

Characterisation of current groundwater uses in the Surat and Bowen Basins

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Aim: better estimate amount of water extracted by groundwater bores in and around the Surat Cumulative Management Area (CMA)

1 - Approach

Use statistical models to collate estimates of groundwater extraction and quantify uncertainty, using existing datasets:

- Existing observations: baseline assessment data, OGIA estimates, DNRM metering
- Other explanatory information: climate, stocking, pasture, soils, surface water availability, bore data, etc.

Collect further extraction data to improve statistical models

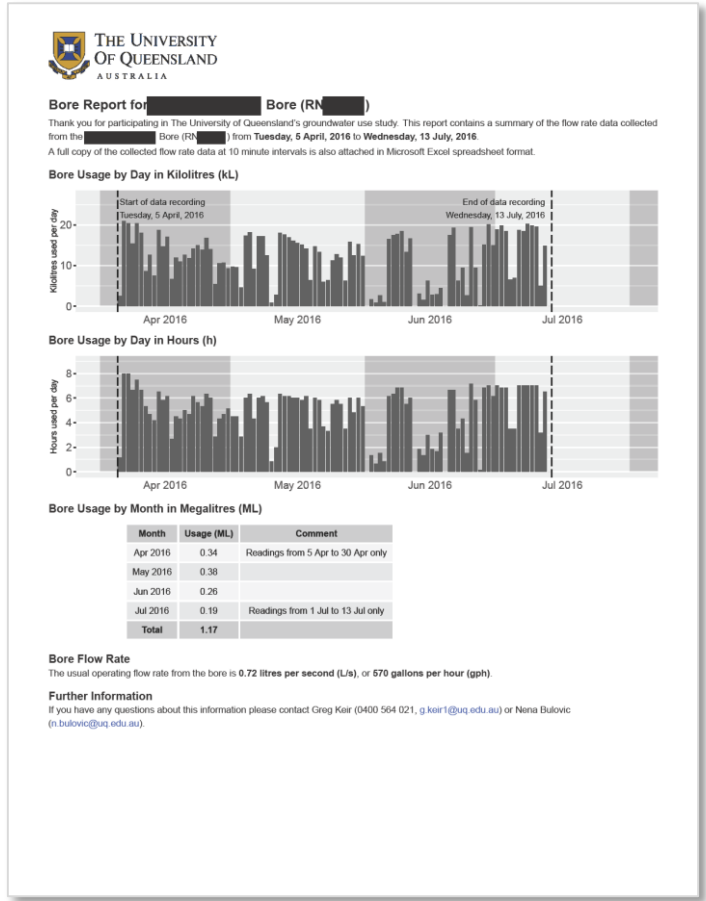
- UQ field monitoring program, 43 bores
- Private data supplied to UQ (council metering, landholder metering, UQ survey responses)
- ARC Linkage submitted to meter another 50 bores using innovative measurement techniques



Photographs of UQ non-invasive bore flow monitoring equipment

2 - UQ bore flow monitoring program

- Successfully running since December 2015
- Landholder participation in study voluntary and confidential
- Flow meters installed on 43 bores across the Surat CMA
- Temporary non-invasive metering technology (ultrasonic flow meters): self-contained, self-powered, and do not require pipe / headworks to be disassembled
- Data provided to landholders every 6 months – example report shown to left
- Looking to extend and further develop the UQ monitoring program (see ‘What’s next?’)

