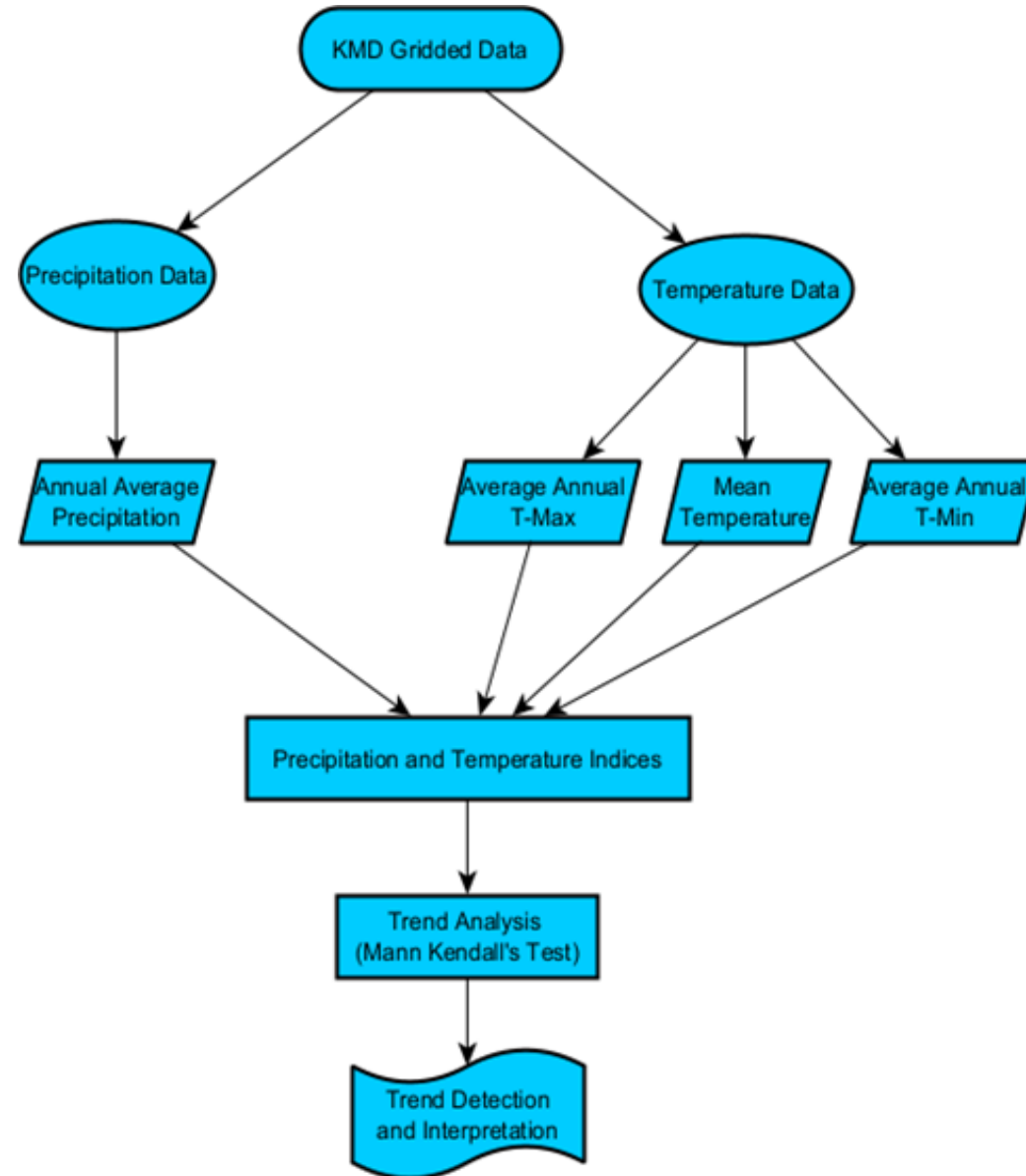


Land cover classification flowchart



Data Analysis

Objective 2: Assess the trend in local climate in terms of rainfall and temperature patterns from 1984 to 2020 in the study area



