Remote Sensing of Land-Atmosphere Systems Research Experiences for Undergraduates Program

Using streamflow forecasts, in addition to soil moisture, to indicate the impacts of floods in agricultural areas of Kisumu, Kenya
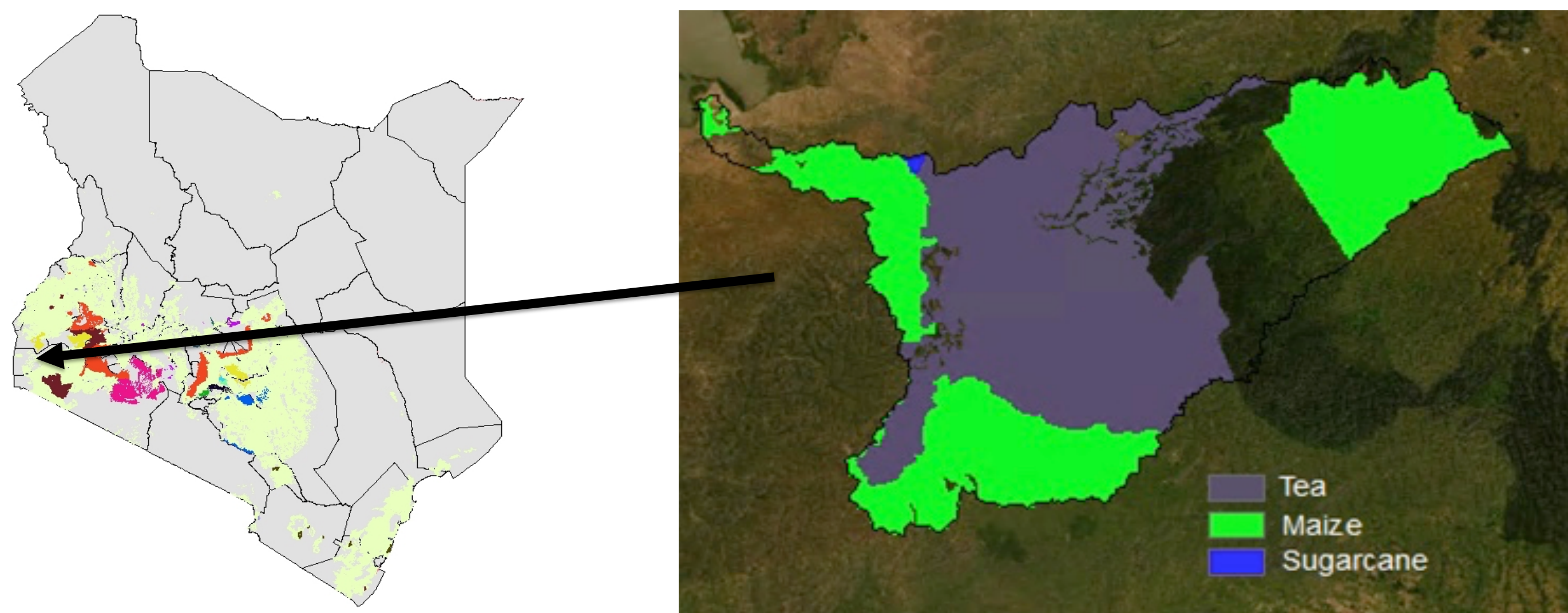
https://youtu.be/FXrijwi0ZjA

Kayla Krohman[1] and Eric Anderson[2,3,4]

