Explore our newsletters

Analysis and Environment

Cannabis has a shocking environmental cost – here's how to fix it

Growing cannabis can consume astonishingly large amounts of electricity and water, as well as damage ecosystems, but it doesn't have to be that way

By Jeremy Hsu

17 October 2023

Cannabis farms can compete with communities for water

inga spence/Alamy

When California legalised the recreational use of cannabis in 2016, Houston Wilson saw an opportunity to study the plant's environmental impact. To say his research has been challenging would be an understatement. He was refused official permission to visit farms in 2018 because some of his funding comes from US federal sources – and cannabis is still illegal at the federal level. Even meeting marijuana growers in neutral venues proved difficult, because some farmers were still unwilling to talk after operating outside the law for years. "There was some degree of hesitation," he says.

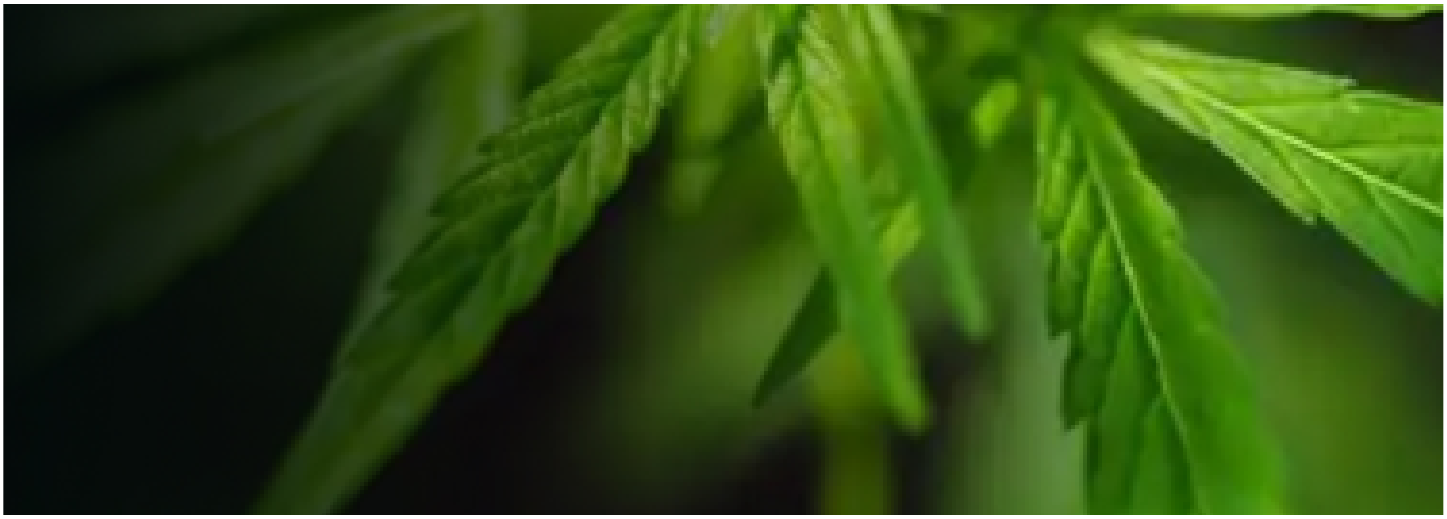
The difficulties experienced by Wilson, who is at the University of California, Riverside, are typical of a broader problem. Cannabis was one of the first crops cultivated by humans some 12,000 years ago. But researchers are still playing catch-up when it comes to evaluating the environmental impacts of cultivating it.

What little we do know suggests the environmental costs can be surprisingly high. A 2012 study in the US, conducted while cannabis was still illegal in all 50 states, concluded that indoor marijuana production alone may consume 1 per cent of the nation's electricity.

Producing cannabis outdoors, particularly by unlicenced growers, brings its own problems. It can provide unwelcome competition for scarce water resources and threaten local wildlife through the use of strong pesticides.

The issue may be getting worse. "I think with legalisation [in California] there was an expectation that the [environmental] issue would subside quickly, and I think it did the opposite," says Greta Wengert at the Integral Ecology Research Center in California.

But, many researchers agree, it doesn't have to be this way. From a land-use perspective, cannabis cultivation has a tiny footprint. For instance, California – the fifth largest supplier of agricultural products in the world – has an estimated 109 billion square metres of agricultural land. Of this, an estimated 8 million square metres – or less than 0.01 per cent – is used to grow cannabis.



The science of cannabis

As the use of marijuana and its compounds rises around the world, New Scientist explores the latest research on the medical potential of cannabis, how it is grown and its environmental impact, the way cannabis affects our bodies and minds and what the marijuana of the future will look like.