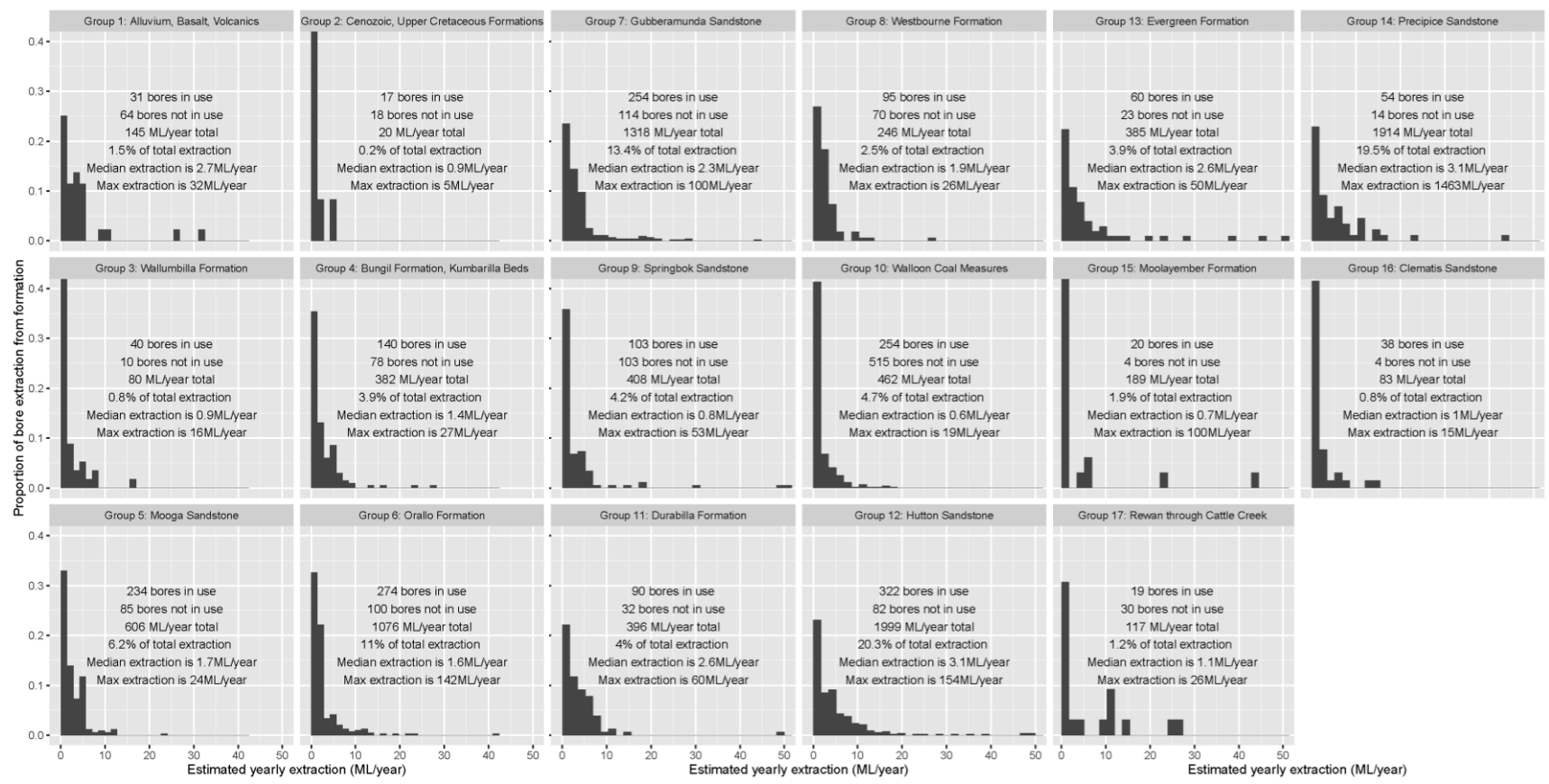


Example anonymised bore flow report provided to participating bore owners

3 - Interpretation of company baseline assessment data

Baseline assessment data from three companies interpreted on property-by-property basis:

- Provides statistical information about long-term average stock and domestic (S&D) bore usage for each aquifer
- Estimates of long-term average water take produced for over 2,000 bores
- Estimation algorithm agrees well with estimates prepared by companies



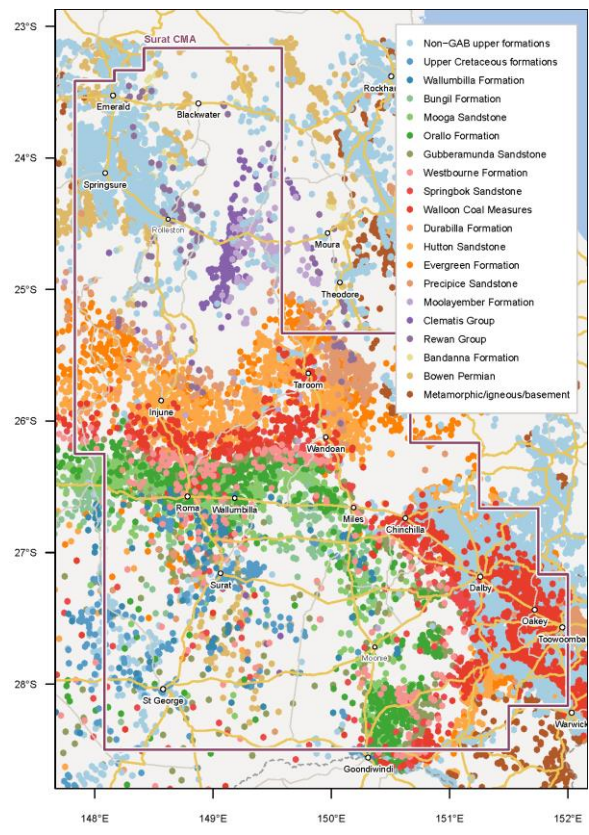
Estimated S&D extraction for bores in baseline assessment datasets by aquifer; based on interpretation of company baseline assessment data

