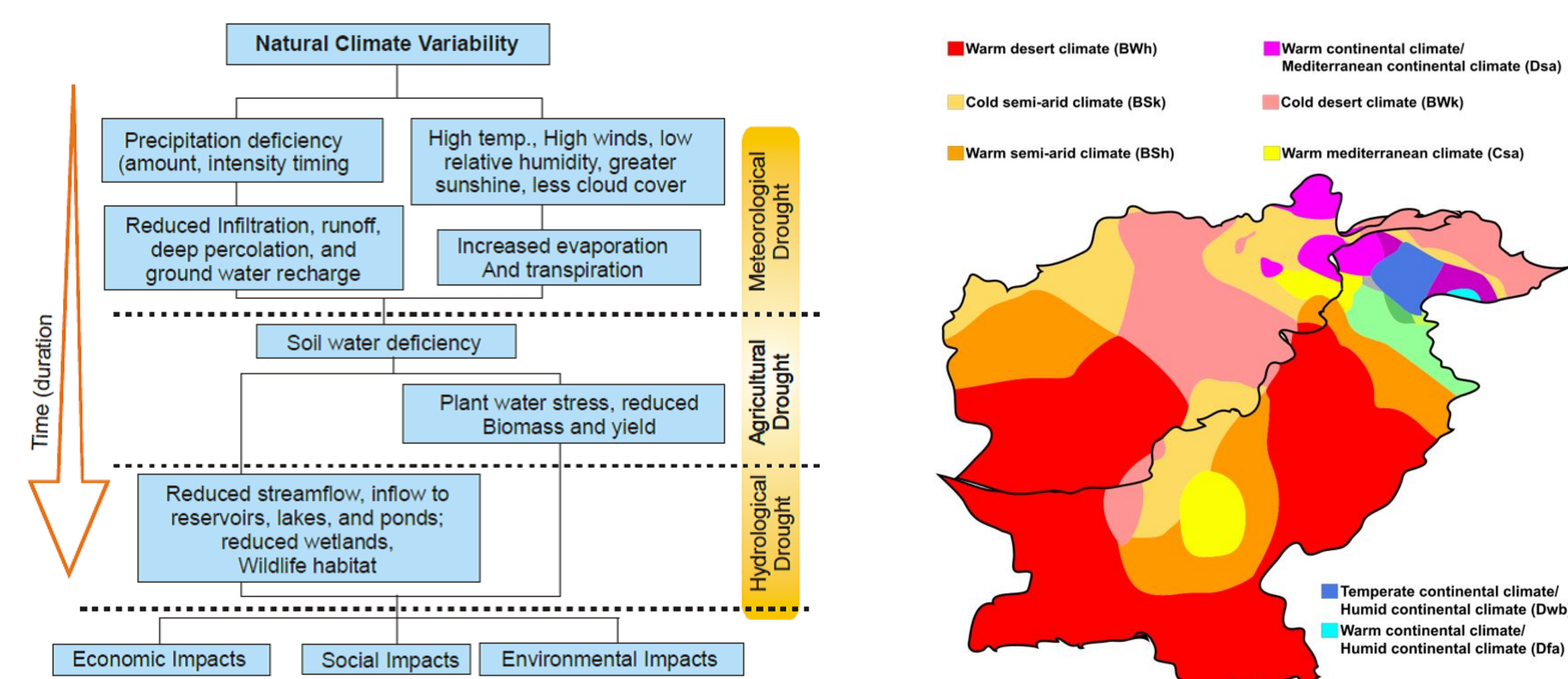


Objectives

- Identify climate- and satellite-based drought indices that better capture historic droughts (as observed by production trends)
- Build database for retrospective analysis of time series data to provide evidence of indices ability to capture historic drought incidents
- Analysis of drought frequency:
 - Temporal and spatial distributions of drought frequency for HKH countries (**A case study for Pakistan**)
 - Build a **framework** to combine indices that could better help in monitoring drought and food security
 - Identify the relationships between the drought indices (e.g., Standardized Precipitation Index, SPI) and crop yields at a local level: **A case study for Wheat Production**
- Develop proof-of-concept Composite Drought Index and evaluate it with crop correlation to compare with a single drought index over the same local study area (**Pakistan**)

Why a composite drought index?

