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A review on the driver of fires and associated biodiversity impacts in Southeast Asia

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Abstract

Peatland ecosystem in Southeast Asia has seen significant deforestation and degradation in recent decades. The clearance of natural forests for agricultural land followed by drainage has become a substantial issue in peatlands. Peat fires are the primary cause of smog or transboundary haze, biodiversity loss, and increased greenhouse gas (GHG) emissions. This review study aims to identify best management practices in managing peatland ecosystems in Southeast Asian countries. Initial findings suggest that excessive draining (via canal construction), fires, logging, and land conversion are the primary sources of peatland degradation. Furthermore, conflict over land as an essential source of livelihood has impacted the peatlands. Peatlands' economic use necessitates planned after-use, such as agriculture, forestry, recreation, wildlife habitat, and biodiversity protection (nature conservation). This will almost certainly require some form of restoration or rehabilitation, such as rewetting to raise water tables. There is a lack of understanding of the function of peatlands, resulting in peatland management that does not align with the ecological functions of peatlands. ASEAN member countries have been conducting peat restoration activities and for them to run effectively, efficiently, and economically, there is a need to understand and apply the required technical principles. Peatland restoration should return degraded peatlands to conditions that are as close to natural as possible within practical constraints and at a reasonable cost. As part of after-use plans, carbon emission reduction and sequestration projects should be assessed for feasibility and options included.

Keywords: Keywords: best practices, peatland, Southeast Asia

References

Anderson JAR (1961) The ecology and forest types of the peat swamp forests of Sarawak and Brunei in relation to their silviculture. Unpublished PhD dissertation, vol. I (191 pp) and vol. II (appendices). University of Edinburgh Aribal LG, Fernand ES (2018) Plant diversity and structure of the Caimpugan peat swamp forest on Mindanao Island, Philippines. Mires and Peat.22(7): 1–16 ASEAN (2021) Executive Summary of The Final Review Of The Asean Peatland Management Strategy 2006-2020. ASEAN Secretariat, Jakarta ASEAN Investment Report (2018). ASEAN Secretariat, Jakarta ASEAN Peatland Forests Project [APFP] (2014) Asean Peatland News June