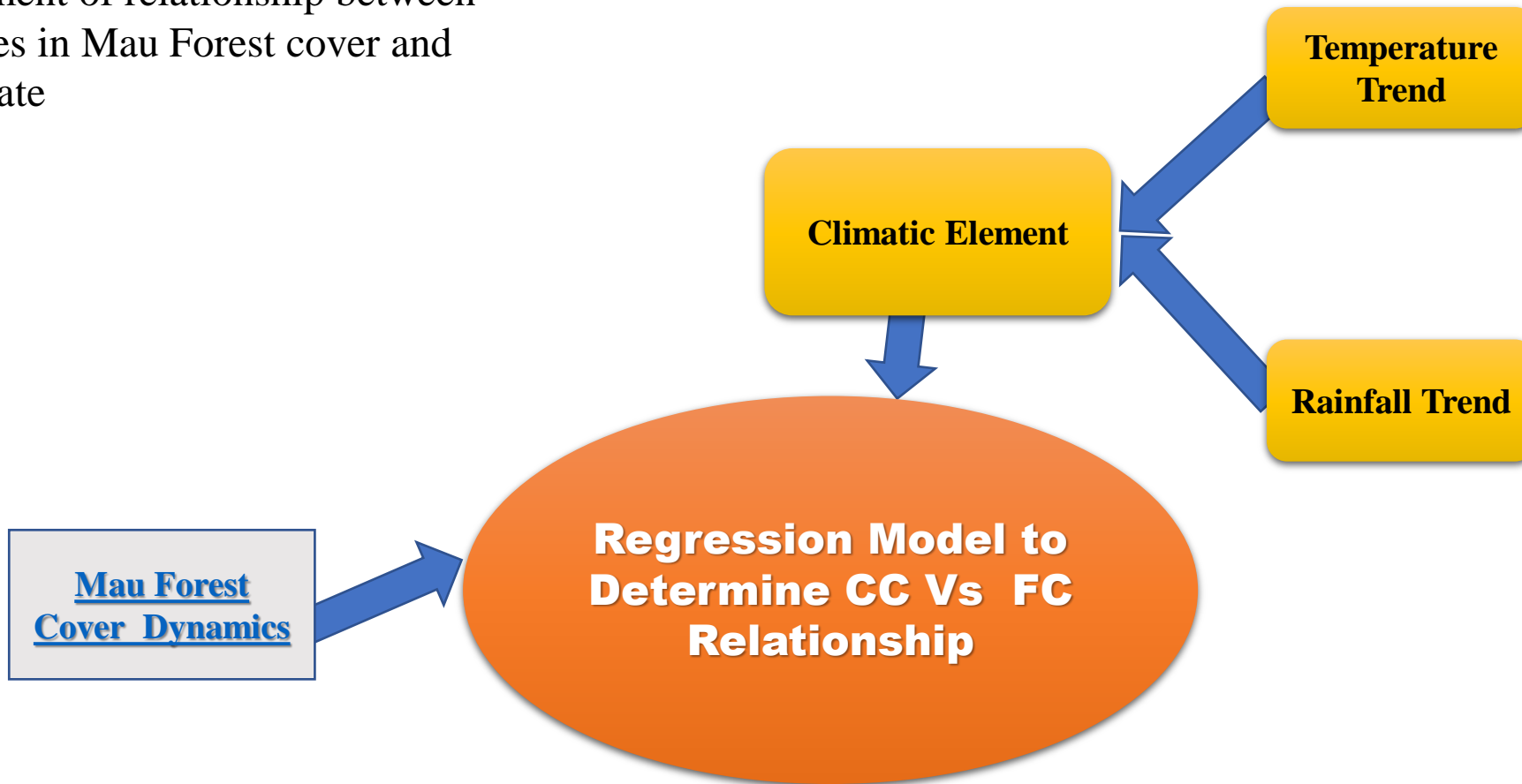
Climatic trend analysis flowchart



Data Analysis

Objective 3:

Establishment of relationship between the changes in Mau Forest cover and local climate





Data Analysis

Objective 4: Investigation of factors that led to people settling in the Mau Forest, Kenya

Logit Regression

The logit model for this objective is expressed as:

$$\log(p/1-p) = b_0 + b_1*x_1 + b_2*x_2 + b_3*x_3.....b_n*x_n \quad (3.1)$$

where P= Motivation for settling in the Mau Forest (dependent variable)

b= regression parameters

x= factors that led to settling in Mau Forest (independent variables)

Expressed in terms of the variables used in this study, the logistic regression equation is

$$\log(p/1-p) = b_0 + b_1(LAV) + b_2(LAF) + b_3(AP)+b_4(LS)+b_5(GBG)+b_6(PO)$$



Data Analysis

Objective 5:

