

Value and Vulnerability of the Central Congo Basin Peatlands



This Policy Brief was developed collaboratively between UNEP-WCMC, the University of St Andrews and the University of Leeds, in the context of the CongoPeat project. It was produced as part of a Doctoral Internship placement of University of St Andrews PhD candidate George Elliot Biddulph at UNEP-WCMC, between July and September 2023.

About CongoPeat

CongoPeat is a 5-year project led by Professor Simon L. Lewis of the University of Leeds / University College London, funded by the UK's Natural Environment Research Council (NERC). The project aims to gain a comprehensive understanding of the central Congo Basin peatland ecosystem by answering key questions about its past, present and future. It brings together leading experts from six UK universities and five Congolese organizations to study this newly discovered ecosystem, alongside science-policy communication specialists to explain their results.

CongoPeat researchers aim to provide the very best scientific information to allow policy-makers and civil society to make wise decisions about this globally significant ecosystem.

For more information, please visit <https://congopeat.net/>

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About this policy brief

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Suggested citation

CongoPeat Consortium (2023). Value and Vulnerability of the Central Congo Basin Peatlands. A product of the CongoPeat network. United Nations Environment Programme World Conservation Monitoring Centre, Cambridge.

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Acknowledgements

We would like to thank all the villages that hosted our fieldwork in Republic of Congo: Bokatola, Bolembé, Bondoki, Bondzale, Ekolongouma, Ekondzo, Itanga, Mbala and Moungouma and the local communities for hosting CongoPeat field campaigns in DRC including Lokolama, Bosukela, Mpama, Befale, Bonsole, Mweko, Mpeka, Bondamba, Bolengo, Boleke, Pombi, Boboka, Ipombo, Lobaka, Bolombo and Bonzembo.

Our gratitude also goes to the Groupe d'action pour sauver l'homme et son environnement (GASHE), Greenpeace Africa, the DRC Peatlands Management Unit and the Wildlife Conservation Society Congo Programme for logistical support.

This policy brief is the result of the collaboration within the CongoPeat network. The authors would like to thank Dafydd Crabtree, Bart Crezee, Charlie Hackforth, Shona Jenkins, Joe Langley and Danielle Paffard for providing pictures from the field, Corinna Ravilious (UNEP-WCMC) for her help in producing the maps, and all our reviewers as listed above. The CongoPeat project work was made possible through the generous contributions of various funders including NERC (Large Grant 'CongoPeat' NE/R016860/1), Montpelier Foundation, Royal Geographic Society (special thanks to Shona Jenkins, Cassie Dummett and Joe Langley) and University of St Andrews (George Biddulph's doctoral internship).

Finally, we thank the governments of the Republic of Congo and Democratic Republic of Congo and the authorities of Marien Ngouabi University and University of Kisangani for their support in the project and permission to conduct research in the peatlands. In particular, the CongoPeat project thanks the Minister of Environment, Sustainable Development and the Congo Basin of the Republic of Congo, H.E. Soudan-Nonault and Minister of Environment and Sustainable Development of the Democratic Republic of Congo, H.E. Bazaiba Masudi.

Data availability

Papers are published in international peer reviewed scientific journals, and data is publicly available, on permanent archives. See www.congopeat.net for detail, or the individual publications.

The map data is available for download at www.congopeat.net/maps/. Visualizations are available on the UN Biodiversity Lab map portal: please visit www.unbiodiversitylab.org/en/ and search Layers for "CongoPeat".

Cover photo: Travelling by dugout canoe is the main mode of transport for researchers and locals in much of the peatland forest, especially during the wet season (©Shona Jenkins).

Summary

In 2017, a Congolese-UK team of scientists discovered and mapped the world's largest tropical peatland complex, in the central Congo Basin, covering an area greater than the size of England and Wales combined. These forested peatlands stretch across the Republic of Congo (RoC) and Democratic Republic of Congo (DRC), and store in their soils carbon equivalent to three years' worth of global greenhouse gas emissions.

The ecosystem is a refuge for threatened species, including the world's densest population of western lowland gorillas. Around 5.5 million people live within or around the Congo Basin peatland complex,¹ many of whom depend on peatland resources for their livelihoods. Since 2017, the original research team has grown to form the "CongoPeat network", including additional scientists from universities in the DRC, RoC, UK and elsewhere. This collaboration has hugely increased our understanding of this ecosystem and its functioning, human impacts on the ecosystem and its value to the communities depending on it, though there is still plenty to learn. Here, we share our major findings and their relevance to the conservation of this fragile ecosystem.

