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The see-saw relationship of air pollution with climate: novel challenges to urban ecosystems

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The significant transformations from rural to urban living encompasses substantial challenges related to climate action and sustainable development. Gaseous pollutants that were traditionally associated with rural livelihood are now also a challenge to urban ecosystems with CO being a prime example. Despite an overall decline in CO across the globe, the rate of decrease has actually slowed down in several regions of the world raising concerns of a global reversal. The trends in CO are found to be heterogeneous over urban regions of the world and concentrations do not always tally with emission inventories. Further, it is not only the trends that are changing over decades but also the global hotspots of several air pollutants, SO₂ being a key example with the high values in Eastern China during the 2000s to enhanced values in Eastern India during the 2010s. Interestingly, when it comes to SO₂, driven by the burning of coal, the hotspots in India are not in the Indo-Gangetic Plains (IGP) unlike CO or NH₃, which are though driven by different sources e.g. combustion technologies and agricultural activities, respectively. Further, pollutants that were associated with indoor air studies with ramifications to human health are now increasing significantly at several locations in outdoor air, HCHO being a prime example. While the concentration of CO in India occurs in the IGP, unexpectedly enhanced formaldehyde levels were seen in certain pockets of India, away from the IGP, with trends that are higher than reported HCHO values across several parts of the globe. Apart from primary sources, HCHO is also an oxidation product of atmospheric volatile organic compounds (VOCs) and the high trend in HCHO observed during the summer months, generates interest on possible implications of atmospheric chemistry on ozone formation regimes in urban ecosystems. The changing temporal and spatial patterns necessitate mitigation strategies that do not completely depend on emission control and reduction but use alternate strategies like nature based solutions (NBS), particularly for urban ecosystems that harbor a larger population.