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Impact Assessment and Model Simulation to Urban Extreme Weather Vulnerabilities to Advance Climate Adaptation

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Cities emit significant and increasing quantities of greenhouse gases and rising temperature (5/AR-IPCC) cites projections that urban land cover will increase by 1.2 million sq. km from 1999 to 2030. Karachi is the largest city in Pakistan, 16.22 million populations and 7th largest metropolitan city worldwide, highly vulnerable to extreme climatic events (IPCC/SR 1.5 degree 2018). A severe heat waves (HW) with high temperatures 49°C (120°F) high humidity (65-80%) struck city and southern parts of Pakistan. It caused the deaths of about 2900-3200 people from dehydration, CVD and heat stroke/year. In April 2018, city recorded the highest temperature of 50.2 °C (122.3 F) which is the highest temperature to ever be recorded on Earth. Heat wave was a response of global and regional climate change and extreme weather events aggravated by rapid urbanization, industrialization and motorization leads to higher amount of CO_2 level in air create high temperature. Another reason of these disasters is deforestation and degradation of Mangrove Forest (MF) by recent urbanization reduced green spaces. This research finding illustrates the application of SILVA and SWAT growth model in comparison relationships with urbanization and urban green spaces habitat's strategic plan (HSP) to mitigate future HWs, improve air quality index (AQI) and simulate the possible opportunities to health and build resilient toward disaster risk. SILVA model simulations resulted that 43.61% of the urban CO_2 stock can be deposited which contributes 19% of the ecosystem. Model projected that forest area around city has ability to absorb CO_2 emissions up to 55.4 million-tons. Integrated comparison of RCM and SILVA estimated that forest population has sink capacity to absorb 86.01 million tons atmospheric CO_2 to mitigate regional and global climate change impacts and efficiently contributes to improve the AQI and HW. GCM model calibration projected that urban heat island effect (UHI) can be counteracted. This research provides initial assessment to develop NAP (National Adaption Plan-UNFCCC), and advancement of meteorological forecasting GHG emission (408ppm) to develop Climatology Early Warning System (CEWS) to observations and projections.

Key Words: Urban Climate, CO_2 Emission, Modelling Tools, Vulnerabilities Assessment