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**Improved Management of Peatlands for the Promotion
of Sustainable Rural Livelihoods and Ecosystem Services of Carbon Storage
in Giam Siak Kecil-Bukit Batu Biosphere Reserve, Riau, Indonesia**

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A great dilemma exists in regard to realizing the sustainable management of tropical peatlands. First, conservation of the ecosystem services of peatland (e.g., water resources, carbon storage, and wide biodiversity) is needed. Second, it must be recognized that peatland can provide a solution to the problems of population growth, livelihoods and the lack of farm land. Our study was carried out in the Giam Siak Kecil-Bukit Batu Biosphere Reserve, which covers a total area of 698,663 ha. This biosphere reserve is used to conserve and promote the sustainable development of tropical peatland. Poor management and land conversion resulted in a loss of almost 300,000 ha of natural peat swamp forest from 1998 to 2002. Forest and land fires occurred annually, especially in the dry season, and the remaining peat swamp forest was subject to illegal logging activities and natural disturbances. In core and buffer areas, villagers converted the remaining natural peat swamp forest into jungle rubber gardens and oil palm plantations.

Our study reveals that it is important for the remaining natural peat swamp forests to be conserved because of their unique and distinct forest-type formations and their huge store of above and below carbon stocks. Mixed Peat Swamp Forest and Bintangur Forest, which have distinct dominant species, floristic composition, diversity, and local environment characteristics, were identified as the main forest types in the biosphere reserve. The total amount of below-ground carbon stored was higher compared to that of above-ground carbon in both forested areas and developed peatland areas. The above-ground and below-ground carbon in forested areas was estimated to be in the range of 26.75 to 94.25 Mg C ha⁻¹ and 4410 to 5775 Mg C ha⁻¹, respectively. The above-ground and below-ground carbon in developed peatland areas was estimated to be in the range of 42.57 to 68 Mg C ha⁻¹ and 2772 to 6552 Mg C ha⁻¹, respectively. The total above-ground carbon storage is considered to be around 11,470 million C tons in the biosphere reserve, assuming that the average total above-ground carbon storage is 64.05 Mg C ha⁻¹ in the 178,710 ha of remaining natural forest. Human activities and natural disturbance reduce the ability peat swamp

forest ecosystem to sequester CO₂ shown in logged over forest and wind disturbed forest. Improved management of secondary forest must be achieved through rehabilitation, halted forest conversion, and reducing the impact of wind and fire disturbance factors. Natural regeneration is very important to improving the condition of secondary degraded peat swamp forest, but is not sufficient to bring back the forest vegetation and its associated biodiversity. At this point, some form of human-assisted regeneration is needed. Rehabilitation commenced in February 2010. We selected two different levels of forest and peatland degradation in logged forest in the Bukit Batu conservation areas of Temiang Village and severely degraded peatland areas in Tanjung Leban Village. The results demonstrate that the six indigenous species of peat swamp forests (i.e., *Cratogeomys arborescens*, *Dyera lowii*, *Callophyllum lowii*, *Palaquium sumatranum*, *Palaquium burckii*, and *Tetramerista glabra*) could be promoted for both the ecosystem services of carbon storage and the economic values of timber and non timber forest products. Some of the species that were suitable for rehabilitating heavily or even severely degraded forest and peatland areas such as *Cratogeomys arborescens*, *Palaquium sumatranum*, *Palaquium burckii*, and *Tetramerista glabra* had high survival rates in the range of 73.3 to 100%. Rehabilitation of logged forest areas increased from around 2.42 Mg C ha⁻¹ during the ten months of monitoring both natural regeneration processes and planting trees. Another option to promote sustainable rural livelihoods and the ecosystem service of carbon storage was the Reducing Emissions from Deforestation and Forest Degradation (REDD+) mechanism. This mechanism provides opportunities and challenges related to reducing carbon emissions as well as alleviating poverty and conserving biodiversity.

Key words: Biosphere reserve, peat swamp forest, rural livelihoods, carbon storage, rehabilitation