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# Increased Use of Chemicals in Agriculture Worldwide Seen as Major Environmental Threat

Agriculture will be a major driver of global environmental change over the next 50 years, rivaling the effect of greenhouse gases in its impact, according to a new study published in this week's journal Science.

"The global impact of agriculture will be at least as great as climate change," said lead author David Tilman, visiting researcher at the National Center for Environmental Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara. "We have to find wiser ways to farm."

As an NCEAS working group, the co-authors spent eight months gathering all the data they could find on the global impact of humans mediated by anything except climate change. Agriculture turned out to be the largest.

World population, expected to be 9 billion (double the present population) by the year 2050, will require the conversion of natural ecosystems covering an area larger than the size of the United States including Alaska, as demand for food doubles. This expansion of agricultural land is expected to occur mostly in Latin America and sub-Saharan central Africa. The authors also explain that additional natural habitat would be lost to urban and suburban development.

"During the first 35 years of the Green Revolution, global grain production doubled, greatly reducing food shortages, but at a high environmental cost," said the authors.

The increase in grain production was accomplished through adding nitrogen, phosphorus and pesticides to the soils which are then carried in run-off into the nearest bodies of water, explain the authors. These nutrients then cause large algal blooms to grow, which use up the oxygen, die, create scum and cause the fish in the area to die. Currently there is a "dead-zone" in the Gulf of Mexico, first discovered by fishermen. This zone is about 50 by 100 miles and is caused by agricultural run-off from the Mississippi Delta. Such "dead zones" are expected to increase world-wide.

Use of fertilizers and pesticides and habitat destruction has also caused a "major extinction event," according to the authors who predict the trend to continue, thus lowering the world's biodiversity and changing its ecology. Ecosystem "services" such as clean drinking water and carbon storage continue to be lost.

"Neither society nor most scientists understand the importance of agriculture," said Tilman. "It's grossly misunderstood, barely on the radar screen, yet it is likely as important as climate change."

He said that those who are trying to farm sustainably are hit economically and it is often the more careful farmers who are squeezed out. "We need to rethink incentives for farmers," said Tilman.

The authors give a number of suggestions using existing knowledge to reduce the environmental impact of agriculture and still increase productivity. "Integrated pest management, application of site- and time-appropriate amounts of agricultural chemicals and water, use of cover crops on fallow lands and buffer strips between cultivated fields and drainage areas and appropriate deployment of more productive crops can increase yields, while reducing water, fertilizer, and pesticide use and movement to nonagricultural habitats," they explain.

They call upon international agencies to aid third world farmers in the transition. Nonetheless, they state, "If global population stabilizes at 8.5 to 10 billion people, the next 50 years may be the final episode of rapid global agricultural expansion. During this period, agriculture has the potential to have massive, irreversible environmental impacts."

Tilman explained that this research project could only have happened at NCEAS where working groups from many institutions are able to assemble and manage

large computer data sets, and take the time to interpret them. "It's the only facility that allows this type of cross-disciplinary integration of data," said Tilman.

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