Key messages:

- CongoPeat analyses show that these peatlands store 29 Gt of soil organic carbon (29 billion metric tons) and cover 167,600 km². The peatlands are a carbon-dense, globally significant carbon store, and are currently largely intact.
- The peat swamp forests host large populations of forest elephants, lowland gorillas, chimpanzees, dwarf crocodiles, and species such as Allen's swamp monkey that are highly dependent on swamp forests. However, most resident species have yet to be inventoried or even identified, including plants, fish and invertebrates.
- The peatlands contribute to community livelihoods, including as a source of fish – a major protein source – and through income from forest products. Their current use by local communities appears to be largely sustainable.
- CongoPeat analyses demonstrate that these peatlands were sensitive to past droughts, which led to peat decomposition and carbon loss. Future drying of the peatlands risks carbon release, contributing further to climate change. These risks can be reduced by keeping the peatlands wet, and by achieving the Paris Agreement goals to stabilize the climate system.
- Near-future threats to the peatland include commercial land-use activities, such as industrial logging, oil exploration and drainage for large-scale agriculture. Concessions have been proposed, and some have been granted, but activities have not, to our knowledge, begun. These risk turning the ecosystems into a major carbon source to the atmosphere while damaging wildlife and all the other ecosystem services they provide.²
- The relatively intact nature of the peatlands, the reliance of local communities on ecosystem goods and services the peatlands provide and the opportunity for finance to support the global carbon and biodiversity benefits suggest that community-based conservation could have a strong role to play in protecting the peatlands.



In this fishing camp, the local Indigenous People are renowned experts in the fabrication of thatched roofs made out of *Raphia laurentii* leaves. The mature leaves are selectively harvested in a way that does not harm the tree and allows for regrowth and overall sustainable harvesting. Équateur Province, DRC (© Shona Jenkins).

Carbon storage

Across the central Congo Basin, peatlands cover over 167,600 km² between the Republic of Congo (RoC) and Democratic Republic of Congo (DRC)³ – an area nearly half the size of the Republic of Congo – representing the world's largest tropical peatland complex (Fig. 1).^{3,4}

How extensive are the peatlands?

167,600 km², is 16.76 million hectares, or over 22 million football (soccer) pitches.

This area is 2,836 times the size of Manhattan island, the entire size of England and Wales combined or 5.5 times the size of Belgium.

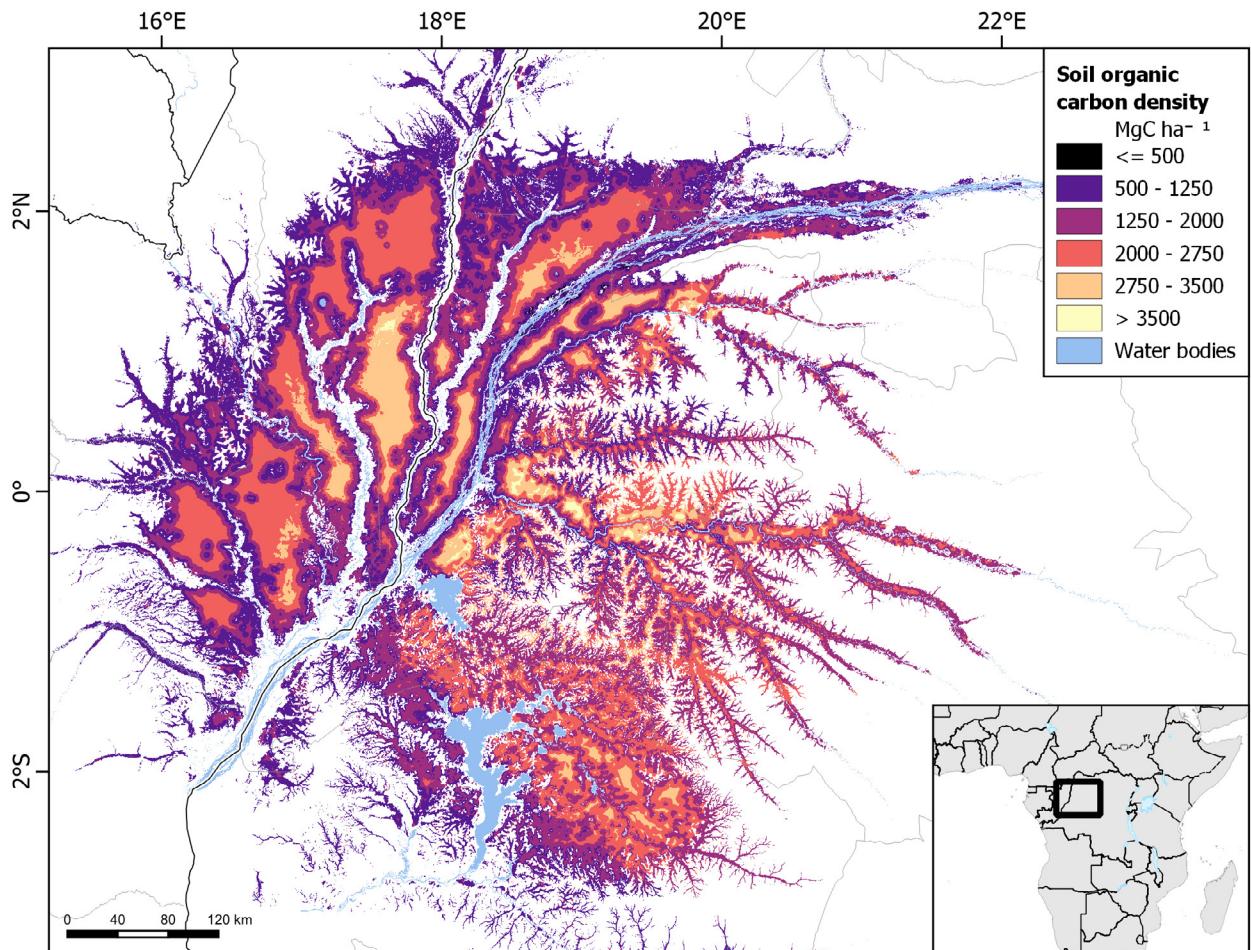
The northeastern edge of the peatland complex in Republic of the Congo is approximately 800 km from the southwestern edge of peatland complex in DRC.

