How Does Peat Soil Impact Climate Change Through Greenhouse Gas Emissions

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Introduction

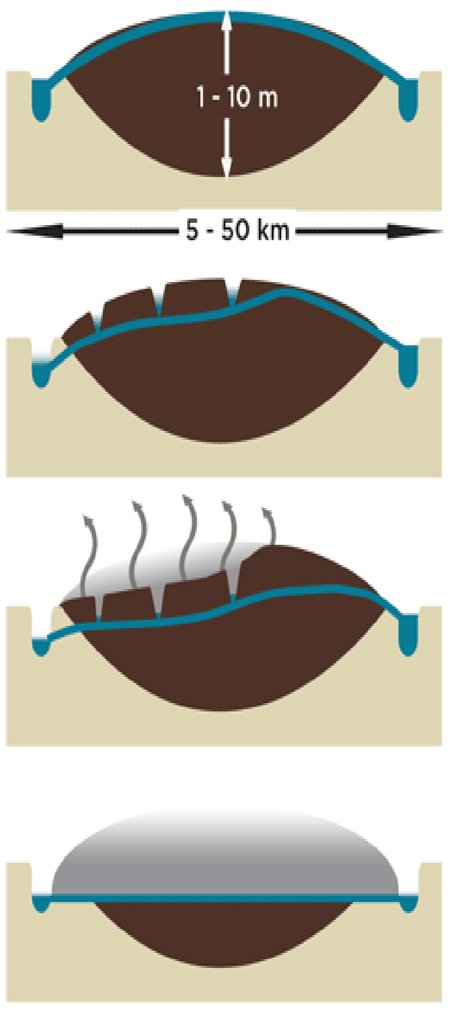
Peatlands have important implications for climate change and greenhouse gas emissions because they are globally important terrestrial carbon pools and are vital components of carbon soil-atmosphere exchange processes. Substantial research has been conducted quantifying the amount of carbon stored as well as the amount of carbon dioxide (CO_2) and methane (CH_4) released from peat soils. Peatlands are traditionally thought of as carbon sinks; however, large deforestation projects can emit significant amounts of greenhouse gases while episodic ebullition events can result in large gas releases over a short time scale that substantially contributes to the increase in atmospheric CO_2. This paper focuses on peatlands in the Florida Everglades, Southeast Asia, Minnesota and Hokkaido, Japan. Studies from these various locations will be assessed to discuss the amount of CO_2 and CH_4 being released from peat soils around the globe. These results will be utilized to emphasize the climate changing effects of greenhouse gas emissions from worldwide peat soils.

Methodology

A literature review was conducted to identify relevant studies reporting on the release of greenhouse gases into the atmosphere from peatlands and how it effects sea level rise. By utilizing Google Scholar and FAU SearchWise, I synthesized papers that focused on peatland GHG emissions and incorporated them into this study.

Study Area

Preliminary Results



Source: (Page *et al. 2011)*

Natural situation:
- Water table close to surface
- Peat accumulation from vegetation

Drainage:
- Water table lowered
- Peat surface subsidence and GHG emission starts

Continued drainage:
- Decomposition of dry peat: CO2 emission
- High fire risk in dry peat: CO2 emission
- Peat surface subsidence due to decomposition and shrinkage

End stage:
- Most peat carbon above drainage limit released to the atmosphere within decades
- Unless conservation/mitigation measures are taken

Studies have shown that, aside from steady ebullitive fluxes, episodic ebullition events can result in large gas releases over a short time scale. Glaser *et al.* (2004) conducted a study using 4 to 12 hour GPS surveys a day for two months in a peatland in Minnesota, and estimated ebullition losses up to 35,000 mg CH_4 m^{-2} in minutes or hours. A study conducted by Comas *et al.* (2008) estimated that a single releasing event between 100,000 and 172,000 mgCH_4 m^{-2} occurred within less than 4 hours in a northern peatland.

A study conducted by Hooijer *et al.* (2010) has shown that Forested tropical peatlands in Southeast Asia store at least 42 Gt of soil carbon, and it has been drastically decreasing in the past few decades owing to deforestation, drainage and fire. Of the 27.1 Million hectares (Mha) of peatland in Southeast Asia, 12.9 Mha had been deforested and mostly drained by 2006, emitting GHG into the atmosphere.
In 1997, there were widespread fires throughout the forested peatlands of Indonesia during the 1997 El Niño event. A study by Page *et al.* (2002) on this event used satellite images of a 2.5 million hectare study area in Central Kalimantan, Borneo, from before and after the fires, and it is calculated that 32% (0.79 Mha) of the area had burned, and 91.5% (0.73 Mha) was peatland. It is estimated that between 0.81 and 2.57 Gt of carbon were released to the atmosphere in 1997 as a result of burning peat and vegetation in Indonesia, which is equivalent to 13 to 40% of the mean annual global carbon emissions from fossil fuels.

Discussion & Conclusion

Many affects of climate change are already being noticed. Floods occur more regularly during storms and high tides, inland cities experience more floods. In many vulnerable areas, insurance rates are rising and in other areas, insurance isn't available. Many areas around the world are draining and clearing peatlands, which releases large amounts of CO_2 and CH_4 into the atmosphere causing a negative impact on climate change. Along with these human induced peatland GHG releasing events, studies by Glaser *et al.* (2004) and by Comas *et al.* (2008) conclude that there are rapid shifts in gas fluxes in the peat due to the heterogeneous nature of ebullition events. Gas fluxes in peat soils do not maintain steady values but shift on a weekly basis, suggesting that rates of ebullition vary due to environmental conditions (i.e., atmospheric pressure). Future research should include new methods to capture released GHG from peat soils over a long period of time.

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