Trends in crop water stress and its influence on socio-economic changes and societal adaptation

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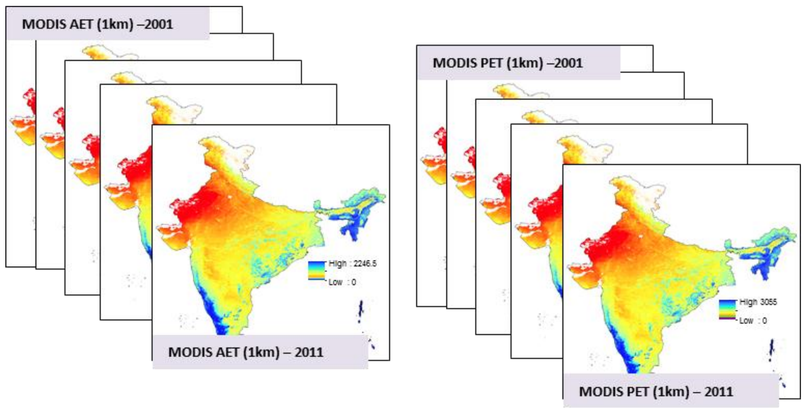
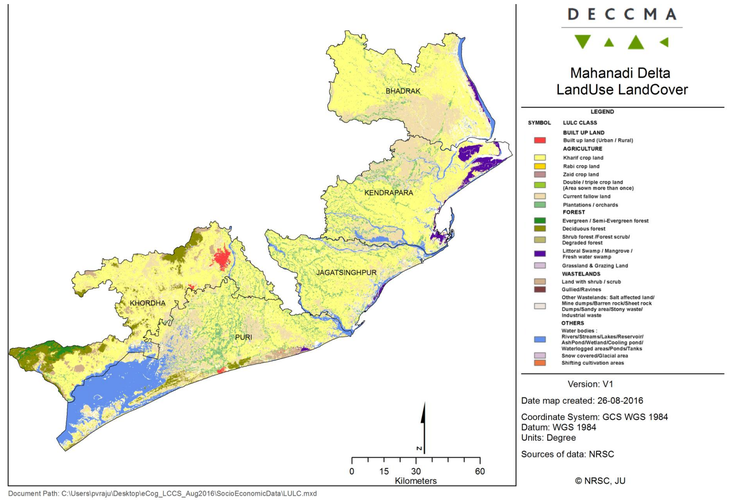
Monthly MODIS AET/PET Products for 10 years

