


This abandoned coal mine near Howard in the Hervey Bay area in Queensland was home to little bent-wing bats but conservation of the site had to be abandoned after gas levels rose to dangerous levels.
Photo: Bruce Thomson

APPLYING BEST BAT-PRACTICES AT ABANDONED MINES

Bats don't care whether their cave is natural or artificial, so why should we? **Bruce Thomson, Corinne Unger** and **Elizabeth Williams** call for a systematic national focus on protecting bat roosts in abandoned mines.



What bats perceive by echolocation is different from what we see.

Real estate options for some bats have expanded in the past 200 years due to the human desire for coal and metals like gold, silver and copper. For several of Australia's 31 cave-roosting bat species, the tunnels and shafts of old mines are now critical habitat, including as sites for raising their young. At least 11 bats rated as threatened or near threatened in Australia's 2012 action plan for mammals make some use of old mines.

Mighty conservation battles have been fought to protect some bat caves – most famously at Mt Etna in Queensland – but because old mines are human-made structures, often posing safety and pollution hazards, they have won little official attention as bat habitats. This is changing, but the future for some bats will be less than glittering unless there is a more systematic approach to protecting such roosts.

Take Australia's ghost bat, the world's second-largest microbat, with a 60 centimetre wingspan. Many roost in abandoned mine tunnels. The single greatest concentration is in an old gold mine in the Northern Territory. To breed and raise young they congregate into just a few sites, with females mostly returning to the cave they were born in. To access optimal microclimates, they may shift from cave to cave as their young develop. In the Pilbara, the only known maternity roosts are in gold and copper mines that are now collapsing or being cut open, and in caves that may be mined for iron over the next 30-50 years. Australia's mammal action plan predicts that on current trends most Pilbara roosts will be destroyed.

Any species that congregates largely in one location is highly susceptible to the site being damaged or destroyed. This can impact the whole ecosystem if caves are rare in the landscape. Bats radiating out from their roost sites forage over large tracts of land – in some cases up to 20 kilometres from their refuge.

The destruction of one key roost can remove a species and its insect-eating services over a considerable area.

Abandoned mines

There are more than 50,000 records of abandoned mines in Australia. With no individual or company legally responsible for managing them, the task falls to governments and private landholders. Most were abandoned when community expectations were lower, mining regulations were weaker and governments did not require bonds or bonds large enough to cover the costs of rehabilitation.

A 2010 national framework for managing abandoned mines developed by Australian governments and the mining industry says there has been a shift from regarding such sites only as 'legacies with safety risks, contamination and environmental impacts' to also recognising their potential for 'positive uses'. But this framework has yet to be implemented; there is no implementation plan or clear responsibility at a national level.

The backlog of rehabilitation work needed is huge, with not enough being done to keep pace with the growing economic and environmental liabilities of abandoned mines. The impacts on groundwater of acidic and metalliferous drainage (due to the weathering of sulphide and other minerals in waste rock and tailings) worsen over time, and the heritage and environmental values of some mines deteriorate from vandalism or decay. Although the national liability resulting from abandoned mines is unknown a 2012 Queensland audit put it at \$1 billion for that state alone.

Bat roosts are just one of many issues needing attention. These sites are often hazardous – with open shafts, collapsing tunnels, and rotting timbers – and contaminated by acid and ►



The rare lesser large-eared horseshoe bat (left) is found only in a small part of Cape York Peninsula. Like many other bats, it uses caves and mines only seasonally, so multi-seasonal surveys are needed to reliably determine whether sites are being used as roosts. The eastern horseshoe bat (centre), is a common inhabitant of abandoned mines in eastern and northern Australia. At 9 cm long, the diadem horseshoe bat (right) is one of the larger bats to roost in caves and mines. *Photos: Bruce Thomson*

metalliferous drainage, and salinity in water bodies that were used for processing, and in runoff and seepage.

The estimate of 50,000 abandoned mines is based on incomplete records scattered amongst various state and territory government departments. As part of implementing a national approach, we need an inventory as a basis for evaluating mine values and liabilities, and the conservation needs and opportunities. There are opportunities, for example, with residual minerals to couple further mining with site improvement.

Challenges

Protecting bat roosts is often not straightforward. Old tunnels and shafts are liable to collapse or flooding, mining may recommence, bats may be frightened by human visitors into abandoning roosts, access may be blocked to protect human safety, and high levels of pollution can harm bats as well as humans. Other impediments are the remoteness of some sites, access difficulties, costs and the desires of fossickers, cavers, locals or tourists to access sites.

Knowing which mines suit bats can be difficult. Each species has temperature and humidity requirements that may change with the seasons and for different purposes – for breeding and raising young or for overwintering, for example. This means that potential roost sites should be assessed over different seasons, and protected by maintaining existing microclimates.

