

RAINFALL AND AGRICULTURE  
IN CENTRAL WEST AFRICA:  
*Predictability of Crop Yields in Burkina  
Faso\**

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# OUTLINE

- Research Objective I
  - Rainfall in Central West Africa (CWA)
- Research Objective II & III
  - Agriculture & Rainfall vs. Yields
- Research Objective IV
  - Predictability of Crop Yields in Burkina Faso (BF)
- Conclusions

# STUDY AREA AND MAIN GOALS

- Choice of Country (geographic)

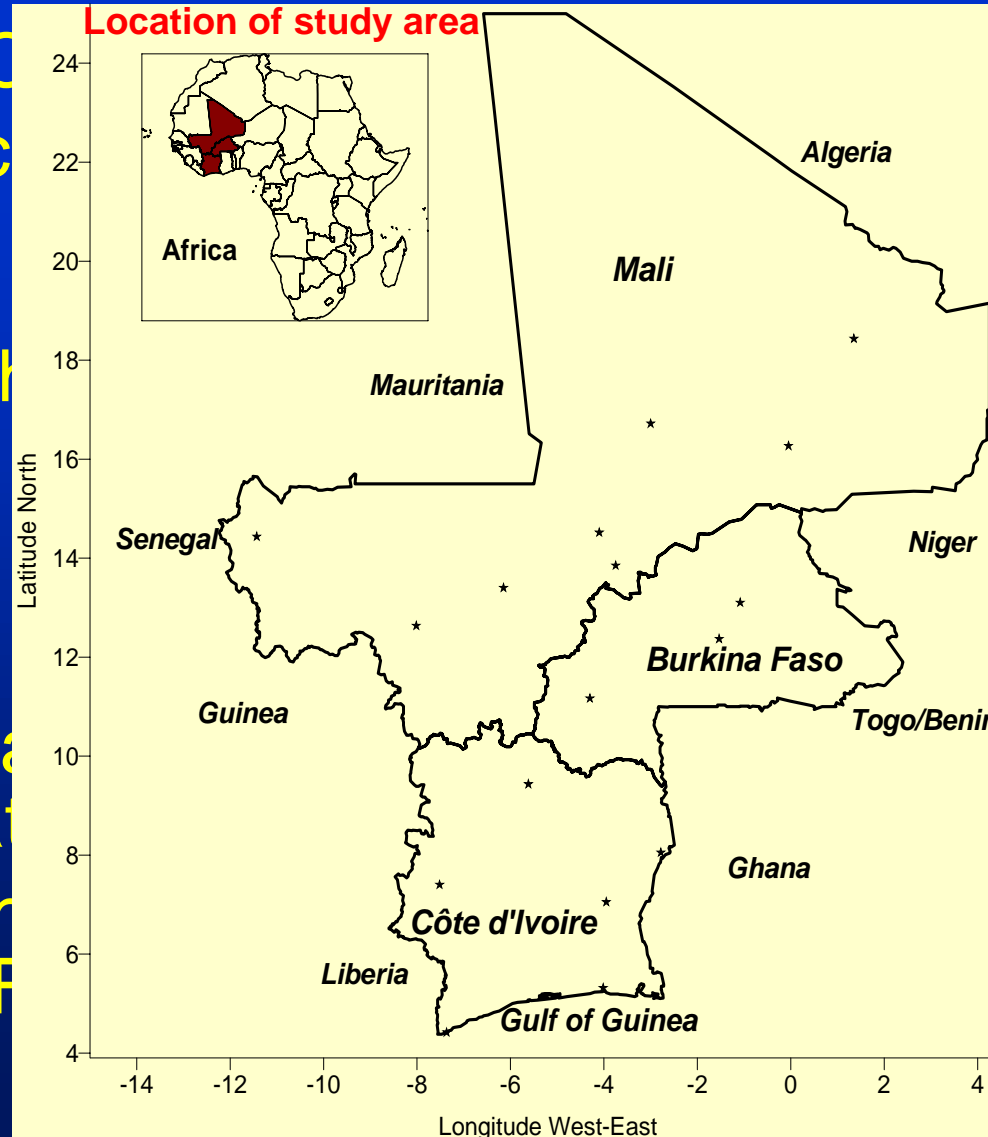
- Rainfall is the
- Agriculture

