



## Visualizing Australia's urban extent: a comparison between residential housing addresses and night-time light data

Bin Xie & Yan Liu

To cite this article: Bin Xie & Yan Liu (2018) Visualizing Australia's urban extent: a comparison between residential housing addresses and night-time light data, *Regional Studies, Regional Science*, 5:1, 365-368, DOI: [10.1080/21681376.2018.1526648](https://doi.org/10.1080/21681376.2018.1526648)

To link to this article: <https://doi.org/10.1080/21681376.2018.1526648>



© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 08 Nov 2018.



Submit your article to this journal [↗](#)



Article views: 987




View related articles [↗](#)



View Crossmark data [↗](#)

# Visualizing Australia's urban extent: a comparison between residential housing addresses and night-time light data

Bin Xie  <sup>a,b</sup> and Yan Liu  <sup>b</sup>

## ABSTRACT

This graphic uses the 2014 Geocoded National Address File (G-NAF), a geocoded address database containing the physical addresses of all properties in Australia, to extract residential property addresses, and then uses Baidu eCharts visualization library to map out the extent of urban areas in Australia and its major metropolitan regions. By comparing with the DMSP-OLS night-time light data we identify the advantages of using G-NAF for mapping urban extent and its potential in monitoring and modelling urban growth and change.

## ARTICLE HISTORY

Received 2 September 2018; Accepted 18 September 2018

## KEYWORDS


Urban extent; Geocoded National Address File (G-NAF); DMSP-OLS night-time light data; Baidu eCharts; Australia

## JEL CLASSIFICATIONS

R11; R12; R14; Y10

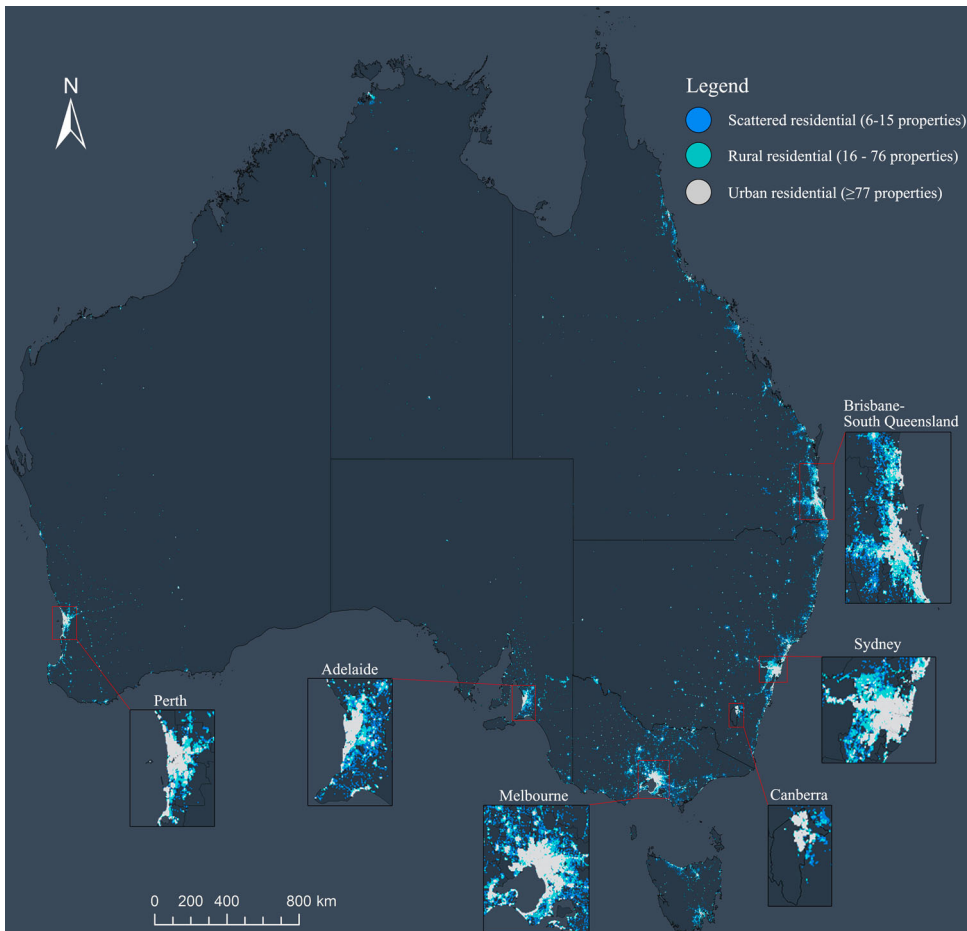
Detecting the extent of urban areas is a continuous effort by geographers and planners in order to plan, manage and optimize urban growth. A number of methods have been developed to identify the urban extent, including the classification of land uses from satellite imagery (Trianni et al., 2015), the population density approach (Linge, 1965) and the use of night-time light data (Henderson, Yeh, Gong, Elvidge, & Baugh, 2003; Imhoff, Lawrence, Stutzer, & Elvidge, 1997; Shi et al., 2014; Sutton, Goetz, Fildes, Forster, & Ghosh, 2010). While widely applied, these approaches have their inherent limitations, including classification and accuracy issues (Huang, Li, Liu, & Li, 2016), the varying population density standards adopted in different country contexts (Herbert & Thomas, 1997), and the inherent limitation with night-time light data (Henderson, Storeygard, & Weil, 2012).

