

A decade of battle against PM_{2.5} in Beijing

Environment and Planning A:

Economy and Space

2018, Vol. 50(8) 1549–1552

© The Author(s) 2018

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/0308518X18766633

journals.sagepub.com/home/epn**Lun Liu**  and **Elisabete A Silva**

University of Cambridge, UK

Jianzheng Liu 

University of Cambridge, UK; Department of Urban Planning and Design, Faculty of Architecture, The University of Hong Kong, Hong Kong, China; Shenzhen Institute of Research and Innovation, The University of Hong Kong, China

Abstract

PM_{2.5} pollution has been a major environmental concern in Chinese cities for the past decade. In order to understand how pollution has proceeded, we produced a calendar view of the daily concentration of PM_{2.5} in Beijing from 2008 to 2017. The graphic shows that the pollution in Beijing intensified from 2008 to 2011 and then began to alleviate in 2012. The reduction has become more significant since 2015. However, air quality still falls below the international standard for healthy air and it is still early for Beijing to declare victory in the battle against PM_{2.5}.

Keywords

PM_{2.5}, Beijing, calendar view, air pollution

Air quality, as part of environmental amenities, is related not only to health but also community quality and individual satisfaction (Marans and Stimson, 2011). It is widely acknowledged to be an indicator of the quality of urban life and further links to the profiles of ‘competitive city’, ‘urban sustainability’, etc. (Rogerson, 1999). Unfortunately, the air quality in Beijing, the capital city of China and an emerging node in the global city system, has been red-flagged in recent decades and caught the world’s attention. This study therefore

Corresponding author:

Jianzheng Liu, Department of Urban Planning and Design, Faculty of Architecture, The University of Hong Kong, Hong Kong, China.

Email: jzliu@connect.hku.hk

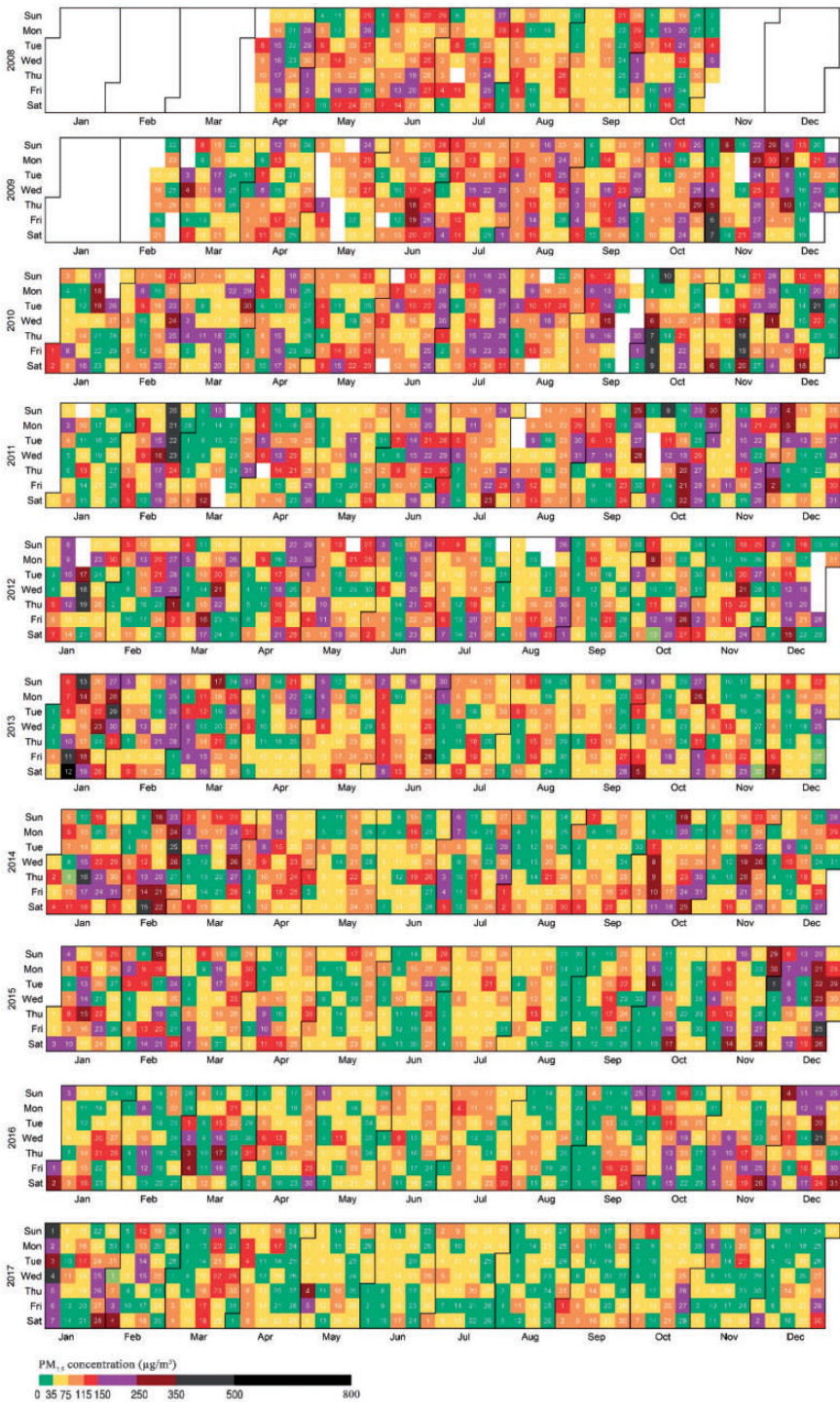
aims to explore the day-to-day trend in $PM_{2.5}$ pollution in Beijing over the past decade. The experience of Beijing can be a reference for cities in the developing world that may face the same challenge of reconciling development and environmental protection in an era of global urbanization.