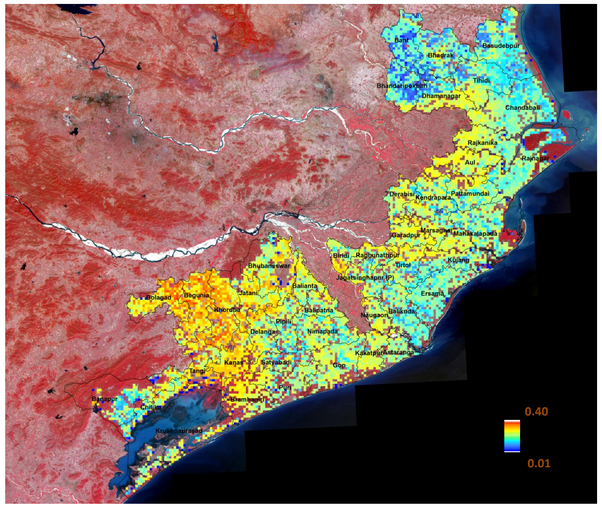


Source: www.ntsg.umt.edu/project/mod16

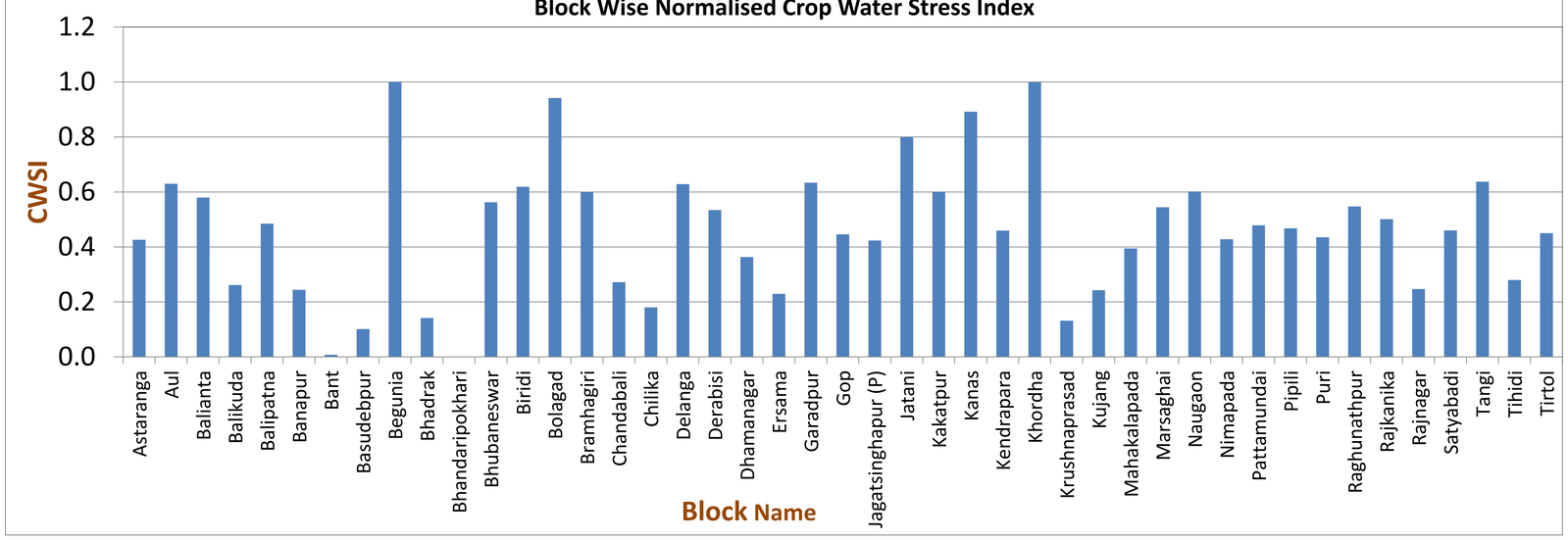
Mahanadi Delta Land Use Land Cover



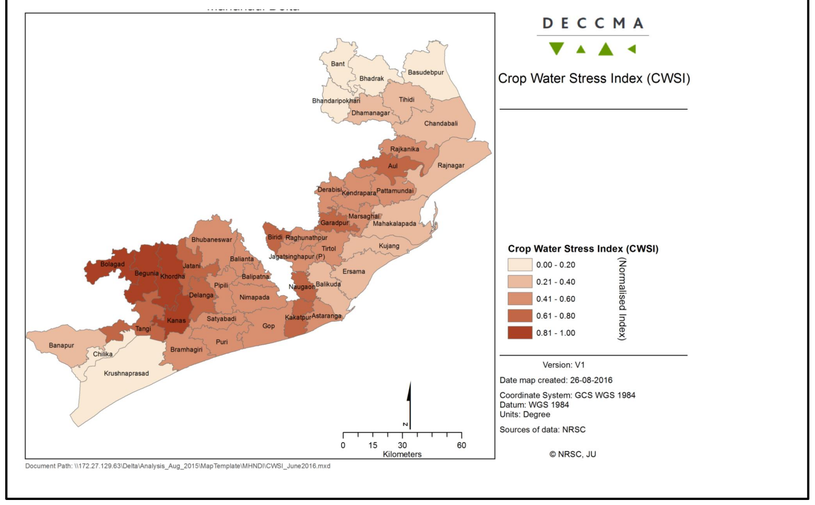
Mean(2001-2011) CWSI over Agricultural Area



Block Wise Normalised Crop Water Stress Index



Block wise normalised CWSI Map



Abstract

Long-term trends in reliability and adequacy in water needs are generally related to socio-economic changes. Regions with greater assurance and reliability in water supply show positive socio-economic development, especially among water dependant economic societies. Water stress conditions are projected to be of higher order & frequency during anticipated climate change scenarios. Consequently, river deltas, with water dependent economy (agriculture, aquaculture, etc.) and with dense population are projected to be more exposed and vulnerable during climate change. Hence, there is a need to study the adaptation or societal response under varying conditions of water-stress.

The present study is to investigate the spatial patterns of agricultural water stress in Mahanadi delta and its possible correlation with socioeconomic adjustments/changes. Crop water Stress Index (CWSI), which is neither a drought nor a remote sensing index, but can be effectively used for characterizing agricultural water stress (Jackson et al. 1981; Fant et al. 2016). CWSI is the ratio of deficit of actual evapotranspiration (AET) from the potential evapotranspiration (PET) to PET, which quantifies the crop water satisfaction in comparison to its requirement. Monthly MODIS Evapotranspiration data (1 km resolution) for the years 2001- 2011 were used for the estimation of CWSI. The index was derived for the agricultural area for the months of June of October, was averaged to obtain the seasonal CWSI values. The long term average of these seasonal values was obtained to identify the long-term spatial patterns of water stressed crop areas. The long term average of CWSI was observed to vary to from near zero to 53 % among the sub-districts (blocks) in Mahanadi delta. The block level decadal CWSI was analysed with trends socioeconomic data, such as, agricultural dependant population, crop production, cropping dynamics.

Such tools and studies can effectively investigate comprehensive relationships between stress drivers, sectoral impact and consequent societal response and can be useful in engaging and informing decision makers.

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