

- improve local economic conditions while reducing fire and degradation problems.
- d. As part of rural development projects, negotiate arrangements whereby communities agree to control their burning and to protect and restore larger wetland areas beyond the annually burnt strips. Provide incentives, raise awareness, and set up local institutions and regulations to support and implement such measures.
3. On established transmigration sites, support community interest in shifting from annual to estate crops or agroforestry in partnership with companies. This could help improve livelihoods and avoid annual burning.

Large-scale development:

4. For currently remote, sparsely-inhabited forested wetlands of Indonesia, reconsider development policies to avoid the vicious cycle of fire and environmental degradation. Avoid large-scale developments (such as commercial logging, transmigration and plantation development) that deforest or drain the peatlands, improve access and increase the population pressures in these marginal areas.
5. Review the appropriateness of existing wetland use allocation for logging and plantation development versus conservation or community use in different regions including all stakeholders.

References

1. RePPProT. 1990. *The Land Resources of Indonesia: A National Overview*, Land Resources Department, Natural Resources

Institute, Overseas Development Administration, London, UK and Direktorat Bina Program, Direktorat Jenderal, Penyiapan Pemukiman, Departemen Transmigrasi, Jakarta, Indonesia.

2. Tacconi, L. 2003. *Fires in Indonesia: Causes, costs and policy implications*. CIFOR occasional paper No. 38. CIFOR, Bogor, Indonesia.
3. Chokkalingam, U., Suyanto, Permana, R. P., Kurniawan, I., Mannes, J., Darmawan, A., Khususyiah, N. and Susanto, R. H. Forthcoming. Community fire use, resource change and livelihood impacts: The downward spiral in the wetlands of southern Sumatra. *Mitigation and Adaptation Strategies for Global Change*.
4. Chokkalingam, U., Kurniawan, I. and Ruchiyat, Y. Manuscript. *Fire, livelihoods and environmental degradation in the Middle Mahakam Peatlands*. CIFOR, Bogor, Indonesia.
5. ADB (Asian Development Bank)/BAPPENAS (National Development Planning Agency). 1999. *Causes, Extent, Impact and Costs of 1997/98 Fires and Drought. Final Report, Annex 1 and 2*. Planning for Fire Prevention and Drought Management Project, Asian Development Bank, TA 2999-INO Fortech, Pusat Pengembangan Agribisnis, Margules Pöyry, Jakarta, Indonesia.
6. Page, S. E., Siegert, F., Rieley, J. O., Boehm, H. D. V., Jaya A. and Limin S. 2002. The amount of carbon release from peat and forest fires in Indonesia during 1997. *Nature* 420:61-65.
7. Chokkalingam, U. and Suyanto. 2004. *Summary of workshop results*. Pages 20-34 in *Kebakaran di Lahan Rawa/Gambut di Sumatera: Masalah dan Solusi*. CIFOR, Bogor, Indonesia.

This summary is mainly based on detailed analysis of wetland sites in southern Sumatra and East Kalimantan, and the perspectives of key stakeholders from the wetlands of Sumatra shared during a workshop in December 2003. This work was jointly carried out by CIFOR and ICRAF, with funding from the EU and ACIAR. The opinions expressed here are those of the author and do not necessarily reflect the views of the funding agencies.



Australian Government
Australian Center for
International Agricultural Research



CIFOR
Center for International Forestry Research
Jalan CIFOR, Situ Gede
Bogor Barat 16680, Indonesia
Tel: +62 251 622622
Fax: +62 251 622100
E-mail: cifor@cgiar.org
www.cifor.cgiar.org
Cover photos by A. Erman



World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

ICRAF
World Agroforestry Centre
Jalan CIFOR, Situ Gede
Bogor Barat 16680, Indonesia
Tel: +62 251 625415/17
Fax: +62 251 625416
E-mail: icraf-indonesia@cgiar.org
www.worldagroforestrycentre.org/sea



FUTURE
HARVEST



Center for International Forestry Research

Environmental
Services and
Sustainable Use of
Forests Programme

Fire Brief

Fire, livelihoods and environmental degradation in the wetlands of Indonesia: A vicious cycle

By Unna Chokkalingam, CIFOR (u.chokkalingam@cgiar.org) and Suyanto, ICRAF (suyanto@cgiar.org)

Indonesia contains a large area of peat and connected freshwater wetlands, approximately 19 million hectares or 10 percent of the land area¹. Peatlands make up 89% of the 19 million hectares. Most of these wetlands are located on three islands, West Papua, Sumatra, and Kalimantan. These tropical wetlands are naturally covered by closed forest and often contain valuable timber species - however, their commercial extraction appears unsustainable. They play a critical role in carbon storage, biodiversity conservation and hydrological regulation. They are also a major breeding ground of fish for both domestic and export markets. Many people rely on these wetlands for livelihood support, often in the form of fishing, logging and agriculture.