Assessment of the impacts of the evictions on the people's livelihoods

Descriptive statistics such as frequency counts and percentages were used to analyze data. Results were presented in;

- i. Graphs
- ii. Charts
- iii. Tables

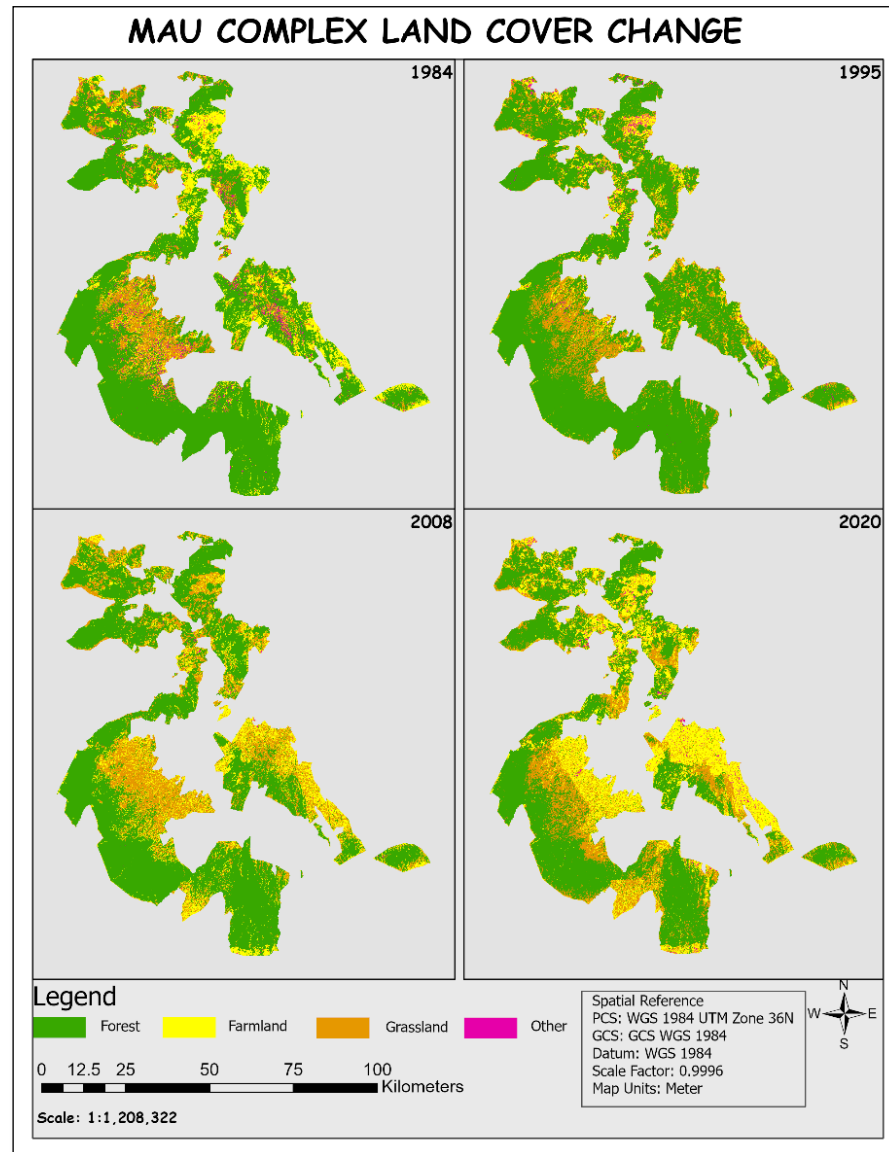
Narrative analysis was used to assess qualitative data. Sustainable livelihood approach was used to guide the assessment of impacts of evictions on livelihoods



4. Findings

Objective 1: Land Use

- Four land cover classes were selected and coded as 1-Forest, 2-Farmland, 3- Grassland and 4- Other, whereby other land cover represented waterbodies, built-up areas and bare land.

