Judul:

Sanggahan terhadap dampak jangka panjang pertanian di lahan gambut tropis akan mengakibatkan kehancuran

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Running head:

Sanggahan terhadap isu-isu jangka panjang pertanian di lahan gambut

Kata Kunci

Lahan gambut tropis, pertanian, keberlanjutan, emisi, subsidensi, kelapa sawit dan akasia

Tipe Artikel

Surat kepada Editor

Teks Utama:

Untuk pertama kalinya, Kongres Gambut Internasional (*The International Peat Conggres*/IPC) diselenggarakan di wilayah tropis, tepatnya di Kuching (Malaysia). Lebih dari 1000 ilmuwan gambut dan mitra industri internasional dari seluruh dunia hadir dalam kongres. Kongres ini mencakup seluruh aspek ekosistem gambut dan pengelolaannya, dengan menitikberatkan pada tantangan lingkungan, sosial dan ekonomi terkait dengan konversi lahan gambut tropis berskala besar untuk pertanian (termasuk perkebunan dan hutan tanaman - sebagai pemasok utama pabrik pulp dan kertas).

Namun, usaha ke arah pengelolaan kawasan gambut tropis yang lebih baik baru-baru ini telah dimentahkan dengan tajuk-tajuk utama dan pernyataan yang menyesatkan dalam beberapa surat kabar, yang dirilis saat konferensi berlangsung. Artikel pada media massa regional yang menyatakan bahwa penanaman kelapa sawit di lahan gambut telah berhasil dilakukan dengan baik (BorneoPost, 2016; Cheng & Sibon, 2016; Nurbianto, 2016a, 2016b; Wong, 2016) telah tersebar luas ke ranah publik di wilayah ini. Artikel tersebut menggambarkan kesepakatan umum atau kesimpulan dari kongres tersebut, yaitu bahwa praktik pertanian di lahan gambut tropis, seperti perkebunan kelapa sawit, tidak berpengaruh negatif terhadap lingkungan. Pandangan ini berbeda dengan pendapat kebanyakan ilmuwan, dan bertolak belakang dengan bukti-bukti ilmiah bahwa model pengelolaan pertanian di kawasan lahan gambut tropis saat ini adalah tidak berkelanjutan.

Penelitian ilmiah yang telah dikaji oleh para ahli (*peer-review)* selama 19 tahun terakhir, sebagaimana dirangkum oleh Panel Antar Pemerintah tentang Perubahan Iklim (*Intergovernmental Panel on Climate Change*, IPCC) ke dalam dokumen penting terkait inventarisasi gas rumah kaca di lahan basah (*Wetland Supplement*) secara jelas memastikan

bahwa kawasan lahan gambut tropis yang dikeringkan akan mengalami laju kehilangan karbon yang tinggi (Drösler et al., 2014). Hutan rawa gambut tropis telah menyerap karbon selama berabad-abad lamanya dan berfungsi sebagai simpanan karbon bawah permukaan yang signifikan secara global (Page *et al.*, 2011; Dommain *et al.*, 2014). Namun demikian, teknik pertanian di lahan gambut yang ada saat ini berpengaruh besar terhadap fungsi tersebut, melalui pembukaan lahan, pengeringan dan juga pemupukan, serta proses yang sering melibatkan pembakaran. Seiring dengan hilangnya keanekaragaman hayati yang disebabkan oleh deforestasi (Koh *et al.*, 2011; Posa *et al.*, 2011; Giam *et al.*, 2012), simpanan karbon di lahan gambut yang dikeringkan akan teremisi secara cepat melalui proses oksidasi, pelarutan dan kebakaran (Couwenberg *et al.*, 2009; Hirano *et al.*, 2012; Ramdani & Hino, 2013; Schrier-Uijl *et al.*, 2013; Carlson *et al.*, 2015; Warren *et al.*, 2016). Kebakaran lahan gambut tropis merupakan penyumbang emisi gas rumah kaca global utama dan menyebabkan kabut asap lintas negara yang berdampak signifikan/nyata kepada kesehatan manusia, ekonomi regional dan ekosistem (Page *et al.*, 2002; Marlier *et al.*, 2012; Jaafar & Loh, 2014; Chisholm *et al.*, 2016; Huijnen *et al.*, 2016; Stockwell *et al.*, 2016). Dengan perkiraan meningkatnya frekuensi dan intensitas El-Niño (yang menyebabkan kekeringan panjang di kawasan ini) di masa depan (Cai *et al.*, 2014) dan dengan kecenderungan kebakaran yang tidak hanya terjadi pada saat musim kemarau (Gaveau *et al.*, 2014), kebakaran yang disertai kabut asap berskala besar di masa depan akan lebih mudah terjadi, mengingat luasnya kawasan lahan gambut yang telah dikeringkan dan menjadi rawan terbakar (Kettridge *et al.*, 2015; Turetsky *et al.*, 2015; Page & Hooijer, 2016).

