4.2 Development pressure from extraction or infrastructure

4.2.1 Protected areas and development corridors

The historical under-investment in African transport infrastructure has led to renewed investments in recent decades. While the expansion of infrastructure in development corridors will have positive economic and social impacts, they may be harmful to nature. Balancing infrastructure development and biodiversity conservation will be crucial for ensuring that the continent's development is sustainable.

Sustainable Development Goal 9 aims to *"build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation"*[1]. Infrastructure refers to the variety of facilities that provide human communities with the services for energy (e.g., coal, wind, gas, solar, hydropower, waves, power lines, oil, and gas pipelines), water (e.g., canals, dams, pipelines), transport (e.g., ports, roads, railways), and telecommunications (e.g., internet cables)[2].

Carefully designed infrastructure has the potential to improve synergies between the development and conservation agendas. Adopting integrated development approaches could align the infrastructure development cycle with national and global climate goals and biodiversity targets. For instance, the Global Biodiversity Framework encourages spatial planning, restoration, and conservation (Targets 1, 2, 3, 8), integrating biodiversity into development planning (Target 14), reducing negative impacts from business activities (Target 15), and financing the framework implementation (Target 19)[3].

Development corridors refer to instances where larger, often transnational, geographical areas are targeted for domestic and international investment in (linear) infrastructure[4]. Development corridors have the potential to encourage development and improve livelihoods, but they also amplify environmental pressures in areas that would otherwise remain inaccessible[5].

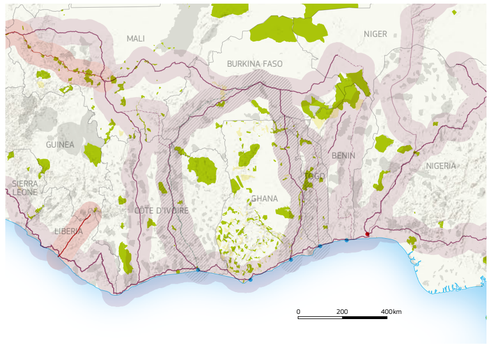
Roads can have massive impacts on both the biotic and abiotic components of landscapes by modifying the availability of resources like water, light, and nutrients; increasing animal mortality or impeding their movements; supporting the spread of alien invasive species; and fragmenting the landscape[6]. They may, however, also create new habitats for others species (e.g., swallows that nest on the undersides of bridges)[6]. A preliminary assessment of the costs and benefits of development found that the roads and railways at the heart of development corridors could cut across 408 African protected areas[7]. The same assessment also found that many of these development corridors would only yield limited benefits (in terms of enhanced food security, for example) while severely degrading African biodiversity[7].

This feature map presents information from a spatially explicit database of development corridors in Africa[4], which built on earlier efforts[6] to improve coordination, efficiency, monitoring, oversight, strategic planning, transparency, vulnerability risk, and impact assessments for multiple African stakeholders. Identifying and assessing development corridors and their impacts is complex and multidimensional, but spatial information on the corridors and the related infrastructures is a necessary first step. The feature map shows linear and point infrastructure associated with 79 development corridors consisting of 184 projects in Africa. Regional development banks have invested in most development corridors, followed by international banks – including 10 projects financed by the European Investment Bank[4]. The database reveals that the predominant form of infrastructure in Africa's development corridors is roads (n = 64, 34.8%), followed by wet ports (n = 38, 20.7%), passenger and freight railways (n = 33, 17.9%), and airports (n = 14, 7.6%). Most projects are in Kenya, followed by Tanzania, South Africa, and Democratic Republic of the Congo. The linear distance of these development corridors is more than 120 000 km.

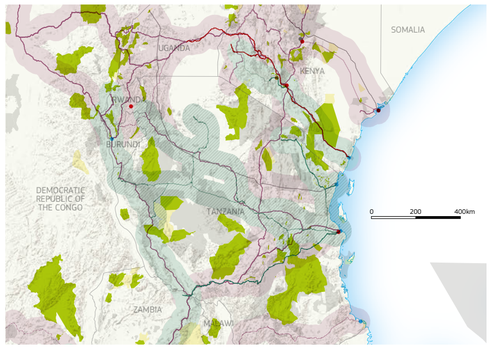
Infrastructure development can be improved through careful planning and design. A more integrated approach to planning could mitigate many of the factors that ultimately determine the severity of impacts. The Development Corridors Partnership – a collaborative initiative between academia, NGOs, and UNEP-WCMC – has proposed 10 key principles to guide planning of truly sustainable development corridors that comply with environmental and social standards[8].

Ten principles for planning sustainable development corridors.

