CongoRea

NEWSLETTER #3 MARCH 2020

Introduction

CONGO PFΔT

by S Lewis, University of Leeds

Unfortunately Coronavirus is spreading worldwide. Universities in Republic of Congo, Democratic Republic of Congo, the UK and continental Europe are physically closed. Little movement is allowed in most countries. This means disruption to our lives, and to the CongoPeat research programme. As the newsletter shows, we have made huge progress in understanding Congo's peatlands, and I am here to help this continue as we take into account the new situation, so please let me know how I can help.

Practically, the latest extensive DRC field campaign, reported below, while extremely successful, had to end a week early due to new travel restrictions, with all samples left in DRC with our partner GASSHE. We aim to collect them once travel is possible. The whole team returned home safely. The June extensive field campaign is postponed.

The team monitoring the GEM plots, reported below, have done a fantastic job completing one year of data collection in March. Their work in RoC is not currently impacted by Coronavirus, but we are carefully monitoring the situation.

ECR update

by N Girkin, Cranfield University

The CongoPeat Early Career Researcher (ECR) group met in November 2019, allowing us to discuss our work in a more informal atmosphere, exchange ideas and decide on ways we can be more effectively supported in our research. One of the outcomes of our discussions was an agreement to start developing an ECR led paper identifying the key research questions regarding peat swamps in the Congo basin, with topics including peatland formation and development, plant community succession, the regulation of greenhouse gas fluxes, and how ecological processes might respond to future change. We will aim to submit the assessment to a French language journal in the summer. We next meet online (Tue 28 April) before the main CongoPeat meeting: any additional items for the agenda are welcome (email: nicholas.girkin@gmail.com). NEXT PROJECT MEETING ONLINE:

29 - 30 April 2020 Agenda items: please send to admin@congopeat.net

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Submit an article for next issue by 31 August 2020.

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NEWSLETTER #3

Latest fieldwork in the DRC

by B Crezee, University of Leeds

Fieldwork continued in the DRC in January, when Greta Dargie and Simon Lewis (both U. of Leeds), Joseph Kanyama (U. of Kisangani), Pierre Bola and Ovide Emba (both ISP-Mbandaka) set off on a big expedition up the Congo river. Until the end of March, the team is sampling various new field sites along the main stem of the Congo river, between Mbandaka and the town of Makanza. This work will help improve the accuracy of our peatland maps, by verifying predicted peat swamp locations in the field. The fieldwork will also provide new samples for palaeo analysis, carbon estimates and gas fluxes.

Before departure, the team organized a conference at ISP-Mbandaka, at which Bart Crezee (U. of Leeds) was also present. Staff and students from multiple universities in Mbandaka, as well as representatives from various local civil society organisations, attended the event. Greta, Joseph, Simon and Bart gave presentations about the Congolese peatlands in general and the CongoPeat project in particular. Bart also gave a similar presentation about the work of CongoPeat to researchers at the local nature reserve and research centre CREF Mabali, near Lake Tumba.

Ovide Emba (ISP-Mbandaka) in the floodplain forest along the Ikelemba river, DRC. Credit: Bart Crezee





Joseph Kanyama (U. of Kisangani) in the floodplain forest along the Ikelemba river, DRC. Credit: Bart Crezee

In addition to the main expedition, Simon, Bart, Joseph, Pierre and Ovide also briefly returned to two transects that were previously sampled in 2018. In early January, they visited a transect that runs perpendicular to the Ikelemba river, in what turned out to be a floodplain forest. Because the wet season had only just ended, the local village and the first half of the transect were still entirely flooded by the river overflowing its banks. The contrast with the same site at the height of the dry season in 2018 – without any inundation or waterlogging – was striking. It showed the large variation in water table depths that these floodplain forest can experience. When more data becomes available, we can hopefully try to understand this kind of peat swamp forest better.

The team also briefly returned to the village of Lokolama, where a new peat core from 5 km inside the swamp revealed the deepest peat so far found in the Cuvette Centrale: exactly 6.0 m.



