Reducing CO_2 Emissions Through Microbiology

Probiotic Microbes Found in Sarawak Neutralises CO_2 Emissions From the Soil.

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- The soil composition in Sarawak and the Arctic are similar,peat rich with high carbon concentrations but low CO_2 emissions.
- The reason for the low emissions is the presence of 'probiotic' microbes.
- The aim of this research is to identify and grow the microbes in the lab to reduce soil CO_2 emissions.

Peat + Air= CO_2

Southeast Asian peat soils store huge amounts of carbon and are currently undergoing severe disturbances due to deforestation and agricultural practices. The current practise of draining peat enriched marshy soil for agriculture or development brings the peat into contact with air and it releases a very high level of CO_2. This is basic science and peatlands in Southeast Asia release their carbon either directly to the atmosphere or via rivers. But not all soil and not all rivers behave the same. A river in Maludam National Park which is surrounded by undisturbed peat emits surprisingly low amounts of CO_2 and this is what our research team from Swinburne Sarawak are investigating.

Peat swamp forest, Sarawak © Ch'ien C.Lee

Dr. Moritz Müller (centre) and his research team

Microbes hold the key

Together with the University of Bremen our team measured CO_2 concentrations and release from several rivers in Sarawak. We have measured, for the first time, various components of carbon and CO_2 in rivers in and around Maludam National Park. By combining these data with measurements of the same nature in Indonesia, we find that Southeast Asia is not releasing as much carbon as previously presumed. The amounts released are actually three times smaller than recent estimates which change the current view on the role of Southeast Asia in the global carbon cycle. While both chemical and physical reasons exist for the moderate CO_2 fluxes, microbiology is likely the key reason why CO_2 readings are low.

> *The carbon present in the peat soil is the main source of food for soil microorganisms and although they are small, they underlie and control most processes in the soil, such as decomposition and nutrient release.*

From Sarawak to Svalbard

Similar work of measuring CO_2 fluxes and the role of microbes in it is being undertaken worldwide. Two areas of particular interest are the polar regions, where a lot of carbon is stored in the permanently frozen soils. With the University of Manchester, UK, and the University Centre in Svalbard, Arctic, Swinburne Sarawak is examining microbes in Svalbard. Microbes in peat environments remain relatively understudied. However, advanced, novel molecular methods are slowly beginning to unravel the amazing diversity in these extreme ecosystems and it is becoming clear that microorganisms are key players in the turnover of soil organic carbon and in biogeochemical cycles of nitrogen, sulphur, and iron. Our research is focused on identifying, isolating and ultimately promoting the growth of specific microbes from both regions to find

those that can help to reduce the emission of CO_2. A unique fact about Maludam and the Arctic is that the peat environment can be studied in its natural state; undisturbed and uncontaminated. What is special about the two study sites is that they are so far apart (worlds apart so to say) but are very similar chemical environments (in terms of peat and acidity) but at very different temperatures.

This similarity at totally different temperatures is what prompted our investigation of microbes present in the Arctic. We want to see if the same microbes are present in both places and to understand if there are the same or different key players for similar environmental processes (i.e. the formation of CO_2 gas, accumulation of nitrogen, reduction of iron, etc.) In the long run, with the results obtained from the ongoing studies, we hope to create conditions to enhance the growth of 'probiotic' microbes which can help reduce the CO_2 emissions when the peat rich soil is being drained.

Svalbard, Arctic *Paul Williams*