

Burning Issues

Thinking for more effective fire management

Burning peatlands equal smoke and haze

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Each year millions of people across South East Asia suffer from choking smoke and haze. Smoke and haze is responsible for about 1/3rd of the total economic losses from forest fires, equalling around 800 million in 1997/98. Politically, transboundary haze affecting neighbouring countries is a very contentious issue.

Peatlands – What are they?

New data and research show that about 60% of smoke and haze including carbon emissions from fires in Indonesia originate from peat lands, which only cover 10-14% of Indonesia’s land mass. Preventing peatlands from burning can therefore considerably reduce haze and smoke pollution. Prevention of fires is the more important, as fire fighting in peatlands is very problematic. The best way to prevent fires in peatlands is to conserve these in their natural state, since they cannot be rehabilitated and their natural ‘fire proof’ conditions not recreated.

Why do normally fireproof peatlands burn?

This issue looks at fire and their management in peatlands to reduce haze and smoke pollution, while also conserving these rare ecosystems.

Peatlands and Fire

Peatlands – What are they?

Fireproofing peat lands?

Peatlands (sometimes called peat bogs, swamp) develop where vegetation inundated by water decays slowly. The resulting peat is composed of rotting plant material at various stages of decomposition. The characteristic of peatlands is their high content of this organic matter (over 65%). Peat can reach depths of 15 m and more.

In their undisturbed state, peatlands fulfil important ecological functions; regulating surface and ground water. With sponge-like properties, peatlands absorb excess water, which is then slowly and continuously released. This makes the water flow more consistent and sustained and thereby prevents floods and attenuates droughts.

Further Reading

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Peatlands are major carbon sinks. They cover only about 3% of the earth, but contain 20-35% of all terrestrial stored carbon. Tropical peatlands, such as the ones in South East Asia have particularly high carbon storage capacity (3-6 times more than in temperate peatlands).

Peatlands are also very rich in biodiversity, with many species unique to peat swamps.

Why do normally fireproof peatlands burn?

The water soaked peatlands do not naturally burn, with the exception of extreme drought years. This was demonstrated in the tragic circumstances of peat swamp forests in Viet Nam sprayed with defoliants and burned by napalm during the war. The resulting fires were kept in check by the natural, wet properties of peatlands.

Despite their poor soils, and the difficulties for large-scale agriculture in swamp areas, increasing areas of peatlands are being logged and drained. To undertake these activities canals are dug in the peatlands to drain water, provide logging access and to prepare the peatlands for agriculture. This first step is problematic because it lowers ground water levels and surface water drains away. Irrigation of adjacent agricultural land can also cause the water table to drop. Once peat dries out excessively its natural sponge-like properties are lost and so is its water regulating capacity. Unnaturally dry peatlands are more susceptible to drought. Fire, accidental or deliberate, follows with the damage proportional to human activity and disturbance.



Fires in drained peat swamp next to canal in Central Kalimantan; picture © WWF-Canon/Alain Compost

Canals provide access into formerly inaccessible peat lands. Increased human access introduces fire and other activities, such as logging activities, which disturb the natural balance of peatland ecosystems. Some traditional activities, such as sonor rice planting (where rice is planted on deliberately burnt swamp areas in drought times) and inland fishing (where fishermen use fire for better access and to enhance fish habitats) are also sources of fires in peat areas. Because inland fishing and sonor rice cultivation are especially important for local communities' livelihoods in years of drought, the associated risk of peat ignition is high.

Peatlands and Fire

Fires in peatlands must be prevented. They are the largest source of smoke and haze from forest and land fires in Indonesia. In the large fires in 1997/98 damage worth about 800 million USD (from transportation delays, loss in the tourism industry and increased health costs) was due to the effects of smoke alone.



Smoke from burning peat in Central Kalimantan; picture © WWF-Canon/Alain Compost

Burning of peatlands destroys some of the world's most important carbon sinks and sets large amounts of carbon free. A recent study estimates that during the fires in 1997/98 the carbon release from burning peat was equal to 13 to 40% of annual emissions caused by the burning of fossil fuel around the world.

Firefighting in peatlands is problematic, expensive and may damage the ecosystem in the long run. Peatlands burn above, and below ground, which makes it very difficult to extinguish fires in peatlands. The possible firefighting methods are also all expensive. To effectively control fire in peatlands one must either dig up the underground burning peat or inundate the peatlands. However, in dry periods, when fires ignite, water is often scarce and flooding not an option.

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Ecologically, the burning, of peat swamps accelerates the destruction of unique environments and their ecological services.

Some peatland fire fighting techniques require the digging of additional canals (for access to the fires). Sometimes saltwater is pumped in to inundate the peatlands. Both these techniques are likely to further degrade peatlands.

If peat fires are not completely put out, they can smoulder below ground for long periods even years and start new fires, as soon as the weather becomes dryer again. The fires burning underground destroy the root system of trees that then become unstable and fall over or die. This generates large amounts of dead wood and debris, potential fuel for the next fire, scattered on burned peat soils.

Ecologically, the burning, of peat swamps accelerates the destruction of unique environments and their ecological services (e.g. water regulation and flood prevention). However, one has to be careful not to mix up cause and effect. The underlying causes of biodiversity reduction are mismanagement of peatlands and land use planning allowing the conversion of peat soil areas. Fire follows and accelerates the negative effects of drainage and speeds up the degradation of peatlands.



Newly burnt peat swamp in Central Kalimantan; picture © WWF -Canon/Alain Compost

Fireproofing peat lands?

The best way to prevent fires in peatlands is to conserve them in their natural state, with particular attention paid to sound water management, appropriate land-uses and sustainable forest management. This means preventing draining and conversion of peat areas.

When peat lands dry out excessively, they lose permanently their natural sponge-like properties and cannot be rehabilitated anymore. These degraded peatlands should be managed to prevent them from becoming grass-covered wastelands, which easily and regularly burn providing a source of fire to neighbouring areas including peatlands. Local communities' fire use in peatlands can only be prevented, if valid livelihood alternatives are created, what these alternatives might be is currently unclear.

Some countries have taken note of the complications associated with peat fires and specifically prohibit any fire use on peat soils, but perversely continue to allow conversion and development of peat areas. Malaysia and Indonesia are countries where fire has been completely banned on peatlands by the law but draining and development is allowed.

Further Reading

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Project FireFight Southeast Asia is seeking to secure the essential policy reform at national & regional level within South East Asia that provides a legislative and economic basis for controlling harmful anthropogenic forest fires.



IUCN's vision is a just world that values and conserves nature. It seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.



WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature. One focus is on forests and WWF works with its partners to protect, manage and restore them through its national offices and programmes in the South East Asia and across the world.



The European Commission through its programs and projects throughout the world, and particularly in South East Asia the EC-Indonesia Forest Program, seeks to improve understanding and intensify relations between the EU and its partner nations in pursuit of mutual interests and co-operation in fields such as trade, development, science, education, human rights and culture.



The Centre for International Forestry Research (CIFOR) contributes to the sustained well-being of people in developing countries, particularly in the tropics, through collaborative strategic and applied research and related activities in forest systems and forestry, and by promoting the transfer of appropriated new technologies and the adoption of new methods of social organization of national development.



The International Centre for Research in Agroforestry (ICRAF) aims to reduce rural poverty, increase food and nutritional security and enhance ecosystem resilience in the tropics through improved agroforestry systems.

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