2014 ASEAN Peatland Forests Project [APFP] (2014). GAMBUT: ASEAN Peatland Forests Project Malaysia (APFP) Component Special Publication. Forestry Department Peninsular Malaysia, Kuala Lumpur Malaysia. Balzer M (2020) Conservation of Parosphromenus fishes and other peat swamp specialist fishes in Malaysia. Meeting report February 2020 Basuki I, Budiman A, Netzer M,, Safitri R, Maulana R, Nusirhan TSE, Syamsir, Bernal B.2021. Dynamic of groundwater table, peat subsidence and carbon emission impacted from deforestation in tropical peatland,Riau, Indonesia Bhomia RK and Murdiyarso D. 2021. Effective monitoring and management of peatland restoration. Working Paper 270. Bogor, Indonesia: CIFOR. Biawas S, Lasko K, Mar Z (2015). Factors Controlling Vegetation Fires in Protected and Non-Protected Areas of Myanmar PLOS ONE. DOI:10.1371/journal.pone.0124346 Biswas S, Vadrevu KP, Lwin ZR, Lasko K, Justice CO (2015) Factors Controlling Vegetation Fires in Protected and Non-Protected Areas of Myanmar. PLOS ONE | DOI:10.1371/journal.pone.0124346 Bourgoin JJC, Castella D, Pullar G, Lestrelin, Bouahom B (2012). Toward a land zoning negotiation support platform: "Tips and tricks" for participatory land use planning in Lao PDR, Landscape and Urban Planning 104: 270–278 Boutthavong S, Hyakumura K, Ehara M, Fujiwara T (2016) Historical Changes of Land Tenure and Land Use Rights in a Local Community: A Case Study in Lao PDR. Land.5, 11; doi:10.3390/land5020011 Carlson KM, Curran LM, Ratnasari D, Pittman AM, Soares-Filho BS, Asner GP, Trigg SN, Gaveau DA, Lawrence, Rodrigues HO (2012). "Committed carbon emissions, deforestation, and community land conversion from oil palm plantation expansion in West Kalimantan, Indonesia." Proceedings of the National Academy of Sciences of the United States of America 109(19): 7559-7564. Chin SY, Parish F (2013). Peatlands: status, challenges and actions in Southeast Asia. Chokkalingam U, Suyanto R, Permana P, Kurniawan I, Mannes J, Darmawan A, Khususyiah, Susanto RH (2007). "Community fire use, resource change, and livelihood impacts: The downward spiral in the wetlands of southern Sumatra." Mitigation and Adaptation Strategies for Global Change 12(1): 75-100. Clews E, Ho JKI, Kim DE, Corlett RT, Liong SY (2018) The biological, ecological and conservation significance of freshwater swamp forest in Singapore. Gardens' Bulletin Singapore 70 (Suppl. 1): 9–31. 2018 9 doi: 10.26492/gbs70(suppl.1).2018-02 Decree (2019) Decree No. 06/2019 / ND-CP on the management of endangered, precious and rare forest plants and animals and implementation of the Convention on international trade in endangered wild animals and plants. Vietnam Government. Decree (2018) Decree No. 77/2018/ND-CP of the Government: Regulations on supporting the development of small irrigation, inland irrigation, and advanced irrigation, saving water. Vietnam Government. Decree (2016) Decree No. 155/2016/NĐ-CP on Regulations on sanctioning of administrative violations in the field of environmental protection. Vietnam Government. Decree (2006). Decree No. 09/2006/ND-CP on Regulation on fire management. Vietnam Government. Department of Environment (2019b) Draft Master Plan for Management of Fire Prone Peatlands in Malaysia 2021–2030 Diemont WH, Joosten H, Mantel S, Murdiyarso D, van Noordwijk M, Rieley J O, Veldsink J W, Verhagen A, Wakker E, Wind J, Setiadi B and Limin S H (2001) Poverty alleviation and wise use of peatlands in Indonesia Int. Peat J. 11 79-87 Dohong A, Aziz AA, Dargusch P (2017a) A review of the drivers of tropical peatland degradation in South-East Asia. Land Use Policy 69:349–360. https://doi.org/10.1016/j.landusepol.2017.09. 035 Dohong A, Cassiophea L, Sutikno S, Triadi BL, Wirada F, Rengganis P, Sigalingging L (2017b) Modul Pelatihan Pembangunan Infrastruktur Pembasahan Gambut Sekat kanal Berbasis Masyarakat. Kedeputian Bidang Konstruksi, Operasi dan Pemeliharaan, Badan Restorasi Gambut Republik Indonesia, Jakarta Edict (2002) Edict No. 21/2002/CT-TTg on Intensity activity for forest fire control and prevention. Vietnam Government FAO (2020) Global forest resources assessment 2020 – key findings. FAO, Rome. https://doi.org/ 10.4060/ca8753en Fitzherbert EB, Struebig MJ, Morel A, Danielsen F, Brühl C A, Donald P F and Phalan B (2008) How will oil palm expansion affect biodiversity? Trends Ecol. Evol. 23(10) 538-545 Gaveau D, Locatelli B, Salim MA, Yaen H, Pacheco P, Sheil D (2018) Rise and fall of forest loss and industrial plantations in Borneo (2000–2017). Conservation Letters. 1-9. DOI: 10.1111/conl.12622 Gaveau DLA, Sloan S, Molidena E, Yaen H, Sheil D, Abram NK, Ancrenaz M. Nasi R, Quinones M, Wielaard, Meijaard E. 2014. Four decades of forest persistence, clearance