The fire problem in the wetlands

Indonesia's wetlands have suffered extensive fire damage in recent El Niño years. In the 1997/98 El Niño event, forest fires on dried-out wetlands accounted for 2.1 million ha or 18 percent of the total area burnt in Indonesia². As would be expected, much of the burning occurred in logged or drained wetlands, such as those in southern Sumatra. But even intact peat forests such as in the Middle Mahakam Area, East Kalimantan and Berbak National Park, Jambi suffered due to increased human activities (such as turtle hunting and logging) within the forests.

Fire in the Gelam forest, Lampung. (Photo by Rizki Pandu Permana)

Fires are also common in non El Niño years but are smaller in scale and restricted to accessible areas along rivers, streams and lakes^{3,4}. Deforested and drained peatlands are, however, becoming major annual fire flashpoints, such as in Central and West Kalimantan and, more recently, in Riau.



Compared with dryland fires, wetland fires tend to have larger negative environmental impacts of concern on a regional to global scale. They are a major source of both the annual smoke haze blanketing Southeast Asia and the greenhouse gas emissions contributing to global warming. In the 1997/98 El Niño event, Indonesian wetland fires accounted for 60 percent of the regional haze⁵ and emitted 0.81-2.57 Gt of Carbon⁶, making Indonesia one of the largest air polluters in the world. In Kalimantan and Sumatra, recurrent fires and associated disturbances in wetlands have led to widespread deforestation, forest degradation and biodiversity loss. In East Kalimantan, repeatedly burnt degraded forests are ultimately transformed into open floodplains and shallow lakes as the peat collapses with vegetation removal or is lost with burning.



Fishing is a lucrative livelihood in the Mahakam peatlands. (Photo by Andi Erman)

Causes of fire ignitions: Companies versus communities

Fire is a cheap and effective community wetland management tool in Indonesia, and is a major cause of fire ignition in much of the wetlands of Sumatra and East Kalimantan^{3,4,7}. Fire is used by communities to clear vegetation and improve access into the peatlands for harvesting fish, timber, and other products; to clear land for cultivation; to generate fresh grass for cattle; and to ward off insects and cold while camping. As yet, no viable alternatives to using fire have been identified for communities. Burning is not controlled because wetland fires are difficult to control and communities do not perceive the need to control them. In non El Niño years, community fires are generally small and not a problem, except in the case of drained peatlands. In El Niño years, intensified community activities and dry conditions lead to more widespread fires.

Logging concession staff may have been partly responsible for fire ignition within the forests during periods of commercial logging. Direct company burning for conversion to forestry plantations or estate crops has also played a major role in fire ignition in the wetlands of Sumatra over recent decades. From 1995-2003, 49 companies were investigated for illegally using fire in land clearing operations on drylands or wetlands and two were finally convicted⁷. Major pulpwood plantation companies operating in the peatlands claim they have a strict no-burn policy for land clearing and that the wood is harvested to supply their mills.

Disputes between companies and communities over land-tenure can sometimes lead to arson. In the wetlands of Lampung, tenure conflicts between local communities and companies establishing coconut palm plantations have seen deliberate and repeated acts of burning³. In contrast, arson has not occurred in oil palm plantations set up in partnership with local communities.

Large-scale developments make wetlands fire prone

Though the relative importance of company versus community ignitions is still unclear, large-scale developments contribute indirectly to widespread wetland fires in a significant way. Commercial logging, forestry and estate crop plantations and transmigration projects make the wetlands more fire prone and contribute to the expansion of community fire-based wetland use³. Logging increases the fuel loads of dead trees and dense regrowing biomass, promotes rapid drying by

opening up the canopy, and improves forest access through logging tracks. Draining dries out the peat, alters the vegetation structure, and provides access through canals into remote peatlands. The major developments also bring more people into the wetlands as transmigrant farmers or to work in commercial logging and plantation operations, thus increasing overall human activity in these areas.

Many transmigration projects in the peatlands have failed because of peat subsidence, difficulties with water management, acid sulphate conditions and low fertility. With the failure of agriculture, transmigrant communities in southern Sumatra have adopted fire-based wetland rice cultivation in drought years and informal logging in neighbouring forest areas, thus increasing the incidence and spread of fire in wetlands. Large-scale pulpwood plantation development on peatlands is also risky given high costs, low productivity, and difficulties of sustainably managing the biophysical and social environment. Failed transmigration and plantation areas are likely to become annual fire hotspots.