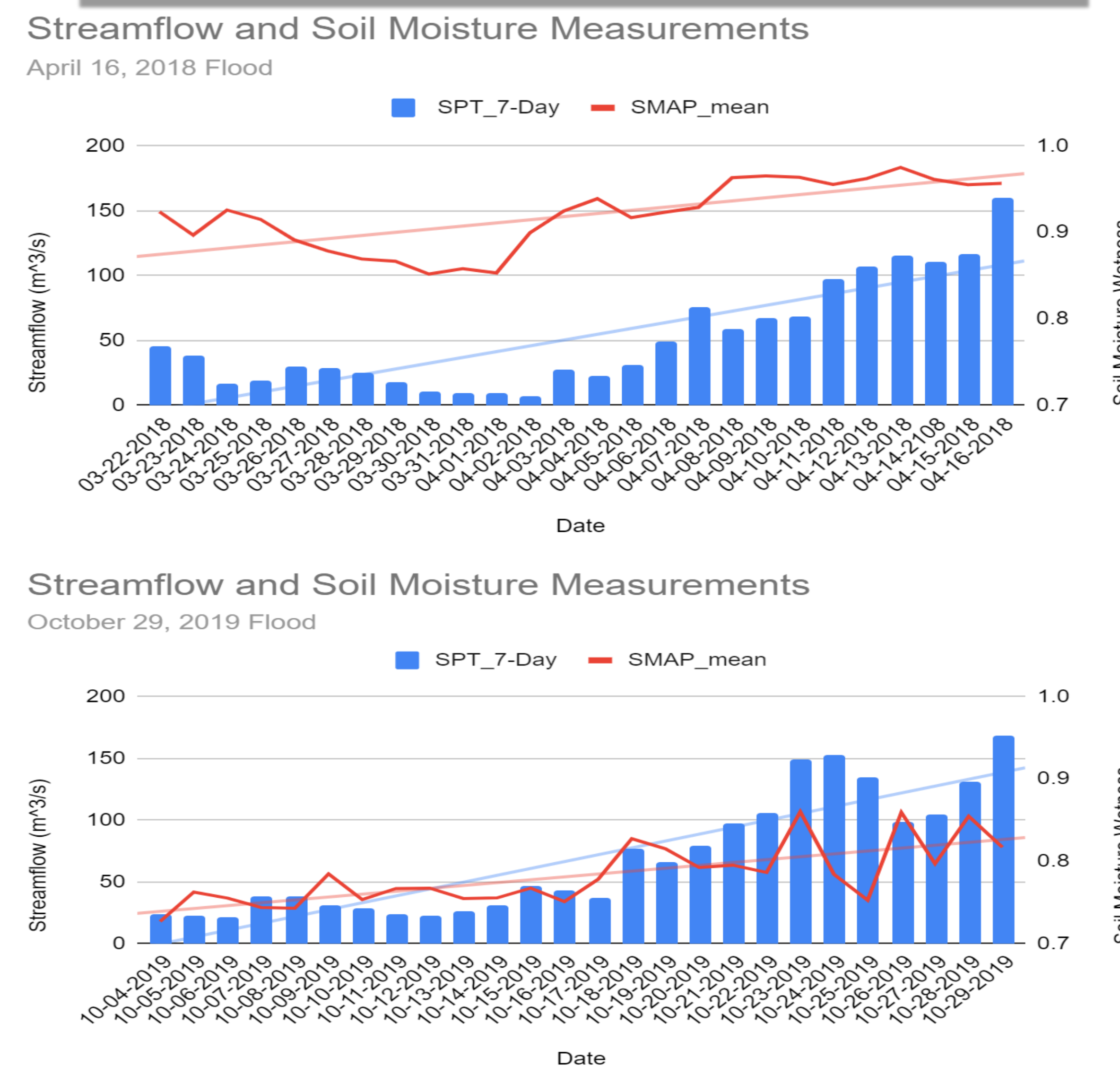*Western Kentucky University[1], Earth System Science Center[2], University of Alabama in Huntsville[3], NASA/SERVIR Science Coordination Office[4]*