and logging on Borneo. PLoS ONE. 9(7): e101654. doi: org/10.1371/journal.pone.0101654. Giesen W, Sari EN (2018) Tropical peatland restoration report: the Indonesian case. Berbak green prosperity partnership/Kemitraan Kesejatheraan Hijau (Kehijau Berbak). Millennium challenge account Indonesia, contract no. 2015/Grant/010. Euroconsult Mott MacDonald in association with Universitas Jambi, Mitra Aksi foundation, Perkumpulan Gita Buana and Perkumpulan Walestra. For the Indonesian Peatland Restoration Agency, Badan Restorasi Gambut, p 82. https://doi.org/10.13140/RG.2.2.30049.40808 Giesen W (1991) Berbak Wildlife Reserve, Jambi, Sumatra. PHPA/AWB Sumatra Wetland Project Report No.13. Glauber J, Gunawan I, Adriani M, Moyer S, Kendrick A, Henry G, Wood S (2016) The cost of fire: an economic analysis of Indonesia's 2015 fire crisis. Indonesia Sustainable Landscapes Knowledge Note: 1. The World Bank Group, Jakarta, Indonesia. Gustafsson L, Nasi R, Dennis R, Nghia NH, Sheil D, Meijaard D, Dykstra D, Priyadi H, Thu PH. 2007. Logging for the ark: Improving the conservation value of production forests in South East Asia. Indonesia: Center for International Forestry Research (CIFOR). ISSN 0854-9818 ISBN: 978-979-1412-19-3 74p. Harrison ME, Rieley JO (2018) Tropical peatland biodiversity and conservation in Southeast Asia foreword. Mires Peat 22:1–7 Harianto, S.P & Dewi B.S.2017. Biodiversitas Fauna di Kawasan Budidaya Lahan Basah Hergoualc'h K, Carmenta R, Atmadja S, Martius C, Murdiyarso D, Purnomo H (2018) Managing peatlands in Indonesia: challenges and opportunities for local and global communities. Infobreifs no. 205 Center for International Forestry Research, Bogor Hergoualc'h KA, Gutiérrez-Vélez VH, Menton M, Verchot LV (2017) Characterizing degradation of palm swamp peatlands from space and on the ground: an exploratory study in the Peruvian Amazon. Forest Ecology Management. 393: 63–73. doi: https://doi.org/10.1016/j.foreco.2017.03.016. Hooijer A, Page S, Jauhiainen J, Lee WA, Lu XX, Idris A, Anshari G (2012a) Subsidence and carbon loss in drained tropical peatlands. Biogeosciences 9:1053–1071 Hooijer A, Triadi B, Karyanto O, Page SE, van der Vat M Erkens G (2012b) Subsidence in drained coastal peatland in Southeast Asian: implications for sustainability. In: 14th International Peat Congress, Stockholm, Sweden Hooijer A, Page S, Canadell JG, Silvius M, Kwadijk JM, Wosten H, Jauhiaine J. 2010. Current and future CO2 emissions from drained peatlands in Southeast Asia. Biogeosciences, 7, 1505–1514, 2010. Hoyt AM, Chaussard E, Seppalainen SS, Harvey CF (2020) Widespread subsidence and carbon emissions across Southeast Asian peatlands. Nat Geosci 13:435–440. https://doi.org/10.1038/ s41561-020-0575-4 Huijnen V, Wooster MJ, Kaiser JW, Gaveau DLA, Flemming J, Parrington M, Inness A, Murdiyarso D, Main B, Van Weele M (2016). Fire carbon emissions over maritime Southeast Asia in 2015 largest since 1997. Scientific Reports 6:1–8. https://doi.org/10.1038/srep26886 Jauhiainen J, Hooijer A, Page SE (2012) Carbon dioxide emissions from an Acacia plantation on peatland in Sumatra, Indonesia. Biogeosciences 9:617–630 JICA. 2017. Annual Reports Jones SH (1998) "Vegetation fire and land use in southeast asia: The interpretation of remotely sensed data for Cambodia." Geocarto International. 13(3): 63-73. Kim SN, Sasaki, Koike M (2008) "Assessment of non-timber forest products in Phnom Kok community forest, Cambodia." Asia Europe Journal. 6(2): 345-354 Kobayashi, S (2016) Peatland and Peatland Forest in Brunei Darussalam. In book: Tropical Peatland Ecosystems (pp.75-89) DOI: 10.1007/978-4-431-55681-7_5 Koplitz SN, Mickley LJ, Marlier ME, Buonocore JJ, Kim PS, Liu T (2016) Public health impacts of the severe haze in equatorial Asia in September– October 2015: demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure. Environmental Research Letters 11:94023. https://doi.org/10.1088/1748-9326/11/9/ 094023 Lim KH, Lim SS, Parish F, Suharto R (eds) (2012) RSPO manual on best management practices (BMP) for existing oil palm cultivation on peat. RSPO, Kuala Lumpur MacMillan DC (2013) Development of Financing and Incentives Options for Sustainable Management of Peatland Forests in Southeast Asia, ASEAN Peatland Forests Project and Sustainable Management of Peatland Forests Project, ASEAN Secretariat and Global Environment Centre, Kuala Lumpur McNamara SDV, Tinh PD, Erskine D, Lamb D, Yates, Brown S (2006) "Rehabilitating degraded forest land in central Vietnam with mixed native species plantings.. Forest Ecology and Management 233(2-3): 358-365. Medrilzam M, Smith C, Abdul Aziz A, Herbohn J, Dargusch P (2017) Smallholder farmers and the dynamics of degradation of

