Can You See Clearly Now?
Monitoring the Effects of Air Quality in India During the COVID-19 Lockdown

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India's 1.366 billion people are exposed daily to high levels of airborne particulate matter, increasing risk of cancer and cardio-vascular and respiratory disease [1]. In 2015, an estimated 1.09 million deaths were attributed to ambient (outdoor) particulate matter pollution [2]. This year, many countries saw decreases in air pollution as their economies slowed due to both lockdowns and a general lagging of the economy caused by COVID-19 pandemic. On the 25th of March India went into a nationwide lock-down, which lasted officially until May 31st. The objective of this project was to visualize what happened to the air quality during this time, the changes that people noticed, and how these changes affected them.

Data

Air quality is often measured by the Air Quality Index (AQI), a measurement of how polluted and, therefore, how unhealthy the air is. In light of data availability, this study considers particulate matter with a size of less than 10 µm (PM10) as the quantitative measure of air quality based on a strong correlation with AQI. Data was collected from OpenAQ and the Central Pollution Control Board (CPCB) of India and included 349 stations across 20 states and territories from January to July for 2018, 2019, and 2020. In addition, a voluntary survey was deployed to gauge people's perception of the air quality before and after the lock-down and how any changes affected them personally.

Analysis

Time series analysis: Weekly aggregates of PM10 data for each monitoring station were interpolated using Inverse Distance Weighting to create a series of maps reflecting the quantitative change of air quality over time. Basic statistics were applied to perform statewide analysis of trends.

Analysis of survey results: Each survey response was scored based on how people perceived changes in air quality for both the pre-lockdown and lockdown periods.

Visualization

The results are presented in an ArcGIS StoryMap, which includes an interactive dashboard to visualize the change of PM10 (Figure 1) and an interactive web app to display the survey results (Figure 2). Snapshots of the web content were adapted for this poster.

Results

There was overall improvement in PM10 levels from 2018 to 2020 in the time before lockdown. India experiences annual seasonal pollution improvement as winter moves to spring and weather patterns change, and as festivals and crop burning season come to an end, but this year the improvement was much higher than expected during the lockdown period. From March to May, PM10 levels in states with unhealthy air quality improved significantly. PM10 levels remained steady for the states which already had "good" levels pre-lockdown.

70% of survey participants reported that air quality improved during the lockdown. Citizens living in urban areas noticed an improvement in air quality, while those living in rural areas did not.