## CONTACT

(Corresponding author)  [yan.liu@uq.edu.au](mailto:yan.liu@uq.edu.au)

<sup>a</sup>Institute of Remote Sensing and Earth Sciences, Hangzhou Normal University, Hangzhou, China.

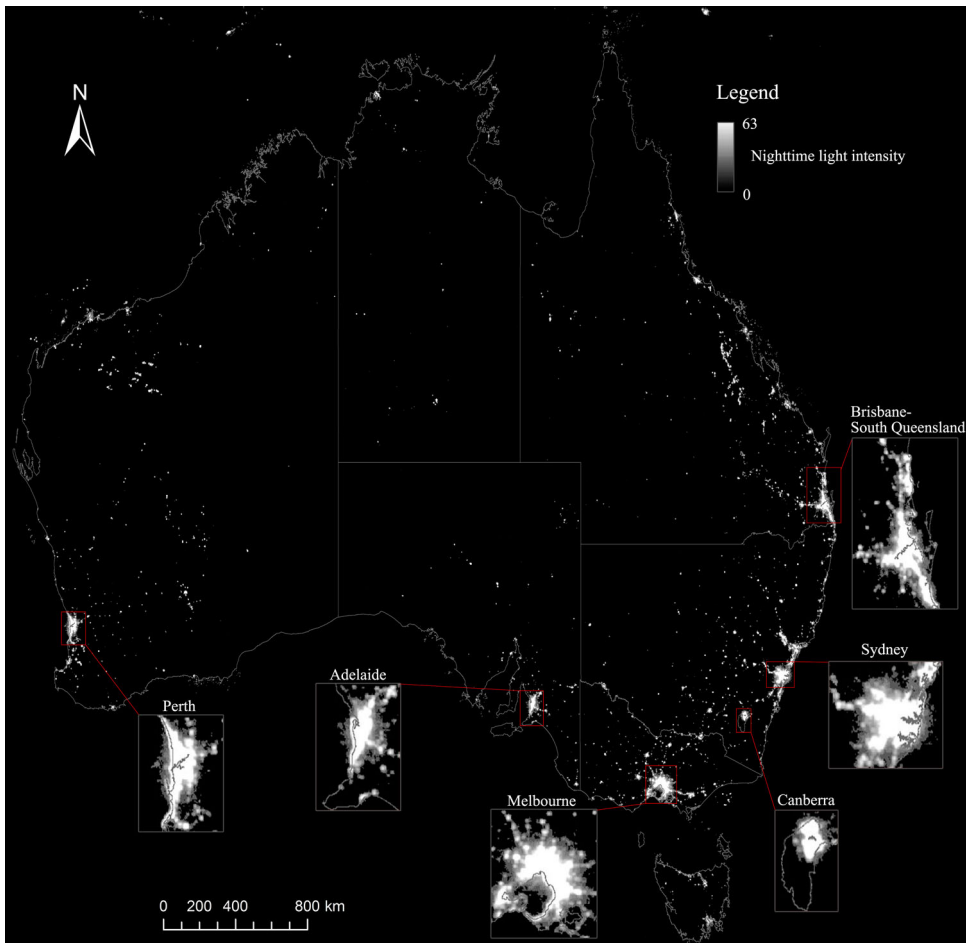
<sup>b</sup>School of Earth and Environmental Sciences, The University of Queensland, Brisbane, QLD, Australia.



**Figure 1.** Mapping Australia's urban extent using 2014 G-NAF data, with insert maps showing the major metropolitan areas.