Explore our coverage

What's more, there is no reason why cannabis farming should carry an unusually high environmental burden. "Cannabis is not inherently more detrimental to the environment than almonds or grapes or lettuce," says Wilson, whose research aims to help cannabis growers manage pests without using environmentally harmful chemicals.

The trouble is, years of hiding from law enforcement officials during prohibition has shaped the industry, encouraging cannabis growers to adopt energy-intensive or environmentally damaging practices. For instance, to escape scrutiny, many growers have had to operate indoor farms that require inefficient artificial lighting.

Directly measuring the energy use and carbon footprint of such farms is extremely challenging, but researchers are attempting to do it anyway. In 2012, a large-scale study by Evan Mills at the Lawrence Berkeley National Laboratory in California estimated that indoor cannabis production in the US consumed about 4 per cent of all electricity used in US agriculture at the time – an estimated 1 per cent of the nation's total electricity supply. It generated carbon emissions roughly equivalent to driving 3 million average-sized cars for a year.

More recently, a 2021 study by a team at Colorado State University modelled the energy usage and carbon footprint of indoor cannabis farms. It found that those in the US Midwest and Mountain West regions can be particularly carbon emissions-intensive. This is partly because climate conditions in these areas are less suited for cannabis cultivation. As a result, more energy is required to power the artificial grow lights, heating, ventilation and air conditioning systems that provide the optimal conditions for cannabis growth.

This research may seem to suggest that cannabis growers should cut their environmental impact by farming outdoors – but the science is more complicated. Even before some countries and US states legalised recreational marijuana, many growers operated outside. However, still keen to avoid scrutiny from the law, they tended to set up farms in remote wilderness areas – sometimes even within environmentally-protected US national parks. Here, they liberally used banned pesticides and occasionally diverted local streams, disrupting sensitive ecosystems.

Crucially, marijuana legalisation has not eliminated the illegal cannabis market – or its profits. Six years after California first legalised the drug, a 2022 investigation by the *Los Angeles Times* used satellite imagery to show that unlicenced growers outnumbered licenced growers by as many as 10 to one in the state's biggest cannabis cultivation areas.

"With state legalisation, it seemed the private yet un-permitted or illegal market just grew," says Wengert.

A cannabis plant is no thirstier than a tomato plant. But water theft attributed to illegal cannabis farms became an especially sore spot for California's residential communities and other agricultural producers during intense drought conditions in 2021. At the time, California's state water board estimated that approximately 80 per cent of California's 30,000 cannabis farms were unlicenced.

A legal cannabis farm in Santa Barbara County, California
George Rose/Getty Images

Meanwhile, the rampant use of pesticides by some illegal cannabis growers in California has contributed to wildlife deaths, says Wengert. She and her colleagues identified the fisher (*Pekania pennanti*) – a locally endangered mammal belonging to the same family as weasels and otters – as especially vulnerable to the anticoagulant rodenticides used by unlicenced marijuana farms operating in the southern Sierra Nevada region.

Wengert's follow-up research, funded by the US Fish and Wildlife Service, showed how unlicenced growers often choose cultivation sites in regions that overlap with habitats of several threatened species, including the northern spotted owl (*Strix occidentalis caurina)* and Humboldt marten (*Martes caurina humboldtensis*). Wengert was also involved in a 6-year-long monitoring study, which discovered surface water contamination downstream from illegal cannabis farms within four national forests in California.

A single illegal operation in a national park can cover between 2000 and 12,000 square metres in total, says Mourad Gabriel at the US Forest Service's Pacific Southwest Research Station in California. He adds that US government agencies have identified more than 6000 illegal cannabis farms on public lands across the US and more than 3800

in California alone. Given the likelihood that more illegal farms have escaped detection, California may have more than 6000 such sites and the US may have more than 8000, he says.

New Scientist

Follow this series

Sign up to receive emails about the science of cannabis

Sign up

However, newer technologies are helping US government agencies find and shut down the illegal farms. Using satellite imagery and computer models, it is possible to predict public land areas where illegal growers are likely to be found. Researchers at the Integral Ecology Research Center, meanwhile, are working with the US Forest Service to develop AI capable of identifying cannabis cultivation site patterns from Google Earth satellite images.

Despite the modest success that agencies have had detecting and removing these farms, Gabriel warns that they are falling behind in the race to eradicate all the new illegal operations appearing each year. He calculated that the agencies could "address each and every cultivation site" if the US Congress appropriated an additional $240 to $280 million – about the cost of suppressing one major wildfire.

