

Wombat Soil Profiler

by David Allen & Matthew Stockings

January 2024





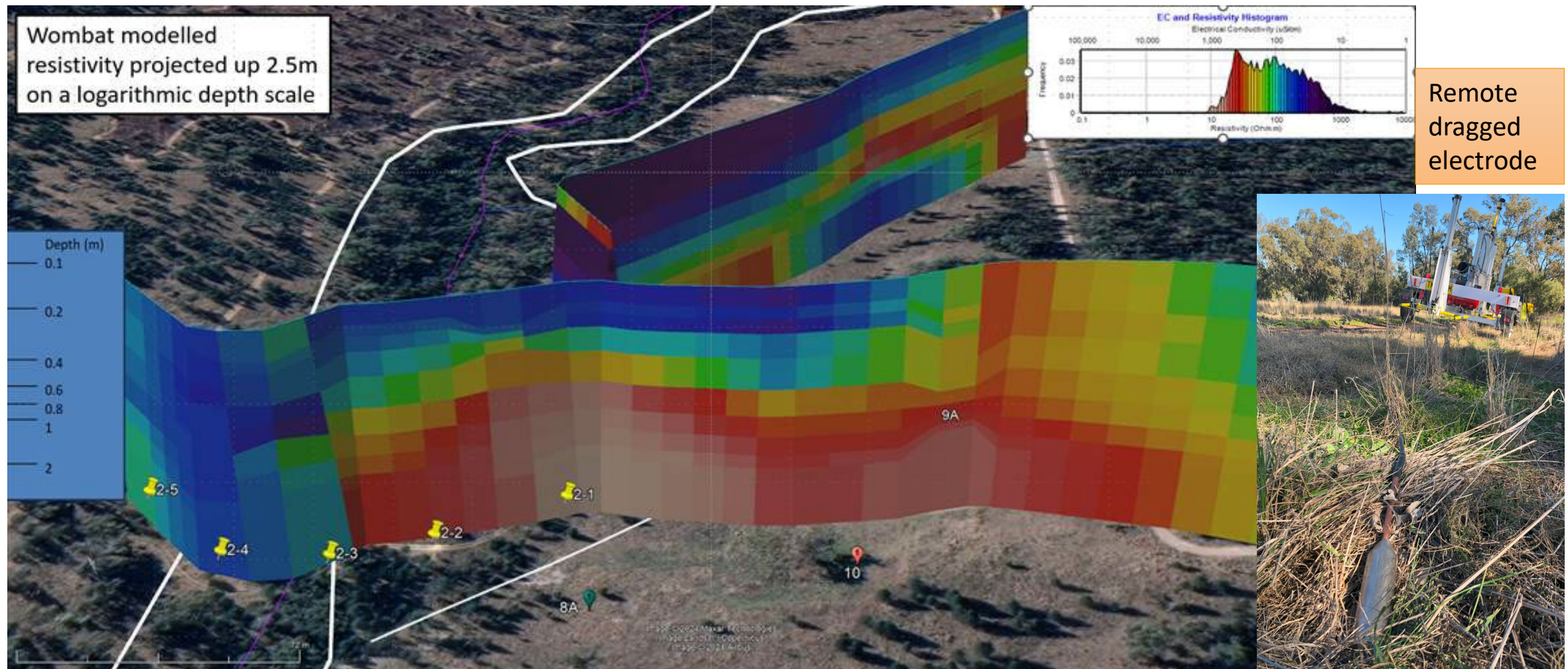
Wombat Soil Resistivity Profiler

Wombat soil resistivity profiler

For rapid soil imaging reflecting soil horizons' depths, salinity, moisture content, and clay content.



