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Submission on behalf of Wetlands International

To the Subsidiary Body for Scientific and Technological Advice (SBSTA)

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Concerning issues relating to agriculture (SBSTA)

This submission is in response to the invitation in the draft conclusions proposed by the Chair (FCCC/SBSTA/2013/L.20, paragraph 2, dated 13th June 2013) for:

Views from Parties and relevant organizations on the current state of scientific knowledge on how to enhance the adaptation of agriculture to climate change impacts while promoting rural development, sustainable development and productivity of agricultural systems and food security in all countries, particularly in developing countries, taking into account the diversity of the agricultural systems and the differences in scale as well as possible adaptation co-benefits.

Wetlands International welcomes this opportunity to submit information about organic soils (peatlands) and agriculture. This submission provides evidence of the important role played by peatlands in climate change mitigation and adaptation. It explains why those ecosystem services are threatened by agricultural expansion, and in particular illustrates how conventional agricultural practices on peatlands inevitably lead to soil subsidence and consequent flooding and loss of land, compromising food security and livelihoods.

The submission then suggests options for sustainable uses of peatlands which can contribute to climate change adaptation and food security, while simultaneously delivering significant benefits in terms of climate change mitigation, biodiversity and local livelihoods.

A large part of the information contained in this submission can be found in the joint publication by the Food and Agriculture Organization of the United Nations (FAO) and Wetlands International:

Joosten, H., Tapio-Biström, M.L., and Tol, S. (eds) 2012. *Peatlands – guidance for climate change mitigation through conservation, rehabilitation and sustainable use*. Second edition (available on www.wetlands.org/peatlands-guidance).

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Peatlands, agriculture and climate change:

High potential for adaptation and mitigation

Introduction

Peatlands are waterlogged wetland areas with organic soils (peat), which result from the accumulation of dead plant material over thousands of years. Peatlands cover about 3% of the total global land surface (over 4 million km^2), which makes up about half of the world's wetlands. Peatlands occur in over 180 countries, stretching from boreal and subarctic regions to tropical zones, including in high mountain areas[1].

Peatlands provide a range of ecosystem services, which are relevant for climate change adaptation (e.g. water regulation) and mitigation (e.g. carbon storage). However, peatlands are being degraded and destroyed at an alarming pace.

This destruction typically stems from the drainage of peatlands for agricultural and other uses. While the use of drained peatland may lead to significant short-term economic profits, its inherent unsustainability may have severe long-term socio-economic consequences. Drained peatlands lose their intrinsic properties in terms of water storage and regulation, and emit enormous quantities of CO2. In addition, drained peatlands inevitably subside – exposing large tracts of land to permanent flooding and rendering them unsuitable for agricultural use, which in turn endangers livelihoods and food security.

Maintaining peatlands wet and in good condition can provide local communities with enhanced economic and biodiversity benefits, contributing to sustainable development. Well-functioning peatland ecosystems also have greater resilience to climate change which may assist local communities in adapting to a changing climate while contributing to sustainable livelihoods.

Climate change will affect all of the world's ecosystems, including agricultural landscapes. For this reason, it is necessary to adapt land management and use to changing temperatures and rainfall patterns. This is also valid for peat landscapes which are in drained situation much more prone to suffer from weather extremes then when in natural or restored condition.

Policy makers must make the choice between the continuation of unsustainable peat swamp development with short-term economic benefits, or the conservation, restoration and non-drainage land-use options that will provide long-term sustainable benefits for local communities, the economy and the global climate.

Peatlands and climate change

Healthy peatland ecosystems play a key role in buffering the impacts of climate change. Peatlands are particularly critical for water regulation: peat soils are generally several metres deep and consist of 90% water, meaning that they store large quantities of water. Peatlands therefore play an important role in protection against floods after heavy rainfall, and they release water slowly during dry periods. Peat soils also contribute to water purification, ensuring a supply of clean water throughout the year. Waterlogged peatlands are an important buffer against fires as they barely burn. On the other hand, drained peatlands are prone to fires which are very difficult to extinguish, are a source of smoke haze and emit large amounts of CO2.

Climate change impacts such as changes in rainfall patterns and rising sea levels will only increase the importance of healthy peatlands to provide ecosystem services and livelihood opportunities in the affected areas.

[1] Joosten, H. (2010). *The Global Peatland CO2 Picture*, *Peatland status and emissions in all countries of the world.* Greifswald University and Wetlands International, Ede.