Pada kenyataannya, dari simpanan karbon yang diperkirakan sebesar 69 milyar ton (Page et al., 2011) masih belum dapat dipastikan berapa jumlah yang hilang dari kawasan lahan gambut tropis Asia Tenggara akibat sistem pertanian yang dilakukan saat ini. Hal yang lebih mengkhawatirkan hingga kini adalah belum adanya penerapan sistem pertanian yang dapat mencegah kehilangan lahan gambut dan penurunan permukaannya akibat pengeringan (Wösten *et al.*, 1997; Melling *et al.*, 2008; Hooijer *et al.*, 2012; Evers *et al.*, 2016). Proyeksi terkini menunjukkan bahwa kawasan gambut pesisir yang dikeringkan tidak akan dapat dibasahkan kembali, dan secara bertahap akan tergenang dalam jangka waktu lebih panjang oleh air tawar dan akhirnya oleh air laut (Hooijer *et al.*, 2015a, 2015b; Sumarga *et al.*, 2016). Dengan peningkatan resiko intrusi air laut, pertanian di kawasan pesisir akan semakin tidak mampu untuk bertahan, sehingga pernyataan terkait "Keberlanjutan jangka panjang pertanian di kawasan lahan gambut tropis" menjadi hal yang layak dipertanyakan.

Dalam hal ini akan lebih tepat digambarkan bahwa pertanian di kawasan lahan gambut dengan menggunakan drainase dapat dipandang sebagai industri ekstraktif, dimana suatu sumber yang terbatas (gambut) "ditambang" untuk menghasilkan makanan, serat dan energi, yang dipicu oleh permintaan global. Negara-negara berkembang yang populasinya terus meningkat, memiliki alasan sosial dan ekonomi yang kuat untuk mengeksploitasi sumber daya ini untuk kesejahteraan masyarakat setempat dan pembangunan ekonomi secara luas (Mizuno *et al.*, 2016). Namun demikian, harus diakui bahwa kehilangan gambut yang terjadi pada saat ini sudah tidak dapat dielakkan lagi. tindakan berbasis sains menuju pengelolaan yang lebih baik, termasuk