david@groundwaterimaging.com.au 0418964097

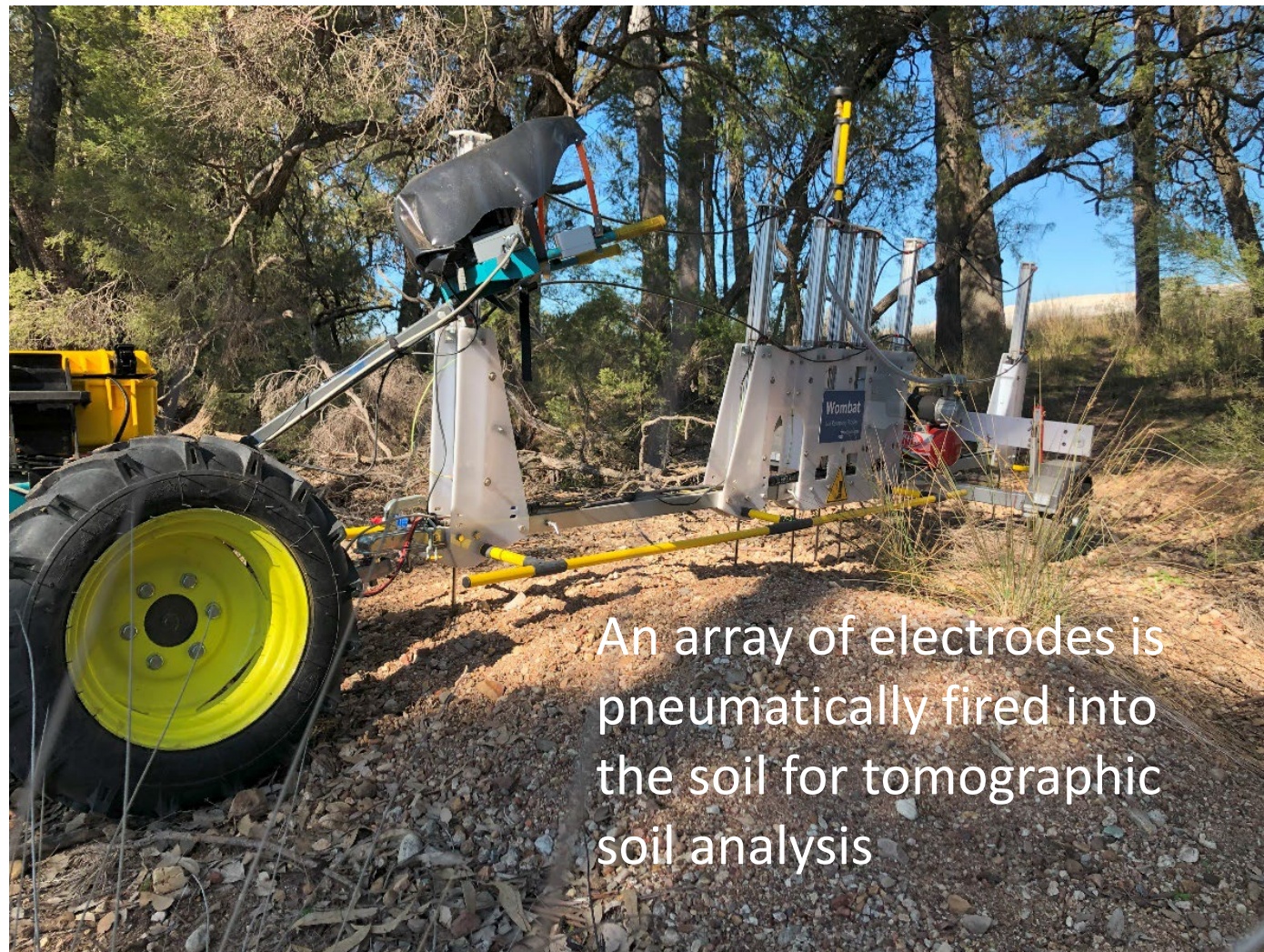


Wombat soil resistivity profiler

For rapid soil imaging reflecting soil horizons' depths, salinity, moisture content, and clay content.



david@groundwaterimaging.com.au 0418964097



An array of electrodes is pneumatically fired into the soil for tomographic soil analysis

Wombat is a direct current resistivity and induced polarization sounder/profiler. Unlike EM soil bulk conductivity meters, which collect data faster, it is operated in stop-go manner and remains drift free providing reliable accurate vertical profiles to 2.5m deep. Direct Current resistivity is the standard for remote soil conductivity measurement but without Wombat's pneumatically powered electrode insertion process it is too tedious for routine application in soils.