Tropical peat swamp forests are efficient at capturing and storing carbon when trees, shrubs and other plants die in oxygen-deficient conditions that prevent organic material from fully decomposing. Over time, the accumulation of semi-decomposed plant remains results in the formation of peat, a process that began at least 20,000 years ago in the central Congo Basin.⁵

The latest estimates published by CongoPeat indicate that the central Congo Basin peatlands store 29 billion tonnes of soil organic carbon.³ With new ground data far from the previous data collection points, the new analyses are more accurate, reducing the uncertainty around the peatlands' carbon stocks compared to previous estimates.⁴ This new analysis confirms the central Congo peatlands' importance as a globally important carbon store. This carbon accounts for 28% of the tropical peatland carbon pool. If it were disturbed and all released as CO₂, it would be equivalent to 44% of the remaining carbon emissions budget needed to avoid 1.5°C of warming.⁶

The soil carbon stored in the peatland ecosystem is estimated to be greater than the carbon stored in the trees of all forests of the RoC and DRC combined, making it a critically important carbon-dense hotspot.⁷ New carbon density estimates from CongoPeat suggest that, on average, there is around nine times as much carbon per hectare stored in the peat of the central Congo Basin (1,712 ± 634 MgC ha⁻¹) as there is in the trees of typical African moist tropical forests (~198 MgC ha⁻¹).⁸ The central Congo peatlands are, on average, twice as carbon dense as those in the Peruvian Amazon.^{3,9}

Carbon storage (continued)



The boundaries and names shown, and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

* Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined; Final status of the Abyei area is not yet determined

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Figure 1 – Peat extent and carbon density of the central Congo Basin peatlands.³ Black lines show national borders and light grey lines show subnational administrative boundaries.



Great blue turaco (*Corythaeola cristata*) pictured in a locally disturbed area of peat swamp forest. Ruki river region, DRC (© Joe Langley).

Biodiversity

The central Congo Basin peatlands are home to many different species of animals and plants including thriving populations of several that are elsewhere threatened according to the IUCN, particularly in the peatlands of the Republic of the Congo. This includes three species of great ape: the western lowland gorilla (*Gorilla gorilla gorilla*, Critically Endangered), chimpanzee (*Pan troglodytes*, Endangered) and bonobo (*Pan paniscus*, Endangered).^{10,11,12} The peatlands also host large populations of the African forest elephant (*Loxodonta cyclotis*, Critically Endangered), the African dwarf crocodile (*Osteolaemus tetraspis*, Vulnerable), and Allen's swamp monkey (*Allenopithecus nigroviridis*, Least Concern but reliant on inundated forests like these).⁷

The flora and fauna of the peatlands are integral parts of a unique ecosystem. For example, the numerous gorillas of the Lac Télé-Likouala region use *Raphia* palm fronds to build their nests in swamps.¹³ Dwarf crocodiles have been observed to burrow in peat and use it to build nests.¹⁴ African forest elephants are effective seed dispersers^{15,16} of at least 41 timber species. These include *Panda oleosa*, useful for building canoes, in medicine and for its nutty, oil-rich seeds.¹⁷

CongoPeat scientists have been investigating two under-studied aspects of the peatland forests' biodiversity: the moths, butterflies, dragonflies and beetles that live in the swamps, and the composition and distribution of the plant communities making up the forests themselves. CongoPeat is examining the differences between the palm and hardwood swamp forests and comparing these with nearby *terre firme* (non-flooded) forests. The insect research looks set to describe species that are new to science in the near future (C. Hackforth, pers comm). Tree diversity is lower in the swamps than the *terre firme*, and so far no tree species endemic to the peatlands have been found.^{18,19} This pattern may not be the same for understorey plants, as these have not been studied in as much detail. Overall, this work will yield a better understanding of peatland ecology, including insect pollination patterns and the influences of wet and dry seasons.



