

# Mine closure and reclamation as regeneration: coal mining and regeneration success criteria

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## Abstract

*Mine closure practices and expectations continue to expand beyond simply managing risk and liability. As creating a safe, stable and non-polluting site is technically achievable, transition planning and investments in post-production/post-closure opportunities are increasingly reflected in regulatory, industry and third-party standards and guidelines. In particular, the potential for regeneration holds growing appeal because it is fundamentally based on the idea of converting waste and degradation into valuable resources while speaking to calls for circularity and nature-based solutions, demands for a just energy transition, and scrutiny on sourcing and supply chain accountability. However, in the mining sector there remains limited understanding of appropriate criteria for evaluating whether regeneration is likely to be successful. This paper focuses on reframing mine closure and reclamation as regeneration, or the potential enhancement and/or maximising of social, economic and environmental value. It then sets out a potential framework for developing success criteria associated with regeneration. It draws on our work, particularly in coal mining regions around the world, and takes into consideration operational as well as inactive and legacy assets. This paper speaks to the continuing need to expand mine closure thinking to post-closure realities and to the enduring call from industry for clarity in navigating successful regeneration processes and outcomes.*

**Keywords:** *regeneration, success criteria, value creation, just transition, coal*

## 1 Introduction

Regulatory bodies, industry stakeholders and third-party organisations increasingly accept mining as a temporary land use, incorporating considerations of post-mining land uses and opportunities for regeneration in their standards and guidelines. The potential for regeneration in particular – or the potential to create value from mining waste or former mine site degradation – holds growing appeal because it speaks to contemporary calls for circularity and nature-based solutions and demands for a just transition through the creation of better mine closure outcomes.

In this paper we focus on mine closure and reclamation as a foundation for regeneration, or the enhancement and/or maximising of social, economic and environmental value post-mining. More specifically, we argue that understanding and articulating the regeneration potential of mine sites is one means of framing mine closure success and developing success criteria or determining the feasibility of *what comes next* after the extraction of resources ends. Our particular focus is on the potential regeneration of social and economic value, recognising that these are intrinsically tied to environmental values and outcomes at mine sites or mining regions.

Our focus in this paper is also on the regeneration potential associated with coal mine closures in distinct geographies where we have worked, including the United Kingdom (UK), Ukraine and Colombia. We focus on coal partly because it is a commodity that is present regionally (i.e. coalfields), with coal mine closures and regeneration potential therefore also ideally framed through a regional lens. Moreover, as momentum around

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achieving a just transition is gathering pace as part of global dialogues around decarbonisation and efforts to mitigate the effects of climate change, coal mine closures are key components of just transition work.

The concept of “just transition” – originally associated with labour rights for workers exposed to pollution – is recognised internationally within the legally binding 2015 Paris Agreement, to which Ukraine, Colombia and the UK are all signatories (United Nations 2016; World Bank Group 2018). The concept is used in the Paris Agreement to ensure that the transition to a low-carbon economy is fair and equitable for workers, their families and communities (UNFCCC 2015). This involves investment in alternative economic opportunities that effectively utilise the resources in the local area while supporting mine workers and communities to not only avoid socio-economic hardship but to thrive. Achieving a just transition, and thus potentially regional sustainability or regional development, is fundamentally based on understanding regeneration potential.

## 2 Defining successful closure and assessing regeneration potential: key indicators for a regeneration framework

Assessing regeneration potential includes understanding potential future values or post-mining land uses, and potential constraints to their development or implementation. Following Hesketh et al. (2024) and the ever-expanding literature and practical focus across the sector on post-mining land uses, an (eco)system approach allows for understanding potential values created within and across the entire ecosystem of a project, and how these values might be increased or enhanced through changes to system inputs and/or interconnections. Framed another way, the potential for regeneration of social and economic value can also be understood in terms of dependency and resiliency – that is, the extent to which a mining operation (or operations) drives the creation of local or regional socio-economic value, and the ability of the local area to withstand the “shock” of mine closure(s) through drawing on available resources to transition to sustainable alternative (or regenerative) activities (Gagen et al. 2024; Syahrir et al. 2021).

