

temperatures of the planet's surface – some airborne microbes could survive.

Before seriously considering that possibility, scientists are eager to make sure that phosphine really is present on Venus. Not everyone is yet convinced by the team's observation. That's partly because the researchers identified only one absorption line for phosphine in their data, says Matthew Pasek, a cosmochemist at the University of South Florida in Tampa. "Someone else needs to confirm it."

"The atmosphere and the clouds are the platform for life."

Astronomers are now hoping to follow up on the detection using other telescopes on Earth. "We are proposing to use two instruments," says planetary scientist Jason Dittmann at the Massachusetts Institute of Technology, who plans to conduct observations with Sousa-Silva. One of the instruments is at the NASA Infrared Telescope Facility in Hawaii; the other is on NASA's Stratospheric Observatory for Infrared Astronomy, a plane that carries a telescope.

Observations in the infrared and other parts of the spectrum will enable scientists to look for other absorption lines associated with phosphine, providing a way to verify its presence. They could also offer more data on where the phosphine is located, and how its levels vary over days and weeks. Dittmann's team had hoped to observe Venus in July 2020, but the coronavirus pandemic has pushed its telescope time back. "We're hopeful we'll start getting data in the near future," he says.

Flying visit

Away from Earth, other plans are afoot. Three missions are scheduled to fly close to Venus in the coming months: Europe and Japan's BepiColombo spacecraft, on its way to Mercury, and the European Space Agency's Solar Orbiter and NASA's Parker Solar Probe, both on their way to the Sun.

Observations by these spacecraft are advantageous because they would not be constrained by Earth's atmosphere. But the crafts' instruments are designed to look at other things, such as the surface of Mercury or the Sun, so it's not clear whether they have the right sensitivity to detect phosphine in the Venusian atmosphere.

BepiColombo has a slim chance of detecting the gas in a fly-by this October, and a better chance next August, with its infrared instrument. The Parker Solar Probe, too, might be able to make a detection, with an instrument designed to study solar particles. "It is a low probability, but I would not completely rule it out," says Nour Raouafi, an astrophysicist

at the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, who is the project scientist on the mission.

There is also a spacecraft currently orbiting Venus: Japan's Akatsuki mission, which entered orbit in 2015 and is studying Venus's weather and searching for volcanism. Although it lacks the instrumentation required to spot phosphine directly, it could help in other ways. "The atmosphere and the clouds are the platform for life," says project scientist Takehiko Satoh, a planetary scientist at the Japan Aerospace Exploration Agency in Sagami. "We can provide information about that."

Future missions

More promising are likely to be missions still in development, which could be altered to support the detection of phosphine. The discovery strengthens the case for such missions, says Jörn Helbert at the German Aerospace Center, who is a member of the BepiColombo team.

The Indian Space Research Organisation (ISRO) has a Venus orbiter called Shukrayaan-1, planned to launch in 2025. ISRO did not respond to *Nature's* request for comment

about its plans for Venus. But Sanjay Limaye, a planetary scientist at the University of Wisconsin–Madison, says that ISRO has enough time to reconsider its instruments. "They would be mistaken if they don't see that opportunity," he says.

In the meantime, if astronomers can confirm the detection of phosphine, they will want to rule out other plausible production methods before considering that it is being made by living organisms. That will include creating models to investigate non-biological routes of production, and conducting laboratory experiments to look for chemical pathways that were not considered in the initial study. "Modelling is a reasonable response right now," says Pasek. "Most chemistry that we think of for Earth is dominated by water. On Venus, that's not the case. So there's a lot of experiments that no one has done."

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3. Seager, S. et al. *Astrobiology* <https://doi.org/10.1089/ast.2020.2244> (2020).

TRUMP'S SUPREME COURT PICK COULD AFFECT SCIENCE

Amy Coney Barrett is likely to influence environmental regulation and agency transparency.

By Nidhi Subbaraman

Amy Coney Barrett, a conservative legal scholar, appeals-court judge and law professor, is US President Donald Trump's pick for a seat on the country's Supreme Court. If approved by the Senate, Barrett would tilt the already conservative-majority bench further to the right. That in turn could limit the federal government's power in environmental regulation, temper the influence of federal science agencies in highly technical court cases and change the transparency required of such agencies, say legal scholars interviewed by *Nature*.

Composed of nine justices, the Supreme Court has the final say in disputes over how US law is interpreted and administered. Currently, five of its justices are conservative, and three are more liberal; Barrett would replace liberal justice Ruth Bader Ginsburg, who died on 18 September of complications from pancreatic cancer.

Although Ginsburg was best known for using

the law to expand women's rights, she leaves behind a legacy of rulings that protect the environment. For instance, her vote in a landmark 2007 dispute deemed that greenhouse gases such as carbon dioxide are pollutants and can therefore be curbed under the Clean Air Act. That 5–4 vote gave the US Environmental Protection Agency (EPA) the responsibility to regulate against climate change.