"Anybody can do the math to see that we're treading water, and our neck is above water," says Gabriel. "But in several years, we'll be below water."

Even as moves to legalise the sale and recreational use of cannabis continue in the US and elsewhere, funds for cannabis research remain limited. What's more, government restrictions continue to make it challenging for many researchers to legally get their hands on cannabis samples, which can make it difficult to assess the environmental impact of growing the plant. For instance, Wilson's research on pesticide use by cannabis farmers is complicated by his inability to obtain samples.

“Now I think I do have some clearance to go visit farms and collect insects,” he says. “I just can’t bring any plant material back.”

Read more

Is cannabis today really much more potent than 50 years ago?

“Because it’s been illegal for so long, there’s just very little research about the agronomy of the plant,” says Ariani Wartenberg at the Leibniz Centre for Agricultural Landscape Research in Germany.

In a 2021 review paper, Wartenberg and her colleagues found relatively few scientific studies about the environmental impacts of cannabis before 2012 – the year that Colorado and Washington became the first US states to legalise its use recreationally.

One bright spot for research has been California, where the state’s 2016 ballot measure legalising recreational marijuana also set aside $20 million annually for public universities to research the impacts of this decision. However, few studies have explored the environmental impacts of cannabis beyond the US border, says Wartenberg.

For example, African countries account for about 25 per cent of the world’s commercial cannabis production. “Whereas cannabis is largely grown in greenhouses in highly controlled environments in Europe and America, in Africa, it generally grows in the wild or in the open environment,” says Godwin Anywar at Makerere University in Uganda. He co-authored a 2022 review of cannabis cultivation across Africa which highlighted huge knowledge gaps in assessing how these open-air farms impact local ecosystems.

A broader movement to legalise recreational cannabis could spur much-needed research projects while creating a regulatory environment suitable for greener marijuana cultivation. In the US, for example, Mills has written in the past that local officials could incentivise well-regulated outdoor cannabis cultivation with tax breaks and better licencing fees to make outdoor cannabis operations less expensive and easier to establish. He also argued that a federal move to allow transporting cannabis across state lines could tilt the market in favour of cannabis growers based in parts of the country where the climate is most suitable for growing the plant outdoors, therefore lowering its environmental impact.

Read more

But given the current landscape, what are the best options for cannabis consumers who want to buy the most environmentally friendly products? According to Van Butsic at the University of California, Berkeley, the short answer is to look for products sourced from a licenced cannabis grower who operates outdoor fields or greenhouses. Not only will these growers avoid the energy costs and carbon emissions associated with indoor grow lights, they will also undergo routine official inspections to ensure their operation complies with environmental regulations.

"As a consumer, I would probably feel good about purchasing any legally grown cannabis in California from an outdoor producer," says Butsic. "If you're purchasing cannabis that's not from a regulated source, there is the potential for it to be produced in ways that negatively impact the environment."

Topics:
Cannabis

More from *New Scientist*

Explore the latest news, articles and features

Health

Is cannabis today really much more potent than 50 years ago?

News Free

Society

Driving under the influence of cannabis: How high is too high?

Analysis Subscriber-only

Mind

Psychedelic health claims may be promoting risky self-medication

News Free

Technology

AI can detect if you have recently smoked cannabis

News Subscriber-only

Popular articles

Trending New Scientist articles

1 **Seven wonders of the Milky Way: An astronomer's guide to the galaxy**

2 **Mathematician warns US spies may be weakening next-gen encryption**

3 **High-dose vitamin D may lower your risk of going to hospital**

4 **Cannabis has a shocking environmental cost – here's how to fix it**

5 **Ukrainian AI attack drones may be killing without human oversight**

6 **Student uses AI to decipher word in ancient scroll from Herculaneum**

7 **The quantum experiment that could help find evidence of the multiverse**

8 **How to see the Draconid meteor shower peak tonight**

9 **Early humans lived in Ethiopian highlands 2 million years ago**

10 **Paris's bedbug problem is probably no worse than other major cities**

Download the app

Download on the App Store

GET IT ON Google Play

Find us on social media

- Instagram
- Facebook
- X / Twitter
- Tiktok
- LinkedIn

Subscriptions

- Subscriber benefits
- Gift
- Student
- Educational
- Corporate

Support

- Help
- About us
- Advertise
- Write for us

Tools

- Events
- Science Jobs
- CoLab
- Syndication
- RSS feeds

Legal and privacy

- Contact us
- Privacy policy
- Cookie policy
- Terms & conditions
- Cookie Settings

© Copyright New Scientist Ltd.

Back to the top