1. **Corridors must seek to achieve positive sustainability outcomes.** This means that developments should support the broader sustainability visions of a country or region, rather than merely mitigating negative impacts.
2. **Integrated and interdisciplinary approaches are needed when planning corridors.** Because corridors are extensive, complex, and multifaceted features that traverse whole landscapes, they should consider significant transformational changes to physical, economic, social, and cultural systems.
3. **Corridor proponents should clearly demonstrate the consideration of alternatives.** Options should not default to the preferred proposal favoured by elites, but should rather consider all feasible alternatives (including maintenance of the status quo) while making the risks and opportunities of each option explicit and transparent through meaningful consultation.
4. **Public participation and stakeholder engagement should be at the core of corridor planning.** Corridors can affect the lives and rights of local communities in profound ways, so engagement should happen at the first available opportunity to ensure that consultation occurs before making strategic decisions.
5. **Mainstreaming and tiering are fundamental for corridor success.** Tiering ensures that environmental and social issues are considered alongside financial and technical considerations from the start of strategic planning process, and not just retrospectively as issues arise.
6. **An iterative process is needed to adjust planning when circumstances and available information change.** Corridors exist in dynamic environments, so they need to respond to changing circumstances and priorities.
7. **Corridors must ensure the effective use of available tools.** Good quality decisions can be promoted through best practice for strategic environmental assessment, environmental impact assessment and cost-benefit analyses.
8. **Corridors must be planned with resilience and adaptability in mind.** Preventing the negative impacts of corridors will always be better than reacting in hindsight, so corridors should be resilient and adaptable in anticipation of unforeseen future events.
9. **Corridors should plan to enhance capacities for impact, influence, and implementation.** The quality of decisions and implementation ultimately lies in the capacities of those responsible, so attempts should be made to enhance these capacities for more sustainable outcomes.
10. **Infrastructure planning should contain the ambition to create true development corridors.** Linear infrastructure projects often evolve into comprehensive development corridors by chance and spontaneity, but this need not be the case if planning is systematic, comprehensive, and integrated.