Understanding ways to mitigate the negative social and economic impacts of mine closures while maximising opportunities for the creation or enhancement of socio-economic value requires identification of indicators through which change (or value creation/enhancement) can be measured (Gregory et al. 2023). Indicators that emerge consistently through studies, master and strategic planning documents corporate policies and our experience as practitioners are primarily related to the following themes:

- **Jobs and skills** – measured by employment, economic indicators, demographic changes (retention benefits and/or availability of jobs and job quality, as well as upskilling, retraining or supporting the transferability of skills to different sectors locally, without significant out-migration).
- **Health, wellbeing and/or prosperity** – measured by health inequalities and the burden of disease, poverty, income, purchasing power relative to the cost of living, and rates of crime and violence.
- **Green or circular economies, innovation and/or the uptake of clean technology** – more recent, and measured through built infrastructure, energy efficiency and emissions reduction opportunities, among others.

These appear in examples relevant to case studies covered in this paper, including:

- the Coalfields Regeneration Trust 2024–2029 Strategy (“Building Community Wealth”), which points to five missions to build community wealth in Britain’s former coal-mining areas – community, health, skills, jobs and climate
- the most recent Regional Development Plan for Cesar 2024–2027 (“Governing an Incomparable Cesar”) – Cesar being one of the primary coal-producing regions in Colombia experiencing mine closures, which refers to four pillars through which to create regional value – modernity and efficiency; innovation; humanity and focus on social welfare; safety and reliability

- regenerative Framework for Novovolynsk, Ukraine 2023, which outlines a number of pillars that support fairness in transition, responsible closure and equity and growth for mining regions, which are underpinned by various elements of Ukrainian legislation and regional development plans
- similarly, the UK's Cornwall Plan 2020–2050 (“Together We Can”), which sets six aims for growth: creative, net zero economy; sustainable food, land and seas; thriving places with decent, affordable homes; equality, education and entrepreneurship; safe, healthy, resilient communities; and a digital revolution for sustainable living. While Cornwall was not known for coal mining so much as copper and tin, this speaks to similar considerations for former mining areas more broadly.

In the following sections we discuss each of these indicators in more detail as part of a framework for developing success criteria associated with regeneration.

## 2.1 Jobs and skills

Focus on successful social closure outcomes and regeneration tends to specifically centre around employment and income, and the potential reverberating socio-economic effects of changes to jobs and wages as mining operations cease (Edwards et al. 2022; Shift Project 2025). There is significant planning associated with creating and/or enabling workforce transition opportunities and ensuring the creation of a positive legacy following mine closure. Workforce transition planning should include detailed mapping of financial flows, focusing on understanding both immediate, direct income losses and interdependent economic networks associated with mining regions. As mining operations cease and the so-called revenue “tap” is turned off, losses in income for the mining workforce and third-party contractors and suppliers often lead to a reduction in consumption and spending on goods and services, potentially compromising the viability of local and regional economies. Comprehensive consideration of jobs and skills is needed to support post-mining transitions and develop a post-mining economy, facilitating successful regeneration. In particular, a focus on creating equitable jobs and skills is a core component of achieving a just transition (World Bank Group 2018), including understanding how workers displaced from traditional energy-producing sectors fare after job loss, and whether skills needed from livelihood activities such as coal mining are transferable to “green” sectors (Chen & Morissette 2020; Shift Project 2025; World Bank Group 2024).

With jobs and skills as one theme to understand the potential socio-economic impacts of mine closure, and/or the enhancement of social and economic value post-mining, the following interrelated questions define associated success criteria:

- How can the mine site's workforce demographics be characterised? How many people will lose jobs, retire, and receive retention or compensation packages (if at all) with closure?
- What are the other ways people make a living in the area, and what proportion of the area's population is employed at the mine?
- How does mine closure affect overall wages in the area? Will income decrease overall as a result of the mine's closure? In addition to direct impacts, what are the indirect and induced impacts of fewer jobs and/or reduced incomes resulting from closure?
- How can the diverse jobs associated with the mine site be classified? How many jobs are entry-level or require less training, and what kinds of training or certifications are required for these different types of jobs? How does overall education attainment in the region support alternative employment opportunities?
- What is the mine site's zone of influence/area of influence? Is the site embedded within a town or city, or do workers FIFO and send money home/spend money elsewhere?
- What is the potential for former mine workers to find comparable jobs in the industry (at other mines) and to “be absorbed” by that industry, particularly within the same region?

- What transferable skills do workers have to find jobs in comparable or associated industries? What are comparable or associated industries within the same region, or what might they be (particularly regions transitioning from coal)? What entrepreneurial support can workers be provided with to upskill or expand their training to work in other (“cleaner”) industries/enterprises?
- What have community outreach or social investment programs delivered through the life of mine? How can these programs align to closure needs and transition/regeneration potential?

