DRIVERS AND INDICATORS OF WATER QUALITY IN CHINA

Prioritising local action for water quality improvement using citizen science; a study across three major metropolitan areas of China.

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The study used data from FreshWater Watch and a machine learning approach to identify key indicators, and potential drivers of water quality across three major metropolitan areas of China. Results identified stream water colour as a good indicator; drivers related to artificial and agricultural land use coverage; and controls related to the presence of bankside vegetation in highly populated river basins. Thornhill et al. 2017. Sci Total Environ. 584-585: 1268-81

Aims

The study aimed to:
- establish an overarching approach to understand key drivers and indicators of stream water quality – nutrient (nitrate and phosphate) concentrations and turbidity.
- assess the relative importance of micro and macro scale predictors of water quality from citizen science and remote sensing.
- compare water quality across four Chinese cities- Shanghai, Guangzhou and Foshan (Guangdong province) and Hong Kong.

Approach

1200 citizen science measurements were collected from 51 river sites across Shanghai, Guangzhou and Foshan and Hong Kong between March 2013 and May 2016. Trained citizen scientists collected data on key nutrients and turbidity and recorded surrounding land use, potential point source pollution inputs (e.g. discharges), bankside and instream vegetation complexity and water colour.

The approach combined the water quality and local land use data with satellite-derived regional data to predict the likelihood of sampling sites to be classed as having good or poor water quality. Regional data that characterized land-use and demography factors were used to assess their influence upon water quality.

Impacts

The study demonstrates that citizen science data, coupled with remote-sensing data provides an easily accessible and cost-effective way to investigate water quality in complex catchments.

China has been experiencing rapid development over the last few decades exposing many freshwater ecosystems to urbanization-induced environmental risks. The results of this study provide useful information to develop effective management strategies to maintain ecosystem health.

Key results

- Potential drivers of poor water quality at a watershed scale related to land-use composition, in particular the prevalence of artificial surfaces and agriculture.
- The presence of bankside trees reduced turbidity at a local scale. Trees have the ability to secure and stabilize soil and thus reduce the soil erosion and sediment loading that can cause high turbidity.
- Shanghai rivers had significantly higher turbidity than Hong Kong and higher nitrate concentrations than either Hong Kong or Guangdong. Phosphate concentrations were similar across all three regions.
- The most influential predictor of water quality was water colour. Brown and yellow water indicated elevated turbidity and nutrient concentrations.
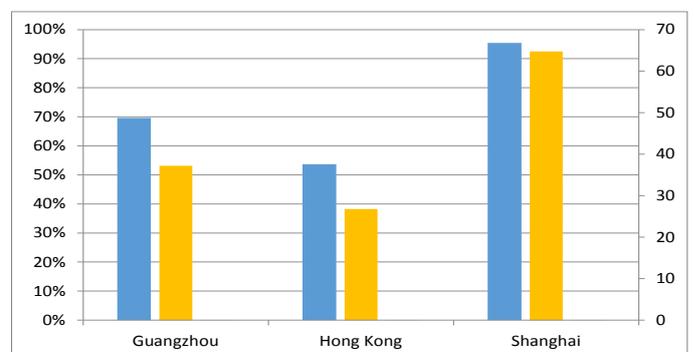

Figure shows observed colour, a measure of nutrient concentrations (blue), and average turbidity (yellow) across the rivers sampled in Guangzhou, Hong Kong and Shanghai.