It can also be hard to predict what modifications will work best for bats. What they perceive by echolocation is different from what we see. A gate or grille erected to keep people out of a mine may also deter bats even if the gaps look big enough for them to fly through. The gaps recommended for human safety may be too small to allow access by some bats, particularly the fast-flying, less agile species. Poorly designed gates may alter airflow and change the microclimate – some mine roosts have been abandoned after the installation of supposedly 'bat-friendly' gates. Bat gates need to be robust, for some fossickers go to great lengths to break them down, lured by the thought of treasures beyond.

We are encouraged by a growing interest in protecting roosts.

Few bat gates have been monitored to see if they work. The one published Australian study,

by Christopher Slade and Brad Law, found that some bats had 'marked difficulty' negotiating gates with horizontal bars 125 millimetres apart on mines near Eden in NSW. Bat numbers in the roosts dropped after gating. Longer term monitoring was needed to test whether this short-term impact would persist.

POLICIES AND STRATEGIES

Each state and territory has its own approach to managing abandoned mines. In 2010, to promote more convergence between them, the federal, state and territory governments, with the minerals industry, launched the Strategic Framework for Managing Abandoned Mines in the Minerals Industry.

The framework recognises the importance not only of minimising safety and contamination risks but of protecting historical, educational, social and environmental values including for bats. However, there has been little or no progress in implementing the framework.

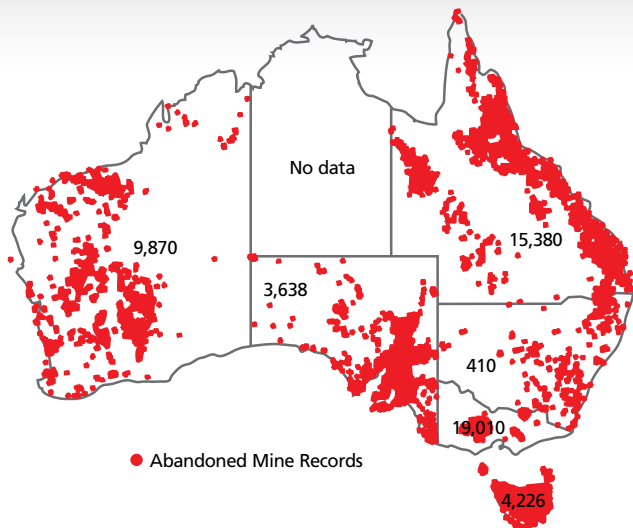
New South Wales has shown leadership in protecting bat roosts in mines. In 2001, the state government released its Strategy for the Conservation of Bats in Derelict Mines, with proposals to develop procedures to assess derelict mines as bat habitats, guidelines for surveying and monitoring bats and options for management, and training and education programs. Derelict mines for conservation in public reserves are

to be identified and prioritised. It recommends a collaborative approach with conservation, mining and government organisations. As highlighted on page 46, the state has trialled a regional approach to assessing roosts in mines.

The Northern Territory and Queensland governments have made some progress in developing similar strategies. Queensland has been developing guidelines for assessing abandoned mines in that state.

Although not all states and territories have formal abandoned mine programs, we have observed a growing awareness of the need to conserve bat habitat and other values. It is likely also that some mining companies are doing good work in managing mines for bats without it being known publicly.

READING: MCMPIR/MCA. 2010. *Strategic Framework for Managing Abandoned Mines in the Minerals Industry* (downloadable) ■ NSW National Parks and Wildlife Service and NSW Department of Mineral Resources. 2001. *Strategy for the Conservation of Bats in Derelict Mines* (downloadable).



There are more than 50,000 abandoned mine records in Australia, with the number per state (current to 2011) shown on this map. The records for some states or territories are incomplete. Source: Unger et al. (2012, listed in 'Reading').

Progress

We are encouraged by a growing interest in protecting roosts. Some states, including New South Wales, have developed bat conservation protocols for derelict mines and others are moving to include bat surveys as part of site assessments. Although a lack of monitoring means we do not know how effective most bat gates are, that they have been installed in several places around Australia shows that some governments, mining companies and landholders are willing to invest in roost protection.

For more effective and widespread protection, Australia needs a systematic national approach and a support network with bat experts to hasten adoption of good practices. Canada and the United States are showing how well such networks can work. We need best-practice guidelines for assessing, protecting and monitoring roosts, and for such work to become a routine part of managing abandoned mines.