pembatasan terhadap pengembangan lahan perkebunan, dapat digunakan untuk meredam laju kehilangan lahan gambut (President of Indonesia, 2011). Kebijakan berbasis bukti kuat seperti di atas, yang didukung dengan data dan perangkat legal, akan diperlukan di masa depan yang berkelanjutan. Pendapat tanpa basis ilmiah yang menyatakan bahwa pertanian di kawasan lahan gambut yang didrainase akan "berkelanjutan" dan kehilangan lahan gambut dapat dihentikan, melalui metoda yang belum terbukti, seperti usaha pemadatan gambut misalnya, dapat melemahkan usaha-usaha untuk menemukan opsi-opsi pelestarian. Sejauh ini, isu-isu yang terkait dengan ketidakberlanjutan pengelolaan lahan gambut telah diakui oleh berbagai sektor industri (Wilmar, 2013; APP, 2014; Cargill Inc., 2014; Mondelēz International, 2014; Sime Darby Plantation, 2014; APRIL, 2015; Olam International, 2015), pemerintahan (Presiden Indonesia, 2014, 2016; Mongabay, 2015; Mongabay Haze Beat, 2015; Hermansyah, 2016) dan konsumen (Wijedasa *et al.*, 2015). Memahami adanya keterbatasan dan risiko pembangunan lahan gambut, banyak perusahaan kelapa sawit dan hutan tanaman berskala besar dan berpengalaman telah menghentikan pembangunan lebih lanjut di lahan gambut dan menerapkan persyaratan pengelolaan yang ketat di perkebunan yang berada di lahan gambut (Lim *et al.*, 2012). Akan tetapi, penyangkalan terhadap basis empiris tentang perlunya pengelolaan lahan gambut yang lebih baik ternyata masih cukup berpengaruh di ranah kebijakan, seperti yang diilustrasikan dalam artikel yang dirilis ketika berlangsungnya konferensi tersebut ("penanaman kelapa sawit di lahan gambut telah berhasil dilakukan dengan baik", menurut Uggah, 2016; Cheng & Sibon, 2016; Nurbianto, 2016a, 2016b).

Pencarian teknik-teknik pertanian lahan gambut yang lebih bertanggungjawab melibatkan beberapa inisiatif yang menjanjikan untuk pengembangan tanaman budi daya di lahan gambut yang berada dalam kondisi tergenang atau basah (Giesen, 2015; Dommain *et al.*, 2016; Mizuno *et al.*, 2016). Sementara metoda pertanian lahan gambut yang benar-benar berkelanjutan belum terwujud, masyarakat ilmiah dan industri saat ini saling bekerjasama untuk mencari solusi terhadap hal ini (International Peat Society, 2016), dan sebagai langkah awal untuk mengurangi laju hilangnya gambut pada lahan perkebunan yang telah dikelola saat ini. Kegagalan untuk mengakui dampak buruk akibat penggunaan lahan gambut saat ini dan kegagalan untuk bekerjasama dalam menyelesaikannya dapat menyebabkan generasi mendatang terpaksa menghadapi kondisi ekosistem yang sudah tak dapat diperbaiki lagi (*irreversibel*) dan tidak berfungsi sebagaimana mestinya, dimana tak satupun pihak, baik itu lingkungan, masyarakat, global atau lokal yang akan menjadi pemenangnya.

References / Pustaka:

APP (2014) APP Forest Conservation Policy Update 2014.

APRIL (2015) APRIL Group's Sustainable Forest Management Policy 2.0. 1–4.

Cai W, Borlace S, Lengaigne M et al. (2014) Increasing frequency of extreme El Niño events due to greenhouse warming. *Nature Climate Change*, **5**, 1–6.

Cargill Inc. (2014) Cargill Policy on Sustainable Palm Oil.

Carlson KM, Goodman LK, May-Tobin CC (2015) Modeling relationships between water table depth and peat soil carbon loss in Southeast Asian plantations. *Environmental Research Letters*, **10**, 74006.

Cheng L, Sibon P (2016) Sarawak opening up coastal lowland areas for agriculture, plantation devt — Adenan. *BorneoPost*.

Chisholm RA, Wijedasa LS, Swinfield T (2016) The need for long-term remedies for Indonesia's forest fires. *Conservation Biology*, **30**, 5–6.

Couwenberg J, Dommain R, Joosten H (2009) Greenhouse gas fluxes from tropical peatlands in south-east Asia. *Global Change Biology*, **16**, 1715–1732.

Dommain R, Couwenberg J, Glaser PH, Joosten H, Suryadiputra I, Nyoman N (2014) Carbon storage and release in Indonesian peatlands since the last deglaciation. *Quaternary Science Reviews*, **97**, 1–32.

Dommain R, Dittrich I, Giesen W, Joosten H, Rais DS, Silvius M, Wibisono ITC (2016) Ecosystem services, degradation and restoration of peat swamps in the Southeast Asian tropics. In: *Peatland Restoration and Ecosystem Services: Science, Policy and Practice* (eds Bonn A, Allott T, Evans M, Stoneman R, Joosten H). Cambridge.