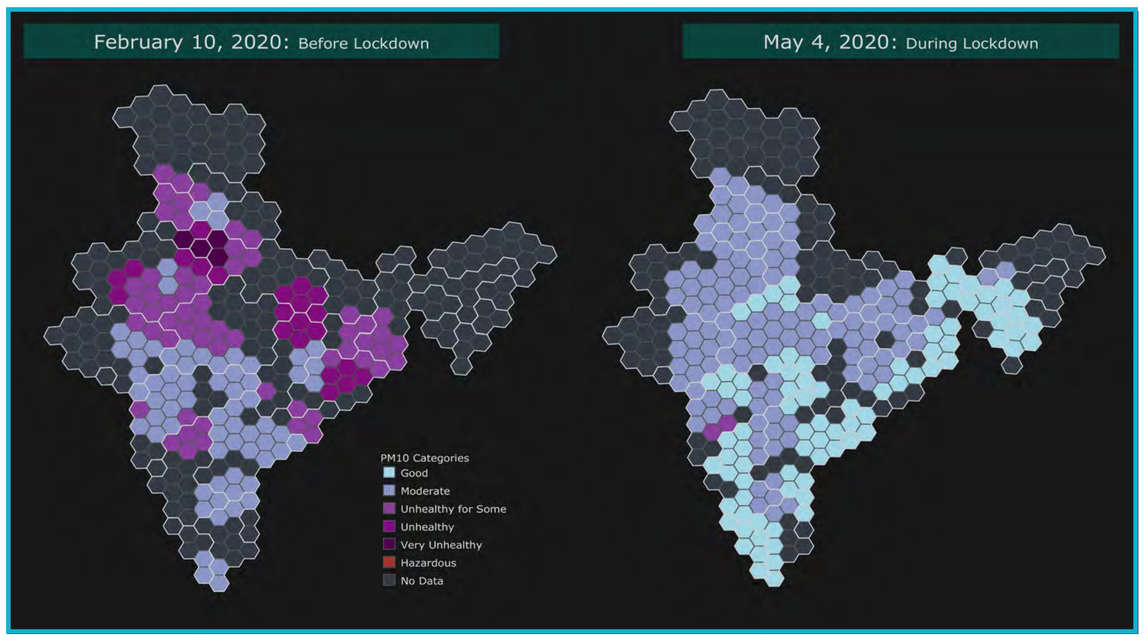

Figure 1: A representation of the time series map on the interactive dashboard. Users can click on a state to update a line graph.

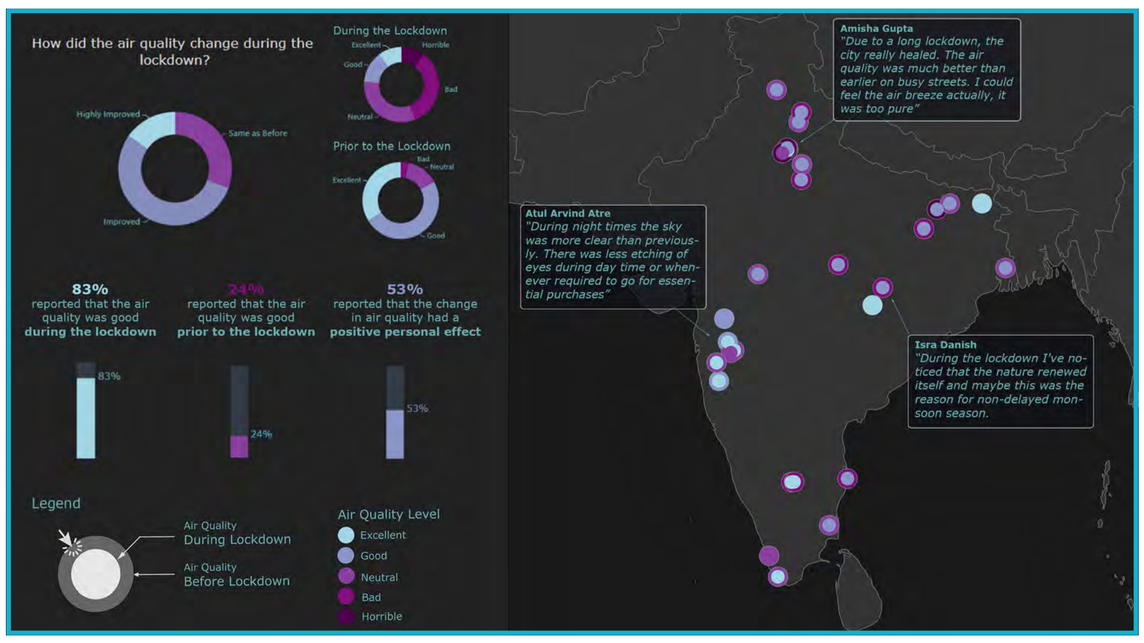

Figure 2: A snapshot of the interactive web app showing the survey results. Users can click on a symbol to read the participant comments.

Conclusion

In 2020, India was the fifth most polluted country in the world. Airborne particulate matter remains a major danger, killing as many as 980,000 people per year [3]. Further preventative measures are required to bring pollution levels under control. As one participant said, "We should learn from the lockdown period how we have impacted our mother Earth in all these years by polluting it and should adopt some measures to preserve our Earth for the future generations."

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Best viewed on a desktop monitor

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