## 2.2 Health, wellbeing and prosperity

Mine closure also has the potential to impact health, wellbeing, regional prosperity and/or quality of life in distinct directions (Bainton & Holcombe 2018; D’Silva & Norman 2015). In many cases, mines and surrounding communities develop an interdependent relationship during operations, particularly regarding employment, services, infrastructure, environmental impacts, and payment and uses of taxes and royalties (Rao & Pathak 2009). Mine closures can particularly affect the ability of local or regional governments (municipal, state or provincial, for example) to provide social services, programs and infrastructure, particularly through the loss of tax revenue associated with mining operations. Moreover, the individual and collective stress and anxiety associated with the closure of mining operations can have conspicuous impacts on the physical and mental health of people living and working in mining regions. The annual World Happiness Report (Wellbeing Centre/Gallup/United Nations 2024), which examines wellbeing data from over 140 countries, captures these and other indicators. The Report groups variables under four themes – life evaluation; explanatory factors (including social support, gross domestic product [GDP], healthy life expectancy and perceptions of corruption); emotions; and benevolence – considered the keys to wellbeing (or “happiness”).

With health, wellbeing and prosperity as another key theme to understanding both the potential impacts of mine closure and potential post-mining opportunities, the following indicator questions also help define associated success criteria for regeneration potential:

- How might closure affect GDP and tax revenue locally/regionally? What programs/services/infrastructure/investments are most likely to lose funding with the loss of revenue?
- How might closure affect access to and/or the quality of healthcare, if at all? What kinds of health impacts might closure cause or exacerbate?
- How might job and income loss impact spending on health and wellbeing, including access to nutritious/high-quality food and mental health support, and overall levels of community/civic engagement and social support?
- What are the overall employment rates and how might closure affect existing employment rates? What proportion of working-age people already want to stay in the area versus leave?
- What proportion of the population lives at different income thresholds? How might closure affect existing poverty rates?
- How might closure affect the availability and/or affordability of housing and/or land?
- How might closure and/or job and income loss affect crime and violence, perceptions of security and safety in the region, local communities or specific neighbourhoods?

## 2.3 Green economies, innovation and clean technology

Managing the impacts of coal mine closures and achieving components of a just transition typically include engaging with Green Economies and innovative uses or uptake of “clean” alternatives that can support a mining workforce. While understanding the regeneration potential of former coal-mining sites or regions is very much an area of active research and growing understanding (Carr 2024), potential indicators for green economies, innovation and clean technology success criteria include:

- What potential land and/or infrastructure uses are included in regional plans, zoning, or permitting? How is the feasibility of these potential land or infrastructure uses assessed?
- What current or near-term energy efficiency or low-energy use considerations are included in regional plans, zoning or permitting?
- What are current or near-term decarbonisation and/or emissions reduction targets, and what kinds of financial and/or entrepreneurial investment incentives are there locally or regionally to meet those targets?

## 2.4 Aligning indicators with realistic closure timelines

As difficulty in defining success criteria is regarded as one of the largest impediments to relinquishing mine sites, as per Manero et al. (2020), it is also a challenge for closed sites being repurposed – or regenerated – for alternative use(s).

The International Council on Mining and Metals (ICMM 2019) recommends the use of the SMART acronym to develop and assess relinquishment criteria for mine closure, in line with country- or region-specific guidance, with SMART meaning:

- Specific – Closure objectives and related criteria must be clearly defined and tied to the specific context of the mine site and its closure goals.
- Measurable – Criteria should be quantifiable, allowing for monitoring and tracking of progress towards the desired outcomes. Criteria may draw on established key performance indicators or other metrics to assess performance.
- Achievable – Given the available resources, technology and expertise, the criteria must be realistic and attainable. They should be challenging but not overly ambitious, ensuring they can be met within a reasonable time frame.
- Relevant – Criteria should align with the overall closure objectives and the specific needs of the stakeholders, including the environment, communities and regulatory bodies. They should address the key risks and opportunities associated with the mine site and its closure.
- Time-bound – A clear time frame should be established for achieving the criteria, providing a deadline for the successful completion of the closure process as this helps ensure accountability and focus on achieving the desired outcomes within a specific period.