Drösler M, Verchot L V., Freibauer A et al. (2014) Chapter 2: Drained inland organic soils. In: *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (eds Hiraishi T, Krug T, Tanabe K, Srivastava N, Jamsranjav B, Fukuda M, Troxler T), pp. 1–79. IPCC, Switzerland.

Evers S, Yule C, Padfield R, O'Reilly P, Varkkey H (2016) Keep Wetlands Wet: The Myth of Sustainable Development of Tropical Peatlands - Implications for Policies and Management. *Global Change Biology*, 1–16.

Gaveau DLA, Salim M, Hergoualc'h K et al. (2014) Major atmospheric emissions from peat fires in Southeast Asia during non-drought years: evidence from the 2013 Sumatran fires. *Scientific reports*, **4**, 1–7.

Giam X, Koh LP, Tan HH, Miettinen J, Tan HTW, Ng PKL (2012) Global extinctions of freshwater fishes follow peatland conversion in Sundaland. *Frontiers in Ecology and the Environment*, **10**, 465–470.

Giesen W (2015) Utilising non-timber forest products to conserve Indonesia's peat swamp forests and reduce carbon emissions. *Journal of Indonesian Natural History*, **3**, 10–19.

Hermansyah A (2016) Soil compaction puts peatland at risk, agency says. *The Jakarta Post*, 1–6.

Hirano T, Segah H, Kusin K, Limin S, Takahashi H, Osaki M (2012) Effects of disturbances on the carbon balance of tropical peat swamp forests. *Global Change Biology*, **18**, 3410–3422.

Hooijer A, Page S, Jauhiainen J, Lee WA, Lu XX, Idris A, Anshari G (2012) Subsidence and carbon loss in drained tropical peatlands. *Biogeosciences*, **9**, 1053–1071.

Hooijer A, Vernimmen R, Visser M, Mawdsley N (2015a) *Flooding projections from elevation and subsidence models for oil palm plantations in the Rajang Delta peatlands, Sarawak, Malaysia*. Deltares report 1207384, 76 pp.

Hooijer A, Vernimmen R, Mawdsley N, Page S, Mulyadi D, Visser M (2015b) *Assessment of impacts of plantation drainage on the Kampar Peninsula peatland, Riau*. Deltares Report 1207384.

Huijnen V, Wooster MJ, Kaiser JW et al. (2016) Fire carbon emissions over maritime southeast Asia in 2015 largest since 1997. *Scientific Reports*, **6**, 26886.

International Peat Congress with over 1000 participants! (2016) *PeatNews*.

International Peat Society (2016) Statement regarding the Jakarta Post article of 18th August.

Jaafar Z, Loh TL (2014) Linking land, air and sea: Potential impacts of biomass burning and the resultant haze on marine ecosystems of Southeast Asia. *Global Change Biology*, **20**, 2701–2707.

Kettridge N, Turetsky MR, Sherwood JH et al. (2015) Moderate drop in water table increases peatland vulnerability to post-fire regime shift. *Scientific Reports*, **5**, 8063.

Koh LP, Miettinen J, Liew SC, Ghazoul J (2011) Remotely sensed evidence of tropical peatland conversion to oil palm. *Proceedings of the National Academy of Sciences of the United States of America*, **108**, 5127–5132.

Lim KH, Lim SS, Parish F, Suharto R (2012) *RSPO Manual on Best Management Practices (BMPs) for Existing Oil Palm Cultivation on Peat*. RSPO, Kuala Lumpur, Malaysia, 214 pp.

Marlier ME, DeFries RS, Voulgarakis A et al. (2012) El Niño and health risks from landscape fire emissions in southeast Asia. *Nature Climate Change*, **3**, 131–136.

Melling L, Goh KJ, Beauvais C, Hatano R (2008) Carbon Flow and Budget in Young Mature Oil Palm Agroecosystem on Deep Tropical Peat. *Planter*, **84**, 21.