A large moth in the family Saturniidae captured in the traps in the palm swamp one night. Ekolongouma, Republic of Congo (@Charlie Hackforth).



A local resident of a fishing camp (left) and CongoPeat research assistant, Esther Bokungu (right), discuss how traditional fish traps are made from fibres from the *Raphia* sese palm trees of the swamp forest. Équateur Province, DRC. (© Shona Jenkins).

Supporting local livelihoods

Human-focused research in the peatlands is scarce, but it is well known that peatlands support the livelihoods of rural and Indigenous communities in this region. It is estimated that around 5.5 million people reside within a 10 km distance of the central Congo Basin peatland complex, of which 4.6 million reside in the DRC.¹ Peatlands hold social, economic, cultural, and spiritual value for many people who live in the Cuvette Centrale region,²⁰ especially those communities that are heavily reliant on peatland ecosystem services. Peatlands are materially valuable to people because they provide food, drinking water, wood and fibre for constructing houses and tools for harvesting peatland resources (e.g., fishing baskets), fuel wood and traditional medicine. In general, local sources of income from the peatland forest include the sale of dried, salted and fresh fish, artisanal timber, palm thatch for construction, and charcoal and bush meat. In rural and Indigenous communities far from towns, these are the main income sources for many families. Ethnographic research conducted by CongoPeat researchers in two communities in the DRC's peatlands showed that livelihood strategies are strongly influenced by cultural identities and traditions. The variety of livelihood activities practiced can vary between ethnic groups (for example, between Bantu and Indigenous communities), social groups (for example, between men and women) and environmental conditions (for example, heterogeneity across the forest landscape). CongoPeat researchers found that small-scale commerce involving the sale of staple food items like cassava, fish, salt, spices and bread are extremely important for women, especially in communities without access to non-flooded arable land on the periphery of the peatland forest. Shifting agriculture is otherwise an important livelihood activity for women in communities with access to non-flooded arable land adjacent to the peatland forest.

Collaboration between rural and Indigenous communities, and the scientific community is critical for improving understanding of ecosystem dynamics under sustainable use in the peatlands. Indigenous Peoples and local communities possess a wealth of knowledge on peatland biodiversity and the ways in which these valuable ecosystems function, much of which has not been documented in the academic literature. Rural communities have been successful in protecting the central Congo peatlands. For example, the Lac Télé community reserve in the Republic of Congo is a collaboration between multiple stakeholders, including the local communities, government ministries and NGOs whose aim is to protect both the livelihoods of people who live in and around the 4,400 km² area and the biodiversity and wider environment (Fig. 5).



Flooding during the wet season limits access to the forest. Ekolongouma, Republic of Congo (© Dafydd Crabtree).

Vulnerability to climate change

New evidence published by CongoPeat in the journal *Nature* reveals that between 5,000 and 2,000 years ago, the peatlands were severely affected by a shift towards drought conditions.²¹ Analysis from peat cores across the peatland complex showed that a large amount of carbon was lost through decomposition over that period.²¹ Analysis of fossil pollen shows that not only was peat lost, but the character and diversity of the peat swamp forests changed.²²

Analyses revealed that from around 5,000 years ago, this region of Central Africa experienced climate drying that became progressively worse, until 2,000 years ago. Drought conditions lowered water tables in the peatlands and caused up to 6.4 meters of peat to decompose, creating a "Ghost Interval" seen in cores across the peatland complex (see Fig. 2).^{21,23} These conditions caused the peatlands to switch from being a major carbon sink to a major carbon source, until the water table recovered and peat accumulation resumed.

These findings have identified a climatic threshold in the peatlands, which, if crossed, may cause the peatlands to become a carbon source once again. With emerging evidence

suggesting that seasonal patterns are changing, droughts may become more likely,²⁴ and create a real risk that these peatlands begin to emit vast quantities of greenhouse gases. Considering that these peatlands store carbon equivalent to three years' worth of anthropogenic global greenhouse gas emissions,⁷ starting to lose it to the atmosphere through degradation and fire would considerably reduce the remaining global carbon budget.

New flood maps published in 2023 (Fig. 3) covering a large subset of the peatlands found that nearly three quarters of the area is either fully or partially rain fed.²⁵ That is, they rely on rainfall to stay wet, and it is difficult to predict how rainfall patterns will respond to global climate change. With drought conditions becoming more common across the central Congo region,²⁴ it is key that we avoid altering the hydrology of these peatlands through drainage or other activities, so that the peatlands have the best chance to survive under future climate change.

