

## **Mining Affects Rangeland Management and Integrity**

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Rangelands are a rich and often readily accessible source of minerals, coal, conventional and unconventional gas and this has much potential for mining activities to impact the rangeland environment and farming of grazing animals. This gives rise to conflict that is often an unequal contest because of the relative capital investment capacities of mining companies and grazing land resource managers. Mining always involves land disturbance of some nature much of which is irreversible.

Mining often has a major impact on rangeland hydrology, often over a considerable area e.g. increase in erosion propensity and fine-particle transport to streams and potentially the Great Barrier Reef; saline and acid water contaminant release inadvertently to the ground surface or to aquifers; and drainage of aquifers into voids created by the mining activity. This can impact on landholders' ability to conduct their enterprises effectively and sustainably. This can also affect the value of their land tenure through the environmental damage making the grazing enterprise less profitable.

The mining companies' efforts to gain access for exploration and production activities can lead to stress on families such that they feel forced to sell their land to the mining company in order to minimise the effects on family health. This is usually done with a nondisclosure confidentiality agreement regarding the conditions of the sale contract. Proximity to mining activity *per se* and having coal seam gas (CSG) wells on a property (or neighbouring) reduces land valuations affecting the ability to borrow money and driving down property land values towards a negative equity outcome. Mining company property "buy up" also affects the fabric and health of rural communities (Haswell and Shearman 2019).

It is difficult for mining companies to restore the land they have used to something approaching the original environmental values and very few cases of land restorations have been signed off by Government as successful. The Queensland legislation on mined land rehabilitation partially addresses this for new activities through financial provisioning but appropriate risk assessment based on the precautionary principle and local community engagement are needed to ensure that the mining occurs with least impact on the environment and rehabilitation occurs satisfactorily, for example such that voids are filled in and not left. Some existing voids perform a useful role in pumped hydro production of electricity. The legislation around mining does not address industry insurance to ensure that landholders are adequately covered for impacts of mining. Landholders themselves are unable to obtain such insurance e.g. against soil and water contamination by CSG mining and loss of aquifer (well) water. This affects land valuations, investment and future land use.

Mining uses large amounts of water and this is often competitive with other land uses for the water taken. Aquifer draw down is a major issue because of the long time taken for recharge, and it affects lateral flow of water into streams and springs. Much of the rangeland water accessed for mining processes is from the Great Artesian Basin and interconnectivity of aquifers within the Basin is an issue affecting available water quantity and quality particularly in the Channel Country. Fracking for unconventional gas (shale and CSG) water requirements (in the USA to be between 42 and 90 million litres per shale gas well Ingraffea AR, Cornell Univ pers. com. and Kondash et al 2018) places a large burden on water resources in Australia (and road resources as this water may be trucked in). The CSG industry in Queensland is now extracting 60,000 megalitres per year of produced water, and the way this is used along with the disposal of the salt produced (by reverse osmosis remediation of produced water to enable disposal to water ways or agricultural/environmental use) is very controversial and not yet settled. This water is a public good and not managed as such (Monckton 2019). The aquifer "make-good" agreements in land access contracts between mining companies and landholders do not ensure restoration of the loss of aquifer water, only a monetary compensation, or a new bore maybe into another aquifer if available.

The number of bore drawdowns from CSG mining is increasing (Underground Water Impact Report 2019 [https://www.dnrme.qld.gov.au/\\_\\_\\_data/assets/pdf\\_file/0010/1445554/uwir-2019-report.pdf](https://www.dnrme.qld.gov.au/___data/assets/pdf_file/0010/1445554/uwir-2019-report.pdf)).

Seismic events are a more regular occurrence than usually acknowledged and can be induced by mining *per se*, and are another risk for aquifer integrity with the faults opened up allowing water and the contained contaminants moving between aquifers (eg Concerned Health Professionals of NY 2019).

Mining company vehicle movement poses a very large risk to biosecurity and particularly the spread of weeds such as parthenium (Bajwa et al 2017; <https://www.abc.net.au/news/rural/2014-02-10/csg-weeds/5249638?site=southqld> ). CSG mining companies have moved onto properties to establish pipelines without washdown and this causes landholders considerable distress. Washdown of vehicles is required but not policed/monitored and facilities are often not available or provide adequate cleaning (Khan et al 2018).

Fugitive emissions are not adequately measured on a continuing basis and usually baseline measures are not taken before mining starts. Such fugitive emissions not only contain greenhouse gases with a drastic feedback effect on weather events – drought, severe rainfall intensity and flooding – but also volatile organic compounds (VOCs) which can affect human and animal health as the Linc Energy underground gasification case illustrated (also see Haswell and Shearman 2019).

An aspect of unconventional gas extraction is the potential for blow outs. Capping wells with cement concrete may not cut out fugitive emissions as concrete shrinks and bentonite is currently being assessed as an alternative. The concrete lining of the metal tube in the well also can allow fugitive emissions to flow through an inadequate sealing against the rock wall. In the USA research published by the EPA and other organisations showed that aquifer contamination and fugitive emissions occurs with fracking for shale gas extraction.

Agro-economic modelling by CSIRO of the effects of CSG mining in Queensland rangeland showed that losses of up to 10.9% of agricultural revenue could occur (Marinoni and Garcia 2016)

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