Mizuno K, Fujita MS, Kawai S (2016) *Catastrophe & Regeneration in Indonesia's Peatlands: Ecology, Economy & Society* (eds Mizuno K, Fujita MS, Kawai S). NUS Press, Singapore, 466 pp.

Mondelēz International (2014) Mondelēz International Palm Oil Action Plan.

Mongabay (2015) Jokowi to oversee Indonesia peat restoration agency but details thin on the ground. *Mongabay*.

Mongabay Haze Beat (2015) Jokowi pledges Indonesia peatland "revitalization" to stop the burning. *Mongabay*.

Nurbianto B (2016a) Congress may change views on cultivation of peatland: IPS. *The Jakarta Post*.

Nurbianto B (2016b) Malaysia challenges the world over palm oil on peatland. *The Jakarta Post*.

Oil palm planting on peat soil handled well, says Uggah (2016) *BorneoPost*.

Olam International (2015) Olam Sustainable Palm Oil Policy. 1–9.

Page SE, Hooijer A (2016) In the line of fire: the peatlands of Southeast Asia. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, **371**, 20150176.

Page SE, Siegert F, Rieley JO, Boehm H V (2002) The amount of carbon released from peat and forest fires in Indonesia during 1997. *Nature*, **1999**, 61–65.

Page SE, Rieley JO, Banks CJ (2011) Global and regional importance of the tropical peatland carbon pool. *Global Change Biology*, **17**, 798–818.

Posa MRC, Wijedasa LS, Corlett RT (2011) Biodiversity and conservation of tropical peat swamp forests. *BioScience*, **61**, 49–57.

President of Indonesia (2011) Instruction of the President of the Republic of Indonesia number 10 of 2011 about suspension of granting of new licenses and improvement of governance of natural primary forest and peatland.

President of Indonesia (2014) Government Regulation Number 71 of year 2014 about Protection and Management of Peat Ecosystems.

President of Indonesia (2016) Presidential Regulation Number 1 of year 2016 About Peat Restoration Agency.

Ramdani F, Hino M (2013) Land Use Changes and GHG Emissions from Tropical Forest Conversion by Oil Palm Plantations in Riau Province, Indonesia. *PLoS ONE*, **8**, 1–6.

Schrier-Uijl AP, Silvius M, Parish F, Lim KHH, Rosediana S, Anshari G (2013) *Environmental and social impacts of oil palm cultivation on tropical peat: a scientific review*. Kuala Lumpur, Malaysia, 131-168 pp.

Sime Darby Plantation (2014) Sustainability: Peatland planting policy.

Stockwell CE, Jayarathne T, Cochrane MA et al. (2016) Field measurements of trace gases and aerosols emitted by peat fires in Central Kalimantan, Indonesia during the 2015 El Niño. *Atmospheric Chemistry and Physics Discussions*, **53**, 1–37.

Sumarga E, Hein L, Hooijer A, Vernimmen R (2016) Hydrological and economic effects of oil palm cultivation in Indonesian peatlands. *Ecology and Society*, **21**, 52.

Turetsky MR, Benscoter B, Page S, Rein G, Werf GR Van Der, Watts A (2015) Global vulnerability of peatlands to fire and carbon loss. *Nature Geoscience*, **8**, 11–14.

Warren M, Frolking S, Dai Z, Kurnianto S (2016) Impacts of land use, restoration, and climate change on tropical peat carbon stocks in the twenty-first century: implications for climate mitigation. *Mitigation and Adaptation Strategies for Global Change*.

Wijedasa LS, Posa MRC, Clements GR (2015) Peat fires: consumers to help beat them out. *Nature*, **527**, 305.

Wilmar (2013) No Deforestation, No Peat, No Exploitation Policy. 1–9.

Wong J (2016) Yield of oil palm on peatland can be doubled. *The Star*.

Wösten JHM, Ismail AB, Van Wijk ALM (1997) Peat subsidence and its practical implications: A case study in Malaysia. *Geoderma*, **78**, 25–36.