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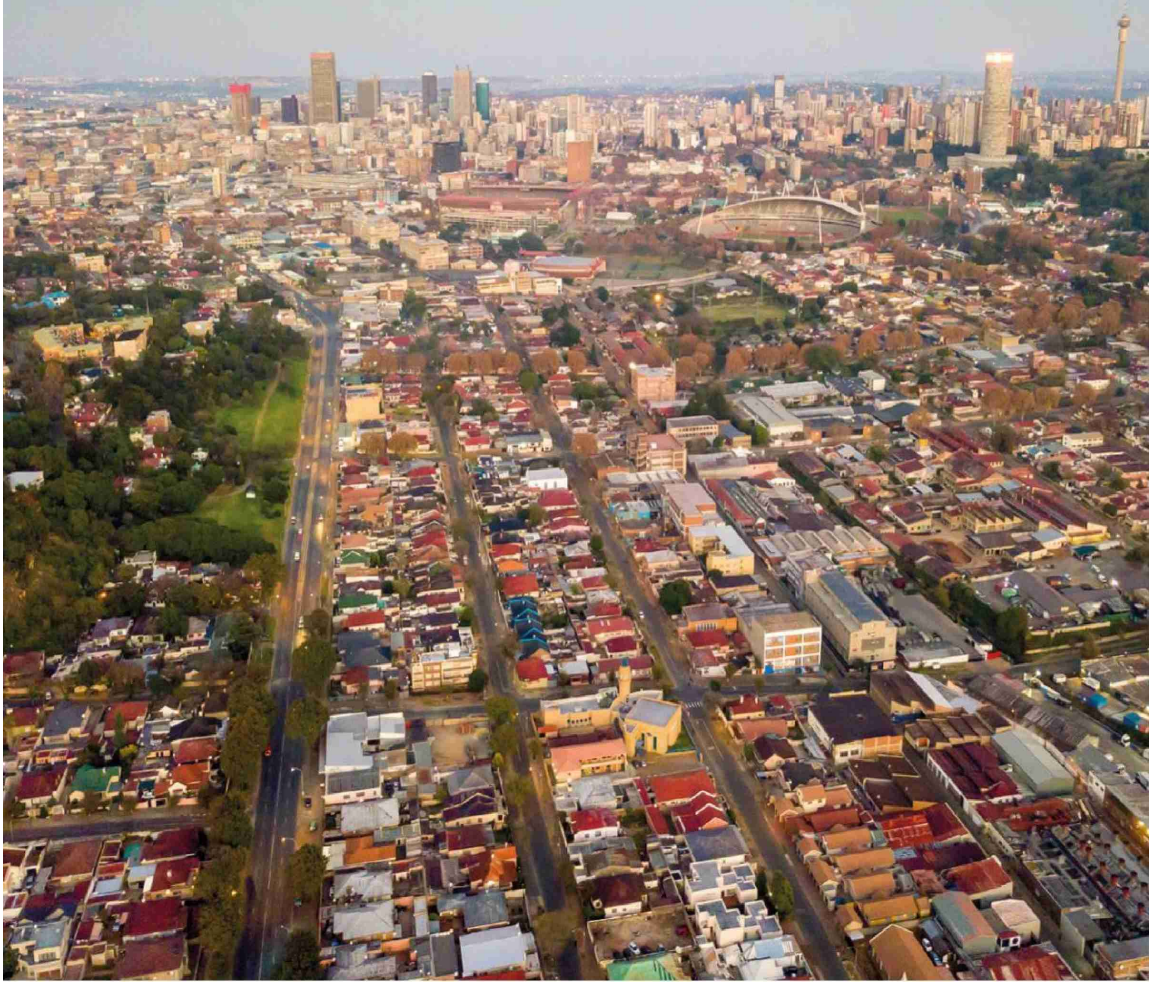
The secret map beneath eGoli

The Gauteng landscape is littered with the byproducts of excavation. Mapping these areas accurately has never been more important.