Using EGM gas analyser in GEM plots Credit: Walter Huaraca Huasco

GEM plots in Republic of Congo

by E Mampouya & M Mbemba, Marien N'GOUABI University Monthly and quarterly data collection continues in the three GEM plots in the Republic of Congo to assess carbon uptake and release in the peatlands and nearby *terra firme* forest.

Monthly data looks at litterfall, Leaf Area Index and soil and stem greenhouse gas efflux. Every three months, in addition to the monthly data, data is collected on growth of *Raphia laurentii* palms, tree growth via dendrometer measurements, samples of dead wood, litter accumulation on the ground, root production and leaf scanning in order to determine specific leaf area.

Currently we have data collected over a one year period in our repository. Last year was affected by severe flooding in November which impeded access to the sites, absence of rhizotrons and malfunctioning of root in-growth cores.

In the field, the second year's data collection will focus on the following at the beginning of 2020:

- New censuses and measurements of large and small trees;
- New censuses and measurements of large Raphia laurentii;
- Census of small Raphia laurentii;
- Identification and measurement of new recruits;
- New in-growth core experiments and the new rhizotron methodology to assess fine root production, implemented by Matteo Sciumbata, a Master's student at Vrije Universiteit Amsterdam;
- Felling Raphia laurentii in order to create an allometric equation, implemented by Dr Yannick Bocko.

Greenhouse gas measurements

by N Girkin, Cranfield University

Analysis of greenhouse gas samples being collected from the GEM plots is ongoing - we are currently analysing samples collected in August 2019. Analysis of samples collected from the Ruki river has now been completed, with fluxes broadly comparable to those measured in the January - March 2019 field campaign in the Republic of Congo. Samples collected by Bart Crezee, Simon Lewis and Ovide Emba in January 2020 from Lokolama and Ikelemba have substantially higher concentrations of methane in particular, likely because these sites are some of the first to be sampled in the region when partially/fully flooded.

In addition, the last greenhouse gas samples from Hayley Curran's (Nottingham Master's student) project have now been collected. Once the last samples have been analysed, Hayley's data will help us understand the extent of nutrient limitation across six sites in the Republic of Congo and Democratic Republic of Congo, and how this relates to peat organic chemistry and rates of potential greenhouse gas production.

Finally, the first paper using greenhouse gas data from the project is in development, linking potential greenhouse gas production throughout the peat profile to changes in organic chemistry, and subsequent emission from the peat surface and the stems of eight common plant species.

Measuring the topography of the peatlands

by I Davenport, University of Edinburgh

In February 2019 we deployed a UAV LiDAR to measure ground elevation in the peatland between Ekolongouma and Epena in Likouala Department, Republic of Congo, along a 43km roughly east-west line, over where we have field transects giving vegetation and peat depth information. The point of this component of the project is to try to work out whether these peatlands are domed or not, and give their precise shape, which in turn helps us determine how they were formed.

We set up launch sites near each village, and the UAV flew from each towards the centre, acquiring LiDAR data giving the elevation of the ground and vegetation. There is a substantial gap between the flightlines, because of the limited range of the UAV, but the data showed a distinct slope upwards from both edges. Some satellite LiDAR data was acquired in this gap, but the uncertainty in these observations is too high to make a reliable direct measurement of the peatland peak height. A central peak around 2m above the edges is consistent with all measurements, matching the slope from the UAV measurements, backing up the idea that these are domed all the way into the centre. This is consistent with a rainfed peatland, and combining this with peat depth measurements, suggests that the peatland may have formed in a shallow basin at least 2-3m deep. This work will be submitted to a journal shortly, and presented at the European Geophysical Union General Assembly in May. To build up a more extensive idea of the topography of the peatland, recentlyreleased data from NASA's Global Ecosystem Dynamics Investigation (GEDI) LiDAR is being analysed. This is an instrument mounted on the International Space Station which can be pointed at regions of interest, which we hope will include our sites.