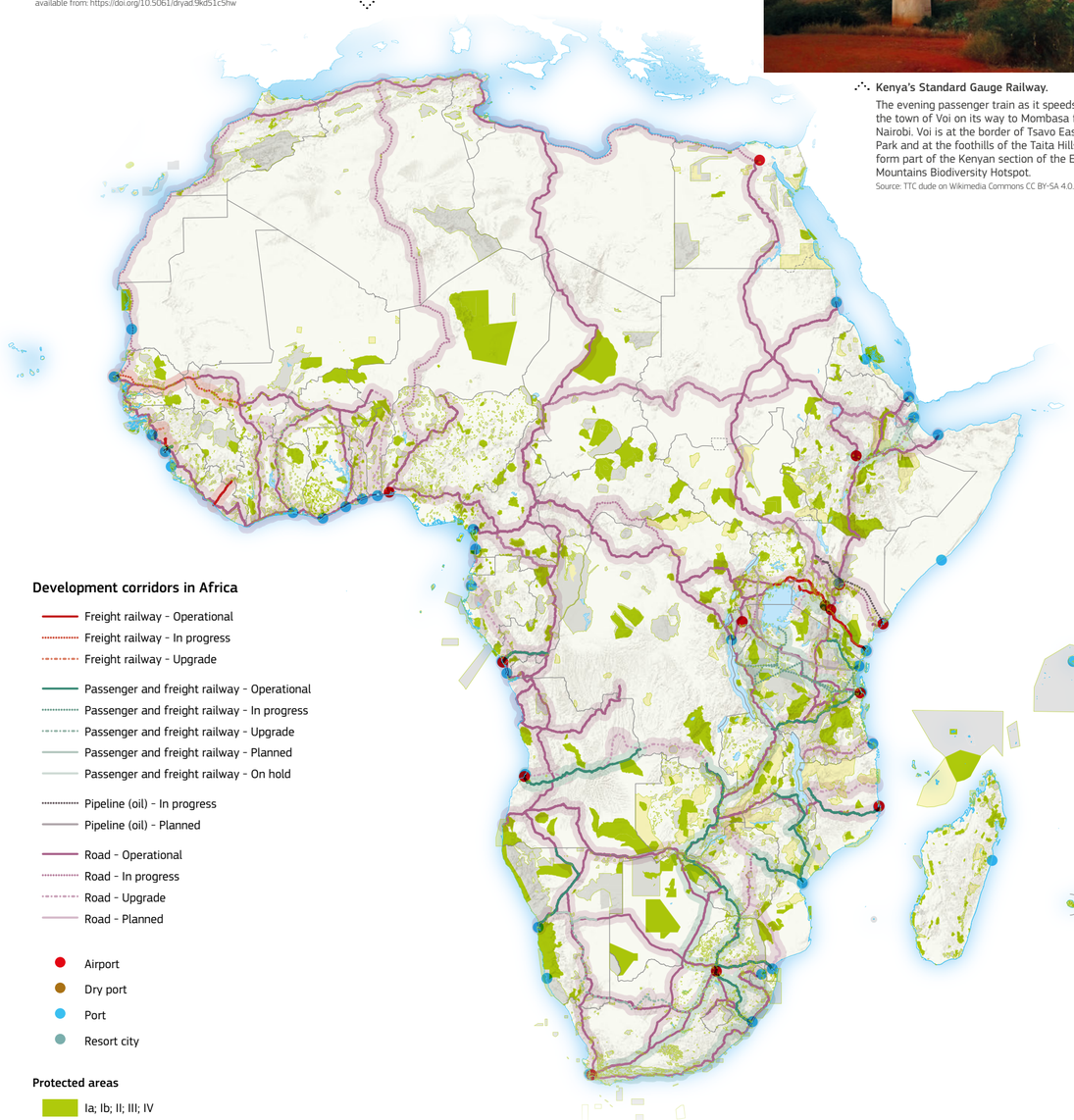


The West Africa Growth Ring Corridor.
This sub-regional development corridor (hatched on map) connects Burkina Faso, Côte d'Ivoire, Ghana and Togo. It seeks to promote sub-regional economic integration for development of economic sectors oriented to sub-regional markets. Despite the strategic economic importance, the ring-shaped corridor risks isolating already fragmented forest reserves.
Source: as main map.



Joint Tanzania-Burundi-DR Congo Standard Gauge Railway (SGR) Project.
Investors have given green light to Burundi and Tanzania to begin construction on Phase II of the Joint Tanzania-Burundi-DR Congo SGR Project in the Central Corridor (hatched on map). This region is characterised by extensive protected areas with high connectivity, which maintain some of the most spectacular large mammal migrations. These migrations could be disrupted by the SGR, which is anticipated to catalyse large-scale mining and commercial agriculture, and connect important industrial zones, population hubs, inland container depots, and economic processing zones.
Source: as main map.

Development corridors in Africa.
This map shows the localities of transport infrastructure within 79 development corridors identified in 2022 for ongoing and planned investment. This dataset synthesises information from multiple sources covering 184 projects on railways, wet and dry ports, pipelines, airports, techno-cities, and industrial parks. Importantly, the width of lines and their surrounding buffers are only for visual purposes, so should not be interpreted as strict boundaries of infrastructure investment.
Source: Thorn, J.P.R., et al. (2022) The African Development Corridors Database: a new tool to assess the impacts of infrastructure investments. *Scientific Data*, 9, art. 679. Dataset available from: https://doi.org/10.5061/dryad.9kd51c5hw



Kenya's Standard Gauge Railway.
The evening passenger train as it speeds through the town of Voi on its way to Mombasa from Nairobi. Voi is at the border of Tsavo East National Park and at the foothills of the Taita Hills, which form part of the Kenyan section of the Eastern Arc Mountains Biodiversity Hotspot.
Source: TTC dude on Wikimedia Commons CC BY-SA 4.0.

References

[1] United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. Available online at: https://sustainabledevelopment.un.org/post2015/transformingourworld [Accessed May 7, 2024].

[2] Woetzel, J., et al. (2016) *Bridging global infrastructure gaps*. McKinsey Global Institute. New York, USA.

[3] WWF & TNC (2022) *Infrastructure in the Global Biodiversity Framework: The opportunity to jointly address the worsening biodiversity and climate crises*. World Wildlife Fund. Washington DC, USA.

[4] Thorn, J.P.R., et al. (2022) The African Development Corridors Database: a new tool to assess the impacts of infrastructure investments. *Scientific Data*, 9, art. 679.

[5] Juffe-Bignoli, D. et al. (2021) Mitigating the impacts of development corridors on biodiversity: a global review. *Frontiers in Ecology and Evolution*, 9, 477.

[6] Coffin, A. W. (2007) From roadkill to road ecology: a review of the ecological effects of roads. *Journal of Transport Geography*, 15, 396–406.

[7] Laurance, W. F., et al. (2015) Estimating the environmental costs of Africa's massive "development corridors". *Current Biology*, 25, 3202–3208.

[8] The Development Corridors Partnership (2022) *Impact assessment for corridors: from infrastructure to development corridors*. Hobbs, J. and Juffe-Bignoli, D. (eds.) The Development Corridors Partnership. Cambridge, UK.