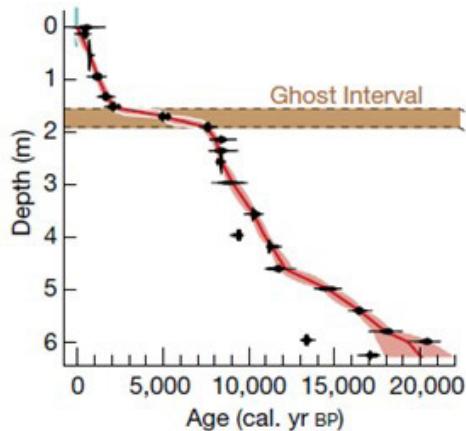


Figure 2 – Age and depth of a central Congo peat core. During the "Ghost Interval", peat accumulation slowed and decomposition began – adapted from Garcin et al. (2022).

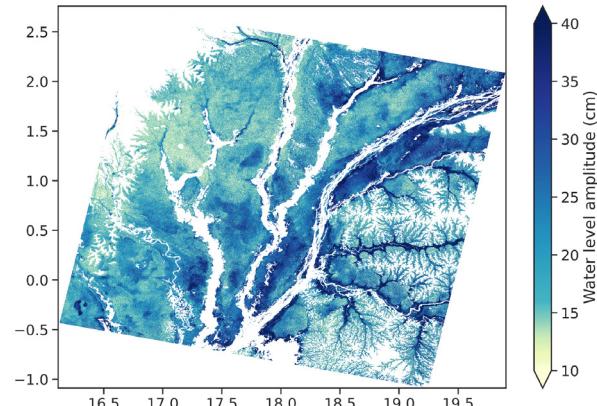


Figure 3 – Flood map showing the change in amplitude of water levels across the peatlands – taken from Georgiou et al. (2023).



CongoPeat researchers lived with a community on the edge of the Ruki River (DRC) and the peatland forest for 6 weeks to study local livelihoods, forest impacts and forest values (© Shona Jenkins).

Threats from land-use activities

Peatlands in the central Congo Basin are under threat from land-use change.^{26,27} Industries which threaten peatlands include mining, logging, agriculture, and oil exploration (Fig. 4). When these industries operate in peatland areas, peatlands are put under stress, through deforestation, digging of drainage ditches for agriculture, and development of accommodating infrastructure. Drainage ditches lower water tables, which leads to peat soils drying out. Road building also alters the flow of water in the landscape and can lead to either drying or flood conditions. Dry peat increases the likelihood of peat fires, a consequence which has ravaged Southeast Asian peatlands in recent decades impacting the economy and local health.²⁸