Peatlands also contribute significantly to climate change. On only 3% of the world's land surface, peatlands hold 30% (550 GT carbon) of all soil carbon, an amount equivalent to 75% of all atmospheric carbon and twice the carbon stock of the entire forest biomass of the world[2]. The majority of the carbon in peatlands is stored below ground, in the peat soil. This carbon is released to the atmosphere when the peatland is drained and when peat fires occur.

Peatlands and agriculture

Peatlands are very poor soils for agricultural production and generally support only low population densities. Nevertheless, millions of people depend on peatlands for herding livestock, catching fish, growing crops, harvesting reeds and non-timber forest products.

Agriculture is the main driver of peatland degradation. The clearing of tropical peat swamp forests or of temperate peat grasslands for croplands, pastures or plantations, including biofuel crops, is a major example of agriculture-driven land use change. Especially in Southeast Asia, but also increasingly in Latin America and Africa, peat swamp forests are being quickly converted to agriculture.

In Southeast Asia, peatlands have been traditionally used for subsistence farming but increasingly high demand for land has led to the conversion of large tracts of peat swamp forests and traditional agricultural areas on peat, often without free, prior and informed consent (FPIC) of local communities. The high global demand for vegetable oil and biofuels has turned palm oil into a major export product, which contributes significantly to the economies of countries such as Indonesia and Malaysia. The conversion of natural peat swamp forests and of agricultural fields for local food supply into oil palm plantations makes local smallholders dependent on the world price for palm oil and on imported food, compromising food security for local communities. Moreover, the demand for biofuels raised the price of palm oil containing food products, further putting food security at risk.[3]

Because peatlands are constantly waterlogged, most land use practices on peatlands (including conventional agriculture), require drainage. The lowering of the water table leads to the exposure of the peat organic matter and to the drying of the peat soil, with severe consequences in terms of greenhouse gas (GHG) emissions, increased fire risk and biodiversity loss. Moreover, peat drainage for agricultural production inevitably leads to peat subsidence and land loss due to flooding.

Peatlands, drainage and subsidence

Most forms of conventional peatland utilisation require a lowering of the water table. As peat largely consists of water, peatland drainage leads to subsidence and compaction of the peat.

Initial subsidence in newly drained areas is mainly caused by compaction and can be more than 50 cm per year, depending on the drainage level and the type and depth of the peat. Peatland drainage also leads to oxidation of the peat layers that are no longer saturated with water. As a result, drained peatlands lose a few millimetres (in cold climates), or up to several centimetres (in temperate zones), or up to 5 centimetres (in tropical zones) of peat per year. These losses are accelerated by the addition of lime, fertilizers and sand or clay (for agricultural use), as well as by water and wind erosion and by peat fires (which can also occur beneath the surface). The resulting lowering of the peatland surface necessitates a continuous deepening of the drainage ditches, which again enhances peat oxidation and further lowers the peatland surface, creating a vicious cycle.

[2] Parish, F. *et al* (2007). *Assessment on Peatlands, Biodiversity and Climate Change*, Global Environment Centre, Kuala Lumpur and Wetlands International, Ede.

[3] Rist, L. *et al.* (2010) The livelihood impacts of oil palm: smallholders in Indonesia. *Biodiversity Conservation*, 19, (4): 1009-1024

Most coastal peatlands originated thousands of years ago when the sea level was much lower than at present and have risen with the rising sea level. As a result their basal peat layers lay mostly (sometimes deep) below the current sea level. In such peatlands, subsidence will render gravity drainage impossible when the land surface has subsided to near or below sea or river level. The associated loss of habitable and productive land can only be avoided by installing pump-operated drainage, which, however, requires significant investment in dykes and pumping capacity. In the Netherlands (the 'Low Lands'), continuous (pump operated) draining has resulted in almost half of the country currently lying several metres below sea level. Similar problems are found in various parts of the world.

In Southeast Asia, the deep drainage required for common agricultural uses, such as oil palm plantations, is expected to result in serious flooding within a few decades due to subsidence. In tropical climates with over 2000 mm of annual precipitation, pump-operated drainage will not be feasible. This is true for example for coastal peatlands under cultivation in Sumatra and Borneo, which currently cover 3.1 million ha and are projected to increase to 6 to 9 million ha by 2020. In Sarawak, where most coastal peat swamps have been allocated for oil palm plantation development, subsidence may lead to the loss of over 10 percent of the entire land area. Expected impacts of climate change such as sea level rise, increasing number and intensity of storms and changes in rainfall patterns (such as heavier monsoon rains) may add to the flooding risk.