- Assess rainfall and their relationship
- Reveal the impact of Burkina Faso

study area

tropical agric.  
water

&  
ca  
in



- Countries
- Capital cities
- Other main cities

# RESEARCH OBJECTIVE I

To analyze rainfall characteristics and trends  
in Central West Africa

Rainfall Variability from the Guinea Coast to the Sahel

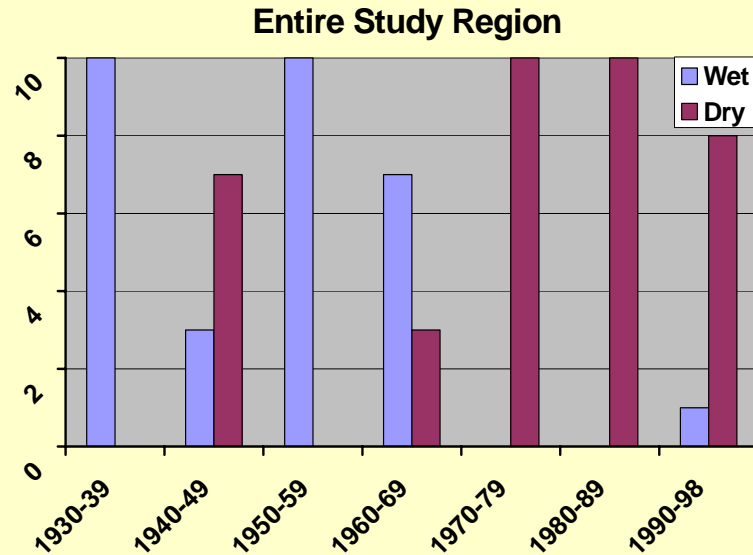
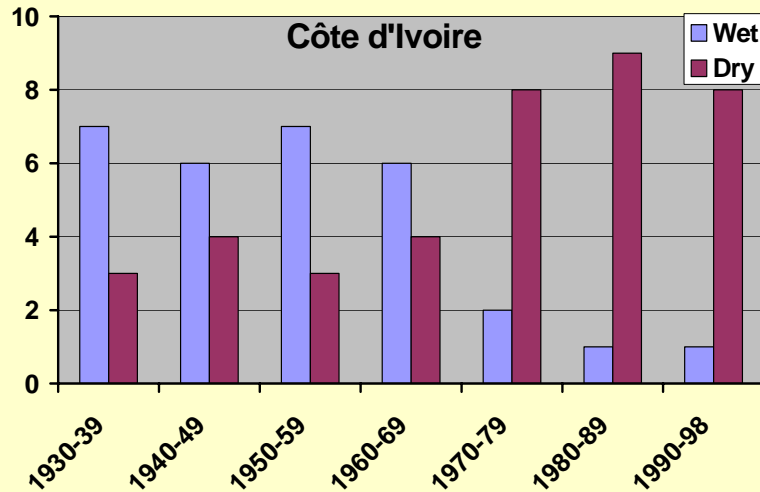
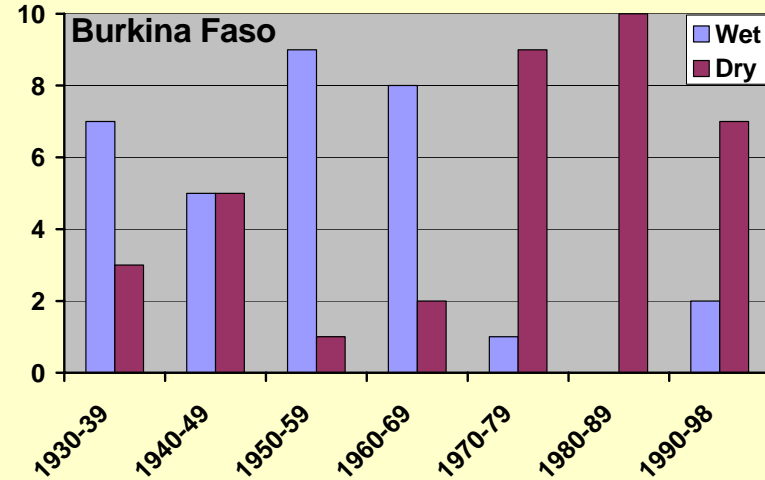
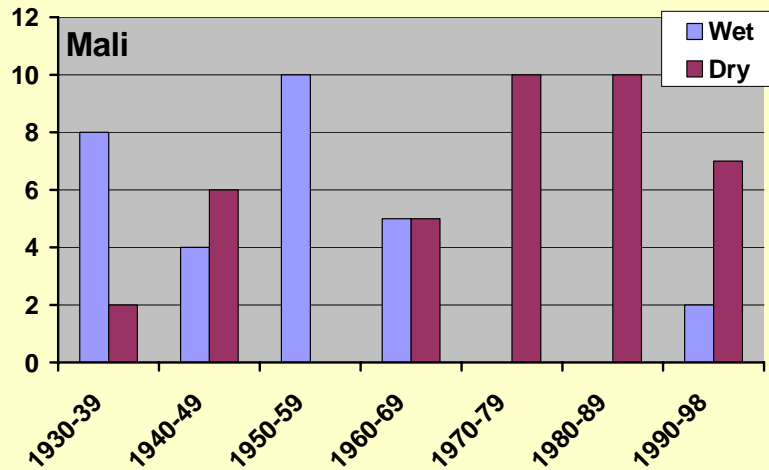
Multidecadal Isohyetal Trend Determination