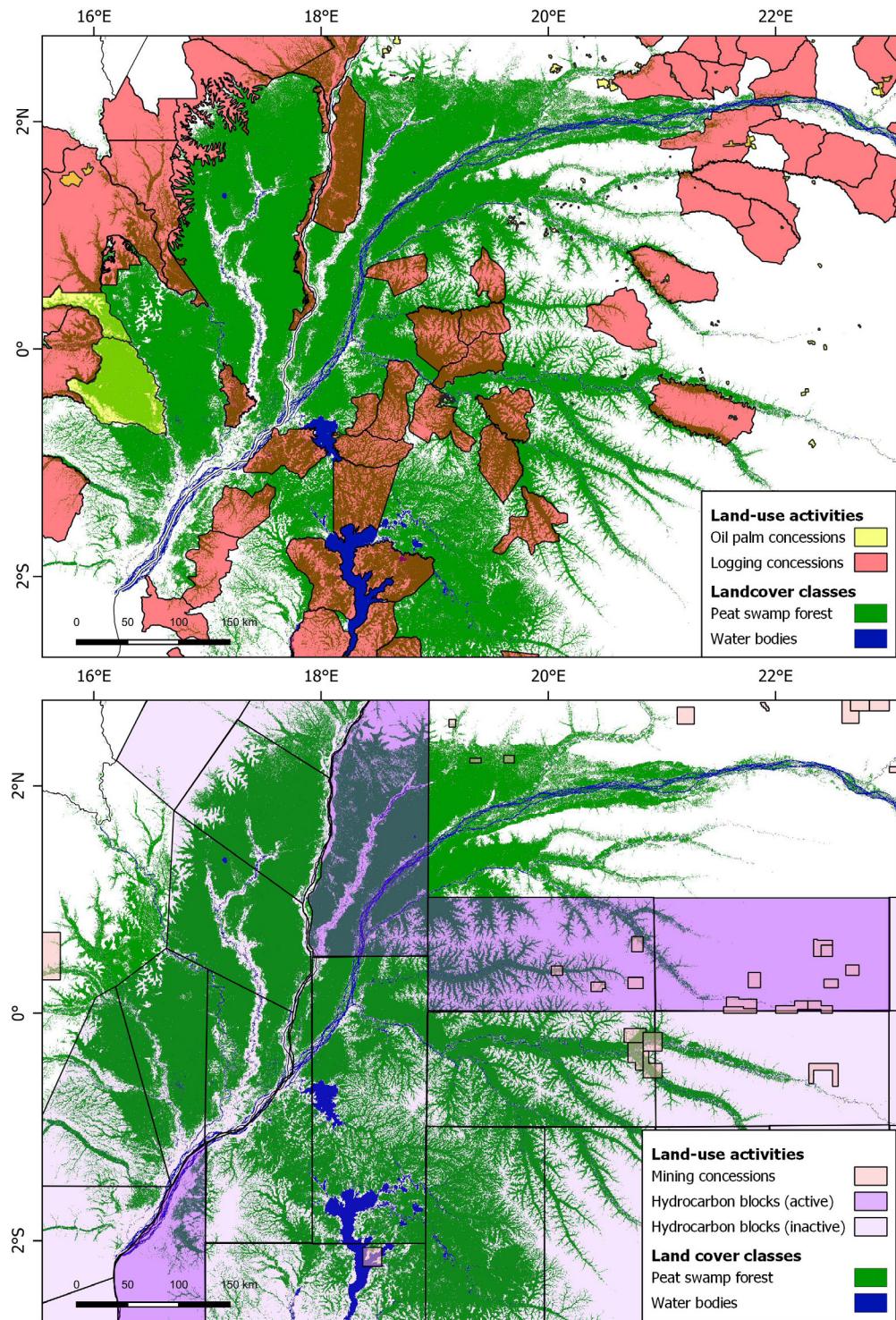
In the Congo, the construction of an access road for logging in nearby *terre firme* forest appears to have accidentally damaged a large area of peat swamp forest (see images on page 14). Construction of similar infrastructure should be avoided. Instead, infrastructure should allow sufficient water flow to maintain the previous patterns of inundation to maintain the peatlands. Environmentally sensitive land-use plans are critical to prevent further environmental degradation.

There are numerous oil palm and logging concessions that include peatlands in the RoC and DRC, particularly in the Mai-Ndombe and Équateur provinces of DRC (Fig. 4). Oil palm, mining, and logging concessions together cover areas representing over 7 billion metric tonnes of carbon, or 26% of the peatlands' carbon stock.

Hydrocarbon concession blocks cover almost all the peatlands. The 27 oil blocks recently proposed for auction in DRC cover more than 11 million hectares of forests, storing an estimated 1.5 billion metric tonnes of carbon.²⁹ A recent review of the effects that oil exploration has on tropical peatlands showed that deforestation, habitat loss, and extensive pollution from oil and wastewater spills, affecting people and wildlife, have all been recorded around hydrocarbon concessions in peatlands elsewhere in the tropics.²⁷ Yet, so far, there is very little exploitation and exploration of oil and gas within the central Congo peatlands.

Given the value of the peatlands and their vulnerability to environmental change, it is critical that any current concessions that have not started operations do not start and future concessions are not granted in peatland areas. Any concessions already within peatland boundaries and already operating should be required to keep peatlands wet and operate in a sustainable manner. Operations within peatland boundaries must only be conducted following wise-use principles outlined in the Ramsar Convention on Wetlands, and meet all commitments outlined in the [Brazzaville Declaration](#) and letters of intent between the Central African Forest Initiative (CAFI) and the RoC and DRC. These measures will contribute to ensuring that the peatlands will continue to store globally significant quantities of carbon, continue to support the development of rural economies, and the livelihoods of millions of rural and Indigenous communities.

Threats from land-use activities (Continued)



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Figure 4 – Map of land-use concessions which threaten the central Congo Basin peatlands. Concessions were digitized using spatial data from RFUK, WRI, MEFDE, DIAF, DGF, and forest atlases of the RoC and DRC.



Photo taken in 1989, light green is inundated swamp forest, which we identify as peat swamp forest; dark green is rainforest; logging camp and access road are brown coloured. Images reproduced from Lewis et al. 2023.⁷