Through good planning and management we can protect old mines for their bats, as well as for human and environmental safety. Bats don't discriminate between artificial and natural, and nor should we. ■

READING: Duncan A, Baker G, Montgomery N. 1999. *The Action Plan for Australian Bats*. Environment Australia (downloadable) ■ Slade C, Law B. 2008. An experimental test of gating derelict mines to conserve bat roost habitat in southeastern Australia. *Acta Chiropterologica* 10(2): 367–76 ■ Tuttle MD, Taylor DAR. 1998. *Bats and Mines*. Bat Conservation International, Resource Publication no 3. (downloadable) ■ Unger C, Lechner AM, Glenn V, et al. 2012. Mapping and prioritising rehabilitation of abandoned mines in Australia. *Life of Mine Conference 2012*. (downloadable) ■ Watkins FA. 2002. *North American bats and mines project: A cooperative interagency approach to bat conservation through mine land reclamation*. National Meeting of the American Society of Mining and Reclamation. (downloadable)

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Photo: Kelly Rowley

BARRING PEOPLE BUT NOT BATS – GRATE TRIALS AT A NSW MINE

Kelly Rowley and Brad Law

Bimbimie gold mine on the south coast of NSW exemplifies some of the quandaries of managing derelict mines. Initiated in 1851 and abandoned in 1984 (when the Australian dollar was floated), the mine was deemed structurally unsafe by the Department of Mineral Resources. Normally, it would be sealed to stop people entering but in this case more than 2000 eastern horseshoe bats and threatened eastern bent-wing bats needed to be considered.

In 2008, two grates were installed, one across a vertical shaft and the other at the entrance tunnel used by bats. The grate across the tunnel had vertical bars at the bottom and horizontal bars at the top, with gaps complying with the Australian Standard for swimming pool fences. To see if it was suitable for the resident bats, the grate was installed in stages, and with an infrared counter we tallied the number of bats passing through the grate at dusk over many nights between February and July 2008. Unfortunately, their numbers dropped from 1830 to just 154 (from our experience we didn't believe this was because of the onset of winter).

So, the design was altered, and the entrance grate was replaced with vertical bars only – more easily negotiated by bats – supplemented by a tall fence and warning signs.

But this was not enough to deter human visitors. Five years later, we were again approached by the derelict mines unit to test a grate with horizontal bars, for the fence and grate had been vandalised and people were entering the mine. Again, the horizontal bars proved offputting for bats, and numbers dropped from 3315 to 513.

Now, a different structure using angled horizontal bars has been installed, based on work in the United States. The access road has been ripped up and rollovers constructed to stop vehicles entering the site. We are yet to learn whether the new design is acceptable to bats.

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Eastern bent-wing bats, clustered here in a mine in NSW, are common inhabitants of abandoned mines in southeastern Australia.
Photo: Bruce Thomson



A STRATEGIC APPROACH TO ASSESSING BAT HABITAT VALUES OF DERELICT MINES

Brad Law and Leroy Gonsalves

Because funding is scarce, derelict mines are often rehabilitated only as crises develop, leading to ad-hoc assessments of their habitat values for bats, lacking local or regional context. In an Australian first, New South Wales scientists recently trialled a more strategic approach by assessing the regional significance of disused mines along the Illawarra Escarpment in southern NSW as bat roosts. This involved producing an inventory of disused mines (on both active and derelict mine sites) and surveying them to identify significant roosts, and then assessing the potential of this regional approach for prioritising management of derelict mines.

Of the 81 disused mines we identified, 56 had been sealed or could not be located. We surveyed 25 mines over 2-3 nights in winter, summer and autumn by recording echolocation calls as bats left their roost at dusk. This revealed that 23 mines have roosts of eastern bent-wing bats (a threatened species in NSW) or eastern horseshoe bats, or both. Since acoustic detectors do not allow reliable estimation of bat numbers, we did video surveys at sites with high bat activity, filming dusk flyouts for one hour and playing back the footage in slow-motion to count the bats. At some of the bigger colonies, we also trapped exiting bats to find out whether the roosts were being used for breeding and raising young.

We identified six mines as regionally significant due to the number of bats they hosted (none are maternity sites), and recommend they be prioritised for management by local authorities. Further investigations are needed to work out how best to manage them while also maintaining human safety. At some sites, mine collapse is already occurring, and fencing to prevent human access is dilapidated or non-existent.

We recommend this strategic, regional approach to prioritise management of derelict mines. This will help minimise the risks of mass entombment of bats by the collapse of tunnels or shafts, and identify mines to close because of human safety risks. A regional approach also ends up costing less than one-off assessments of individual mines.

READING: Gonsalves L, Law B, Wilmott L, et al. 2014. *A strategic approach to prioritising disused mine management for bats along the Illawarra Escarpment*. NSW Primary Industries Report prepared for NSW Derelict Mines.

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Above is an example of a gate at a disused coal mine portal in NSW to prevent human access. It was not intended to allow access by bats but some bats are using the narrow gap indicated by the circle to enter and exit.

Photo: Leroy Gonsalves



The un gated active portal above is used by about 1500 bats in summer and autumn. The collapsing tunnel below is the entrance to a regionally significant mine roost but also a safety hazard.

Photos: Leroy Gonsalves