Average Annual Rainfall Regimes

Mean Onset/Cessation Dates

# Concluding Remarks for Objective 1

Number of wet & dry years determines dominant characteristic for each decade (above & below mean)



## RESEARCH OBJECTIVE II & III

To detect & assess the extent to which crop acreage & production, and the impacts of rainfall variations are valuable indicators of agricultural change, including inter-country comparisons with common crops (cotton, maize, rice) as related to rainfall

- Average Spatial Distribution of Crops - Representative Regions & Crops -- Crop Parameter Relationships
  - Correlations (1970-1998) b/w Rainfall & Cotton/Maize/Rice Yields
- (1) Annual Rainfall Indices vs. Raw & Detrended Crop Time Series (concurrent & lag correlations)
  - (2) Months/Seasonal/Annual Indices vs. Raw & Detrended Crop Time Series (concurrent correlations)
  - (3) Crop regions & associated PCA-based regions: Months/Seasons/Annual totals/onset-cess. vs. Raw Crop Time Series

# Correlation Results between Rainfall & Cotton/Maize/Rice Yields

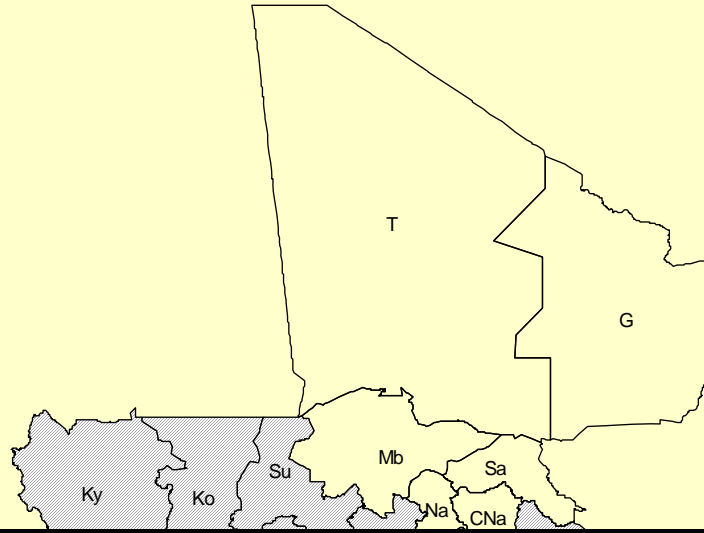
- (1) Mixed results - Evidence of positive relationships
- (2) Coefficients = more + when linear crop trends removed
- (3) More + coefficients for concurrent than lag correlations
- (4) **Mali** = strongly positive esp. Sep/May-Oct/Annual
- (5) **BF/CI/CWA/zones** = complex (weaker + & more -)
- (6) Mali = short & average to long rainy seasons
- (7) BF & CI = average to long rainy seasons

