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### Ethanol and the Elements

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PHOTOGRAPH BY AARON E. PRICE

The VeraSun ethanol plant is near Albion, Neb., a town of approximately 1,800. The plant was designed to be more environmentally-friendly.



# ethanol and the ELEMENTS

Using ethanol in place of gasoline helps to reduce carbon dioxide emissions, but this solution may contribute to the problems.

BY MELISSA DROZDA AND CAROLYN JOHNSEN

**I**t's mid-April in Lincoln, Neb., and Dennis Voldehnal takes his usual afternoon bike route home from work.

He knows something isn't right.

His nose tingles. He snuffles.

His eyes begin to itch, then water, then burn intensely. In a fraction of a second, lungs fill with air, eyes squint, mouth opens, neck muscles tense.

Then he sneezes. He sneezes again.

"It felt like sand hitting my eyes," said Voldehnal, a 53-year-old factory worker.

But it wasn't sand. It was pollen.

"I never had allergy problems like that before," Vodehnal said.

Allergy problems have been blossoming over the last decade. Research shows increased levels of carbon dioxide are partly responsible: More sneezing is caused by more pollen. More pollen is caused by higher levels of carbon dioxide, which warms the earth, boosting pollen production in plants like ragweed.

By burning gasoline in cars, trucks and sport utility vehicles, we contribute to higher levels of CO<sub>2</sub> in the atmosphere.

With about 251 million vehicles on U.S. roads — and numbers steadily increasing — CO<sub>2</sub> emissions are growing.

**S**ome believe ethanol is a solution. Touted as an alternative fuel to reduce America's dependence on foreign oil, ethanol is also promoted as a way to reduce CO<sub>2</sub> levels and global warming. The Renewable Fuels Association says, "Using ethanol in place of gasoline helps to reduce carbon dioxide emissions by up to 29 percent given today's technology."

But this solution may contribute to the problems — both of global warming and of increased human exposure to allergens.

According to researchers at Harvard University, higher levels of carbon dioxide will boost pollen production, and allergy sufferers can expect more sneezing and itchy eyes.

"We are beginning to see some health effects of carbon dioxide build up that we couldn't have foreseen even a few years ago," Paul Epstein, Ph.D., told CBS News. Epstein is one author of the Harvard study, which was published in the June 2006 issue of *Environmental Health Perspectives*.

For the federally funded study, researchers compared concentrations of ragweed pollen under current CO<sub>2</sub> levels with increased levels projected for the future, if levels were to continue to increase at the current rate. Scientists assumed earlier springs caused by global warming contribute to higher pollen levels.

"The clearest sign of global climate change is the earlier onset of spring," the study's lead author, Christine Rogers, Ph.D., told CBS News. "Our goal was to examine the interaction between the lengthening of the growing season and the increase in carbon dioxide."

In fact, the study's findings led the scientists to conclude that "with elevated CO<sub>2</sub>, we predict pollen production will be just as robust in years with late springs as in years with early springs." Higher CO<sub>2</sub> levels pose a public-health concern because "pollen seasons will be more intense and could start earlier than expected."

Ragweed, whose potent pollen causes allergy problems in about 10 percent of the population of

North America, was the subject of the study. The Harvard scientists were also concerned that the combination of the plant's pollen with other pollutants, such as particles of diesel fuel, might "lead to an increase in the frequency or severity of asthma and allergy symptoms."

Although CO<sub>2</sub> doesn't directly affect human health, it directly affects plants; it's the plants that can affect people. Epstein explained some plants grow larger and faster when exposed to higher levels of CO<sub>2</sub>.

CO<sub>2</sub> is what we exhale when we breathe and what plants use, or "inhale," during photosynthesis. CO<sub>2</sub> is also found in carbonated soft drinks, providing the fizz and bubbles in a can of soda. It's a colorless, odorless, non-flammable gas.

But CO<sub>2</sub> is also a greenhouse gas, which means it's naturally part of Earth's atmosphere. In fact, greenhouse gases like CO<sub>2</sub> help create Earth's greenhouse effect because these gases trap energy from the sun and prevent heat from escaping back into space.

With too little greenhouse gas, our world would be a significantly colder place. Too much greenhouse gas could mean drastic changes in global climate and potentially harm our health.

About a quarter of U.S. carbon dioxide emissions come from burning gasoline in the internal-

combustion engines of our vehicles.

The U.S. Emissions Inventory, a yearly report from the Environmental Protection Agency, said vehicles with poor gas mileage contribute the most to CO<sub>2</sub> emissions from vehicles.

The evidence is mixed on whether ethanol can help to lower CO<sub>2</sub> levels.

Ethanol-fueled vehicles emit fewer greenhouse gases than gasoline-fueled vehicles, according to reports published in 2006 and 2007 from Argonne National Laboratory's Center for Transportation Research.

Michael Wang, a researcher at ANL, developed a software model that evaluates alternative fuels from "well-to-wheels." The model showed that vehicles using corn-based E85 instead of gasoline reduced their CO<sub>2</sub> emissions by 18 to 29 percent.

In another 2006 study, Alexander Farrell, professor of energy and resources at the University of California at Berkeley, and others concluded that a switch to corn ethanol reduces greenhouse gas emissions by only 13 percent.

The Farrell study, published in *Science* in January 2006, also assumed that the reduction in emissions varies and depends on how the ethanol is made. Does it come from a factory that's powered by coal or natural gas? The study's authors concluded that coal-powered ethanol plants produce more greenhouse gases than those fueled by natural gas. Suggesting that cellulosic ethanol would do a better job than corn-based ethanol of reducing greenhouse gases, the authors said scientists need more sophisticated methods to fully evaluate the environmental effects

of ethanol production and use. However, the authors were upbeat about the future, saying that a biofuels industry “could play a key role in meeting the nation’s energy and environmental goals.”