Organic Matter Preservation of the Congo Basin

by G Tyrrell, University of Leicester

In January 2020, Genna Tyrrell (U. of Leicester) alongside Donna Hawthorne and George Biddulph (U. of St Andrews) travelled to Leeds to subsample a 5.7 m core from the site Bondamba collected in the June - August 2019 DRC campaign. The core was sampled at every cm and will be analysed in the Stable Isotope Laboratory at the University of Leicester examining the bulk carbon and nitrogen isotopes. Samples were also taken throughout the core for compound-specific isotope analysis of leaf-wax lipids. This will provide greater insight into past precipitation changes within the Democratic Republic of Congo.



Donna Hawthorne and George Biddulph (U. of St Andrews) sampling the Bondamba core at the U. of Leeds. Credit: Genna Tyrrell



Peat core taken near Ekolongouma, ROC. Credit: Donna Hawthorne

Palaeo-environmental update

by G Biddulph, University of St Andrews

George Biddulph joined the Palaeo-environmental team at St Andrews in September 2019 as a PhD student and his research will focus on the spatial palaeoecology of the peatlands. He has begun work on his first cores from Ekolongouma (ROC), sampling them for pollen, geochemistry and isotopic analyses.

Postdoc Dr Donna Hawthorne has been continuing the detailed palaeo-environmental analysis on a central peat core from Ekolongouma (ROC), focusing on proxies such as pollen and charcoal. Additional sedimentological analyses has also been undertaken, including magnetic susceptibility, particle size and loss on ignition, to determine the character of the basal material. The work on this peat core will likely be complete in the next few months. It highlights the long-term history of these peatlands, which appear to have been dominated by swamp forest for many thousands of years.

The subsampling undertaken at Leeds (described in 'Organic Matter Preservation of the Congo Basin') will be used at St Andrews for a range of palaeoecological and sedimentological proxies, including pollen, charcoal and testate amoebae analysis. This will allow a detailed reconstruction of the past vegetation and environment at Bondamba throughout the Holocene, and allow a comparison with the information already analysed from Ekolongouma.

Global policy processes

by L Miles, UNEP-WCMC

Lera Miles (UNEP-WCMC) and Ian Lawson (U. of St Andrews) joined an international team convened by UNEP and FAO for consultations in Brazzaville in the first week of March 2020. The aim was to gather views on a proposal that had been put forward to the German International Climate Initiative (IKI) to promote biodiversity-friendly development pathways in the transboundary Lac Télé – Lac Tumba landscape. The Lac Télé – Lac Tumba landscape covers some 126,400 km², including substantial areas of peat swamp forest.

The feedback from stakeholders on the IKI proposal was broadly positive, with suggestions including to involve multiple actors in and outside government, interest in ways to extend the influence of the project beyond the selected landscape into other parts of the peatland, and debate on how the project would work best with activities under the Central African Forest Initiative (CAFI). Ian presented the work of CongoPeat in the Brazzaville workshop, and we emphasised the need to make sure that any further hydrological or mapping work should understand and build on this ongoing research.

The UN Framework Convention on Climate Change Conference of Parties (COP) was to be held in Glasgow in December, but has been postponed to a date to be specified. The COP will mark the entry into force of the Paris Agreement to limit the global mean temperature rise to no more than 2°C above pre-industrial levels. The meeting will be the forum for countries to submit updated Nationally Determined Contributions (NDCs) for post-2020 climate action, hopefully ramping up their initial pledges so that we have a chance of meeting the Paris agreement. Currently much effort is going into increasing the ambition of the NDCs, with greenhouse gas emissions and removals from land use and land use change a key part of this, especially for developing countries.

In this context, CongoPeat may be able to help the Republic of Congo and the Democratic Republic of the Congo in understanding the scale of potential emissions from business-as-usual development in the peatland regions, which could be avoided by choosing conservation and sustainable management. Knowing the extent and carbon stores of the peatland complex is a first, essential step in this process.



Ubangui River, Republic of Congo. Credit: Walter Huaraca-Huasco 6