By Tiana Cline



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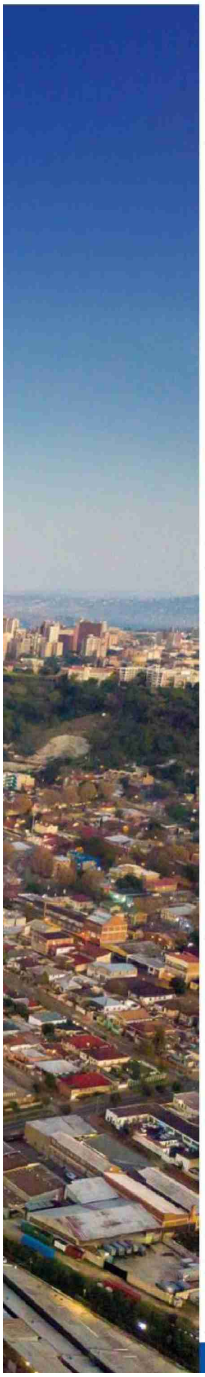

Photograph: Karolina Komendera

The mining towns of Bodie, California, and Rhyolite in Nevada are reminders of what happens when the minerals run out.

Built during the late 19th-century and early 20th-century gold and silver rushes, they grew fast, drew in thousands of prospectors and capital, and then emptied out when mining stopped making economic sense. In the case of Bodie, the boom lasted around five years, until 1882, and the last residents packed up and left in 1943. Today, they survive as preserved ghost towns, visited only by tourists.

Johannesburg took a different path. Gold was discovered along the Witwatersrand basin in 1886 and the-then Transvaal grew around mining infrastructure, labour and investment. By the 1970s, large-scale mining was in decline, but the city kept growing. Finance, manufacturing and services expanded, and Gauteng is now South Africa's economic hub, home to more than 15mn people.

This is a rare occurrence, says Samkelisiwe Khanyile, a senior researcher at the Gauteng City-Region Observatory (GCRO).

"It carries an imprint of extraction in its very basic fabric."

Unlike many former mining regions, the Gauteng landscape is littered with the byproducts of excavation. Communities have grown up alongside and on top of tailings dams and abandoned shafts. Acid mine drainage poisons rivers, and radioactive waste from uranium-rich mines was deposited across the Witwatersrand mining belt. Much of the footprint of mining is underground, leaving tunnels, voids and ventilation shafts that are invisible at ground level. At the same time, old mine dumps are being reworked to extract the remaining gold and there are active mining operations next to towns, such as Mponeng ultradeep Gold Mine next to Carletonville, and the South Deep in Westonaria. "You have post-mining legacies and active mining in a very urban setting," Khanyile says. "There's nowhere else quite like this combination."

Maps are used by planners, policymakers and businesses to inform zoning decisions, infrastructure investment, environmental assessments and rehabilitation. If a feature doesn't appear on a map, it won't be included in the decision-making process.

One of the most persistent problems is how mining is represented on maps, says Khanyile, and that a mine's impact may stretch far beyond its marked boundaries. Underground workings, contaminated soil and water systems extend well beyond what a single point on a map represents. Urban and mining areas are often denoted by neat, separate polygons. On paper, this creates clear boundaries. On the ground, those boundaries blur. "It was very difficult to tell where mining ends and the urban begins and where the urban begins and mining ends," says Khanyile. Her research focuses on representing Gauteng as both an urban area and what it looks like post-mining. Her work shows gradients and overlaps. "You can't fix what you can't see and mapping is how we make the invisible visible, but only if we're using the right techniques and the right data."

> "You can't fix what you can't see. Mapping is how we make the invisible visible, but only if we're using the right techniques and the right data."
> Samkelisiwe Khanyile, Gauteng City-Region Observatory

When maps are inaccurate, decision-making can be affected. Town-planning rules that restrict building within a certain distance of a mine depends on the accurate representation of mining footprints. If a mine is reduced to a single point, those rules can fail in practice. Communities, shops and schools built on contaminated or unstable land may not appear as mining-affected in these datasets. "If mining's influence is invisible in our maps, then it's invisible in our policies," she says, adding that she has seen photos of children playing dangerously close to unsecured mining pits. The problem is also compounded by gaps in the data. Mine closure information and other mining datasets are often difficult to access or are incomplete, despite some being collected with