4.2.3 Mining and resource extraction

Mining is the cornerstone of many African economies. However, each stage of the mining lifecycle can harm biodiversity: from discovery, exploration, production, to closure. As demand for raw material grows – especially those used in clean technologies – mitigating the negative impacts of mining on protected areas will become ever more important.

Mining is the cornerstone of many African economies. Six of the top ten countries on the International Council on Mining & Metals' Mining Contribution Index are African[1]. Despite being central to the continent's economic future, mining activities can be devastating to nature.

All stages of the mining lifecycle can harm nature[2]. The discovery of new mineral deposits can trigger a rush of immigration and human settlement. The expanding road network that accompanies exploration and prospecting can fragment habitats, simplify access by poachers, and form introduction pathways for invasive species. Excavation and construction during the operational phase can destroy habitat and introduce chemical pollutants used for processing ore. Even decommissioned mines can have legacy impacts in the form of partially rehabilitated excavation pits or acid mine drainage.

Mapping African mines is not simple. Information on mining concessions don't necessarily represent active mining sites, nor do they include illegal mining operations. Mining footprints based on satellite data will underestimate small-scale artisanal mines and below-ground mine shafts. So, while different sources of information can give an overall impression of mining on the continent, no single dataset is comprehensive.

The United States Geological Survey maintains a spatial database of existing mineral production and processing facilities[3]. According to this dataset, which is shown in the main feature map, 211 out of 2 408 mineral facilities in Africa (8.8%) are within the boundaries of protected areas. The median distance from mineral facilities to the middle of the nearest protected area (i.e. its geographical centroid) is 28.1 km. One out of every 15 mineral facilities is less than 5 km from the centre of a protected area, and almost one in five facilities is closer than 10 km.

As the world transitions away from outdated fossil-fuel technologies, the demand for the raw materials used in batteries, solar panels, electric motors and wind turbines continues to grow. Globally, the area used to mine these critical raw materials is encroaching on protected areas (12.1% overlap), Key Biodiversity Areas (7.6% overlap), and intact wilderness areas (14.3% overlap)[4]. These facilities also affect species: 136 mammal species (of which one third are threatened by extinction) already have more than 30% of their habitat within 10 km of a mine[5].

While the rush for critical raw materials is a global phenomenon, it promises to affect mega-diverse African countries extensively. Democratic Republic of the Congo produces roughly 60% of the world's cobalt, a critical component of the cathodes in modern batteries[6]. By mid-century, the demand for cobalt is projected to be 15 times higher than today. South Africa, another mega-diverse country, produces more than 70% of the world's platinum group metals, which are necessary for fuel cells and many digital technologies[6]. By 2050, the demand for platinum just for fuel cells will equal the total demand for all uses today.

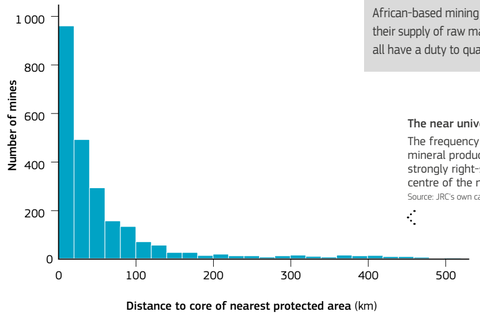
Growing global demand will ensure that mining will not be leaving Africa any time soon. Therefore, mitigating its negative impact on nature should be an urgent priority. Integrated spatial planning of mining and other development activities, partnered with improved environmental impact assessment, will be necessary to limit the environmental downside of Africa's major economic engine.

The Kunming-Montreal Global Biodiversity Framework on mining and biodiversity

Target 15 of the Kunming-Montreal Global Biodiversity Framework calls on parties to encourage and enable businesses to:

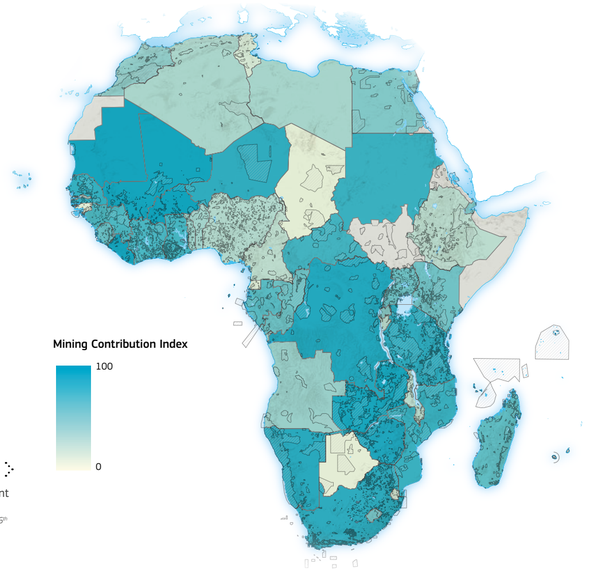
"Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity...in order to progressively reduce negative impacts on biodiversity, increase positive impacts, reduce biodiversity-related risks to business and financial institutions, and promote actions to ensure sustainable patterns of production."