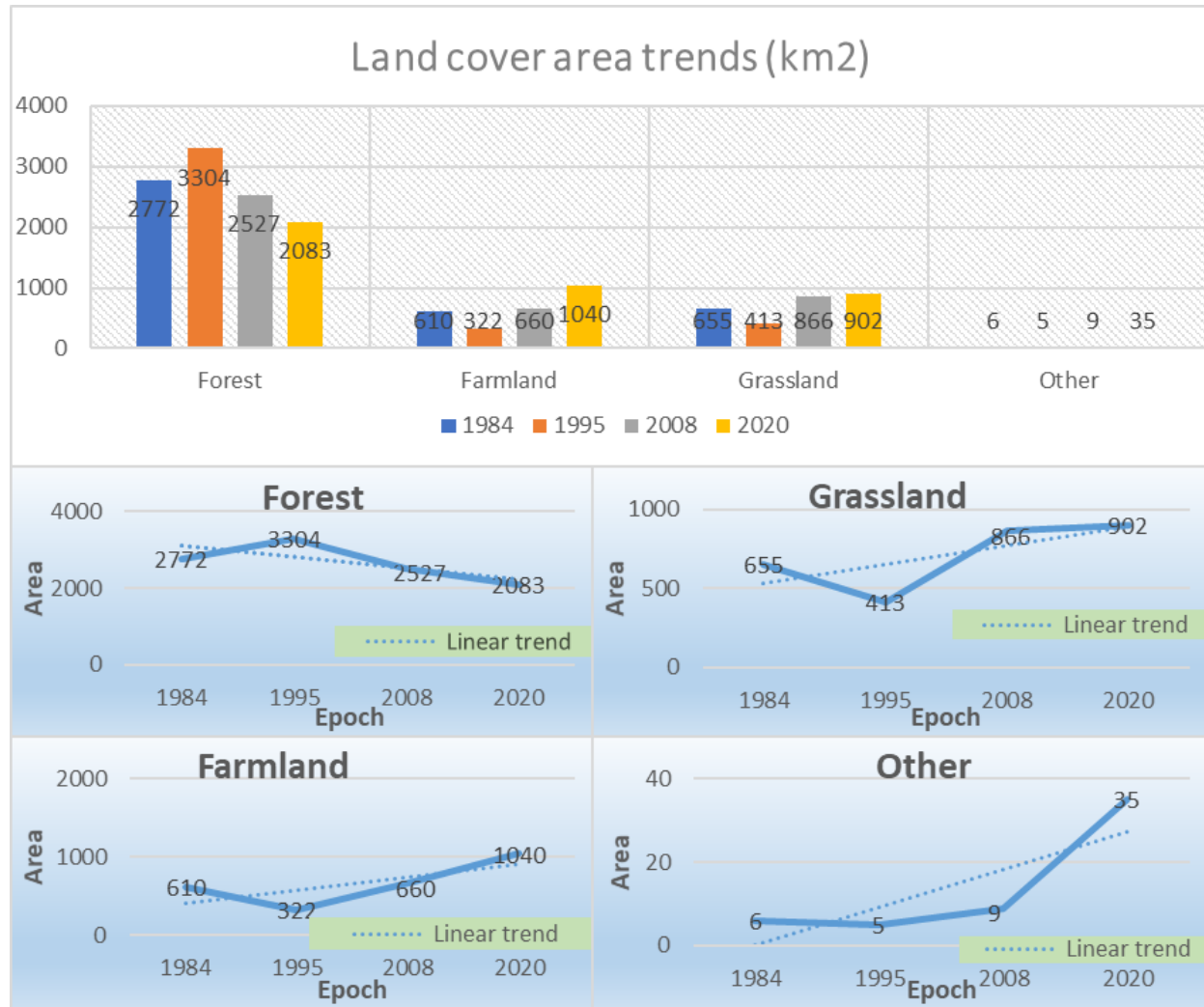




4. Findings

- The study established a decline of 25.2% of forest cover amounting to approximately 699 km² of tree cover.
- The total area under farmland and grassland was found to be approximately 669 km², aggregating to 96% of the total area where tree cover was lost and the remaining 4% covering other land.