Draining peat forest for plantation development, Riau. (Photo by Christian Cossalter)

Livelihoods and fire expansion in El Niño years

In El Niño periods, dry conditions, failure of regular livelihood options in the wetlands and/or alternative livelihood opportunities have led to the intensification and spread of community-ignited fires in both Sumatra and East Kalimantan^{3,4}. Livelihood options are generally more limited in wetlands and often involve land and fire uses that degrade the resources. This is particularly true in long droughts when water levels drop, boat travel is difficult, and critical pursuits such as fishing and dryland agriculture are affected. There is a need to plan for and put in place alternative sustainable livelihood options or assistance programs during these crisis periods to prevent widespread damaging fires, preferably outside the vulnerable wetlands.

Turtle hunting in East Kalimantan⁴

In the 1997-98 El Niño period, around 72-85 percent of the Middle Mahakam Peatlands was burnt. Much of it was mature forest that had not burnt before. These extensive fires are attributed to the extremely dry conditions and the use of fire while hunting turtles or collecting tree bark. Fishing is the pre-dominant livelihood source in the area but river levels dropped in the El Niño period, making navigation and transport of fish difficult. New high-value markets emerged for turtle meat and for tree bark used as an ingredient in commercial mosquito coils. The local government permitted quota-free collection of these items in response to the drought crisis. Thousands of people switched to these alternative activities and entered remote interior peat forests that were scarcely visited before. Fire was used to improve access into the forest, for camping, and to concentrate the turtles in damp areas and catch them easily by burning off the surrounding vegetation. While these activities helped local people survive a difficult drought year as intended, they resulted in widespread fires that damaged the entire peat ecosystem and contributed to the smoke and haze problem.

A vicious cycle of degradation and long-term fire problem

Once degraded, wetland landscapes are prone to recurring fires because they are more easily accessed and more flammable. People are quick to use the newly opened-up areas and the zone of degradation gradually expands from the rivers into interior peatlands. Drained peatlands can become a major annual fire problem. It is very difficult to convert wetlands to sustainable alternative land use.

Recurrent fires reduce the potential for regrowth and recovery. In southern Sumatra, communities report negative impacts of repeated fires on hydrology, soils, fish resources and agricultural

Sonor in southern Sumatra³

Widespread fires in the wetlands of South Sumatra and Lampung in the last El Niño periods of 1991, 1994 and 1997/98 were partly due to *sonor*, a traditional system of wetland rice cultivation. *Sonor* is practised by using fire during prolonged droughts of five to six months. As the wetlands dry out, surface vegetation is burned and rice seeds are broadcast on the ash-enriched soil. As water levels rise, the rice grows and is eventually harvested using boats. *Sonor* produces bumper crops and requires little expense, maintenance and labour. It is a simple and economical way of overcoming the lack of suitable permanent rice cultivation sites in the wetlands, the limited alternative livelihood options, and the failure of upland crops during long droughts. The practice of *sonor* has expanded across southern Sumatra following the transformation of mature high forest landscapes into flammable *Gelam* (*Melaleuca cajuputi*) forests and thickets. It became more common as the incidence of droughts increased, new areas became accessible through canals, and new migrants also adopted the practice.

yields³. Resource degradation following logging and fires has forced down household incomes and livelihood options. The impacts extend beyond local areas as workers migrate into neighbouring forests to extract resources. On the other hand, local communities in East Kalimantan that depend on peatland fish resources perceive positive benefits from fire use and landscape transformation following the widespread fires of the recent El Niño events⁴. Clearly more research is needed into the longer-term impacts of such peatland transformation on hydrology, fish populations and thus livelihoods.

Key recommendations to solve the wetland fire problem

Livelihood improvement and sustainable management:

1. Develop an El Niño response program for wetlands aimed at reducing fire use by communities and providing alternative sustainable livelihood options at these critical times, preferably outside these vulnerable areas.
2. On already degraded or still forested wetlands under severe livelihood pressures, develop a multi-faceted policy to control fires, arrest environmental degradation and halt the spread of unsustainable practices, while supporting livelihoods.
 - a. Examine the technical and socio-economic feasibility of practising controlled burning for local wetland use in the accessible areas along waterways, particularly in long drought years, so that fires are contained.
 - b. Rehabilitate, conserve and restrict activities within much of the wetlands beyond the broad strips along the rivers and lakes to prevent further large-scale fires, haze, carbon emissions, and environmental degradation.
 - c. Develop viable livelihood options, such as small-scale plantations, agroforestry, and fish farming on suitable sites that will