African-based mining companies, the international cooperations relying on their supply of raw materials, and the institutions financing these activities all have a duty to quantify how their economic activities affect nature.



The near universal proximity of mines in Africa.
The frequency distribution of the minimum distance between mineral production and processing facilities and protected areas is strongly right-skewed, with half of all facilities within 30 km of the centre of the nearest protected area (median distance = 28.1 km).
Source: JRC's own calculations.

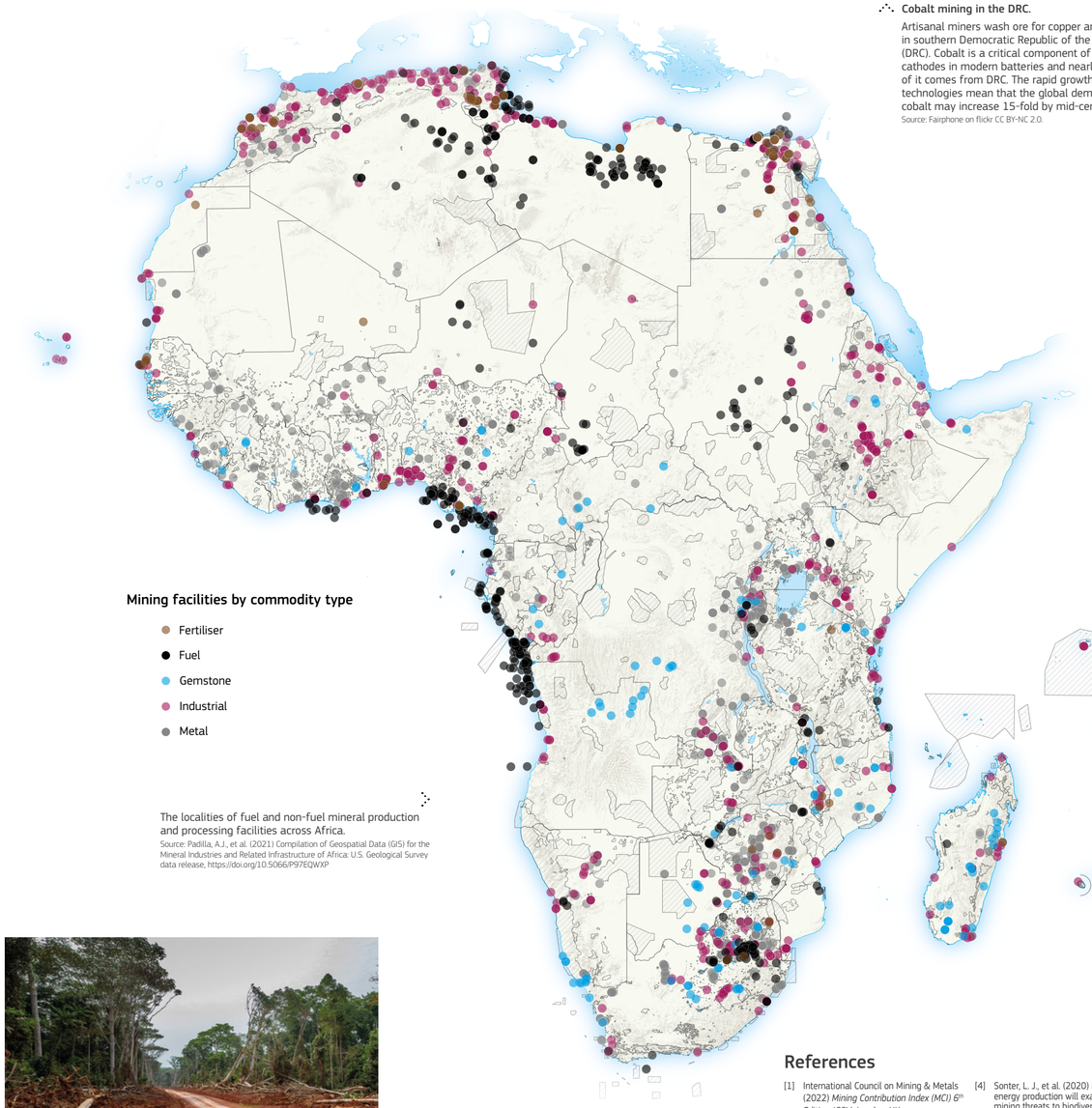
The Big Hole, Kimberley, South Africa.
The diamond rush of the late 19th century reshaped the South African economy. This inactive diamond mine in Kimberley is reputedly the deepest hole ever excavated by hand. Even though a century has passed since mining stopped in 1914, the massive pit serves as a reminder of the long-term impact of mining on natural habitats.
Source: tim ellis on flickr CC BY-NC 2.0.



