Children play on fishing boats at Lake Tanganyika, one of the East African Great Lakes threatened by oil exploitation.

PHOTO: BLICKWINKEL/ALAMY STOCK PHOTO

Oil extraction imperils Africa's Great Lakes

AS THE WORLD'S demands for hydrocarbons increase (*1*), remote areas previously made inaccessible by technological limitations are now being prospected for oil and gas deposits. Virtually unnoticed by the public, such activities are ongoing in the East African Great Lakes region, threatening these ecosystems famed for their hyper-diverse biota, including the unique adaptive radiations of cichlid fishes (*2*). Countries in the region see exploitation of hydrocarbon reserves as a vital economic opportunity. In the Lake Albert region of Uganda, for example, the government foresees a $3.6 billion oil profit per year starting in 2018—a sum almost as high as the country's current annual budget (*3*). However, oil extraction in the East African Great Lakes region poses grave risks to the environment and local communities.

The thousands of oil spills reported in Nigeria (*4*) demonstrate that the extraction and transport of oil are prone to accidents. This is especially bad news for the African Great Lakes because they are virtually closed ecosystems. For example, for Lake Tanganyika, which contains about one-fifth of the world's surface freshwater (*5*), the flushing time is ~7000 years (*5*). This time frame implies that the recovery from an oil spill could take millennia. To make matters worse, the lakes' location in a remote part of the world would impede a quick and effective reaction to an oil spill. Appropriate infrastructures are currently unavailable at the lakes, and bringing in heavy equipment at the time of a spill would be cumbersome, logistically impossible, or prohibitively expensive.

An oil spill would markedly affect the health, water supply, and food security of local communities (*6*). More than 10 million people depend on Lake Tanganyika alone for fisheries and water resources, and many more along the Congo River, into which the lake drains, are highly dependent on the lakes' ecosystem (*7*). In addition to the toll on humans, an oil spill in these lakes would be a global catastrophe for biodiversity. Combined, these lakes are home to thousands of species, almost all of them endemic (*2*). An accident might deal a final blow to these ecosystems, which have already been rendered fragile by anthropogenic stressors such as overfishing, deforestation, and global warming (*8*).

Finally, large parts of the East African region still lack political stability and security (*9*). In addition to the possibility of accidents, competition for hydrocarbon resources could lead to sabotage, as has unfortunately been frequently observed in the Niger delta (*4*).

We are concerned that the risks associated with the intended exploitation of fossil hydrocarbons in the East African Great Lakes region are seriously underestimated. We urge the countries involved in these undertakings to engage with the scientific and lake management communities to identify strong mitigation and control measures that could be put in place before hydrocarbon production begins. Local governments should foster alternative, sustainable plans to develop the region in accordance with the United Nations Sustainable Development Goals (*10*). To this end, the local population, regional stakeholders, governments, nongovernmental organizations, and scientists must cooperate to develop economically and ecologically viable strategies for the region, as is currently being attempted for the Virunga National Park in the DR Congo (*11*).

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SUPPLEMENTARY MATERIALS

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Time for responsible peatland agriculture

THE 15TH INTERNATIONAL Peat Congress, held in Asia for the first time, brought together industry, policy-makers, and academia to discuss responsible peatland management. In Southeast Asia, peatland management is largely driven by the palm oil industry. After the Congress, misleading reports were published by leading Asian newspapers. They claimed that oil palm plantations on peatland can be viewed as sustainable [e.g., (*1*)] and supported the continuation of business-as-usual peatland agriculture. This is contrary to the opinion of an overwhelming number of tropical peatland scientists (*2*) and the vast majority of science published in the past two decades.

Deep, carbon-rich peat deposits are maintained by a combination of steady organic matter inputs and high water tables, which inhibit microbial decomposition (*3*). Conversion of peat swamp forest (the natural vegetation of Southeast Asian peatlands) to agricultural land requires removing vegetation and lowering groundwater tables. The combination of slash and burn techniques and drainage used to prepare peat for agriculture promotes smoldering fires and rapid peat oxidation. Peat fires are globally significant for their greenhouse gas emissions and threats to human health and regional economies (*4*). Peat oxidation leads to high CO_2 emissions and land subsidence. As the land surface falls toward river and sea levels, it will be subject to periodic and eventually permanent flooding, limiting future agricultural production (*5*). Agricultural use of peatlands cannot, therefore, be considered sustainable from either environmental or socioeconomic perspectives.

Industry and academia are working together to develop peatland agricultural systems (*6*) that minimize negative environmental and commercial impacts. In the interim, steps should be taken to improve hydrological management of peatlands under agriculture and to implement landscape-scale management planning. Denial of known issues slows progress toward responsible solutions, which are urgently needed to prevent avoidable losses of Southeast Asia's peatlands, as well as global consequences.

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Protecting China's soil by law

AFTER SEVERE PROBLEMS with air and water pollution, China is getting serious about its soil (*1*, *2*). On 31 May, China's State Council released an action plan for soil pollution prevention and remediation, aiming to make 90% of polluted, arable land safe for human use by 2020 and increase this to 95% by 2030 (*3*). This ambitious action plan calls for the support of strong environmental laws to monitor, prevent, and remediate serious levels of soil contamination. However, national legislation protecting soil quality has lagged behind that of air and water for more than a decade, while Chinese lawmakers debate the focus and purpose of a soil protection law.

On 3 September, China released a draft of its first environmental tax law, which designates four taxable types of pollution: airborne and water pollutants, solid waste, and noise (*4*). Soil is conspicuously absent. A soil protection law could close the current environmental legislation system's loopholes, make China's new environmental tax system more comprehensive, and protect China's soil.

To make a pragmatic soil protection law, the central government must clearly identify local government's liability and responsibility for soil pollution, as ambiguous responsibility has been one of the major problems in soil management in the past. The law must stipulate the division of duties between government agencies, establish a surveying and monitoring system, and introduce funding mechanisms. Remediation of contaminated soil is extremely costly, and China needs to create a national soil fund by allocating an adequate percentage of its land revenues and environmental tax revenues. Some members of the soil pollution plan panel initially suggested that 10% of land revenues be designated to the fund (*5*). Because China lacks comprehensive risk assessment systems for contaminated land management (*6*), the law should stipulate risk management and control approaches for contaminated sites.

China's soil pollution has become a critical issue that affects public health and creates social unrest and instability (*1*, *7*, *8*). China should not repeat its past mistakes of focusing on economic growth at the expense of the environment.

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