Two more recent studies have considered the effects on greenhouse gas emissions if forests and grassland were converted into land to grow crops for ethanol. Soil and vegetation, including trees and grass, are carbon “sinks,” in that they absorb CO<sub>2</sub>, the primary greenhouse gas. But they release it when plowed or burned to grow crops.

**T**hese two studies, published in Science in February 2008, added the land-

use factor, more specifically, the increase in land used to grow plants, like corn, to make biofuels.

Removing natural vegetation means greater release of stored CO<sub>2</sub> and less CO<sub>2</sub> storage in the future.

One of the 2008 studies, by Joseph Fargione — regional science director at the Nature Conservancy — and collaborators, found land-use change for growing corn for ethanol produced in the central U.S. had a carbon debt of 93 years. This means nearly a century would have to pass before the CO<sub>2</sub> benefits of using ethanol as a vehicle fuel would be realized.

In the other study, Timothy Searchinger, a senior fellow at Georgetown’s Environmental Law and Policy Institute, looked at worldwide land-use change and concluded the carbon debt of ethanol production is 167 years. In other words, because of the large amount of CO<sub>2</sub> initially released from clearing land by plowing or burning, it would take 167 years to see the CO<sub>2</sub> reduction benefits of ethanol.

The authors of this study said previous studies did not account for “carbon emissions that occur as farmers worldwide respond to higher prices and convert forests and grassland to new cropland ...”

Whether CO<sub>2</sub> emissions come from burning gasoline or ethanol in our cars, trucks and SUVs or

from converting land to grow crops for biofuels, carbon dioxide is something that can’t be ignored.

If levels aren’t kept in check, CO<sub>2</sub> will increase global warming rates, intensify pollen levels and consequently worsen symptoms for allergy and asthma sufferers.

Yet improvements in biofuel production might ultimately reduce carbon debts, meaning the climate could receive the positive effects on global warming that supporters of ethanol have promised.

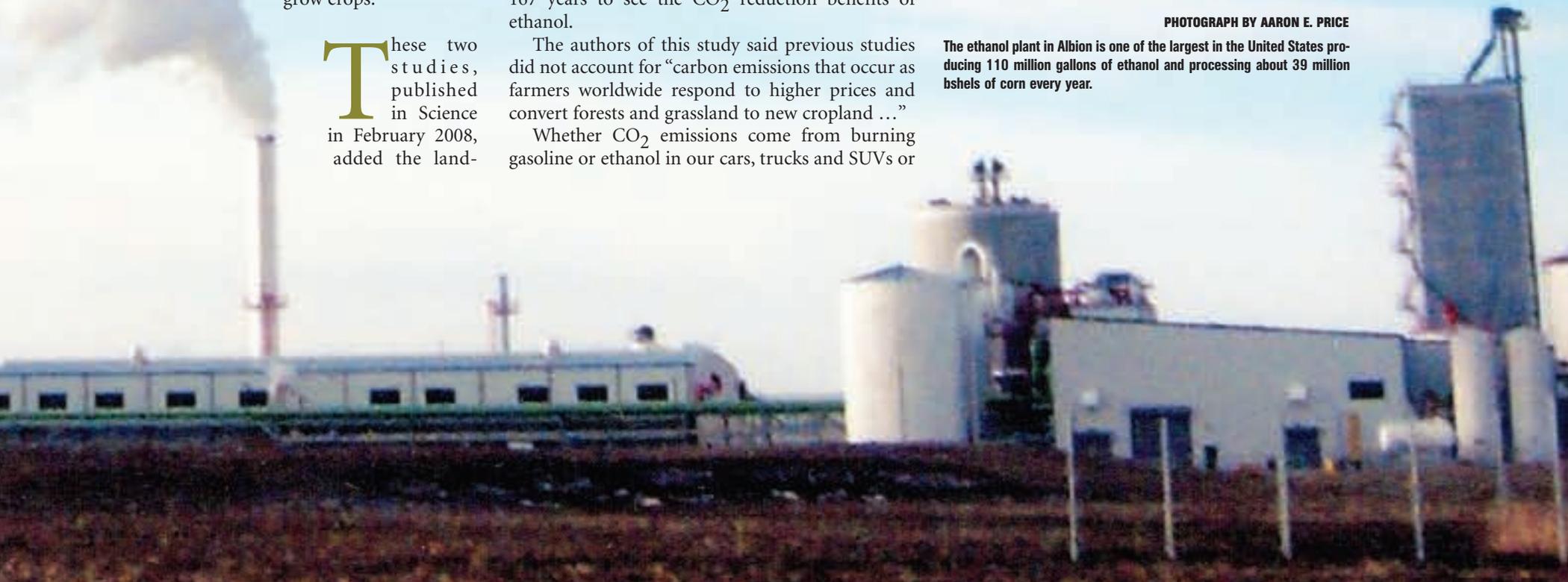
That outcome might make life easier for people like Dennis Vodehnal and his newfound allergies. Vodehnal, the bicyclist, said he’s not sure what the best solution is to combat fuel demands and climate change, but he does know about the problem.

“It’s not because of us,” he said, looking at his wife, Wanda.

“We ride bikes.” 🚲

PHOTOGRAPH BY AARON E. PRICE

The ethanol plant in Albion is one of the largest in the United States producing 110 million gallons of ethanol and processing about 39 million bushels of corn every year.



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