- Drought can be realized in many spatial and temporal dimensions
- Different datasets and indices can capture different components



Source: US National Drought Mitigation Center

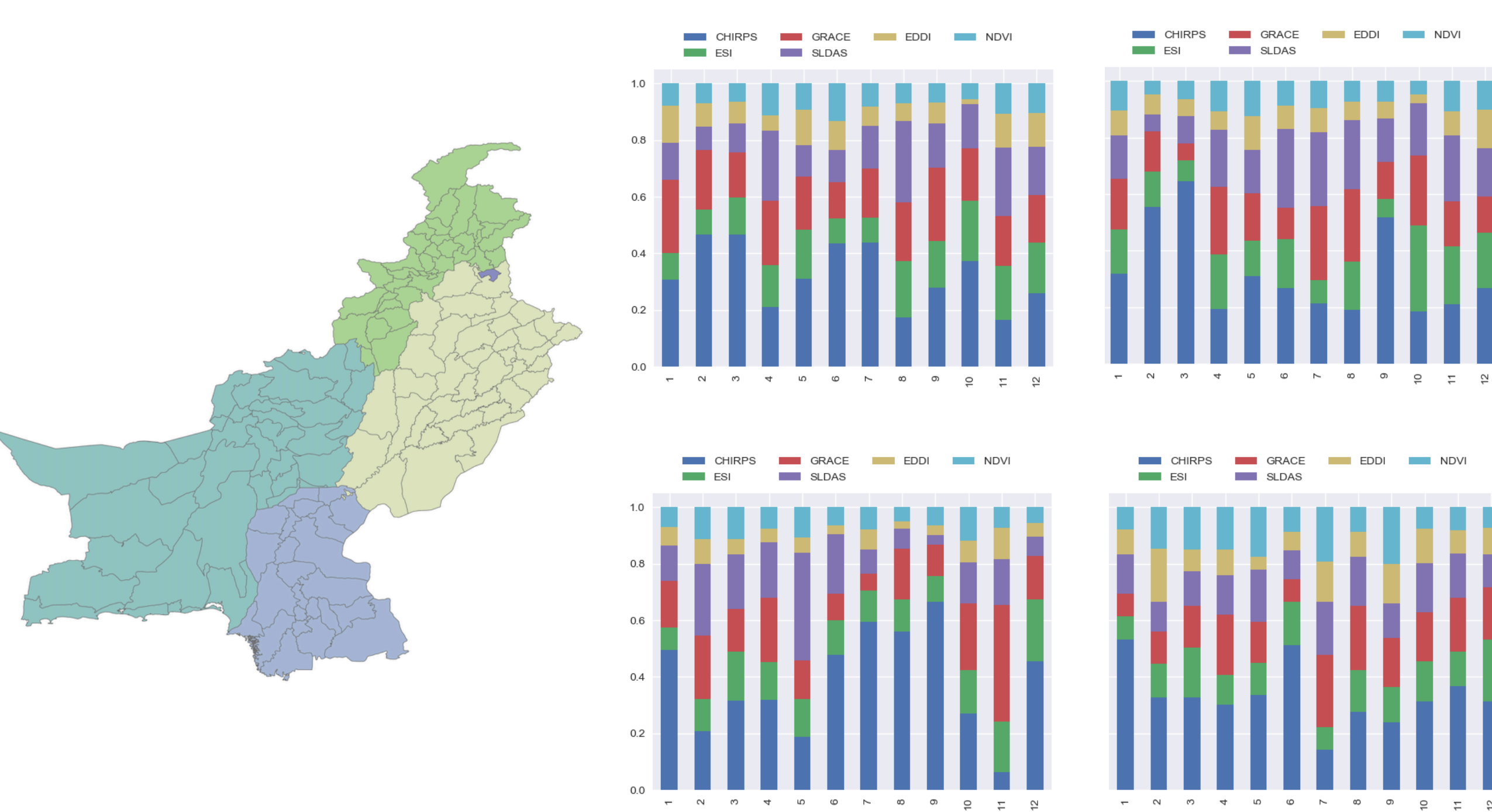
Source: Beck, et al. 2018 Present and future Köppen-Geiger climate classification maps at 1-km resolution. Nature Scientific Data. DOI:10.1038/sdata.2018.214.