Barrett's track record on the environment and on science is unclear because it is rare for the appeals court she oversaw to get such cases, says Robin Craig, an environmental-law scholar at the University of Utah College of Law in Salt Lake City. "She's a bit of a cipher, particularly in the science-related areas of law."

But legal scholars expect that if Barrett is sworn in, the resulting powerful conservative majority is likely to rule in favour of challenges against environmental regulation. And they think science agencies such as the EPA could see their ability to impose rules on industry weakened.

"I think it pretty much leaves the world with



US President Donald Trump named judge Amy Coney Barrett as his choice for the court.

more climate change and fewer wetlands and less biodiversity,” says Daniel Farber, an environmental-law scholar at the University of California, Berkeley. “From my point of view, it’s a setback – and it’s a setback that will probably be with us for a generation or more.”

No matter who wins the US presidential election in November, Farber expects environmental cases to make their way to the Supreme Court over the next few years.

Environmental groups and various US states have challenged the Trump administration’s rollbacks of certain regulations, including the removal of methane-emission limits from oil and gas companies. The cases that these groups have brought forward are now being considered by lower courts in the United States. If Trump wins a second term, they are likely to travel to the top court. If former vice-president Joe Biden wins the November election (see page 177), his administration would probably attempt to strengthen environmental regulations, only to be challenged by industry heavyweights – landing such cases on the Supreme Court’s docket anyway.

“They’re such important issues that I think it’s highly likely that the Supreme Court will decide them,” Farber says.

Scientific ‘deference’

Cases that involve US science agencies could be decided differently with Barrett on board because of a shift in opinion about a principle of judicial review, legal scholars say. Liberal justices, including Ginsburg, have favoured a principle called ‘deference’. When reviewing a technical dispute, they have used deference to give priority to the relevant

agency’s interpretation of a law or to its actions, acknowledging that its employees are experts. For example, in a 1985 case, the Supreme Court accepted the Army Corps of Engineers’ view that a disputed wetland must be regulated under the Clean Water Act, on the basis of a hydrological analysis. Some conservative justices have been critical of this tendency – for example, Neil Gorsuch has argued that it is the court’s role, rather than an agency’s, to interpret the law. Law scholars expect that Barrett could follow suit.

“She’s a bit of a cipher, particularly in the science-related areas of law.”

If the Supreme Court’s position on deference shifts, rather than taking at face value an agency’s position on a statute, judges throughout the United States might be left to parse scientific details in a case and weigh the arguments of the agency and its opponents. Judges have appointed scientific consultants to assist them in past cases, but that approach seems like a misuse of resources when agencies have long-term employees with decades of experience who can offer their views, says Craig.

She adds: “Why are we bothering to build up this agency expertise, science and understanding, only to not take it seriously when the rubber meets the road in court?”

After a US president names a nominee for the Supreme Court, candidates take on average about 68 days to be confirmed by the Senate. Trump has pledged to have Barrett

confirmed before election day on 3 November – just over a month away. He has claimed speed is of the essence because he expects the election to be contested and therefore to be potentially decided by the court. If Barrett is not confirmed before election day, the court will continue hearings without her, and the Senate would have until 2021, when a new president and Congress are sworn in, to complete the process.

Agency transparency

But if she is confirmed in time, one case Barrett would hear might influence the extent to which federal agencies are required to share information with the public about how they devise their regulations. Specifically, the Supreme Court is scheduled for arguments on 2 November over a case between the environmental group the Sierra Club and the US Fish and Wildlife Service.

In 2015, the Sierra Club sued the US Fish and Wildlife Service and National Marine Fisheries Service to gain access to records discussing how the agencies consulted with the EPA on regulation of cooling ponds used by power plants.

Two lower courts have ruled to release some of the documents but to hold back others because, for example, the records were internal discussions and did not represent the final decision arrived at by the wildlife agencies.

The Supreme Court’s decision on how or whether to withhold documents could have a ripple effect beyond environmental regulation. If the court rules in favour of limiting transparency, it might be harder for independent researchers to vet agency science or detect whether an agency decision is politically influenced, says Andrew Rosenberg, director of the Center for Science and Democracy at the Union of Concerned Scientists in Washington DC. “What is at stake is how transparent science agencies need to be with their use of scientific information.”

Just this year, the Trump administration’s pandemic response has been dogged by fears that politically motivated decisions might override science-based directives, concerns raised most recently in the race to deliver a vaccine by the November election.

But Craig notes that justices don’t always vote along party lines, so predicting with 100% certainty how Barrett’s addition to the court will affect such cases isn’t possible. For instance, chief justice John Roberts, appointed by President George W. Bush in 2005, and Gorsuch, appointed by Trump, have taken unexpected sides on cases involving the rights of undocumented residents and people from gender and sexual minorities in the United States.

Says Craig: “Supreme Court justices have surprised the president that appointed them on more than one occasion.”

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