# Assessing climatic constraints under the past and present agriculture in the northern Ethiopia

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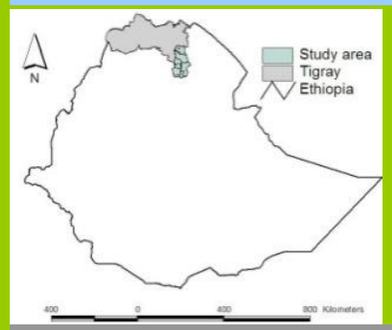
## Introduction

- Rainfall variability has been reported to have significant effect on the country's economy
- However, little has been done to develop techniques for assessing drought risk and to determine how and which variables are related to crop failure circumstances in the northern Ethiopia




## Objectives:

- To develop a simpler technique that can be used to assess the occurrence of past drought (crop failure) years easily and adequately for northern Ethiopia.
- To elucidate the main causes of crop failures

## Materials and methods

- Long-term climate data of four stations in the northern Ethiopia was analyzed in combination with information from local farmers and documented materials
- Moisture deficit and the crop-growing risks and suitability of rain-fed agriculture were evaluated on the basis of relationships between dekadal effective rainfall and reference evapotranspiration as: A wet dekad when the ratio of $D_{Eff}/D_{ETo} > 0.5$ while a dry dekad occur when the ratio of $D_{Eff}/D_{ETo} < 0.5$

### *Drought indices*

Drought indices was computed based on:

$$DI = \left[\frac{M - Z}{S}\right]$$

- DI is dekadal average drought index for the season; M is the average of the ratio of dekadal effective rainfall to dekadal reference evapotranpiration for each season; Z is the long-term average ratio of dekadal effective rainfall to dekadal reference evapotranspiration and S is standard deviation from the average ratio of the long-term dekadal effective rainfall to dekadal reference evapotranspiration. The season was deemed to be:
- Dry when DI was < -0.5 and/or when the number of wet dekads was ≤ 6/5
- Normal season when DI was > -0.5 and when the number of wet dekads was >6/5; and
- Wet when DI was > 0.5 and when the number of wet dekads was > 7.

### *Number of wet dekads*

Seasons shorter than 6 but > 5 wet dekads were considered to be dry seasons (sever yield reduction) due to short growing season. By contrast, season's ≤ 5/4 wet dekads were deemed to be total failures ("total rain failure").

### *Comparison of analyzed and observed data*

We compared our analyzed information with that from the farmers. We designated farmers' data "observed" data and compared it with the analyzed data (''calculated'') from the four climatic stations.

## Result

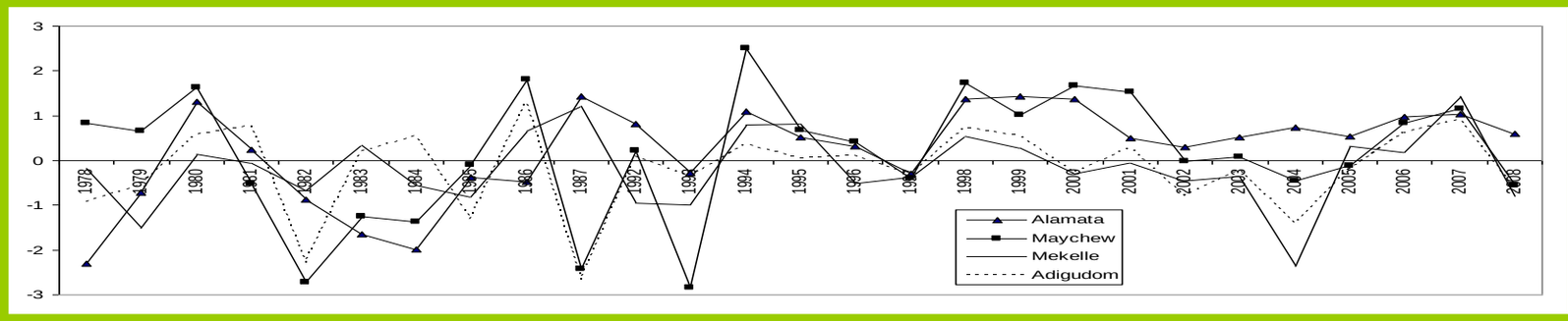



**Fig. I: Time series mean (1978 - 2008) dekadal drought indices for four rainfall stations in northern Ethiopia**

**Table I: Comparison of the farmers' ('observed') and analyzed ranking of the three variables ''short growing period'', ''dry spell'' and ''total failure of rain'' causing crop failure in north Ethiopia.**

| Causes of crop failure | Alamata | | Maychew | | Mekelle | | Adigudom | |
|---|---|---|---|---|---|---|---|---|
| | Observed | Analyzed | Observed | Analyzed | Observed | Analyzed | Observed | Analyzed |
| Short growing period | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 |
| Dry spell | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| Rain failure | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 1 |

## Conclusion

The main agro-meteorological variables that cause crop failure in northern Ethiopia were short growing season, total rain failure and dry spells out of which with the most severe consequences were "short growing period" and "total lack of rain". Applying irrigation in the month of September could reduce crop failure by > 50%. The conditions experienced during the famine years of the early 1980s were primarily caused by the continued total rain failure over multiple years. Generally, the technique was found to be suitable for assessing drought (crop failure) in the study area

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