The Mining Contribution Index, a composite index of four different macroeconomic variables of mining exports and production.
Source: International Council on Mining & Metals (2022) *Mining Contribution Index (MCI) 6th Edition*. ICCM, London, UK.

Pollution risk.
Oil spills, like this one in the Niger Delta, demonstrate the pollution risk of resource extraction to ecosystems and local communities. The new Global Biodiversity Framework requires that companies disclose how their activities may impact on nature.
Source: Friends of the Earth International on flickr CC BY-NC-ND 2.0.

Cobalt mining in the DRC.
Artisanal miners wash ore for copper and cobalt in southern Democratic Republic of the Congo (DRC). Cobalt is a critical component of the cathodes in modern batteries and nearly 60% of it comes from DRC. The rapid growth of green technologies mean that the global demand of cobalt may increase 15-fold by mid-century.
Source: Fairphone on flickr CC BY-NC 2.0.



The localities of fuel and non-fuel mineral production and processing facilities across Africa.
Source: Padilla, A.J., et al. (2021) Compilation of Geospatial Data (GIS) for the Mineral Industries and Related Infrastructure of Africa: U.S. Geological Survey data release, https://doi.org/10.5066/P97EQWXP

Exploration roads in Cameroon.
Exploration roads fragment natural habitats and create entryways for economic migrants, poachers, and alien invasive species.
Source: Grégoire Dubois, with permission, all rights reserved.

References

[1] International Council on Mining & Metals (2022) *Mining Contribution Index (MCI) 6th Edition*. ICCM, London, UK.

[2] South Africa Department of Environmental Affairs, et al. (2013) *Mining and biodiversity guideline: mainstreaming biodiversity into the mining sector*. Department of Environmental Affairs, Pretoria, South Africa.

[3] Padilla, A.J., et al. (2021) *Compilation of Geospatial Data (GIS) for the Mineral Industries and Related Infrastructure of Africa*: U.S. Geological Survey data release, https://doi.org/10.5066/P97EQWXP.

[4] Sonter, L. J., et al. (2020) Renewable energy production will exacerbate mining threats to biodiversity. *Nature Communications*, 11, 4174.

[5] Sonter, L. J. et al. (2022) Conservation implications and opportunities of mining activities for terrestrial mammal habitat. *Conservation Science and Practice*, 4, e12806.

[6] European Commission. Directorate General for Internal Market, Industry, Entrepreneurship and SMEs (2020). *Study on the EU's list of critical raw materials (2020): final report*. Publications Office, Brussels, Belgium.

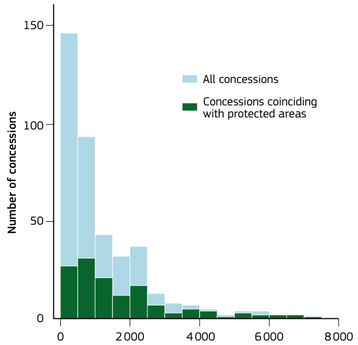
4.2.3 Protected areas and timber concessions

More than 600 million m³ of timber is extracted in Africa per year. Although governments issue logging concessions for commercial timber extraction, these are not the only areas where trees are lost to deforestation. Although protected areas aim to reduce the pressure from deforestation, they are not immune to loss of tree cover. New evidence indicates that sustainable forestry certification leads to better outcomes for biodiversity, suggesting that sustainable forestry practices can mitigate the negative impacts of timber extraction.

According to the IPBES African Regional Assessment[1], more than 600 million m³ of timber is extracted from Africa each year. Local and multinational companies fell trees throughout forests of equatorial Africa for international export. To regulate this significant economic sector, African governments issue logging concessions for legal timber extraction.

The feature map shows the localities of logging concessions in a database compiled from various government sources by Global Forest Watch[2]. Although this dataset is not comprehensive and does not include information from every African country, it does provide public spatial information for more than 430 concessions covering more than 500 000 km² (approximately the same area as Cameroon or Spain).

Despite covering such a large area, tree loss is still common beyond concession boundaries. It is unclear from spatial data alone whether such tree loss is due to unregulated logging, or incomplete concession data. The prevalence of tree loss within many protected areas suggests that logging may be unplanned and unregulated. However, not all tree loss within protected areas is unregulated because roughly 37% of logging concessions coincide with protected areas.