Application - Wombat Soil Profiler

Precision agricultural methods demand quality 3D soil mapping on whole paddock scale before, during and after weather and cropping events. A better rapid profiling tool such as Wombat is needed.

- Wombat is a soil profile imaging tool.
- It measures electrical conductivity (EC) through means of tomography using measurements made through a multiplicity of combinations of electrodes.
- In contrast to drilling, excavating and direct push penetrometers, it is non-invasive – only ground contact is needed.
- In contrast to electromagnetic (EM) mapping tools, it directly injects and detects currents in the soil whereas EM tools induct current into the ground. Inductive tools allow for fast travel over the ground but are relatively hard to calibrate, especially when it comes to resolving many layers within the ground.
- Wombat can conduct individual stop-go EC soundings within seconds due to automated, fast, pneumatic electrode emplacement and removal.
- Entire paddock time-lapse soil moisture profile comparison is facilitated by Wombat because it resolves changes in depth of soil moisture over time and remains calibrated electrically.
- In addition to EC it also resolves IP – induced polarization which is related to clay content.
- Soil permeability mapping.
- Time lapse soil profile comparison.
- Comprehensive soil investigations where a simple EC map is insufficient and ambiguous.
- Deep soil profile imaging coupled with comprehensive soil sampling.
- Soil profile carbon quantification – extrapolating cored data accurately.
- Quick broadacre calibrated 3D soil mapping – extrapolated using electromagnetic mapping tools.
- Geotechnical studies of soil profiles where detail needs to be gained without grid drilling
- Wombat's stop-go operation can simultaneously sample with AMS quadbike mounted rapid 1' deep soil sampler and the Australian Soils_CRC Bandicoot shallow soil penetrometer. The combined results robustly and reliably reveal complex soil structural and chemical interrelationships on paddock scale at cost that otherwise would be prohibitive.

Wombat soil resistivity profiler

- Wombat is a direct current resistivity and induced polarization sounder/profiler. Unlike EM soil bulk conductivity meters, which collect data faster, it is operated in stop-go manner and remains drift free providing reliable accurate vertical profiles to 2.5m deep. Direct Current resistivity is the standard for remote soil conductivity measurement but without Wombat's pneumatically powered electrode insertion process it is too tedious for routine application in soils.
- Wombat electrodes are fired into the soil, tomographic readings are taken in seconds, electrodes are lifted, and pneumatic energy replenished while travelling to the next sounding site.
- While EM meters offer just bulk conductivity, it is easy to add numerous soil sensors to the Wombat platform including a pH probe, U,Th,K,Fe and soil density capable compact spectrometer, shallow moisture probe, digital penetrometer, soil colorimetry and microscopy, and a shallow soil sampler (for later lab-based soil analysis of CEC, N, P, and organic C).
- Wombat quickly packs onto a pallet and a powerful soil corer or auger, that takes the physical strain out of deeper physical sampling, can be fitted to the compact walk-beside electric tractor shown.