- Trends in forest cover from 1984 to 2020





Findings

- The declining forest cover trend was mostly fueled by an increasing demand for agricultural land
- Plate. 1 depicts the different land uses in the Mau Forest

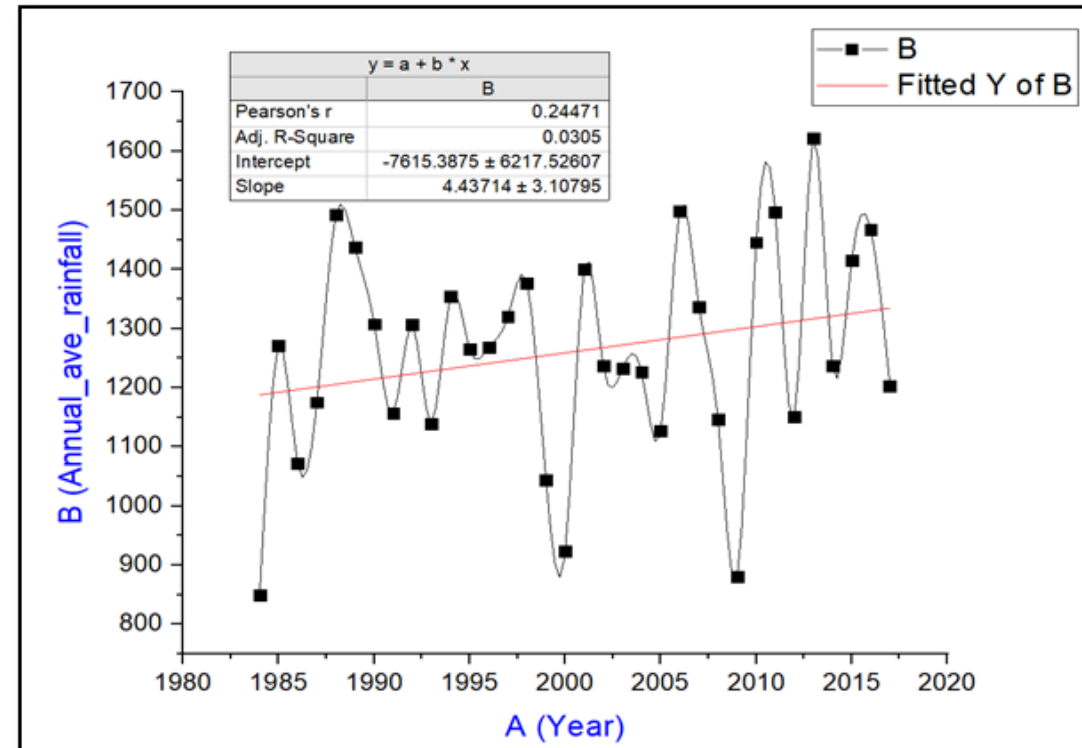




4. Findings

Objective 2: Rainfall Trend

- The study established a slight trend of increasing rainfall across the study period despite decreasing forest cover but the adjusted R-Square value of 0.0305 implies little significance of increasing rainfall with time.