Effectively understanding regeneration potential also requires understanding site-specific post-mining possibilities and setting corresponding, realistic objectives. This may include approaches like ecosystem modelling to understand post-mining land use options and developing a master or strategic plan. The relevance of timeliness in SMART criteria for regeneration is of equal importance as for success criteria aimed at relinquishment (Gimber & Shade 2024). Repurposing or regeneration timelines depend on the scale and complexity of the project or area, and the regulatory and investment complexity. And as with integrated closure planning with the aim of relinquishment, the development of success criteria for regeneration must incorporate real closure timelines and change over time (Coppin 2013). For example, success factors for Year 1 of closure activities will not be the same as those for Year 5 (or Year 10, and so on). Thus, a framework for developing success criteria associated with regeneration takes as a core component that success criteria change as closure progresses and as regeneration potential is realised in more detail (World Bank Group 2024).

## 3 A closer look: case studies

The following global case studies are based on our work as practitioners while incorporating broader trends relating to the development of closure success criteria, repurposing and regeneration. The case studies focus on coal mine closures in the UK, Ukraine and Colombia, with clear links to broader momentum around achieving a just transition through the development of regenerative activities and economies post-mining.

Success criteria are essential tools for guiding mine closure and framing regeneration potential in diverse contexts. In South Wales, UK, the transformation of former coal-mining landscapes into multifunctional community assets shows how ecological restoration and recreational land use can be measured through like land stability, biodiversity recovery and public engagement, and we suggest retrospective success criteria. For western Ukraine we outline how recent work to develop a regeneration framework integrates success criteria to support post-mining recovery in war-affected areas, focusing on outputs such as soil remediation, infrastructure repurposing and socio-economic revitalisation. Meanwhile, in Colombia's Cesar region, the closure of Prodeco's coal mines is now prompting the development of success criteria to assess interlinked environmental rehabilitation and social transition opportunities, with outputs including reforestation progress, water quality improvements and alternative livelihood development. Across these varied geographies, success criteria not only guide the integrated technical and social dimensions of mine closure but also provide a consistent basis for evaluating the effectiveness and sustainability of regeneration efforts.

### 3.1 South Wales

Unplanned coal mine closures in South Wales ("the Valleys") in the 1970s and 1980s led to the establishment of an organisation explicitly tasked with overcoming the negative impacts of unemployment caused by the overall collapse of coal mining, exacerbated by the parallel run-down of agriculture and the contraction of the fishing industry in Wales (Merrill & Kitson 2017). The Welsh Development Agency (WDA) was based on economic regeneration delivered through specific industrial sectors (including food, the motor industry and new technology), and was charged with promoting industrial efficiency, safeguarding and generating employment, and improving or reclaiming the environment in South Wales – while securing a minimum return on business investment of 15 percent (Foden et al. 2014).

The WDA's primary efforts were on continuing an existing government program of land reclamation of derelict and abandoned colliery sites (almost 690 hectares), clearing and landscaping old pits for development, and building factory infrastructure. Nonetheless, factory units built by the WDA did not coincide with areas having the highest unemployment levels following coal mine closures (Merrill & Kitson 2017), and while the factory units built by the WDA played an (eventually) important role in attracting regional investment for repurposing, there was no integrated regional development or regeneration strategy. The WDA merged with the Welsh Assembly Government in 2006, effectively closing the agency.

Following the WDA, other programs and initiatives have been dedicated to placemaking and creating social and economic value in South Wales, such as the Heads of the Valleys Programme and Jobs Growth Wales. These have been supplemented by private investment and development, including the case of Ffos Las, a former open-cast coal mine repurposed into a horseracing course and residential area. Through reclamation planning in 2002–2004, a restoration scheme that envisaged subsequent use for the site, making use of site contours and infill materials, superseded the original agriculture-focused restoration program. Through the development of a business plan for future use, a parcel of land was sold for residential development and provided the necessary capital for further development of the racecourse. Additional land sales for residential development and a solar farm increased revenue from the site after the establishment of the racecourse. A professional management company, Northern Racing, was appointed to operate the site. The site was run as a commercial racecourse for 10 years before being sold to a specialist racecourse operator. The ongoing success of Ffos Las is based on obtaining early buy-in and public support from regulators, local politicians and key stakeholders (such as the British Horseracing Board), developing creative funding mechanisms to finance repurposing, and using the existing resources at the site (such as contours within a central bowl to minimise earthworks and create spectator galleries) to recognise repurposing or regeneration potential.

Although there are specific cases in South Wales of social and economic value creation through regeneration (such as Ffos Las), the Valleys also continue to experience overall out-migration and population decline, and the region is still associated with lower life expectancy and poorer health outcomes than elsewhere in the UK. Fewer than half of the coal mining jobs lost in South Wales between 1978 and 2008 have been replaced (Merrill & Kitson 2017) and, in addition to private investment and development, community and social

welfare programming are critical to overcoming social deprivation (Foden et al. 2014). While the WDA embraced a regional approach to regeneration, examples of successful value creation and enhancement through regeneration are associated with individual sites.