4 - Estimating groundwater extraction for the CMA

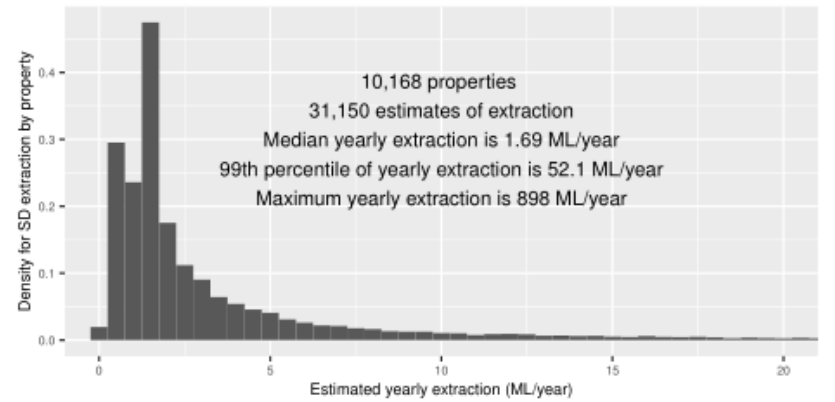
Statistical models developed to:

- Predict total groundwater extraction volume for each:
- Rural property (S&D use)
- Volumetric groundwater entitlement (other use, e.g. irrigation, industrial etc.)
- Predict which bores are being used within each property / entitlement
- Distribute extracted volume between used bores

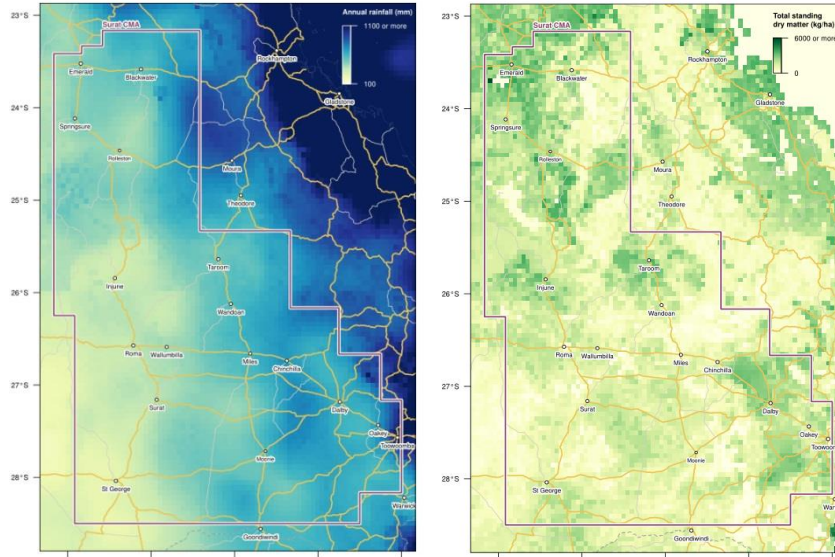
... using information from other factors, e.g. rainfall, pasture growth to improve predictions



Distribution of water bores by aquifer within the Surat CMA



Distribution of S&D groundwater extraction at the rural property-scale



Example of explanatory information used in statistical model: rainfall (L), pasture growth (R)