Hourly $PM_{2.5}$ measurement data from 2008 to 2012 were obtained from the U.S. Embassy in Beijing (<http://www.stateair.net>), while data from 2013 to 2017 were obtained from the Beijing Environmental Protection Monitoring Centre (BEPMC, <http://zx.bjmemc.com.cn/>). To facilitate the visualization, daily mean $PM_{2.5}$ concentrations are calculated by averaging all hourly measurements from all monitoring stations in Beijing (35 in total in the BEPMC data).

The data is visualized in a calendar view with colors representing the daily average $PM_{2.5}$ concentration. The color scale is based on the national air quality standard (Ministry of Environmental Protection of the People's Republic of China, 2016). The calendar view can be more informative than point plots,¹ since it is able to communicate patterns and trends on multiple temporal scales (days, weeks, seasons, years) simultaneously (Liu et al., 2016). In contrast, point plots convey mainly the distribution of values and miss a lot of details. Besides, as a common chart being used and seen in everyday life, the calendar view provides a quick and intuitive insight.

The graphic shows that the $PM_{2.5}$ pollution in Beijing intensified from 2008 to 2011 and then began to alleviate from 2012. The colors in the calendar suggest that 2010 and 2011 experienced the highest number of days of extreme pollution (days in black and dark red). The annual average $PM_{2.5}$ concentrations were 117 and 98 $\mu\text{g}/\text{m}^3$, respectively, which were nine times higher than the standard of WHO (2006). Between 2012 and 2014, the annual averages were around 90 $\mu\text{g}/\text{m}^3$ and dark, reddish colors were still common in the calendar visualization. The improvement has become more significant since 2015. The annual averages reduced to 82, 75, and 60 $\mu\text{g}/\text{m}^3$ in 2015, 2016, and 2017, respectively. This trend can also be seen from the frequency of differently colored days. The number of 'alert' days (red colored and above) decreased from 132 in 2010 to 125 in 2011, then to 67 in 2016, and to 38 in 2017. Meanwhile, the number of good days (green colored) increased from 57 in 2010 to 82 in 2011, then to 109 in 2016, and to 138 in 2017. While the days from May to September are now generally green and yellow, days in the winter still contain many 'unhealthy' colors. This seasonal pattern is largely explained by meteorological conditions and human activities such as coal burning for heating in the winter and is particularly difficult to change.

Despite the visible progress, it is still early for Beijing to declare victory. It is important to keep monitoring and see whether the observed mitigation is merely temporary or a stable trend. More importantly, the air quality still largely falls below the standard defined by the WHO and those of developed countries. In 2017, only 139 days reached the standard of 'good' or 'moderate' defined by the U.S. Environmental Protection Agency and only 22 days reached the standard of 'good' (U.S. Environmental Protection Agency, 2016). The battle will continue.



Author note

Software: R 3.4.2 (<https://cran.r-project.org>), Adobe Photoshop.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding


The author(s) received no financial support for the research, authorship, and/or publication of this article.

Note

1. See for instance, <https://qz.com/197786/six-years-of-beijing-air-pollution-summed-up-in-one-scary-chart/>, which also shows the trends of air pollution in Beijing.

ORCID iD

Lun Liu  <http://orcid.org/0000-0003-1474-1777>

Jianzheng Liu  <http://orcid.org/0000-0003-0039-4786>

References

- Liu J, Li J and Li W (2016) Temporal patterns in fine particulate matter time series in Beijing: A calendar view. *Sci Rep* 6: 32221.
- Marans RW and Stimson RJ (2011) An overview of quality of urban life. In: Marans RW and Stimson RJ (Eds) *Investigating Quality of Urban Life*. Berlin: Springer, pp. 1–29.
- Ministry of Environmental Protection of the People's Republic of China (2016) Technical regulation on ambient air quality index (on trial). Available at: <http://bz.mep.gov.cn/bzwb/dqhjbh/jcgfffbz/201203/W020120410332725219541.pdf> (accessed 19 March 2018).
- Rogerson RJ (1999) Quality of life and city competitiveness. *Urban Studies* 36(5–6): 969–985.
- U.S. Environmental Protection Agency (2016) Technical assistance document for the reporting of daily air quality-the Air Quality Index (AQI). Available at: <https://www3.epa.gov/airnow/aqi-technical-assistance-document-may2016.pdf> (accessed 13 March 2018).
- WHO (2006) *Air Quality Guidelines: Global Update 2005. Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide*. Geneva: WHO.