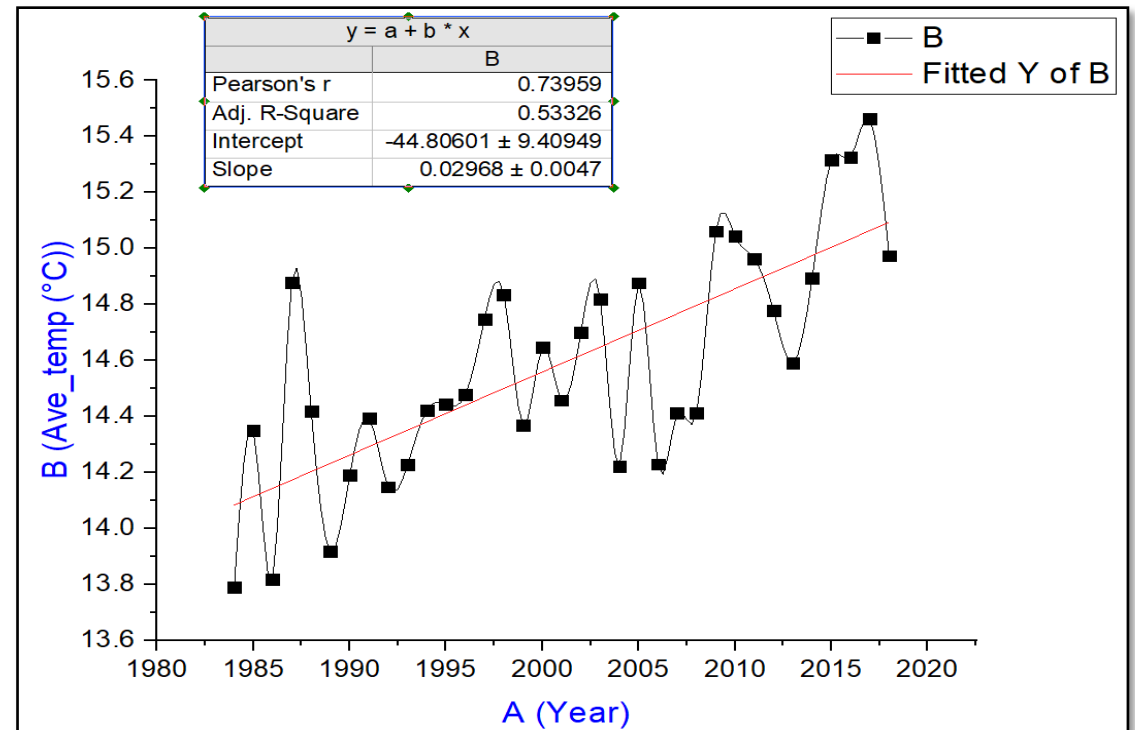




4. Findings

Objective 2: Temperature Trend

- There was a steady increase in temperature from the base year 1984 to 2020 by approximately 2 °C.
- This value is below the threshold value $z < 0.005$ hence we can conclude that there exists a trend in average annual temperature, which in this study's case was increasing against time.

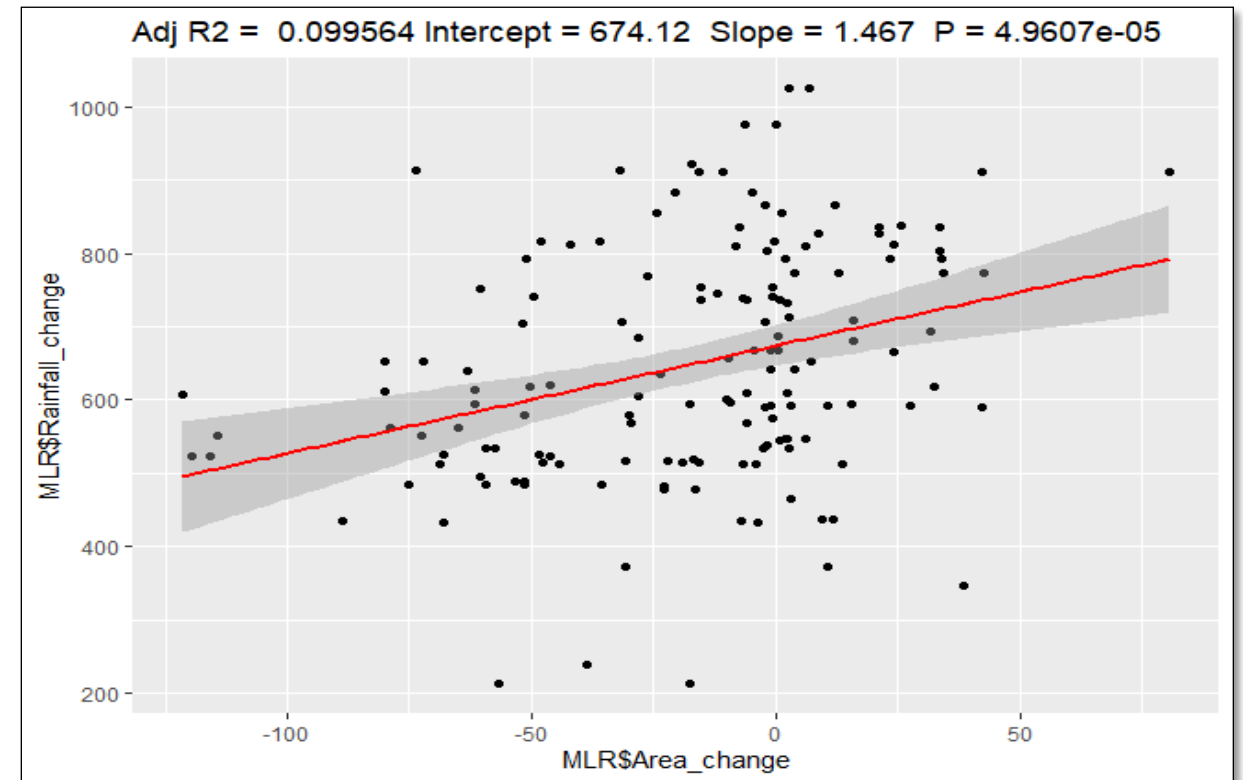




Objective 3. Relationship between forest cover change and local climate change

Forest cover and annual rainfall correlation

- The resultant adjusted R squared value of 0.099564 indicates that changes in forest cover directly affected the amount of rainfall
- The p value score was $4.9607e^{-05}$ suggesting that changes in forest cover significantly affected precipitation.

