GISERA
Gas Industry Social and Environmental Research Alliance

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AGRICULTURAL LAND MANAGEMENT FACTSHEET

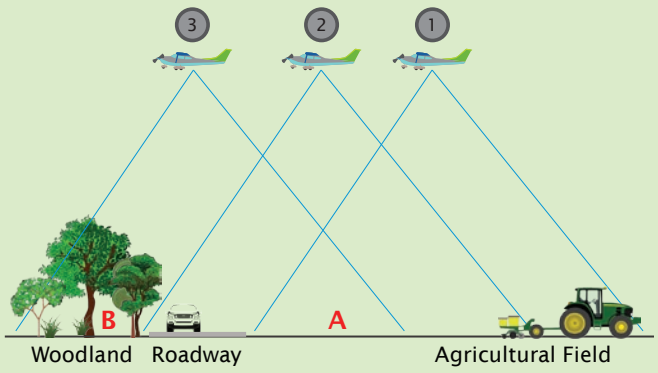
Access tracks and soil erosion

Aerial photogrammetry is used to monitor and model the impact of access tracks on water flows and erosion.

KEY POINTS

- Unsealed rural roads provide a disproportionate source of sediment into waterways.
- Aerial photogrammetry is being used to monitor changes in water flows from access tracks and other CSG infrastructure.
- Information on surface water flows should be used in planning for CSG infrastructure placement.

How does digital photogrammetry work?



A point "A" in an agricultural field is identified in three overlapping images. If the position of the aircraft is known for locations 1,2 and 3, the position of A can be calculated. Ground surface points within wooded areas (e.g. Point B) may need to be inferred from other nearby visible points if the view is obscured by foliage.

Studies from around the world have shown that roadways provide a disproportionate source of sediment into waterways. Commonly, over 40% of the sediment can be shown to have its origin in unpaved rural roads even though these roads only make up about 1% of the total area of a catchment (see Table 1 overleaf).

With CSG development, the intensity of roadways in agricultural land will increase significantly and there is a risk that erosion losses will increase as well. Standard engineering methods for mitigating erosion threats are available if the location of problem areas can be identified. However, the scale of the CSG and hydrological systems are so large that monitoring for threat development using traditional methods is difficult.

Aerial photogrammetry

Aerial photography has been used for many decades to monitor land use and to generate the contour maps of the ground surface.

Modern high precision digital photography and computing techniques allow these procedures to be followed with high spatial resolution over larger areas than ever before.

How can this be used?

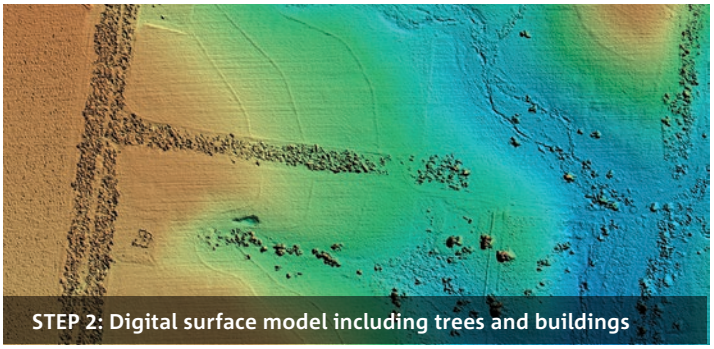
Information on the location and catchment area of water flows can be used by land holders and CSG staff during planning for CSG infrastructure placement. Furthermore, repeated surveys can show changes in water flow or soil surface elevation which may indicate diversion of water flows, soil loss or build-up of sediment within the survey area.

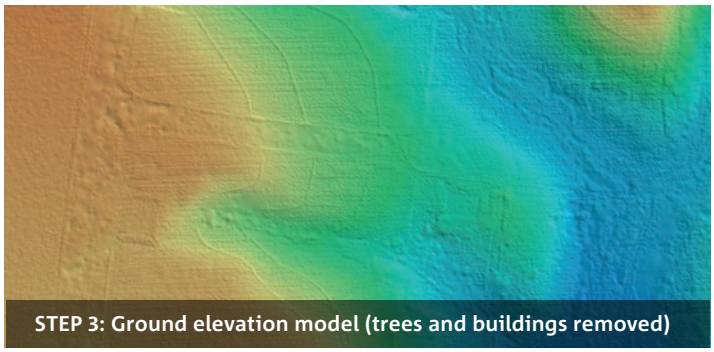
Land holders concerned about surface water flows can use a water flow map to help them communicate their concerns to CSG companies.

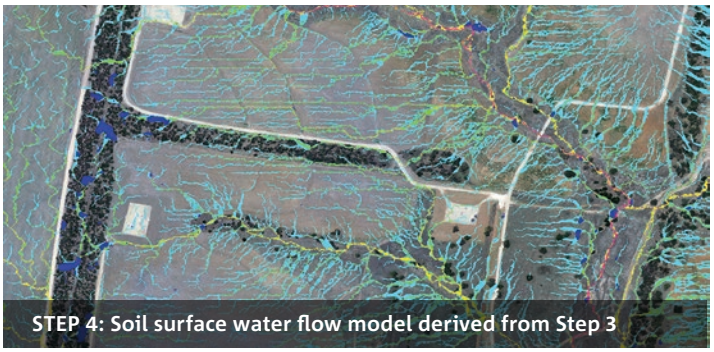
Table 1: Data on roads as % of catchment and % of sediment source.

Country	% of area	% of Sediment
China	1	42.3
Indonesia	5	40
Brazil	1.5 to 2	28-69
USA	Less than 5	23-30
Australia (forest)	2.4	18-39
Australia (farm)	1	41-52


STEP 1: Visual image from aerial survey


STEP 2: Digital surface model including trees and buildings


STEP 3: Ground elevation model (trees and buildings removed)


STEP 4: Soil surface water flow model derived from Step 3

The four main steps in deriving the water flow model. 1) Aerial survey conducted using digital photogrammetry. 2) A digital surface model (DSM) is constructed by triangulating the elevation of each pixel in the image. Note that contour banks and well pads are prominent in the image. The surface also includes surface features such as vegetation and buildings. 3) Surface features are removed and the ground surface beneath them is interpolated. Note that the surface depressions (e.g. "Gilgai") are now revealed from beneath the trees. 4) The ground surface elevation is used to calculate water flows according to small-scale topographical variation and features such as gullies, contour banks, drains and roadways.

FREQUENTLY ASKED QUESTIONS

How did you conduct the research?

We have performed two aerial surveys of 1300 km^2 between Chinchilla, Miles and Condamine. We used this data to create a 3D model of the soil surface with 20 cm resolution.

How does the water flow model work?

The water flow model simply calculates the upstream area of water flow for every pixel on the 3D model of the soil surface.

How did you test the modelling?

We compared our predictions to surveyor's measurements of surface elevation and water flow paths.

FURTHER INFORMATION: 1300 363 400 | gisera@gisera.org.au

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