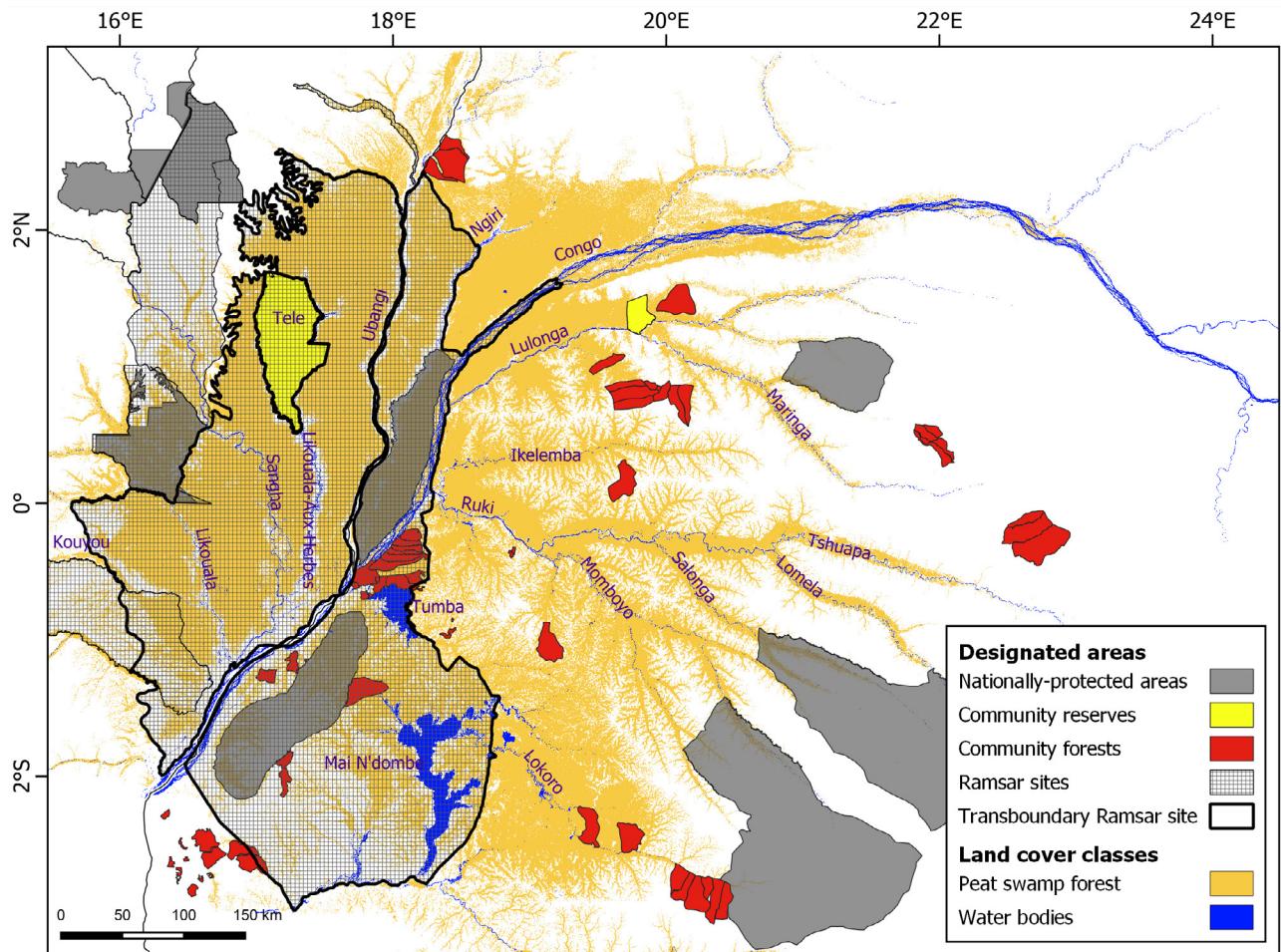


Photo taken in 2018, at the same location, where the trees in the peat swamp are all dead, releasing carbon to the atmosphere.⁷ The tree deaths are coincident with the change in drainage following the building of the road. Dieback like this has not been seen elsewhere in the region where there was no road-building.



An umbrella on a pole marks the corner of a field plot, visible to a drone mapping the area from above. Ekolongouma, Republic of Congo (© Danielle Paffard).

Progress in peatland protection



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Figure 5 – Protected areas and community forests covering the central Congo Basin peatlands. Data for designated areas obtained from World Database on Protected Areas³⁰ and land cover rasters from Crezee et al. (2022).

Only 8% of the peatland falls within formal national protected areas,³ but community forests and international Ramsar sites offer additional means of protection. In 2017, the RoC and DRC declared that three existing Ramsar sites would be jointly managed across international boundaries, as the Complexe Transfrontalier Lac Télé – Grands Affluents – Lac Tumba. This joint site covers

over 40% of the peatlands overall (Fig. 5), and other Ramsar sites cover further significant areas of the Republic of Congo peatlands. This offers a framework through which the peatlands can be managed sustainably, following wise-use principles outlined in the Ramsar Convention on Wetlands.