This case study highlights a successful transition and, with hindsight, areas where success criteria could have been applied include:

- jobs and skills (for example, the number of jobs created)
- health, wellbeing and prosperity (such as increased economic activity measured in terms of racegoers and spending activity at race events, and/or social housing provided)
- green economies, innovation, and clean technology (such as renewable energy generated).

## 3.2 Ukraine

Amidst and despite ongoing conflict in Ukraine, the Ukrainian Government has nonetheless been focused on developing plans to transition to a low-carbon economy, addressing the country's role as one of the largest emitters of CO<sub>2</sub> (from coal emissions) in Europe. At the UN Climate Change Conference in 2021 (COP26), Ukraine pledged to end coal-fired power generation by 2035 and effecting an end to coal mining (UNFCCC 2021).

As of 2014, 148 coal mines operated in Ukraine, with 46 being private operations. Since the collapse of the Soviet Union, the Ukrainian coal sector had already been in a state of decline, with approximately 800,000 people employed in 1995 and approximately half that many by 2020 (Hesketh et al. 2022). Nonetheless, coal mines have continued to provide essential work opportunities in many regional towns with increasingly limited employment opportunities. Strong union pressures relating to coal mine employment, and overall limited regional development planning, underline the need for coal mine closures to be addressed differently now.

As part of planning to transition to a low-carbon economy, the UK Government supported a pilot project to demonstrate how a just transition can be achieved through the development of a regeneration framework applied to two sites in the western Volyn region, both close to Novovolynsk, a town of approximately 60,000 inhabitants in western Ukraine (Hesketh et al. 2023). This work is ongoing, with some progress stilted by the ongoing conflict in Ukraine and the fragility or vulnerability of just transition goals. Nonetheless, key considerations that have differentiated this work and focused on regeneration potential include:

- incorporating pre-closure considerations of the social impacts of mine closure, including a strong understanding of the socio-economic conditions (and strengths) of the region, as well as the structures of support needed to enable a successful transition for both the economy and people prior to closures
- building and aligning on policy and funding for regeneration, including national, regional and bilateral or multilateral mechanisms to leverage or develop (such as the Partnership Body for Regeneration)
- conducting master planning exercises to understand the appropriateness and scale of development needs to form a regeneration guide with alternative, viable economic scenarios.

Priority areas for the ongoing implementation of the regeneration framework include setting up a partnership body, developing a liquidation strategy for the two mine sites, carrying out studies to understand in more detail the site development process and linking employee retrenchment to transferable skills for the future (Hesketh et al. 2024). These speak largely to the three themes outlined above as a framework for developing success criteria for regeneration and aim to provide a functional way of progressing this work to create shared social and economic value. After the initial work (which was funded by the UK's Foreign and Commonwealth Development Office), Russian attacks on energy infrastructure have accelerated a move away from coal-generated power and encouraged planning for diversified and dispersed energy networks with a need for reconstruction to promote regeneration and provide a just transition.

Success criteria in relation to these closures will need to be framed around the regeneration potential of the sites to provide opportunities for workers and communities surrounding or dependent on the sites. Mixed-use master plans for the Buzhanska site are intended to facilitate the following types of development scenarios:

- renewable energy
- agricultural development
- tourism, leisure, recreation (health/nature)
- Smart campus/advanced manufacturing park – innovation, research and development, and training.

SMART criteria for closure and regeneration objectives have not yet been developed but conceivably could include elements such as:

- a repurposed area (for example, more than half [60%] of the site should be available for repurposing within three years of the site closure)
- jobs and skills (for example, the final master plan for the site should provide for a minimum capacity of 500 full-time jobs)
- jobs and skills (for example, post-closure transitioning should involve development of a skills program that promotes skills aligned to the selected development scenario and graduates 30% of 16–18 year olds in local schools/colleges over a four-year period following closure).

### 3.3 Colombia

A just transition approach is increasingly presented as a means of supporting and achieving peace, development and climate goals in Colombia, including reducing significant regional inequality (Godinho et al 2024). The current Colombian Government has committed to establishing a just energy transition road map. It has begun to prioritise thermal coal regions in the Caribbean (Cesar and La Guajira), where coal is a major export commodity. The unexpected ceasing of operations of two coal mines in 2020 in Cesar (owned by Prodeco, a Glencore subsidiary) underscores the challenges of economic dependencies, environmental degradation and sociocultural factors in successful mine closure, and, correspondingly, assessing just regeneration opportunities.