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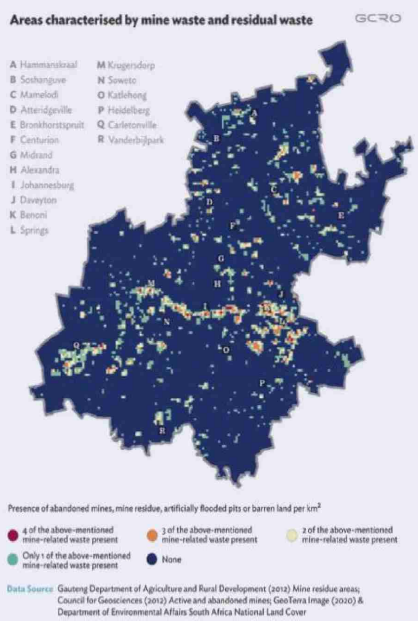
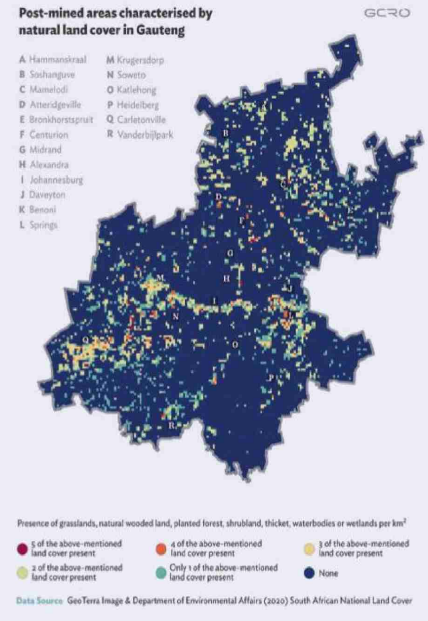
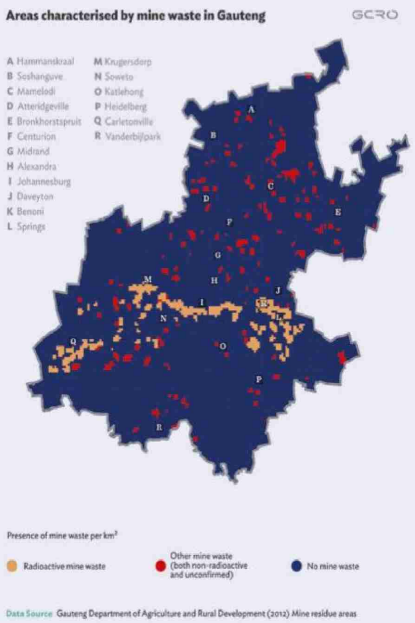
Mapping mining waste







public funds. Responsibilities are fragmented between mining and environmental and water authorities, making holistic mapping, accountability and coordinated rehabilitation difficult.

For businesses, this is a risk issue. Physical risks such as subsidence or pollution, regulatory risk around land-use decisions, and reputational risk all depend on how landscapes are understood and mapped.

Khanyile says she keeps returning to the questions: whose knowledge counts? And who gets to define what actually matters? Many definitions of "urban" and "post-mining" landscapes come from international literature that treats the two as separate.

In her interviews with local academics, civil society organisations and communities, a different picture emerged. People described how mines were encroaching on their communities and described urban areas with mining traits. "A map is not neutral," she says. "Every map is an argument about what matters and whose knowledge counts. Sometimes communities know what maps don't show."

For technology and business leaders, Gauteng's mining belt is a reminder that data quality and model design matter. Simplistic layers and binary classifications may be convenient, but they can hide risk and distort decisions. Better, more inclusive mapping can also reveal opportunities. "The starting point is looking at what we have available, and then integrating it with what is actually happening on the ground," says Khanyile. "A landscape doesn't stop being about mining just because the mine has closed." Areas written off as wastelands may become sites for renewable energy, green spaces or planned development once their constraints are properly understood. Gauteng's mining legacy is not confined to the past. It is built into foundations of Johannesburg. Seeing it clearly is the first step toward deciding what comes next.

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