We are using satellite data products and local cropping information to contextualize drought indices by climate and production patterns in Pakistan

Methodology

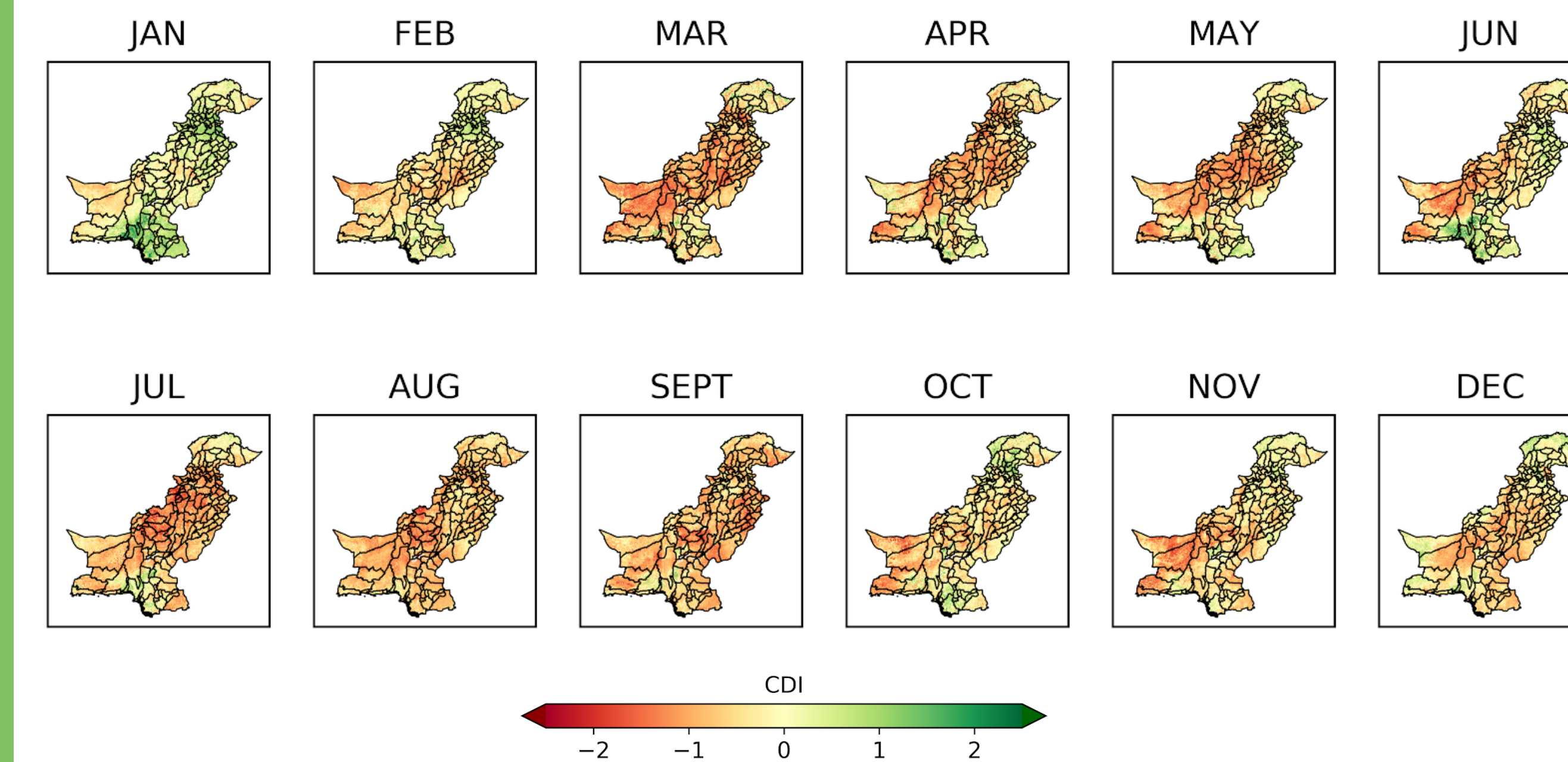
- In this analysis we want to keep the original values, however, we use aspects of PCA to weigh the input variables by how much variation they contribute to the the principle component (i.e. the linear dimension that explains the most variance).