Coal is Colombia's second-largest export after oil and represents less than 3% of the country's total fiscal income, but royalties from coal represent more than 80% of the mining sector's total royalties. Despite some focus on a just transition, coal has continued to play a key role in financing social investment and reducing deficits in the country (Arond et al. 2024; El Colombiano 2025). And while coal mining does not represent the largest employment sector nationally, coal mining operators have been a critical employer in coal regions. In 2020, even after the unexpected halting of operations at the two coal mines in Cesar operated by Prodeco, the remaining three coal mining companies operating in Cesar and La Guajira employed approximately 13,559 people, or approximately 38% of all coal mining employment in the country. These jobs often offer substantially higher wages and benefits than other sectors – including large-scale ranching and palm oil cultivation, both prominent non-mining livelihood activities in Cesar (Agencia Nacional de Minería 2022).

In addition to high economic dependency on coal mines in these regions, Cesar and La Guajira also face clear resource constraints that limit the development of alternative economic activities. These include high water scarcity risks, limited arable land, longstanding land tenure conflicts, high poverty rates, the continuing impacts of armed conflict, limited civic space and/or limited local government capacities, and remoteness from key markets. Cesar and La Guajira have significant potential for renewable energy generation, particularly in solar and wind power, and some moderate potential for tourism expansion (Arond et al. 2024; Peña et al 2023). Nonetheless, limited work has been conducted that is available in the public realm to assess regeneration opportunities, including determining the viability of growth of these alternative sectors, their

potential to offset the economic impacts of coal mine closures, and/or who may have both incentive and capital to invest heavily in post-mining activities in regions where active coal mining operations still dominate.

In the case of Prodeco's recent and sudden mine closures in Cesar, local revenues from coal have reshaped the public budget and severely limited the budgetary capacity of the local municipalities, including La Jagua de Ibirico, and the municipalities' corresponding ability to play a leading role in articulating successful and feasible closure outcomes, or in driving regeneration opportunities. While a recent 2025 court ruling (T-029) in Colombia's Constitutional Court determined the need for a public dialogue process between local communities and former mine site workers as part of formal closure planning for the two operations (Valora Analitik 2025), focus is now largely on compensatory measures to adopt in regulatory closure plans, with the aim of relinquishing the sites to the Colombian state. However, regulatory requirements do not explicitly account for regeneration potential. Considering potential social and economic value creation in this context is already reactive or retrospective, given that operations ceased five years ago. Closure planning, closure activities and post-mining opportunities do not (yet) align with broader national and global discourse around a potential just transition, limiting the articulation of effective success criteria for regeneration.

As well as criteria addressing the environment, social and regeneration considerations should be explored. Colombia is a signatory to COP21 and delivery of a just transition should be a key focus in mine closure and regional development planning. Relevant criteria need to be framed for the short, mid and long-term. Work to develop success criteria is ongoing, but these criteria may include focus on:

- Health, wellbeing and prosperity (for example, within five years of mine closure the incidence of respiratory disease among local communities should decrease by at least 30%)
- Jobs and skills (for example, the number of jobs generated, change in average earnings, quality of jobs/ability to engage with opportunities i.e. futureproofing)
- Green economies, innovation and clean technology, including social infrastructure (for example, regional subsidised access to the internet/other infrastructure).

Considerations for social success criteria are currently centred around access to land and the ability to generate an agricultural and tourism economy post mining. A deeper consideration of the economic viability and reach (beyond immediately gaining access to the land) is required to understand the impact that this could drive and the requirements for any enabling activities to develop the post-mining opportunity.

## 4 Conclusion

In our work to call attention to successful mine closure (and correspondingly the development of effective success criteria) needing to be reframed through the lens of regeneration potential, we draw on coal mine closure cases to demonstrate how social and economic value at closure can be maximised or enhanced – and, indeed, where such regeneration potential has not been fully realised (yet). We outline three broad themes and associated indicators to set out a framework for developing success criteria associated with regeneration. We also emphasise that growing focus on achieving a just transition should fundamentally include navigating mine closures through a repurposing or regenerative lens. This paper speaks to the continuing need to expand mine closure thinking to post-closure realities, and to the enduring call from industry for clarity in navigating successful closure and regeneration processes and outcomes.

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