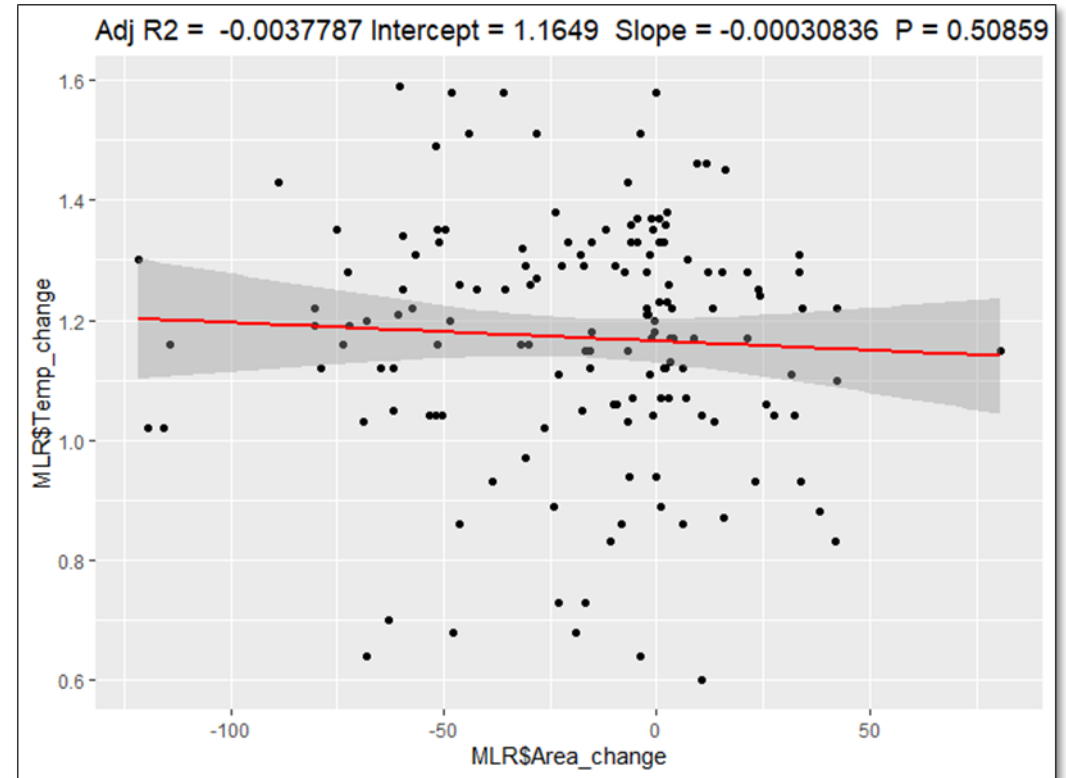




Objective 3. Relationship between forest cover change and local climate change

Forest cover and average temperature change correlation

- The figure depicts no relationship between gradual temperature change and forest area change with a negative adjusted r squared value of -0.00378 showing no evidence of influence.
- A 0.50859 p value score suggested that area change was not a significant factor that led to increase in temperature across the study period.





4. Findings

Objective 4. Factors That Influenced the Respondents to Settle in Mau Forest

i. Land scarcity (odds ratio 2.464). Descriptive statistics revealed that 35.4% of the respondents were landless and another 35.4% owned less than an acre piece of land

*My family had small piece of land and I have 5 brothers so sharing that piece of land among ourselves of which each get a smaller share which made me move away and settle in the forest”
respondent no 77 Simotwet village, Eastern Mau, settled 1998 evicted 2012*

ii. Land affordability (odds ratio 1.002). With an increase in land affordability, the motivation to settle in the forest increased.

“My father refused to give me my share in his land to live and therefore I decided to move and buy land from a relative who lived in the forest” respondent no 3, Sigaon village, Eastern Mau, settled 2001 evicted 2012.

iii. Land availability (odds ratio 2.001). This decision is largely attributed to weak enforcement of forest laws and policies which make it easier for an individual to encroach the forest.