1. Introduction & Background

- Floods in the Kisumu region pose a national threat to the economy and overall food security.
- The region produces crops such as tea, maize, rice, sorghum, coffee, and sugar cane.
- Soil moisture contributes to the overall success of crop production.
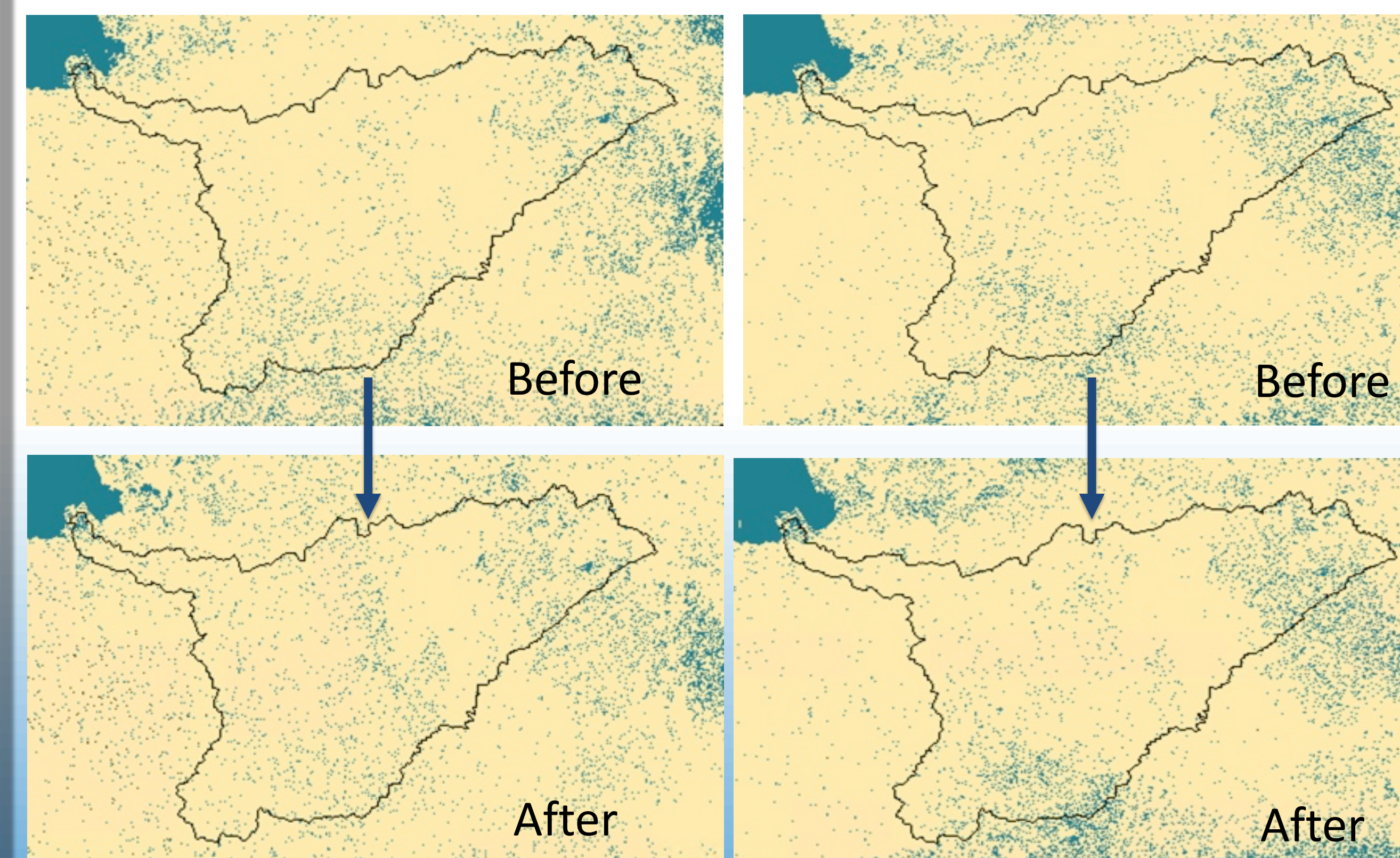- There is a gap between the time a flood forecast is released and the time early actions are taken.

Tea
Maize
Sugarcane

2. Data & Methods

Initial Data	Methodology
Streamflow Prediction Tool: Historic Streamflow 7-Day Forecast	April 16th, 2018 Flood
	October 29th, 2019 Flood
SMAP L4 Global 3-hourly 9 km EASE-Grid Surface and Root Zone Soil Moisture Geophysical Data V004	Convert to Daily Geotiffs
	Find Mean Values in GIS
Inundation/Agricultural Impacts	Create Flood Extent Maps
	Estimate acres impacted

3. Analysis & Results

Streamflow and Soil Moisture Measurements
April 16, 2018 Flood

SPT_7-Day   SMAP_mean

Streamflow and Soil Moisture Measurements
October 29, 2019 Flood

SPT_7-Day   SMAP_mean

2018   2019

Before   Before
After   After

Pictured above are VV images from Sentinel-1 (C band) showing water cover before and after each flood. It is apparent that there is no **open** water over crop areas in our watershed.

4. Conclusions / Discussion

Attempts to estimate or infer flood impacts:
- Field Reports: Non-existent or could not find them…gather more in the future
- Landsat: Cloudy after floods, No apparent floods on the next loops

Can't just blame the sensors:
- Maybe the floods were not as widespread or devastating as initially thought
- What about the floods before SMAP was available (2015)

Soil moisture conditions are different leading up to floods of similar streamflow. Could not distinguish flood extent over agricultural areas from Landsat or Sentinel-1.

5. Summary & Future Work

- Using Sentinel-1 (C band), look at a full time series of every image over our study area for several years.
  - Look for back scatter anomalies in 2018 and/or 2019 in our crop areas.
- If we had access to L band SAR (like NISAR), we could possibly detect partially inundated crops. Standing water with crops sticking out would look very bright.
- Questions for the future:
  1. What is the relevance of rainfall and/or soil moisture in informing flood preparedness?
  2. Can soil moisture composites serve to create better lead time in early action flood plans?

5. Acknowledgments