In addition, the peat's hydraulic properties change, which may decrease the peatland's capacities for water storage and regulation. Reductions in the steady supply of freshwater from deforested and drained inland peat swamps makes coastal areas with mineral soil more vulnerable to drought and salt water intrusion. This reduces the feasibility of agriculture in these areas, which often have acid sulphate soils. Rising sea levels resulting from climate change will amplify the risk of salt water intrusion.

Healthy peatlands: an inevitable part of effective climate change adaptation and mitigation strategies

In order to reap the adaptation benefits of healthy peatlands and avoid the negative impacts of peatland degradation, SBSTA should advise Parties to adopt a hierarchy of management options for the sustainable use of peatlands.

Conservation of intact peatlands

Refraining from causing environmental problems associated with drainage and other unsustainable uses is the best way to maintain organic soils (peatlands) in good condition, with no need for large technological investments. Conservation of the remaining peatlands in their natural state is the best option for adaptation to climate change, delivering significant co-benefits in terms of mitigation due to the carbon sequestration in growing peatlands and avoidance of significant emissions through oxidation and peat fires.

Rewetting and revegetating degraded peatlands

The rewetting of drained peatland involves the partial or entire reversal of former anthropogenic drainage by elevating the water table. The aim is to achieve permanent water saturation of the entire peat body by raising the water table to close to or above the peat surface and by reducing the amplitude of water level fluctuations. Rewetting is achieved by reducing water discharge from the site by decreasing surface drainage, surface runoff, sub-surface seepage, groundwater extraction, and evapotranspiration, and by, where relevant, increasing the water supply from the catchment.

Even if peat formation is a very slow process, rewetting converts drained peatlands into peat forming ecosystems and transforms them into sinks for carbon and soil nutrients and filters of water[4]. Rewetting and revegetating reduces GHG emissions from peat oxidation and substantially lowers the risk of peat fires[5], while stopping the process of subsidence.

Sustainable livelihood options: paludiculture

Keeping or making peatlands wet prevents and reduces negative impacts such as subsidence and flooding, but this means that the area cannot be used for conventional agriculture. Conserving and rehabilitating peatlands, however, does not mean that these areas become off-limits to economic activity. Several options for sustainable use of wet peatlands exist, and local communities have made use of such opportunities for centuries. In addition, peatlands can be cultivated with crops adapted to the wet soil conditions – a practice known as *paludiculture*.

Paludicultures (Latin 'palus' = swamp) are land management techniques that cultivate biomass from wet and rewetted peatlands under conditions that maintain the peat body, facilitate peat accumulation and sustain the ecosystem services associated with natural peatlands. Paludicultures help stop peat oxidation and simultaneously provide sustainable harvests from peatlands. Paludicultures use only that part of net primary production that is not essential for peat formation.[6]

Paludicultures make use of any biomass from wet and rewetted peatlands, from spontaneous vegetation on natural sites to artificially-established crops on rewetted sites. Besides being used for food, feed, fiber and direct combustion, the biomass from paludicultures can be used as a raw material for industrial biochemistry, for producing high quality liquid or gaseous biofuels and for synthesizing pharmaceuticals and cosmetics[7].

An obvious paludiculture practice is the collection of food for direct consumption. In the boreal zone of Eurasia, a wide variety of wild edible berries (*Vaccinium*, *Empetrum*, *Rubus* and *Ribes*) and mushrooms are gathered for food and vitamins[8]. In the Russian Federation and Belarus, these provision services justify the protection and restoration of mires. In other parts of the world, local communities collect from wet peatlands a variety of plants for human nutrition or medical use. Examples include wild (so-called 'floating') rice (*Zizania aquatica*) in North America; bog bean (*Menyanthes trifoliata*), calamus (*Acorus calamus*) and buffalo grass (*Hierochloe odorata*) in Europe; and sago palm (*Metroxylon sagu*) in Indonesia and Malaysia[9] (see Box 1).

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[4] Trepel, M. (2010). Assessing the cost-effectiveness of water purification function of wetlands for environmental planning. *Ecological Complexity,* 7: 320-326; Trepel, M. (2010). Nährstoffrückhaltung in Feuchtgebieten: Prozesse, Risiken, Kosten und Potenziale. *22.Norddeutsche Tagung für Abwasserwirtschaft und Gewässerentwicklung. Tagungsband,* pp. 19-27; Grosshans, R.E. *et al* (2011). Cattatil farming for water quality: harvesting cattails for nutrient removal and phosphorus recovery in the watershed. *Proceedings of WEF-IWA Nutrient Recovery and Management 2011.* Miami.