We extracted all residential property addresses from the 2014 Geocoded National Address File (G-NAF) data (see <https://www.pdma.com.au/products/g-naf>), which is a geocoded address database containing the addresses of all properties in Australia, and used ArcGIS 10.2 software to compute the number of properties at a spatial resolution of a 1 km<sup>2</sup> grid for the whole of Australia (PSMA Australia, 2018). Subsequently, we used the Baidu eCharts (Baidu eCharts; see <http://echarts.baidu.com/>) visualization library to visualize the residential address data. Figure 1 illustrates all address points with at least five addresses in each grid, classified into three categories: scattered residential areas (with 5–15 addresses in each grid), rural residential areas (16–76 addresses) and urban residential areas (> 76 addresses). The distinction between urban and rural residential areas is based on the minimum standard of 200 persons/km<sup>2</sup> adopted by the Australian Bureau of Statistics (ABS) to delimitate urban areas and an average household size of 2.6 persons (ABS, 2015), resulting in approximately 77 properties/km<sup>2</sup>. Insert maps of the major metropolitan areas of Perth, Adelaide, Melbourne, Canberra, Sydney and Brisbane-South-east Queensland are included in Figure 1.

Compared with the 2013 DMSP-OLS night-time light data (see <https://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html>) resampled to a 1 km<sup>2</sup> grid to match with the 2014



**Figure 2.** Night-time light intensity map illustrating Australia's urban extent in 2013.

G-NAF data, it is evident that the settlement areas represented using the residential address data are more accurate than the night-time light data. In all metropolitan areas along the coasts, the extent of urban areas illustrated in [Figure 2](#) extend to outside the coastal boundaries due to the intensity of light along the shoreline. In contrast, the G-NAF data represent only residential locations when delimitating the urban areas. Similarly, urban and rural residential areas in the inland region are also more accurate with the G-NAF data ([Figure 1](#)) compared with the night-time light data, where the latter falsely depicted more 'urban areas' due to non-residential lights (such as street lights or bush fires). Nevertheless, it would be useful to use a combination of population census, residential property addresses as well as night-time light data to define the extent of urban areas more accurately.

Future research opportunities exist using the property address data for continuous monitoring of the change of the urban extent, identifying and modelling the driving factors to urban growth, as well as predicting future growth scenarios and directions.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

## FUNDING

Research for this paper was supported by The Australia Research Council Discovery Project [grant number DP170104235]; the National Natural Science Foundation of China [grant number 41401517]; and the China Scholarship Council.

## ORCID

Bin Xie  <http://orcid.org/0000-0002-7247-1237>

Yan Liu  <http://orcid.org/0000-0002-1612-779X>

## REFERENCES

- ABS. (2015). Household and family projections, Australia, 2011 to 2036 (cat. no. 3236.0). Australian Bureau of Statistics.
- Henderson, J. V., Storeygard, A., & Weil, D. N. (2012). Measuring economic growth from outer space. *American Economic Review*, 102(2), 994–1028.
- Henderson, M., Yeh, E. T., Gong, P., Elvidge, C., & Baugh, K. (2003). Validation of urban boundaries derived from global night-time satellite imagery. *International Journal of Remote Sensing*, 24(3), 595–609.
- Herbert, D. T., & Thomas, C. J. (1997). *Cities in space: City as place* (3rd ed.). London: David Fulton Publishers.
- Huang, X., Li, Q., Liu, H., & Li, J. (2016). Assessing and improving the accuracy of GlobeLand30 data for urban area delineation by combining multisource remote sensing data. *IEEE Geoscience and Remote Sensing Letters*, 13(12), 1860–1864.
- Imhoff, M. L., Lawrence, W. T., Stutzer, D. C., & Elvidge, C. D. (1997). A technique for using composite DMSP/OLS ‘city lights’ satellite data to map urban area. *Remote Sensing of Environment*, 61(3), 361–370.
- Linge, G. J. R. (1965). *The delimitation of urban boundaries for statistical purposes with special reference to Australia*. Canberra: Australia National University.
- PSMA Australia. (2018). Retrieved from <https://www.pasma.com.au/>
- Shi, K., Huang, C., Yu, B., Yin, B., Huang, Y., & Wu, J. (2014). Evaluation of NPP-VIIRS night-time light composite data for extracting built-up urban areas. *Remote Sensing Letters*, 5(4), 358–366.
- Sutton, P. C., Goetz, A. R., Fildes, S., Forster, C., & Ghosh, T. (2010). Darkness on the edge of town: Mapping urban and peri-urban Australia using nighttime satellite imagery. *The Professional Geographer*, 62(1), 119–133.
- Trianni, G., Lisini, G., Angiuli, E., Moreno, E. A., Dondi, P., Gaggia, A., & Gamba, P. (2015). Scaling up to national/regional urban extent mapping using Landsat data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 8(7), 3710–3719.