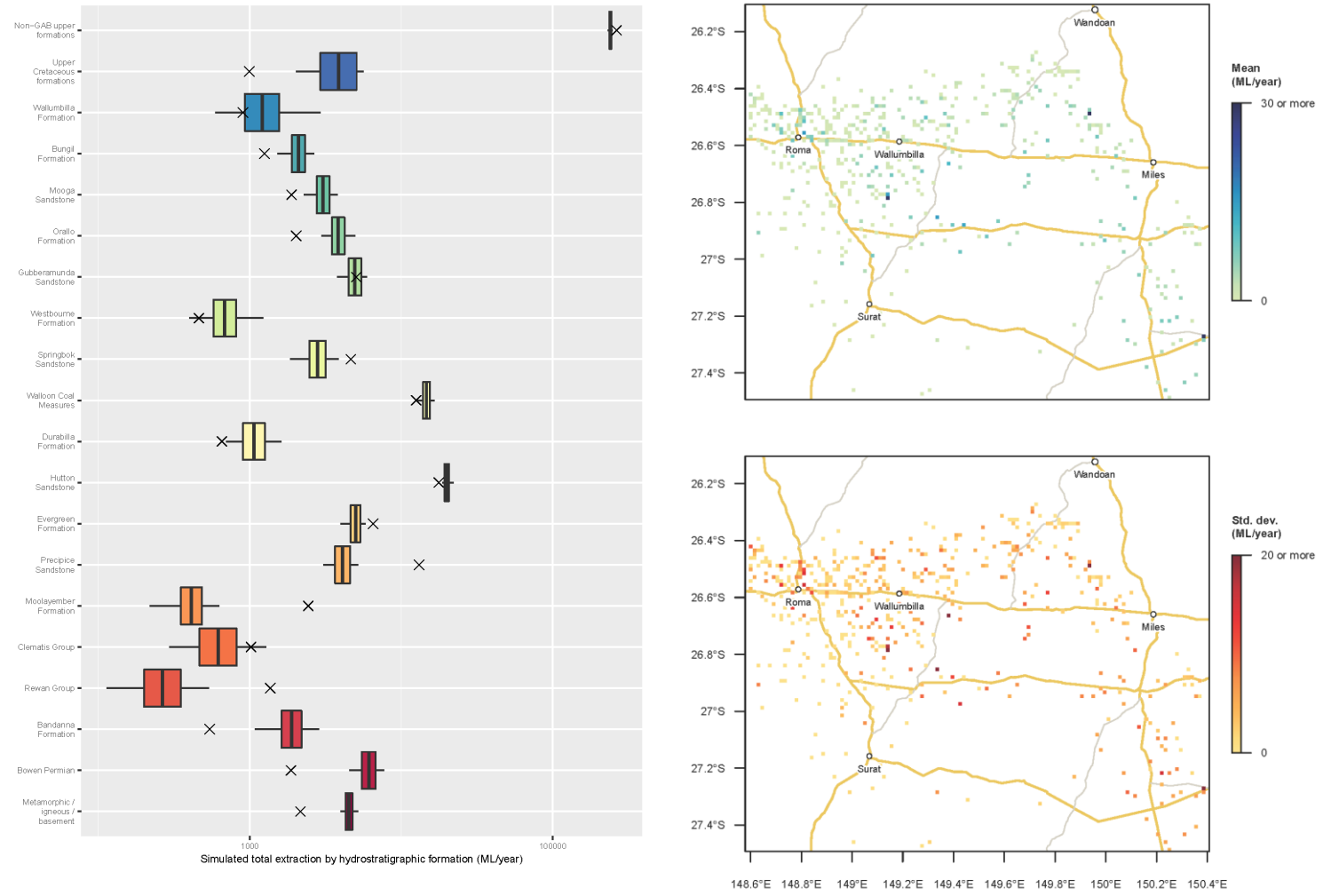
5 – Results

At the CMA-scale, our estimates of groundwater extraction volume are similar to OGIA’s 2016 revised estimates:

- S&D estimates slightly larger than OGIA (in the order of 0-20%)
- Non-S&D estimates slightly smaller than OGIA (in the order of 0-15%)

However, our statistical approach allows uncertainty in estimates to be quantified as well:

- Over 1,000 probable estimates of extraction produced for each of the 35,000+ bores
- Our estimates and methodology will be made publicly available on CCSG web site and hopefully can be used in next round of OGIA modelling to further refine model calibration



Comparison of probabilistic estimates to OGIA 2016 estimates by aquifer (L), and visualisation of mean of probabilistic estimates by OGIA model cell for Gubberamunda Sandstone aquifer (R)

6 – What’s next?

Currently seeking ARC funding to trial innovative measurement methods for 50 additional bores with arrays of cheap sensors: microphones, temperature sensors, power monitors etc.

- Partnering with UQ School of IT and Electrical Engineering

Continue the monitoring program:

- Keep gathering multiple years of data to keep improving predictions & better assess dependence of water bore use on climate conditions

Look at detailed studies of larger properties with multiple bores:

- Monitor every bore, dam, rainfall, streamflow on a property and ‘close the water balance’
- Continue existing monitoring sites as well as recruit new participants

A final thank-you to all the landholders and bore owners who have generously contributed their valuable time and advice – this research couldn’t have succeeded without your help