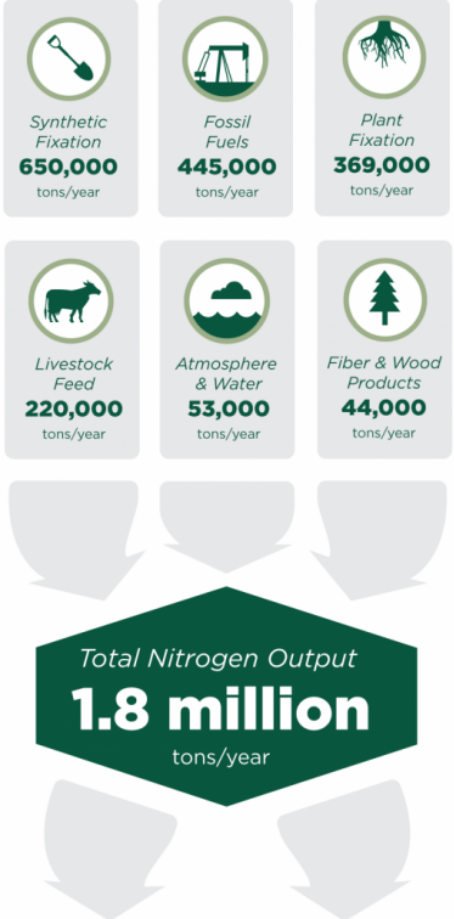


California nitrogen assessment shows the state of the science on nitrogen use and pollution

August 10 2016, by Kat Kerlin

NITROGEN CYCLE

— WHERE NITROGEN COMES FROM —



— WHERE NITROGEN GOES —



The ins and outs of nitrogen in California. Credit: Tom Watts/UC Davis

Nitrogen is essential for agriculture but also has health and environmental impacts. [The California Nitrogen Assessment](#), a new report from the Agricultural Sustainability Institute at the University of California, Davis, presents a big picture of the scale and impacts of nitrogen in the state. The report, published by UC Press, offers a scientific foundation to develop practices and policies that balance nitrogen's benefits and harm.

It's easy for nitrogen to become too much of a good thing, according to the report, which is the first state-level nitrogen assessment. Excess nitrogen can pollute groundwater and air, and impacts the environment, human health and climate change.

The report shows that excess nitrogen in the state comes primarily from agriculture and fuel combustion.

"This problem was created by all of us," said lead author Tom Tomich, director of the Agricultural Sustainability Institute at UC Davis.

"Nitrogen is an issue that affects and is affected by every Californian."

Nitrogen in balance

The seven-year, multi-institutional assessment identifies how much nitrogen enters the state, where it is used, and its eventual fate. It consolidates existing scientific knowledge and weighs options for addressing nitrogen management.

"Many programs in California have been recently put in place to help balance the benefit and harm of nitrogen use," Tomich said. "The California Nitrogen Assessment hopes to contribute to long-term solutions and we see farmers as the leaders in positive change."

Agriculture the major source of California's nitrogen

Each year, about 1.8 million tons of nitrogen enter California.

Agriculture represents the largest source of California's nitrogen imports from synthetic fertilizer, livestock feed, and nitrogen-fixing crops, which pull nitrogen from the air and convert it into a useable plant nutrient.

Nitrogen fertilizer helps California produce 21 percent of the nation's dairy commodities and more than half of the nation's fruits and vegetables.

However, vegetable and fruit crops throughout the state use only half of the nitrogen applied to them on average. For livestock, only about a quarter of the nitrogen in animal feed becomes meat or dairy products. The remaining 75 percent becomes manure, which can emit nitrogen into the air as ammonia, a known air pollutant.

Much excess nitrogen from crops leaks into soil and eventually the state's groundwater. Sixteen percent of the state's net nitrogen imports each year accumulate in groundwater, and 11 percent of nitrogen from crop land and livestock is lost as air pollution.

Nitrogen in groundwater linked to health issues



Tom Tomich, director of the UC Davis Agricultural Sustainability Institute and lead author of *The California Nitrogen Assessment*, kneels in an alfalfa field. Credit: Gregory Urquiaga/UC Davis

Nitrogen leaches into groundwater as nitrate, which has been linked with blue-baby syndrome in infants, adverse birth outcomes and various cancers. While most adults consume more nitrate through food than through drinking water, people who rely on contaminated wells may take in the majority of their nitrate through drinking water.

Parts of the state regularly fail to meet federal drinking water standards for nitrates, and previous reports have shown low-income Latino communities in agricultural regions are the most exposed to groundwater nitrate contamination.

Excess nitrogen in the environment can have detrimental impacts on crop yields, native species and biodiversity, as well.

Nitrogen, fossil fuels and air pollution

Fossil fuel combustion is responsible for nearly a quarter of the nitrogen coming into the state in the form of nitrogen oxides, which contribute to ozone formation, and ammonia, a component of particulate matter.

Well-established scientific evidence links ozone and particulate matter to poor respiratory and heart health.

Much of the nitrogen oxides and ammonia produced in California are transported downwind from California, making the state a major exporter of nitrogen air pollution.

A very small amount of the state's nitrogen, 2 percent, is released as nitrous oxide, a potent greenhouse gas. Nitrous oxide emissions account for 4 percent of California's total greenhouse gas emissions.

Emissions have declined since 1980 as regulations have pushed fuel efficiency advancements, but nitrogen-related air pollutant levels still exceed state recommendations in many areas.

The path forward

The dispersed, "non-point" nature of [nitrogen pollution](#) makes achieving solutions especially challenging. A one-size-fits-all approach will not work for managing nitrogen.

The report highlights practices farmers and ranchers can use to decrease nitrogen losses and save money, such as reducing nitrogen application rates and timing nitrogen application closely with irrigation, practices many farmers in California already are using.

"California has amazing resources to address this issue," said Rich Rominger, a California farmer and former director of the California Department of Food and Agriculture. "The state has skilled and

motivated farmers and a university system that can continue to dive deep into our unanswered questions about nitrogen. California is often looked to as both an agricultural innovator and an example of strong environmental policy. How we deal with [nitrogen](#) can enhance our leadership in these areas."

Provided by UC Davis

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