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**Name of Topic:** Climate Variability and Vulnerability Assessment in Coastal Andhra Pradesh

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### **Major findings**

The outcomes of this thesis clearly show that climate variability, urbanization, population change, industrialization and change in land use/land cover dynamics led to impact coastal Andhra Pradesh. Variability in climate, natural and anthropogenic factors have accelerated the rate of vulnerability in the coastal Andhra Pradesh. The major findings of the thesis have been presented as follows: The swift pace of industrialization and urbanization, particularly along the coast, has drawn people from distant regions, rendering these zones more susceptible to change. This phenomenon is evident in coastal Andhra Pradesh, which has experienced escalating urban development and industrialization, leading to alterations in land use/land cover, vegetation, built-up areas, and water bodies. The Normalized Difference Vegetation Index (NDVI) values of 1991 were notably higher compared to 2018, owing to higher mean rainfall in the respective years. There is a positive correlation exists between NDVI and rainfall pattern in coastal Andhra Pradesh. However, in 2018, extreme climatic conditions led to the disappearance of water bodies, resulting in declining NDWI values in Vishakhapatnam and East Godavari. Srikakulam and Vizianagaram maintained a normal wetness index. Furthermore, the Normalized Difference Built-Up Index (NDBI) exhibited higher values in several areas, particularly in Vishakhapatnam, Vizianagaram, Prakasam, and Nellore. The mean rate of shoreline change across all coastal districts is also presented in the study. The most significant rate is observed in the Vishakhapatnam district, at 1.04 meters per year. On the other hand, the lowest rate is recorded in West Godavari, which stands at 0.08 meters 214 per year. The maximum range of mean shoreline change rate among the nine districts is 11.29 meters per year in Srikakulam, followed by 9 meters per year in Vizianagaram, 9.87 meters per year in Vishakhapatnam, 10.23 meters per year in East Godavari, 9.6 meters per year in West Godavari, 9.97 meters per year in Krishna, 9.5 meters per year in Guntur, 9.8 meters per year in Prakasam, and 8.58 meters per year in Nellore districts. The mean erosion rate is most pronounced in Vizianagaram and Srikakulam,

showing fluctuating patterns and the lowest erosion rate is observed in East Godavari. The overall shoreline change has been classified into five categories: high erosion, moderate erosion, no change/stable, moderate accretion, and high accretion. Out of the total 974 kilometres of coastline, 17.9 kilometres fall under the high erosion category, while 225.2 kilometres indicate moderate erosion. Approximately 420.6 kilometres of coastline remain relatively stable, with rates ranging between -1 and 1. Moderate deposition is observed along about 245.3 kilometres of coastal stretch. Additionally, 65.2 kilometres exhibit a high accretion rate. 215 An extensive analysis of rainfall pattern spanning 36 years has been conducted, using the Mann-Kendall test for evaluation. The test outcomes reveal a statistically significant negative trend with a 95% confidence interval, characterized by a z-value of -2.07, which is notably below -1.5. This indicates an evident downward trajectory in the study area's rainfall, suggesting anticipation of drier years compared to earlier decades. Utilizing the Mann-Kendall test, the temperature's upward trend is confirmed, indicating an increase of 0.01°C annually in the study area's temperature. Furthermore, employing the Standard Precipitation Index (SPI), precipitation trends in coastal Andhra Pradesh across the 36 years manifest a varying pattern of dryness and wetness. The years are categorized into groups based on SPI values, encompassing normal, moderate, and extreme wetness or dryness. Utilizing the Rainfall Anomaly Index (RAI), years such as 2011 and 2018 are classified as extremely dry with RAI values exceeding 4. Very dry years encompass 2002, 2012, 2014, and 2017 due to their lower rainfall. Over 36 years, the Andhra Pradesh coast encountered over 45 cyclones and depressions, averaging at least one cyclone affecting the region. October emerged as the most vulnerable month for cyclone impact. Insights regarding temperature trends indicated that 61% perceived a temperature increase in the past decade, 21% noted no change, 12% abstained from response, and 6% believed in a temperature decrease. In terms of rainfall pattern, 56% of respondents believed there was a decrease, 15% observed an increase, and 11% perceived no change. Among the nine coastal districts, Vishakhapatnam emerged as the most vulnerable, with Nellore, Srikakulam, East Godavari, and Prakasam also highly vulnerable. Vizianagaram, West Godavari, and Krishna were categorized as having lower vulnerability. The integrated vulnerability index (IVI) offers a comprehensive assessment, the result discussed that approximately 77.2 km falls under the "very high vulnerability" category, with Srikakulam (22.5 km), Vishakhapatnam (4.5 km), and East Godavari (17.5 km) as prominent areas. High vulnerability is observed in districts such as Srikakulam (35 km), Vishakhapatnam (32 km), and East Godavari (37.5 km). The moderately vulnerable category encompasses Nellore (187 km) and Vishakhapatnam (50 km). Overall, the study highlights the multifaceted aspects of coastal vulnerability, encompassing physical, social, and integrated dimensions, thus providing valuable insights for effective management and resilience.