Carbon trading

John Mimikakis (*Front Ecol Environ* 2007; **5[1]**: 3) calls for scientists to keep the debate on how best to deal with climate change honest. Following dominant market logic, he suggests that trading carbon credits between industries and participating in offset programs such as the Clean Development Mechanism (CDM) may be the cheapest and most politically feasible way to help industrialized countries like the US reduce emissions. The CDM allows industrialized countries to develop projects that reduce emissions in developing countries in exchange for certified emission reductions (CERs), and it is worth noting that project activities under the CDM have the dual objective of helping to achieve sustainable development *and* reducing greenhouse gas (GHG) emissions (UNFCCC 2007).

Since Kyoto was ratified in February of 2005, more than 1600 projects have been proposed under the CDM, 696 of which have been registered and approved. The US, in fact, was chiefly responsible for climate treaty negotiations in the 1990s that resulted in the inclusion of the CDM in the Kyoto Protocol. Although the US subsequently failed to ratify the treaty, US companies are eligible to participate in offset agreements through the program and then trade achieved CERs on the carbon market. Such market-based programs are receiving increased attention as components of overall climate strategy as GHG emission rates continue to accelerate (Raupach *et al.* 2007).

Scientists have made great strides in understanding how distinct ecologies and environments are responding to changing CO_2 levels in the atmosphere, and continued research supports the development of further carbon sequestration initiatives. But little attention has been paid to evaluating carbon offset project outcomes, both in terms of the total quantity of reduced or sequestered GHG emissions and in terms of social equity. Recent investigative reporting by the UK publication *The Guardian* suggests that more than 20% of registered CDM projects may not meet their stated offset objectives, and that others breach the requirement for sustainable development due to polluting side-effects of carbon-reducing technologies (Davies 2007).

Our own experience with a first generation carbon offset forestry project in Guatemala also raises social equity concerns. Small farmers in Guatemala, with little access to land or resources, are now responsible for sequestering carbon emitted by a coal-fired energy plant in the eastern US. In this case, social equity considerations and inability to achieve stated targets are coupled with a concern that meaningful reductions in atmospheric CO_2 levels are unlikely to be achieved by reforestation projects (Schlesinger 2006), and with recent findings of other environmental consequences of tree plantations, including losses in stream flow and increased soil salinization and acidification (Jackson *et al.* 2005).

Without capping fossil fuel emissions in the short term, market and offset solutions to climate change may do little more than create a profitable market for a "feel-good" product that does little to reverse still rising emissions, while raising serious issues of accountability and imposing long-term constraints on land use for host communities in developing countries. As the global community discusses options to be incorporated into post-Kyoto climate treaties, carbon offsetting that reduces social equity should be avoided, as should approaches that trade carbon sequestration at the cost of other ecosystem services. These two factors are of foremost importance for rural populations in developing countries, whose livelihoods are at greatest risk under climate-change scenarios.

Mark Johnson[1*] and Hannah Wittman[2]
[1]*Department of Geography, University of British Columbia, Vancouver, BC*
[*]*(mark.johnson@ubc.ca)*
[2]*Department of Sociology and Anthropology, Simon Fraser University, Burnaby, BC*

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Remediation of LUST sites

In *T'anks a lot* (Laws of Nature, *Front Ecol Environ* 2007; **5[3]**: 163), Douglass Rohrman reported that state and federal cleanup of sites with leaking underground storage tanks (LUSTs) "may…cost a staggering $12 billion in public funds" for 117 000 sites, and "that the LUST iceberg is a lot bigger than we thought".

A key point not discussed in the column is that regulatory agencies do not use the knowledge they have accumulated over 30 years of investigating LUST sites. This knowledge, which could reduce the projected cost, includes:

- After removing a LUST, most impacted groundwater will self-remediate via natural attenuation processes (NAPs) under aerobic and anaerobic conditions.
- Because of NAPs, contaminant plumes contract without any active groundwater treatment.
- If a plume impacts a water supply, treatment at the point of water use is usually cost-effective, protective, and requires less energy than active remediation at the LUST site.

However, regulatory agencies continue to treat LUST sites as research projects and do not conduct cost–benefit analyses. Also, they require monitoring wells (MWs) to delineate the horizontal and vertical limits of the plume, even when the aquifer is not used (eg in urban areas where drinking water is supplied by surface water or an aquifer has insufficient yield), a condition that is expected to pertain to most of the 117 000 sites.