[5] Couwenberg, J. *et al* (2011). Assessing greenhouse gas emissions from peatlands using vegetation as a proxy. *Hydrobiologia* 674: 67-89; Parish *et al* (2007).

[6] Wichtmann, W. and Joosten, H. (2007). Paludiculture: peat formation and renewable resources from rewetted peatlands. *IMCG-Newsletter,* 2007-3: 24-28

[7] Joosten, H. *et al* (2013). Paludicultures: Sustainable productive use of wet and rewetted peatlands. In *Peatland restoration and ecosystem services: science, practice, policy.* Cambridge University Press, Cambridge.

[8] Joosten, H. and Clarke, D. (2002). *Wise use of mires and peatlands – Background and principles including a framework for decision-making.* International Mire Conservation Group and International Peat Society, Saarjärvi.

[9] Joosten and Clarke (2002); Joosten. *et al* (2013).

Box 1: Paludiculture in Indonesia

So far no true paludicultures have been established in Southeast Asia. However, during the past ten years numerous reforestation trials on degraded peatlands have been developed. These trials also use trees that provide valuable non-timber forest products (NTFP). A popular species often planted in reforestation attempts is Jelutung (*Dyera* sp.), a latex producing tree. The largest Jelutung plantation was established by PT. Dyera Hutan Lestari in Sumatra. This company planted over 2000 ha and started tapping *Dyera latex*. Unfortunately, the plantation burned down due to escalating fires from adjacent areas[10]. The Wetlands International Indonesia Programme also planted Jelutung trees in peatland rehabilitation projects in Sumatra and Kalimantan. Other typically planted species are valuable hardwood timbers, such as Belangiran (*Shorea balangeran*) or Ramin (*Gonystylus bancanus*).

These and other peat swamp timber tree species have the potential to be commercially planted on rewetted peatlands. Moreover, pioneer species, such as *Alstonia pneumatophora*, *Combretocarpus rotundatus* and *Macaranga pruinosa*, which dominate after disturbances, are possible surrogates to exotic *Acacia* species in the production of pulp. Gemor (*Alseodaphne coriacea*) is a well-known peat swamp tree that is harvested in the wild and is in fact often locally overexploited. The bark of this medicinal plant is used as a mosquito repellent and sold on local markets[11]. This species is only one example of numerous medicinal plants that could be widely planted on rewetted peatlands.

Food production is extremely important in rural areas of Indonesia. In the inhabited peatlands of Sumatra and Kalimantan, trials with food plants that do not require drainage need to be developed, especially with permanent crops that reduce the fire risks associated with annual crops and related land clearing practices. Traditional mixed tree gardens with fruit trees and wet agroforestry schemes are promising ways of developing smallholder paludicultures that focus on food and NTFP production. The *hutan-desa* forest concession type allows villages to sustainably harvest timber, implement enrichment planting (including valuable rattans) and engage in agroforestry on areas up to 10 000 ha.

Other traditional low-intensity uses include subsistence hunting and fishing[12]. Especially in tropical peat swamp forests, fisheries are a major economic activity. Aquaculture of indigenous fish species can be an attractive land-use option and offer economic incentives for local communities in areas where many drainage canals must be blocked for hydrological restoration.

Recently, various options for site-adapted land use on wet and rewetted peatlands have been developed and tested. Some of these options revitalize traditional forms of land use through new utilization schemes (e.g. reed cutting for construction materials, such as insulation panels). Other options, such as native plant species which can be used for biofuels and biomass, provide innovative products for growing market demands.

[10] Giesen, W. and van der Meer, P. (2009). *Guidelines for the Rehabilitation of Degraded Peat Swamp Forest in Central Kalimantan.* Technical Guideline Number 5. Master Plan for the Rehabilitation and Revitalisation of the Ex-Mega Rice Project Area in Central Kalimantan. Euroconsult Mott MacDonald, Deltares, Delft Hydraulics in association with DHV, Wageningen University and Research, Witteveen+Bos, Indonesia, PT.MLD & PT.Indec. Government of Indonesia and Royal Netherlands Embassy, Jakarta.
[11] Suyanto, S. *et al* (2009). *Analysis of local livelihoods from past to present in the Central Kalimantan ex-mega rice project area.* World Agroforestry Centre, Bogor.
[12] Wichtmann, W. (2011). Biomass use for food and fodder. In Tanneberger, F. and Wichtmann, W. (eds) (2011). *Carbon credits from peatland rewetting. Climate-biodiversity-land use.* Schweizerbart Science publishers.