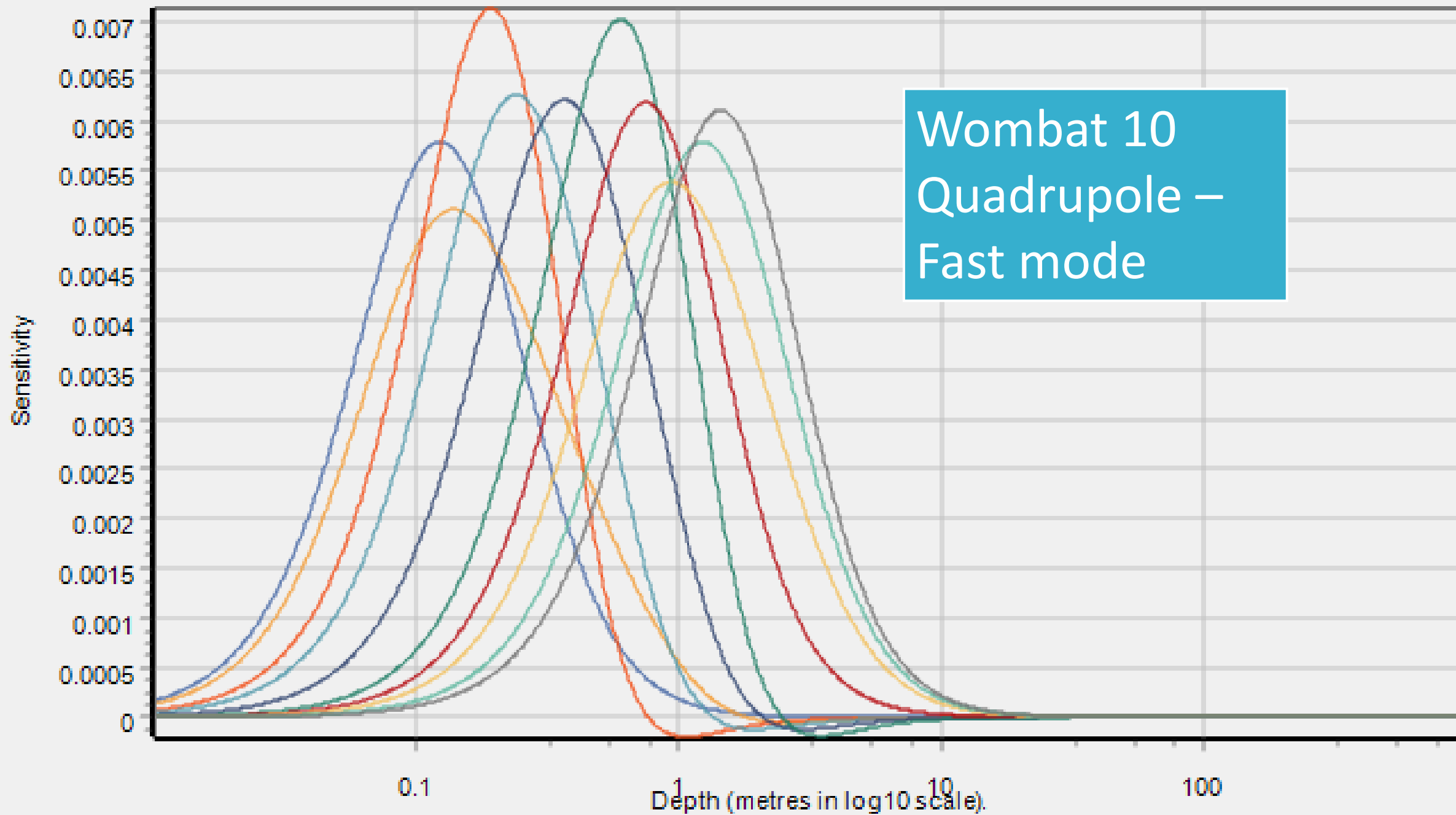


Wombat Electrode Distribution

Electrode Identifier	X – Distance (m)
1	-2.0
2	-0.6
3	-0.2
4	0.0
5	0.2
6	0.6

Additionally, up to 8 extra electrodes can be towed in a streamer for investigating more deeply. Suggested spacings are 4, 10, 16, 24, 32, 40, 48 and 60. One electrode in the list can be replaced with one dragged at the front of the towing vehicle (suggest removing 40 or 60).

Normalized Depth of Investigation Curves



10 Quadrupole Wombat Configuration

