Research reveals carbon footprint caused by China's irrigation system

March 13 2012

China's groundwater irrigation system is responsible for polluting the atmosphere with more than 30 million tons of CO_2 per year -- according to research from the University of East Anglia. Credit: Jinxia Wang, Centre for Chinese Agricultural Policy (CCAP)

China's groundwater irrigation system is responsible for polluting the atmosphere with more than 30 million tonnes of CO_2 per year – according to research from the University of East Anglia.

Groundwater used for crop irrigation in China has grown from 10 billion cubic metres in 1950 to more than 100 billion today.

A research paper, published today in *Environmental Research Letters*, estimates that the pumping systems which support this immense

irrigation network annually produce 33.1 $MtCO_2e$ (33.1 mega tonnes of carbon dioxide equivalent).

China is the largest greenhouse gas emitter in the world, with around 17 per cent of emissions coming from agriculture. Irrigated agriculture in China produces 70 per cent of the country's grain. But it takes some 500 litres of water to grow the wheat for one small loaf of bread.

Pollution is caused by the huge amount of energy needed to pump water from underground – in some areas from an average depth of 70 meters. This research is the first to calculate how much pollution is being created.

It is the result of a collaboration between the university's School of International Development, the UEA Water Security Research Centre and the UEA-based Tyndall Centre for Climate Change Research, with the Centre for Chinese Agricultural Policy, the Chinese Academy of Agricultural Sciences and Cranfield University.

The research team used extensive survey data collected from 366 villages in 11 provinces. They up-scaled these results to calculate the emissions created by groundwater pumping across China's remaining 20 provinces.

The results account for more than 0.5 per cent of China's total CO_2 emissions. For comparison, this is similar to the total amount of CO_2 that the whole of New Zealand emits in one year.

Prof Declan Conway, from UEA's school of international Development and the Tyndall Centre, said: "Generally, there is a surprising gap in research knowledge about the energy required for water use. Irrigation is fundamental to food security in China as it is the world's second largest irrigator. It is vital that we understand the sources of greenhouse gas

emissions in agricultural water use to design and implement sustainable policies for the future."

Prof Jinxia Wang of the Centre for Chinese Agricultural Policy said: "Improved access to pumping technology, cheap energy and the ability to directly control water availability has led to a massive expansion of groundwater pumping across large parts of Asia, particularly in China and India. The small scale of pump operations makes regulation and control of use extremely difficult."

Sabrina Rothausen from UEA added: "Water scarcity in China is already driving policies to improve water conservation so it is crucial to identify water-energy trade-offs and potential co-benefits. Our results suggest that an integrated policy approach could promote considerable water and energy savings."

With a growing population, climate change and socio-economic transition, the report predicts the problem will worsen unless action is taken to improve China's water management policies.

More information: J. Wang, S.G.S.A Rothausen, D. Conway, L. Zhang, W. Xiong, I.P. Holman and Y. Li (2012) China's water-energy nexus: greenhouse-gas emissions from groundwater use for agriculture. *Environmental Research Letters* 7 014035.

Provided by University of East Anglia