# Prairie soil organic matter shown to be resilient under intensive agriculture

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(PhysOrg.com) -- A recent study has confirmed that although there was a large reduction of organic carbon and total nitrogen pools when prairies were first cultivated and drained, there has been no consistent pattern in these organic matter pools during the period of synthetic fertilizer use, that is, from 1957-2002.

"For these prairie soils, some of the best in the world, declines in organic matter from cultivation were likely completed by the 1950s, and since then organic matter pools have remained relatively constant under modern production practices," said U of I biogeochemist Mark David who led the study.

Carbon and nitrogen pools in soil, which are part of organic matter, are important because their alteration can affect greenhouse gases, the sustainability of agricultural production, and are a measure of soil quality. "Monitoring the change through time is important, but can present difficulties because short term, soil-landscape variability accounts for considerable differences in soil organic matter, and it is slow to respond to management shifts," David said.

"Most of the decline in organic matter occurred in the top 50 centimeters of soil, with evidence that carbon and nitrogen moved from the upper soil layers to deeper ones, possibly enhanced by tile drainage," David said.

The study utilized previously sampled fields, archived soil samples, and

made use of prairie remnants to document changes in soil carbon and nitrogen pools in response to agricultural production.

Another member of the research team, soil scientist Robert Darmody said that much of the early documentation was from samples collected in central Illinois from 1901 to 1904 by Cyril Hopkins, who was head of the Department of Agronomy at the time. "His meticulous field notes and maps, laboratory analysis books, and archived samples allowed us to resample fields to compare current soil carbon and nitrogen pools in these fields to those from 100 years earlier."

"Actual archived soil samples, in glass jars, allowed modern chemical techniques to be compared to early ones," Darmody said. Soil Conservation Service sampling sites and data from 1957 were also utilized, so that soil changes during the modern production era of fertilizers, pesticides, and hybrids could be evaluated. In addition, current prairie remnants were sampled and matched with nearby agricultural fields.

"Analytical values of carbon and nitrogen on the archived soil samples were found to match extremely well with modern analytical techniques," said environmental scientist Greg McIsaac. "Without the stored samples, it would have been difficult to know if the data could be compared to modern analyses." McIsaac noted that the University of Illinois has a unique and large archive of soil samples, numbering in the thousands, from this early period and throughout the 20th century, including samples from the Morrow Plots.

David said that over long-time periods, locations of sampling sites are lost, and few samples are archived. "Although the conversion of prairie soils to agricultural fields in the Midwest has been documented to reduce organic matter, there is relatively little information across decades on the changes and profile distribution of organic carbon and nitrogen in

artificially drained agricultural soils."

Results from the study are published in the 2009 January-February issue of the *Journal of Environmental Quality*.

Source: University of Illinois at Urbana-Champaign

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