peatland ecosystems in Central Kalimantan, Indonesia. Ecological Economics 136:101–113. https://doi.org/10.1016/j.ecolecon.2017.02.017 Miettinen J, Shi C, Liew SC (2016) Land cover distribution in the peatlands of Peninsular Malaysia, Sumatra and Borneo in 2015 with changes since 1990. Glob Ecol Conserv 6:67–78. https://doi.org/10.1016/j.gecco.2016.02.004 MOEF (2018) Policy Paper of the Indonesian Delegation at Global Peatlands Initiative: 3rd Meeting of Partners, Brazzaville 21–23 March 2018 Omar W, Aziz NA, Mohammed AT, Harun MH, Din AK (2010). In: Mapping of Oil Palm Cultivation on Peatland in Malaysia, MPOB TT No.473, MPOB Malaysia. Kuala Lumpur, Malaysia, June 2010. pp. 1511–7871. Page SE, Hooijer A (2016) In the line of fire: the peatlands of Southeast Asia. Philos Trans R Soc B 371:20150176. https://doi.org/10.1098/rstb.2015.0176 Page SE, Rieley JO, Banks CJ (2011) Global and regional importance of the tropical peatland carbon pool. Glob Chang Biol 17(2):798–818 Paramananthan S (2008) Malaysian soil Taxonomy, 2nd edn. Param Agricultural Soil Surveys (M) Sdn Bhd., Petaling Jaya Parish F, Afham A, Lew, SY.2021. Role of the Roundtable on Sustainable Palm Oil (RSPO) in Tropical Peatland Management. M. Osaki et al. (eds.), Tropical Peatland Eco-management, https://doi.org/10.1007/978-981-33-4654-3_18 Parish F, Lew SY, Faizuddin M, Giesen W (eds) (2019b) RSPO manual on best management practices (BMPs) for management and rehabilitation of Peatlands, 2nd edn. RSPO, Kuala Lumpur, p 173. Parish F, Dahalan M, Rahim H. Integrated Management Plan for North Selangor Peat Swamp Forest 2014–2023 for Selangor State Forestry Department; Draft (30 June 2014) Revision 2.4; Global Environment Centre: Petaling Jaya, Malaysia, 2014. [Google Scholar] Parish F, Sirin A, Charman D, Joosten H, Minayeva T, Silvius M, Stringer L (eds) (2008) Assessment on Peatlands, Biodiversity and Climate Change: Main Report. Global Environment Centre, Kuala Lumpur and Wetlands International, Wageningen Phairuang WP, Suwattiga T, Chetiyanukornkul S, Hongtieab W, Limpaseni F, Ikemori M, Hata, Furuuchi M (2019) "The influence of the open burning of agricultural biomass and forest fires in Thailand on the carbonaceous components in size-fractionated particles." Environmental Pollution 247: 238-247. Phairuang WP, Tekasakul M, Hata S, Tekasakul J, Chomanee Y, Otani, Furuuchi M (2019). "Estimation of air pollution from ribbed smoked sheet rubber in Thailand exports to Japan Posa MR, Wijedasa LS, Corlett RT (2011) Biodiversity and conservation of tropical peat swamp forests. Biosci Vol 61(1):49–57 Parish, F., Afham,A and Lew, Y.S.2021. Role of the Roundtable on Sustainable Palm Oil (RSPO) in Tropical Peatland Management. M. Osaki et al. (eds.), Tropical Peatland Eco-management. https://doi.org/10.1007/978-981-33-4654-3_18 Pramova E, Locatelli B, Liss BM, Ignacio GB, Villamor M, Sumaylo VE (2013) Integrating adaptation into REDD+: potential impacts and social return on investment in Sogod, Southern Leyte, Philippines. Bogor: CIFOR Working Paper 113 Purnomo H, Shantiko B, Sitorus S, Gunawan H, Achdiawan R, Kartodihardjo H, Dewayani AA (2017) Fire economy and actor network of forest and land fires in Indonesia. Forest Policy and Economics 78:21–31. https://doi.org/ 10.1016/j.forpol.2017.01.001 Puspitaloka D, Kim YS, Purnomo H, Fulé PZ (2021) Analysis of challenges, costs, and governance alternative for peatland restoration in Central Kalimantan, Indonesia. Trees, Forests and People 6:100131. https://doi.org/10.1016/j.tfp.2021.100131 Qodri ST (2001) Fire, Smoke, and Haze The ASEAN Response Strategy. Published by the Asian Development Bank. Manila, Philippines. ISBN No. 971-561-338-1 Stock No. 121300 Quoi LP (2014b) Inventory of Peatlands in Vietnam. ASEAN Peatland Forests Project (APFP). http://www.aseanpeat.net/index.cfm?&menuid.123&parentid.70; www.snvredd.com Rengasamy N, Parish F (2021) Sustainable Peatland Management Focusing on Community-Based Peatland Rehabilitation in Malaysia. M. Osaki et al. (eds.), Tropical Peatland Eco-management, https://doi.org/10.1007/978-981-33-4654-3_24 Rhebergen T, Zingore S, Giller KE, Frimpong CA, Acheampong K, Ohipeni FT, Panyin EK, Zutah V, Fairhurst T (2020) Closing yield gaps in oil palm production systems in Ghana through best management practices. European Journal ofAgronomy 115:126011. https://doi.org/10.1016/j.eja.2020.126011 Rydin H, Jeglum JK (2013) The biology of peatlands. 2nd ed. Oxford University Press, Oxford Tan RBH, Khoo HH (2006) Impact Assessment of Waste Management Options in Singapore. Journal of the Air and Waste Management Association. 56(3): 244-254. Tata HL (2019) Mixed farming systems on peatlands in Jambi and Central Kalimantan provinces, Indonesia: should they be described as