One of my relatives went to live in the forest thereafter come to inform me that there was availability of land in the forest” respondent no 5, Soet village, Eastern Mau, settled 2000 evicted 2012.



4. Findings

Objective 5: Impacts of the evictions on the people's livelihoods

Livelihood Capital	Before Eviction	After Eviction
Physical	<ul style="list-style-type: none"> • Good Housing • Good sanitation • Access to schools 	<ul style="list-style-type: none"> • Loss of shelter • Loss of access to schools • Increased distance to water points • Living in overcrowded spaces
Financial	<ul style="list-style-type: none"> • Availability of income 	<ul style="list-style-type: none"> • Loss of income from agricultural produce and farm animals • Loss of savings • Businesses lost
Social	<ul style="list-style-type: none"> • Social cohesion among the community members • Existing self-help groups 	<ul style="list-style-type: none"> • Self-help groups and support networks lost
Human	<ul style="list-style-type: none"> • Certainty of the future • Steady food supply 	<ul style="list-style-type: none"> • Unsteady supply of food products • Increased expenses in buying food • Reduced food consumption/meals per day
Natural	<ul style="list-style-type: none"> • Land availability 	<ul style="list-style-type: none"> • Loss of land • Insecurity of land tenure



Some of the evicted households



Parents collecting remains of construction materials after school demolition



Nº 08079

OFFICE OF THE PRESIDENT

DISTRICT COMMISSIONER'S OFFICE
NAKURU

ALLOCATION OF LAND

This is to certify that Mr./Mrs. KIPSIKE A. KILEL

I/D No. 427792167

of P.O. Box

has been allocated plot No. 08079

at BOUNDARY STONE

comprising acres or thereabouts.

[Signature]
District Commissioner
Nakuru District

[Signature]
Provincial
Forest Officer

[Fingerprint]
Allottee
PROVINCIAL FOREST OFFICE
R. V. P. NAKURU.

Form 11/95

A land allotment certificate of one of the evictees



5. Conclusion

The results and discussion provide a broad context of the condition of the forest and the situation of the settlers of the Mau Forest before and after eviction.

- Land scarcity and land affordability were more likely to drive people to settle into the Mau Forest.
- The evictions have caused impoverishments
- The trend in forest cover has been declining
- The declining forest cover had an impact on local climate change. The changes in forest cover have little impact on the variability of temperature whereas rainfall is highly influenced by forest cover change.
- The link between forest cover and evictions



6. Recommendations

1. Forest management authorities should involve forest-dependent communities, who are the main stakeholders, in coming up with intervention measures and implementation strategies in order to promote sustainable use of the forest resources and protect the forest from further loss
2. There is a need for forest management to develop specific policies and strategies, with full involvement of the community members, pertaining to the establishment of woodlots, awareness campaigns and incorporation of climate-smart agriculture in farms. This will act as mitigation as well as adaptation measures against the impacts of climate change.
3. The community leaders of the evictees should move forward discussions within the community on a model of sustainable forest management that benefits the community while not endangering the forest resources.
4. The government should address the issues leading to a decline in forest cover while dealing with local climate change. For instance, embracing good reforestation practices, protecting existing forests, working together with the local communities and planting of a wide variety of appropriate tree species



7. Policy Implications

1. The forestry policymakers should consider putting in place concrete national guidelines, programmes and policies for forest evictions that incorporate resettlement plans that not only protect the forest but also serve to protect the livelihoods of the affected persons.
2. In light of the various contributing factors to illegal forest settlement, there is a need to streamline effective policies that will yield sustainable solutions. In the forest conservation efforts, we suggest the implementation of participatory policies and laws that support local communities and institutions in the management of forests.
3. Forest managers and policy makers should promote and popularize non-timber forest products so that the communities are not stressed during the harsh seasons. This could help diversify livelihoods, therefore, coping with changes in local climate.
4. The government should provide an opportunity for open consultations with the affected households and avail the information regarding the eviction plans within a reasonable timeframe. This is to ensure that the evicted persons do not feel that they have been unfairly targeted by their own government and this way there will be no resentments as there will be no loss of property or people being left without shelter.



ACKNOWLEDGEMENTS

- This work was supported by the African Forest Forum (AFF) under a research fellowship on assessment of trends of impacts of climate change on forest and tree-resources and coping mechanisms in Africa
- Research advisors



Thank You