

Researchers publish key findings on regional, global impact of trade on the environment

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In the wake of concerns over [climate change](#) and other emergent environmental issues, both individuals and governments are examining the impact of consumer and producer behavior and policies. In two new studies, three researchers from the University of Maryland's Department of Geographical Sciences publish groundbreaking findings on the [environmental impact](#) of globalization, production and trade at both regional and international scales, and anticipate that their research will inform key [environmental policies](#) and consumer and corporate attitudes in the United States and around the world.

Professor Klaus Hubacek and researchers Yang Yu and Kuishuang Feng's "Tele-connecting local consumption to global land use" will appear in a new *Global Environmental Change* and is available now online. Hubacek and Feng, with co-authors from leading institutions worldwide, [will publish "Outsourcing CO2 within China" on June 10](#) in the *Proceedings of the National Academy of Sciences*.

"Tele-connecting local consumption to global land use"

As local consumption is increasingly met by global supply chains, often involving great geographical distances, the impact of [consumer behavior](#) on the environment is becoming increasingly apparent. Hubacek, Yu and Feng's research concretely connects local consumption to global land use through tracking global commodity and value chains via international trade flows.

Specifically, they have zeroed in on land use attributed to "unusual" sectors including services, machinery and equipment, and construction.

Their findings show how [developed countries](#) such as the United States consume a large amount of goods and services from both domestic and international markets, and thus impose pressure not only on their domestic land resources, but also displace land in other countries, creating an impact on not only how land is used, but in effect consuming land that could potentially be used in more environmentally friendly ways.

For example, 33 percent of total U.S. land use for consumption purposes is displaced from other countries, which is actually at the lower end of the global spectrum: the ratio becomes much larger for the EU (more than 50 percent) and Japan (92 percent).

Hubacek et al. have also illustrated the vast gap between consumption habits of rich and relatively poor countries. Their research shows that rich countries tend to displace land by consuming non-agricultural products, such as services, clothing and household appliances, which account for more than 50 percent of their total land displacement. For developing economies, such as African countries, the share of land use

for non-agricultural products is much lower, with an average of 7 percent.

"In addition, the emerging economies and population giants, China and India, are likely to further increase their appetite for land from other countries, such as Africa, Russia and Latin America, to satisfy their own land needs driven by their fast economic growth and the needs and lifestyles of their growing populations," Hubacek said.

"Obviously, there are significant global consequences when these types of demands exceed the supply of land. We are all competing for the same resources. Land can be used to produce factories for fashion items or food for people or important ecosystems for non-human species."

Hubacek said the very countries that are putting the most strain on the global stage and on developing countries must emerge as leaders to address this problem.

"The EU, United States and Japan need to play a key role in reducing environmental impacts, especially in developing countries. Emerging economies, such as China and India, would also need to play a significant role in global sustainable land use to prevent further degradation in vulnerable regions, such as Amazon rainforests and agricultural land in Africa. An international framework would be needed for such high level collaboration. The consumption-based perspective of land use presented in this work shows an alternative to the production-based accounting by shifting some of the responsibility for environmental pressures to consumers as primary beneficiaries," he said.

Yu, Feng, and Hubacek hope their findings and recommended next steps can be applied to other timely environmental problems.

"The same proposed international framework can be used to link water

extraction or other local environmental problems in one place of the world to consumption in an entirely different part of the world. At the moment, we stop at the national level that is we track global trade flows from country to country, but we are working on a framework to allow us link local environmental degradation to specific groups of consumers within a country. For example, we could examine how demographic or other contextual variables in an area in the U.S. shapes certain consumption patterns and what sort of impacts that might create in other parts of the world," Hubacek said.

"Outsourcing CO2 within China"

Going beyond recent studies demonstrating that the high standard of living enjoyed by people in the richest countries often comes at the expense of CO2 emissions produced with technologies of low efficiency in less affluent, developing countries, Hubacek, Feng and their coauthors have now shown that this dynamic can exist within a single country's borders. Focusing on China, the world's largest CO2 emitter, the authors illustrate that rich regions consuming and exporting high-value goods and services depend upon production of low-cost and emission-intensive goods and services from poorer regions, creating an environmental burden on those poorer regions.

Tracking CO2 emissions embodied in products traded among Chinese provinces and internationally, Hubacek, Feng and their coauthors found that 57 percent of China's emissions, or 4 gigatonnes (Gt) of CO2, are related to goods that are consumed outside of the province where they are produced. For instance, up to 80 percent of the emissions related to goods consumed in the highly developed coastal provinces are imported from less developed provinces in central and western China where many low value added but high carbon-intensive goods are produced.

"The carbon intensity of imports to the affluent coastal provinces is

much greater than that of their exports – in some cases by a factor of 4, because many of these imports originate in western provinces where the technologies are highly inefficient, the economic structure is energy intensive and heavily dependent on coal,"

Hubacek said. "The more ambitious CO₂ mitigation targets set for the coastal provinces may lead to additional outsourcing and carbon leakage if such provinces respond by importing even more products from less developed provinces where climate policy is less demanding."

The researchers warn that without policy attention to this sort of interprovincial carbon leakage, the less developed provinces will struggle to meet their emissions intensity targets while the more developed provinces might achieve their own targets by further outsourcing. Consumption-based accounting of emissions can thus inform effective and equitable climate policy within China.

"The same effect occurs on a global scale, as richer countries outsource polluting industries and manufacturing to developing countries—including China—where costs are lower and regulations may be more lax," says Feng, "we must reduce CO₂ emissions, not just outsource them.

"Developed regions and countries need to take some responsibility, providing technology support or investment to promote cleaner, greener technology in less-developed regions. Current attempts to tackle climate change may simply encourage richer countries to outsource their emissions to poorer regions of the world, placing an unfair and unmanageable burden on those regions," he says.

"Using the consumption based approach not only helps us to distinguish between regions but also traces the responsibility back to consumers," adds Hubacek. "Thus we want to use our research to inform consumers

and decision makers to inform them about their carbon consequences of their choices but also policy makers who for example low income households would be affected by different climate policies."

More information: *Global Environmental Change* article is in press but available as a corrected proof online:

www.sciencedirect.com/science/.../S0959378013000721

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