paludiculture? Mires Peat 25:1–17. https://doi.org/10. 19189/MaP.2018.KHR.360 Taufik M, Minasny B, Mcbratney AB, Van Dam JC, Jones PD, Van Lanen HAJ (2020) Human-induced changes in Indonesian peatlands increase drought severity. Environmental Research Letters 15:1–10. https://doi.org/10. 1088/1748-9326/ab96d4 Thorburn CC, Kull CA (2015) Peatlands and plantations in Sumatra, Indonesia: complex realities for resource governance, rural development and climate change mitigation. Asia Pacific Viewpoint 56:153–168. https://doi.org/ 10.1111/apv.12045 Thung PH (2018) "A Case Study on the Persistence of Swidden Agriculture in the Context of Post-2015 Anti-Haze Regulation in West-Kalimantan." Human Ecology. 46(2): 197-205. UMHNP (2016) Report on statistics of fauna diversity in U Minh Ha National Park 2010. Internal report, 2016. U Minh Ha National Park. 2016. (In Vietnamese) UMTNP (2012) Report on water level monitoring in U Minh Thuong National Park. Technical Report in 2012. U Minh Thuong National Park. (In Vietnamese) van Beukering, Cesar HSJ, Janssen MA (2003). Economic valuation of the Leuser National Park on Sumatra, Indonesia. Ecological Economics 44:1. https://doi.org/10.1016/S0921-8009(02)00224-0 Venkatappa M, Sasaki N, Shrestha RP,Tripathi NK, Ok Ma H (2019) Determination of Vegetation Thresholds for Assessing Land Use and Land Use Changes in Cambodia using the Google Earth Engine Cloud-Computing Platform. Remote Sens. 2019, 11, 1514; doi:10.3390/rs11131514 Vijarnsorn, P (2021) Sustainable Management of Peatland in Thailand. M. Osaki et al. (eds.), Tropical Peatland Eco-management, https://doi.org/10.1007/978-981-33-4654-3_27 VNL (2017) Law on Fisheries in Vietnam, No. 18/2017/QH14. Vietnam National Assembly VNL (2008) Biodiversity Law in Vietnam, No. 20/2008/QH12. Vietnam National Assembly VNL (2004) Law on Forest Protection and Development in Vietnam, No. 29/2004/QH11. Vietnam National Assembly Wang YC, Hu BKH, Myint, SW, Feng CC, Chow WTL, Passy PF. 2018. "Patterns of land change and their potential impacts on land surface temperature change in Yangon, Myanmar." Science of the Total Environment. 643: 738-750. Yu Z, Loisel J, Brosseau DP, Beilman DW (2010) Global peatland dynamics since the last glacial maximum. Geophys Res Lett 37:L13402. https://doi.org/10.1029/2010GL043584

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