# Concluding Remarks for Objective II & III

Analyses identified 12 dominant regions & 8 major crops:

Dominant Crop Regions = 12 (4 per country)

Mali = Koulikoro, Kayes, Sikasso, Segou - Burkina Faso = Center, East, Haut Bassin, Mouhoun - Côte d'Ivoire = Center, Central-west, South, West



## SUMMARY OF ACREAGE (A), PRODUCTION (P), AND YIELD (Y) RELATIONSHIPS

Trend Relation	Mali	Burkina Faso	Côte d'Ivoire	Total
APY = + (27/48 = 56%)	9 (5C, 4S)	11 (6C, 5S)	7 (2C, 5S)	27 (13C, 14S)
APY = - (1/48 = 2%)	0 (0C, 0S)	0 (0C, 0S)	1 (1C, 0S)	1 (1C, 0S)
AP = +, Y = - (14/48 = 29%)	4 (2C, 2S)	3 (2C, 1S)	7 (4C, 3S)	14 (8C, 6S)
AY = +, P = - (0/48 = 0%)	0 (0C, 0S)	0 (0C, 0S)	0 (0C, 0S)	0 (0C, 0S)
A = -, PY = + (6/48 = 13%)	3 (1C, 2S)	2 (0C, 2S)	1 (1C, 0S)	6 (2C, 4S)
<b>Total</b>	16	16	16	48

Note: (+) = same ; (-) = different -- regression-based trends for overall (sub) period