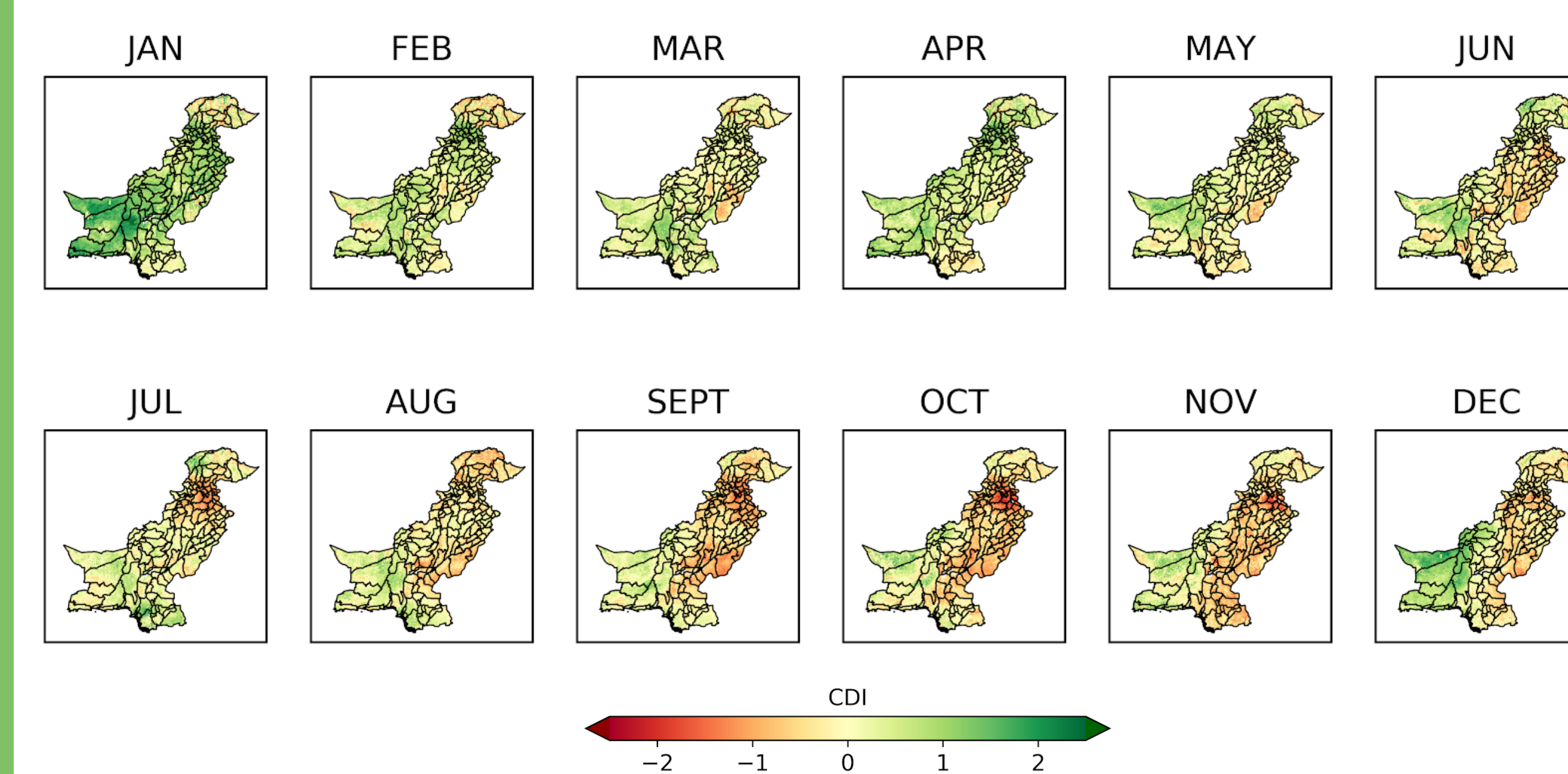
Results

Composite Drought Index

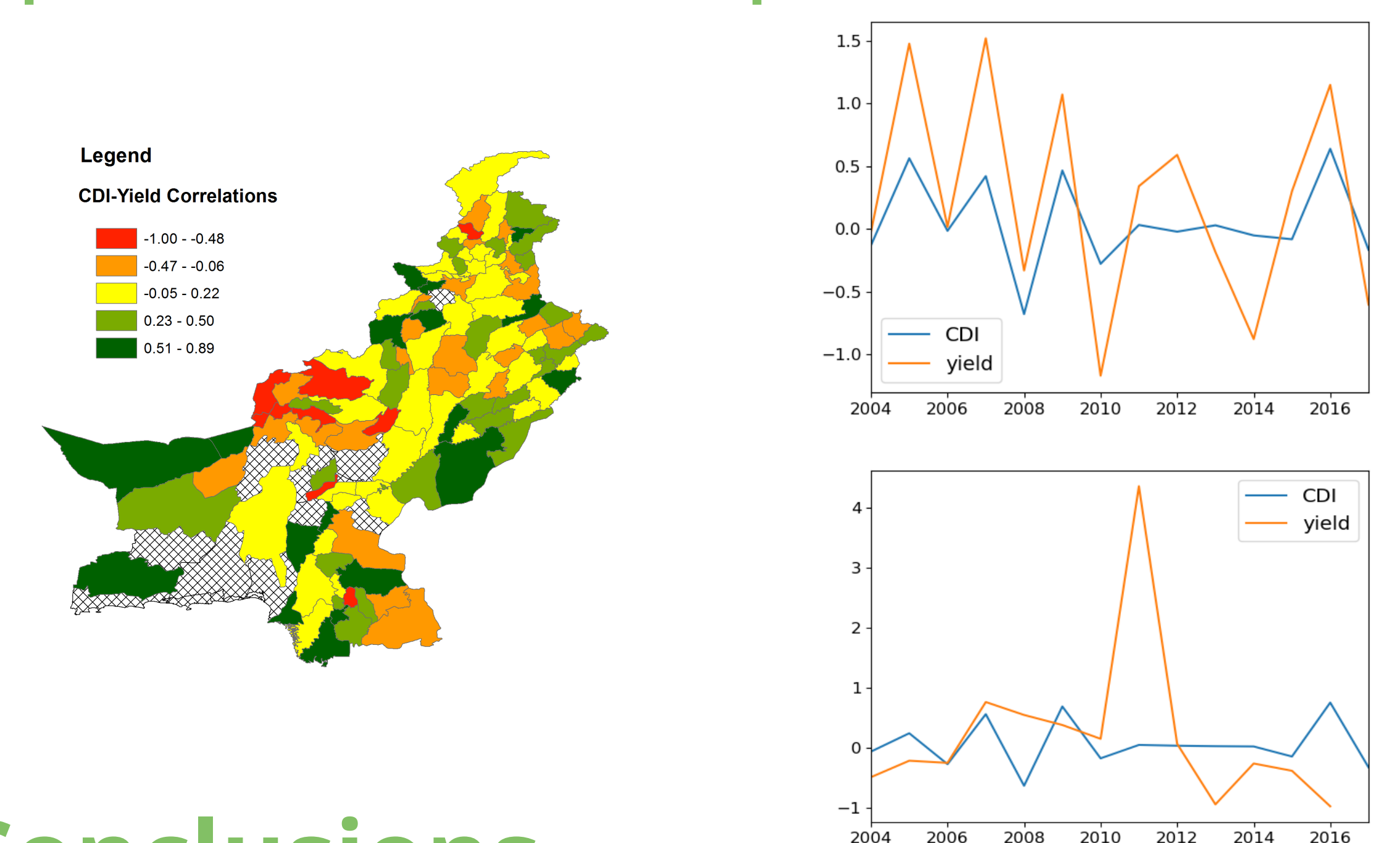
- 2004 was a moderately dry year across the country and is captured well in CDI



- 2009-10 a weaker drought year, particularly acute for Punjab and KPK which is captured well by the CDI



Crop Production Relationships



Conclusions

- Preliminary analysis of the CDI models and evaluation results are encouraging and shows promise in capturing retrospective drought
- The CDI maps for droughts and wetter years shows reasonable climate/drought patterns.
- Correlations against yield show promise
- Next steps
 - Garner feedback on proposed methods
 - Refine study with further datasets (SPI-3, VPD, etc.) and other crops
 - Define thresholds for each province/district?