Progress in peatland protection (Continued)

In 2018, the Brazzaville Declaration was signed between the RoC, DRC, and Indonesia. It is a detailed collaborative agreement, seeking to protect the central Congo Basin peatlands. Additional agreements, commitments, and legislative actions that have focused, at least in part, on protecting peatlands and peatland forests, include:

- Development of legislation in the DRC in 2014 which enabled local communities to obtain community-owned forest concessions up to 50,000 hectares in size for up to 25 years.
- Letters of intent between the Central African Forest Initiative and the RoC and DRC, providing investments and enabling reforms to foster sustainable development.
- Membership of the DRC and RoC in the UNEP-led Global Peatlands Initiative.
- Inclusion of peatlands in the RoC and DRC's Nationally Determined Contributions under the UN Framework Convention on Climate Change, including protection actions in the DRC's NDCs.
- The DRC's existing legal framework that governs the peatland area, including water and forest laws. The country is also in the process of developing its National Peatlands Roadmap.
- Increasing inclusion of peatlands in national forest policies and REDD+ strategies.
- The Lac Télé - Lac Tumba memorandum of understanding, which created the joint Ramsar site.

Over the past six years, the RoC and DRC have substantially increased their efforts to protect the central Congo peatlands. The commitments noted above seek to enhance the protection of the peatlands, through developing sustainable land-use models and regulating harmful land-use activities in peatland areas. It is vital the international community recognizes this progress, and that these commitments are met to ensure that the peatlands can continue to thrive and function properly. These commitments will need sustained political will and appropriate finance to follow up, and to be integrated into broader national development strategies to ensure policy coherence.



Professor Corneille Ewango of the University of Kisangani, DRC, takes notes in a peat swamp forest along the Ikelemba River in DRC (© Bart Crezee).

Next steps and opportunities for protection

Discussions on the future of the central Congo Basin peatlands will be most effective if conducted in a fair, inclusive and gender-responsive manner, which considers and respects the views of all stakeholders involved (including diverse groups of women and men). Collaboration between the two national governments as agreed in the Brazzaville Declaration will also help to ensure coherent policies for peatland protection and management. Regional policy-makers, scientists, NGOs and rural and Indigenous communities all have valuable contributions to make. Here, we present some options for improved peatland protection and conservation, drawing on the findings of CongoPeat and the recent Global Peatlands Assessment (UNEP 2022).³¹

- Strengthen regulations and legislation on harmful intensive land-use change activities in peatland areas, including hydrocarbon exploration, mining, agriculture, and industrial logging, to prevent drainage, deforestation, and habitat loss in the peatlands.
- Revoke agricultural, logging and hydrocarbon concessions if they have not begun operations within the peatlands, and for those that operate, rapidly phase out these activities while ensuring a just transition for the people involved.
- Develop fair and inclusive peatland policy and supportive legislation as needed, which recognizes local and Indigenous land rights and land tenure. In addition, provide communities with resources to map their customary lands, gain collective title over them, and develop long-term management plans in these areas. In the DRC, community forest reserves offer a means to assign rights and tenure to local people.
- Encourage the development of cross-sectoral governance of peatland activities through the co-management of all peatland areas, empowering and compensating stewardship by local communities and Indigenous Peoples. This should aim to recognize and fulfil the unmet needs of communities living around the peatlands to enable them to continue in their sustainable management of the ecosystem.
- Build on the Brazzaville Declaration on peatlands to develop a joint management plan for the Complexe Transfrontalier Lac Télé - Grands Affluents – Lac Tumba e.g using the Site Management Toolkit developed by the Convention on Wetlands.³² Consider whether the peatlands that fall outside the existing Ramsar sites would benefit from Ramsar designation.
- Expand protective governance mechanisms like national protected areas, community forest concessions and recognizing the human and land rights of local and Indigenous Peoples including those in areas located east of Lac Mai Ndombe and Lac Tumba, between the Ngiri and Congo Rivers, and in the floodplains of the Ikelamba, Lulanga, and Ruki Rivers.
- Create a buffer around the peatland areas to discourage harmful land-use activities from encroaching into the peatlands whilst protecting practices by local, and Indigenous communities. In the DRC, community forest reserves offer a means to assign rights and tenure to local people and can help to serve this function.
- Establish a collaborative peatland monitoring system, encouraging sharing of scientific and local/traditional knowledge.

- Continue interdisciplinary research in the central Congo Basin peatlands, focused on better understanding of the ecosystem, its contributions to people, and develop effective strategies for its conservation and sustainable use. Research findings on topics such as risks to peat carbon stocks from land-use change, the co-benefits of peat conservation actions, to hydrological ecosystem services, economic value of peat-supported fisheries should be designed to inform decision making on the management of the ecosystem. Such research should be underpinned by innovative and just ways of integrating scientific and local/traditional knowledge to assist in the long-term protection of this valuable important ecosystem.



A community living on the edge of the Congo River and the peatland forest (DRC) (© Shona Jenkins).

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