# RESEARCH OBJECTIVE IV

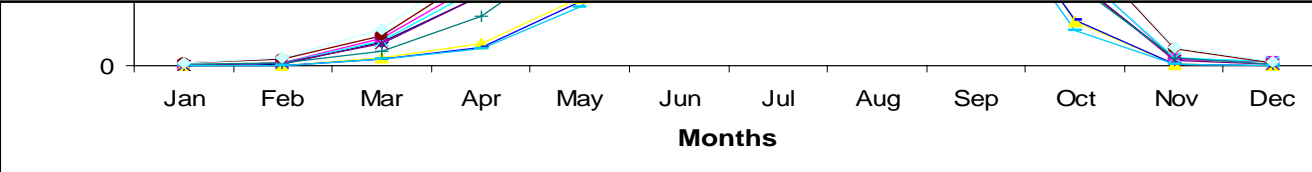
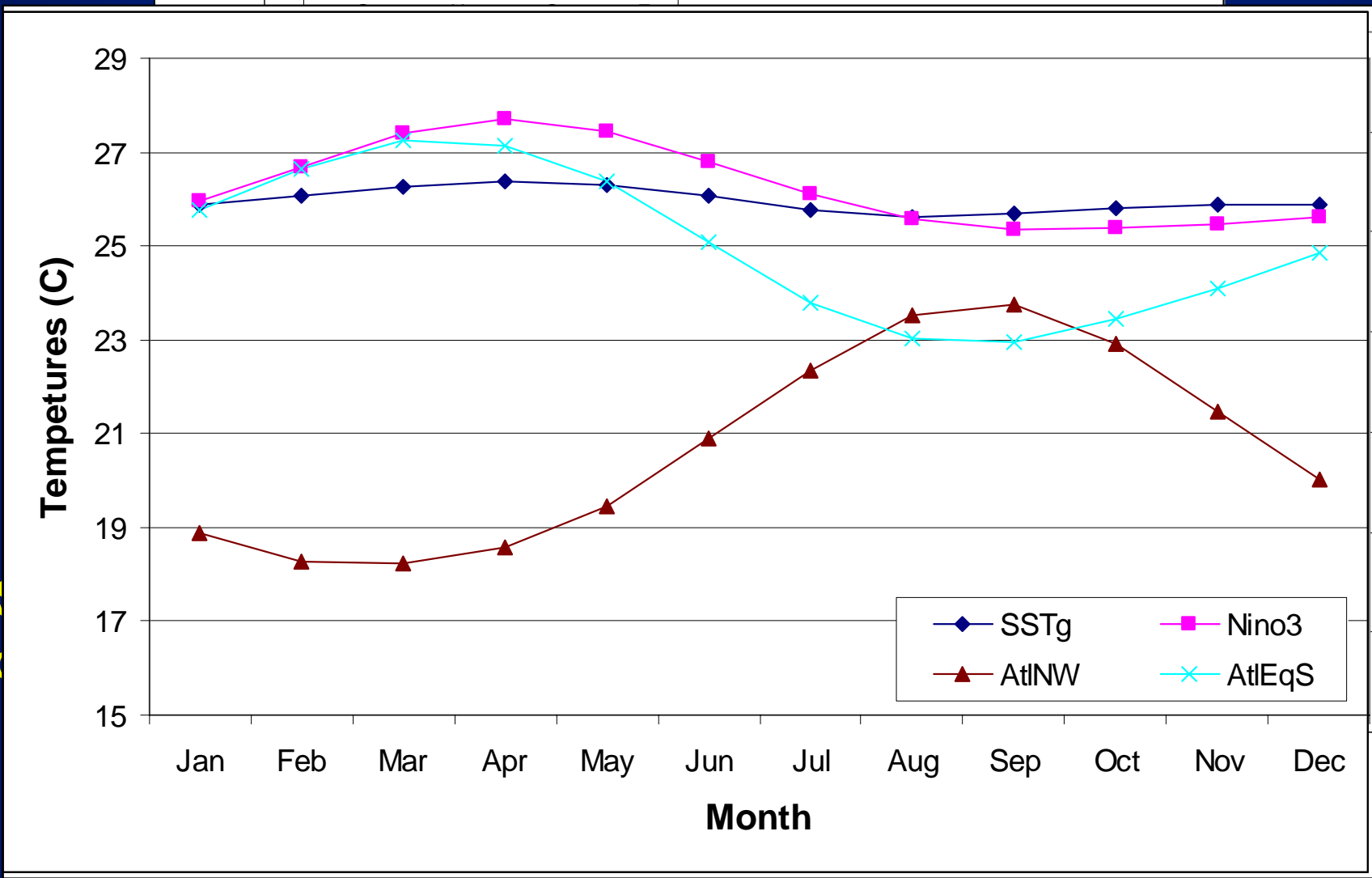
To reveal the relationships b/w crop yields and climate/environmental predictors in Burkina Faso

## DATA & METHODS

- 10 agricultural regions & 10 rainfall stations with 3 levels of information: observed monthly data and calculated April-October and July-September seasons
- 6 crops: Cotton, Maize, Millet, Peanut, Rice, & Sorghum
- 6 global predictors: CMAP (estimated rainfall data), SSTs (Global, Nino3, Atlantic Northwest, Atlantic Equatorial South), & NDVIg (Vegetation Index -- to establish environment vs. climate relations)

Agriculture in BF is mostly rain-fed, therefore there is a need for a better understanding of the relationships among crop, climate & environmental data - BF crop yield residuals are correlated with individual climate/environmental predictors (1984-2003)

