Researchers estimate amount of CO2 released into atmosphere by rivers and streams

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Colorado River, Colorado. Credit: Peter Raymond

(Phys.org) —A large international team of environmental scientists has combined their resources to make a reasonable estimate of the amount of CO2 that is transferred from inland waterways to the atmosphere. In

their paper published in the journal *Nature*, the team describes the resources and techniques they used to measure global inland water surface area, CO2 concentrations in surface waters and the velocity of gas transfer between the water and the atmosphere—all of which were used to make an estimate.

In order to understand the impact that we humans are having on the atmosphere, it's necessary to separate what occurs naturally from what we cause to happen. As part of that effort, scientists around the world have been attempting to measure the amount of CO2 emitted into the atmosphere from all known natural sources. One, of those sources, is water. The ocean emits CO2, of course, as do lakes and reservoirs—estimates for those have already been made. Less well understood is how much CO2 is transferred by water moving in rivers and streams. To find out, the researchers undertook an exhaustive study of data that has already been captured by other efforts. Sources included imagery from space shuttle missions, river and stream monitoring sites and data collected by climate monitoring efforts and stored in databases.

Taken together, the researchers calculated what they believe to be a reasonable estimate of the total global surface area of inland waterways (excluding wetlands because each appears to be unique in several ways). They then applied known formulas for calculating likely CO2 concentrations in those waterways and the velocity of gas transfer and came up with a grand total of 1.8 gigatonnes of CO2 being transferred into the atmosphere each year—a number that is approximately double that of the previous estimate made by an earlier team—and far higher than for non-moving water such as lakes and reservoirs which have been estimated to emit approximately 0.32 gigatonnes of CO2 per year. The new estimate is believed to be closer to reality as the study was far more exhaustive. Also, just for comparison, human activities emit approximately 36 gigatonnes of carbon into the atmosphere each year.

Having come up with an estimate for inland waterways the researchers next plan to try to better understand how and why so much carbon ends up in them and why so much is emitted into the atmosphere.

More information: Global carbon dioxide emissions from inland waters, *Nature* 503, 355–359 (21 November 2013) DOI: 10.1038/nature12760

Abstract
Carbon dioxide (CO2) transfer from inland waters to the atmosphere, known as CO2 evasion, is a component of the global carbon cycle. Global estimates of CO2 evasion have been hampered, however, by the lack of a framework for estimating the inland water surface area and gas transfer velocity and by the absence of a global CO2 database. Here we report regional variations in global inland water surface area, dissolved CO2 and gas transfer velocity. We obtain global CO2 evasion rates of 1.8 petagrams of carbon (Pg C) per year from streams and rivers and 0.32 Pg C yr−1 from lakes and reservoirs, where the upper and lower limits are respectively the 5th and 95th confidence interval percentiles. The resulting global evasion rate of 2.1 Pg C yr−1 is higher than previous estimates owing to a larger stream and river evasion rate. Our analysis predicts global hotspots in stream and river evasion, with about 70 per cent of the flux occurring over just 20 per cent of the land surface. The source of inland water CO2 is still not known with certainty and new studies are needed to research the mechanisms controlling CO2 evasion globally.