The surface area of African timber concessions.

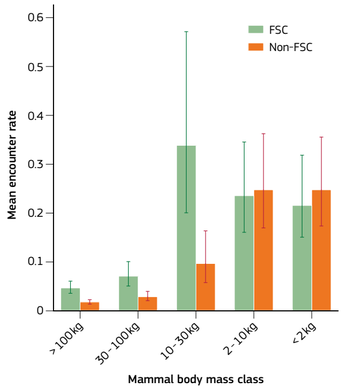
The median area of an African timber concession in the Global Forest Watch database is 741 km². Larger concessions are more likely to coincide with existing protected areas.

Source: Global Forest Watch (2023) *Managed Forest Concessions*. Accessed through Global Forest Watch on 24/04/2024. www.globalforestwatch.org. (Compiled from various government sources).

Larger logging concessions are more likely to coincide with protected areas. Although the median surface area of a logging concession is 741 km², the median area of concessions that partially coincide with protected areas is approximately 1 200 km². This may be problematic for conservation because larger concessions are harder to manage sustainably as a single unit.

It is common for logging to begin at concession edges (which may be adjacent to existing roads or rivers). From there, small logging roads penetrate the cores of concessions for selective logging operations; more than 50 000 km of logging roads have penetrated the Congo Basin in recent decades[3,4]. In other parts of the world, deforestation is four times more likely in areas accessible by logging roads compared to elsewhere[4].

However, not all timber extraction is equally bad for biodiversity. Recent evidence from logging concessions in Gabon and the Republic of the Congo shows that sustainable management practices can mitigate the negative impacts on mammals[5]. By comparing more than a million camera trap images, researchers found that mammals were recorded more frequently in concessions that complied with the Forest Stewardship Council's (FSC) sustainable certification. This effect was most prominent for large threatened species, including critically endangered forest elephants and western lowland gorillas.



Forest management certification schemes are associated with reduced impacts on mammals.

Encounter rates of mammals were higher in logging concessions that comply with the Forest Stewardship Council's (FSC) management certification standards. These effects are most pronounced for large-bodied species, like critically endangered forest elephants and western lowland gorillas.

Source: Zwerts, J.A. et al. (2024) FSC-certified forest management benefits large mammals compared to non-FSC. *Nature*, 628, 563-568.

FSC certification requires that logging companies implement measures to protect concessions from illegal harvesting and hunting[5]. These measures include securing access, closing temporary logging roads, patrolling premises, and designating personnel and resources to detect unauthorised activities. These activities are currently voluntary and encouraged by market forces (because certified timber can potentially attract price premiums on international markets). However, this may soon change as the Global Biodiversity Framework encourages governments to manage areas for forestry more sustainably *"through a substantial increase of the application of biodiversity friendly practices"* (Target 10). The European Union, for one, has already adopted its 'Regulation on deforestation-free products'[6], which prohibits illegally harvested timber and timber products on the Union market. This regulation also encourages using certification or other third-party verification schemes as part of its risk assessment process (though these do not substitute timber companies' responsibility to perform their own due diligence).

Ultimately, timber extraction will continue pressuring African forests and its protected areas. But strategic spatial planning, regulation, monitoring, and management can mitigate the worst of these effects of an important economic sector.

Road access is a main determinant of tree loss.

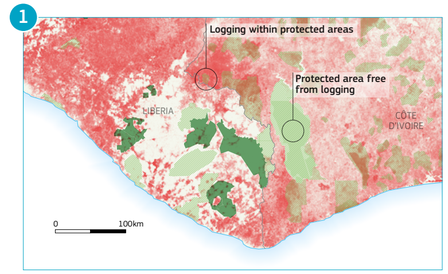
Timber extraction is considered the single biggest driver of road expansion in intact tropical forests. Deforestation can be up to four times higher in areas accessible by logging roads.