# MAJOR FINDINGS

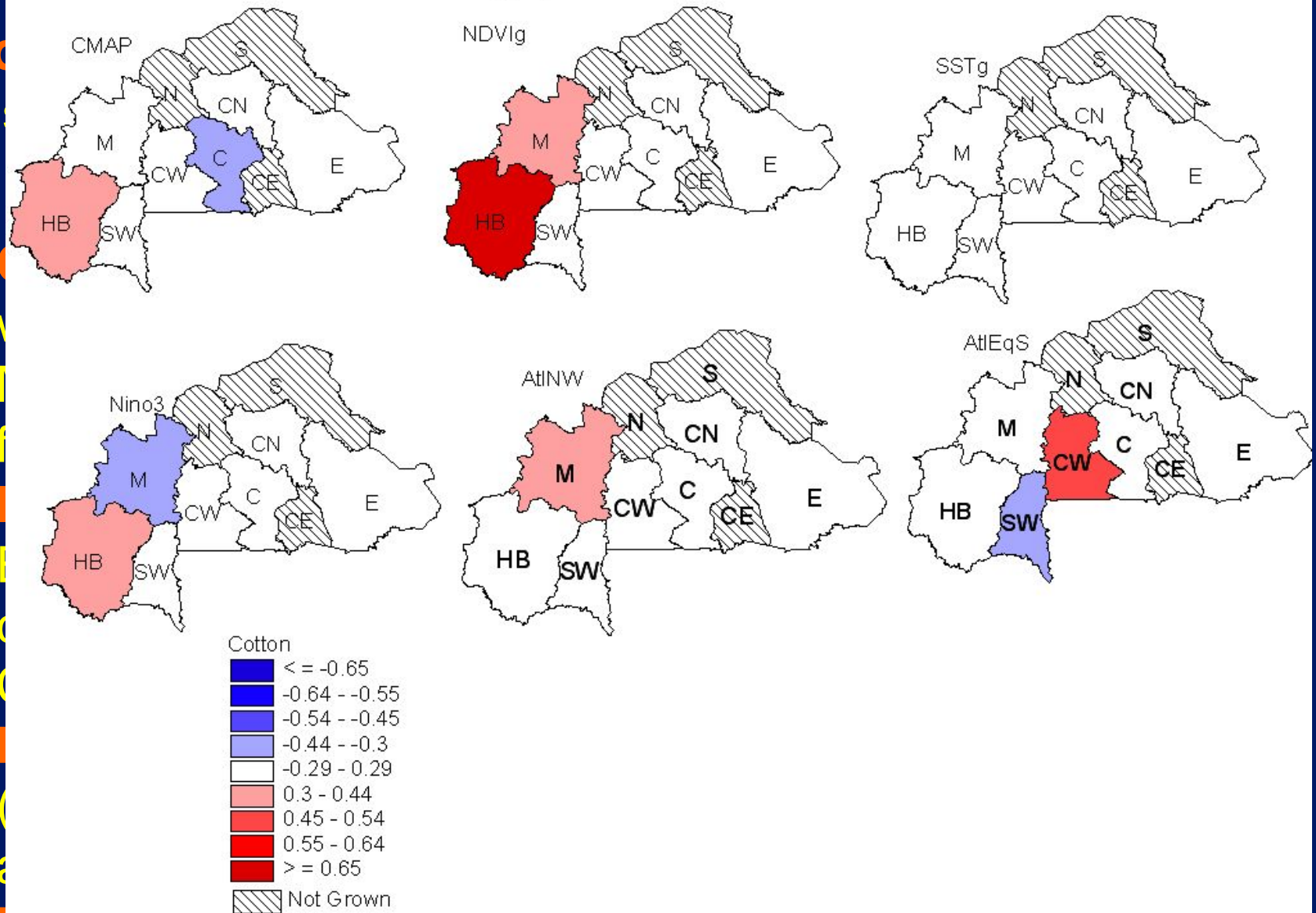


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# MAJOR FINDINGS (Cont')

## May\_Cotton



... millet, sorghum, & peanuts - most cultivated crops in  
 BF - Sufficient production in each region to warrant an

# OVERALL CONCLUSIONS

- This is the first attempt to compile & analyze disparate records (especially CWA crop data & CMAP/NDVIg records for BF agricultural regions)
- Rainfall variability/crop yield relationships are important to monitor & understand CWA socioeconomic development
- Time series & correlation analyses reveal that variations of crop yields mostly coincide with those of rainfall in CWA
- The findings of the rainfall/crop yield relationships in CWA provide important guidance for the study of the predictability of crop yields in Burkina Faso
- Lack of proper knowledge of the associations between climate/ environmental predictors & crop yields undermine the potential value of forecasts that can support end user decisions related to crop production & food security in the region

# ACKNOWLEDGEMENTS

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- National meteorological, agricultural, and environmental institutions in Burkina Faso, Côte d'Ivoire, Mali, and Niger for providing the research data
- Tropical Agriculture Program at the Earth Institute of Columbia University
- Thank you all for coming & listening to this talk