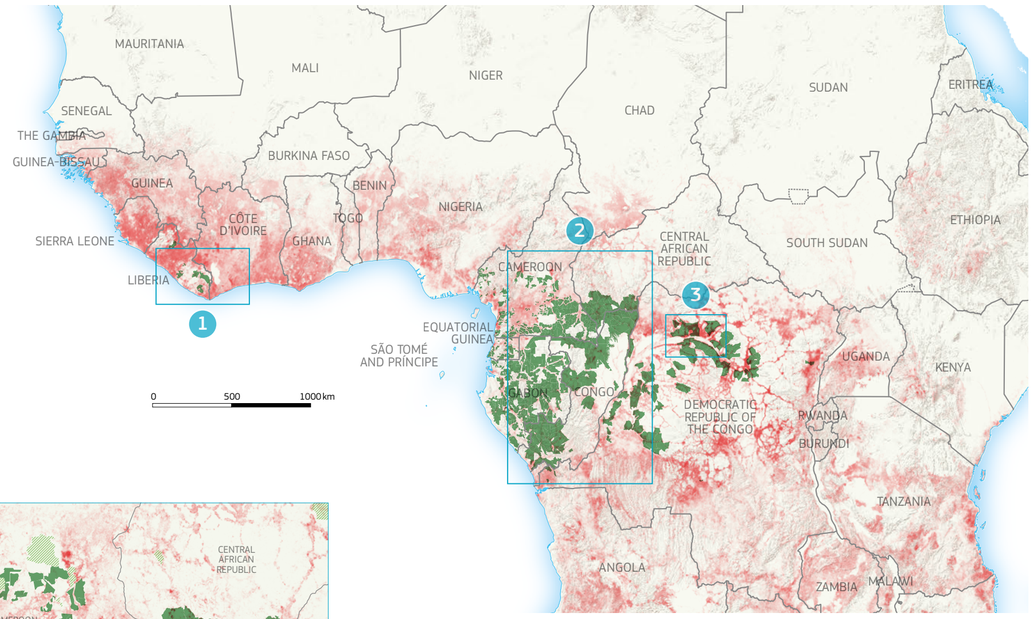
Source: jbdodan on flickr CC BY-NC 2.0.

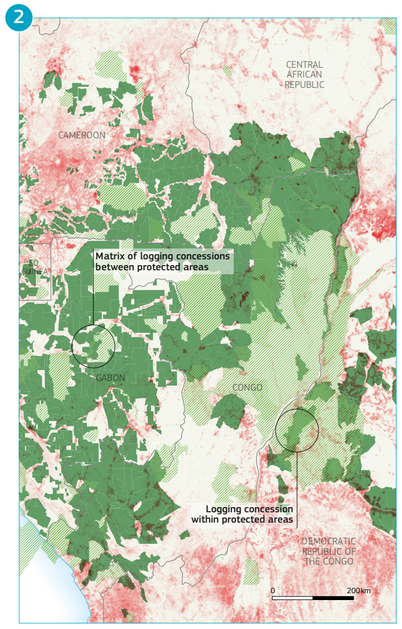
Commercial forestry in the Republic of Congo.

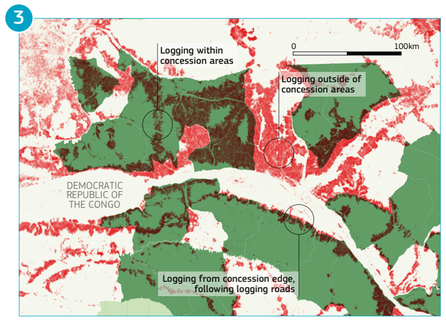
Legal timber extraction occurs throughout equatorial Africa in government-allocated logging concessions. Multinational companies extract timber for international export.

Source: Hugh Eva, with permission, all rights reserved.









Managed logging concessions (2021).

Tree cover loss throughout equatorial Africa has a complex relationship with logging concessions and protected areas. Concessions are areas allocated by governments for the extraction of timber, but there is still considerable tree loss outside of these concession areas. Protected areas prevent deforestation in some, though not all, parts of Africa.

Source: Concession data: Global Forest Watch (2023) *Managed Forest Concessions*. Accessed through Global Forest Watch on 24/04/2024. www.globalforestwatch.org. (Compiled from various government sources). Tree loss: Hansen/UMD/Google/USGS/NASA, accessed through Global Forest Watch (Hansen, M. C., et al. (2013) High-resolution global maps of 21st-century forest cover change. *Science* 342, 850–53.)

References

[1] IPBES. (2018) *The IPBES regional assessment report on biodiversity and ecosystem services for Africa*. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn, Germany. Available from: https://zenodo.org/record/3236178

[2] Global Forest Watch (2023) *Managed Forest Concessions*. Accessed through Global Forest Watch on 24/04/2024. www.globalforestwatch.org. (Compiled from various government sources).

[3] Laporte, N.T., et al. (2007) Expansion of industrial logging in central Africa. *Science*, 316, 1451.

[4] Laurance, W.F., et al. (2009) Impacts of roads and linear clearings on tropical forests. *Trends in Ecology and Evolution*, 24, 659-669.

[5] Zwerts, J.A. et al. (2024) FSC-certified forest management benefits large mammals compared to non-FSC. *Nature*, 628, 563-568.

[6] Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010.