the traits they used to focus on — such as yield and plant height — for faster ways to improve crops. "Those traits are useful but not enough," says Gustavo Lobos, an ecophysiologist at the University of Talca in Chile. "To cope with what is happening with climate change and food security, some breeders want to be more efficient." Researchers aiming to boost drought tolerance, for example, might look at detailed features of a plant's root system, or at the arrangement of its leaves.

A NEED FOR SPEED

The needs of these researchers have bred an expanding crop of phenotyping facilities and projects. In 2015, the US Department of Energy announced a US$34-million project to generate the robotics, sensors and methods needed to characterize sorghum, a biofuel crop. Last year, the European Union launched a project to create a pan-European network of phenotyping facilities. And academic networks have sprung up around the globe as plant researchers attempt to standardize approaches and data analyses.

Large-scale phenotyping has long been used in industry, but was too expensive for academic researchers, says Fiona Goggin, who studies plant–insect interactions at the University of Arkansas in Fayetteville. Now, the falling prices of cameras and drones, as well as the rise of the 'maker' movement that focuses on homemade apparatus, are enticing more academics to enter the field, she says.

At Washington State University in Pullman, biological engineer Sindhuja Sankaran's lab is preparing to deploy drones carrying lidar, the laser equivalent of radar. The system will scan agricultural fields to gather data on plant height and the density of leaves and branches. Sankaran also uses sensors to measure the volatile chemicals that plants give off, particularly when they are under attack from insects or disease. She hopes eventually to mount the sensors on robots.

Sankaran's mechanical minions return from their field season with hundreds of gigabytes of raw data, and analysing the results keeps her team glued to computers for the better part of a year, she says. Many researchers do not realize the effort and computing savvy it takes to pick through piles of such data, says Edgar Spalding, a plant biologist at the University of Wisconsin–Madison. "The phenotyping community has rushed off to collect data and the computing is an afterthought."

Standardizing the technology is another barrier, says Nathan Springer, a geneticist at the University of Minnesota in St Paul. The lack of equipment everyone can use means that some researchers have to rely on slower data-collection methods. Springer has been working with 45 research groups to characterize 1,000 varieties of maize (corn) grown in 20 different environments across the United States and Canada. The project has relied heavily on hand measurements rather than on drones and robots, he says.

Topp now has his own machine to collect computed tomography (CT) images, but processing samples is still a little slow for his liking. He speaks with reverence of a facility at the University of Nottingham, UK, that speeds up its scans by using robots to feed the plants through the CT machine. But he's pleased that he no longer has to haul his soggy cargo across three states to take measurements. "It's just endless, the number of possibilities." ■

PUBLISHING

'Is my review confidential?'

Open-science advocate says journals should be clearer to peer-reviewers about terms and conditions.

BY QUIRIN SCHIERMEIER

Are peer-reviewers free to openly share the content of their reviews if journal editors haven't explicitly told them not to? Jon Tennant, a scientist-turned-outreach specialist, thinks so.

In 2016, Tennant reviewed a research paper submitted to the journal *Palaeogeography, Palaeoclimatology, Palaeoecology*. He recommended that the authors' new approach to studying fossil seabird fauna should be published. The journal's editors agreed and published the paper.

Tennant, who now works as communications director at ScienceOpen, an online platform that promotes open-access research, wanted to receive credit for his unpaid peer-review work. With permission from the authors of the paper, he decided to openly post the text of his review on Publons, a platform for sharing reviews.

But his post was turned down. Publons told him that the journal's publisher, Elsevier, requires reviewers to obtain permission from journal editors before posting a review.

That was not part of the deal — at least, not explicitly — Tennant argues. "I didn't sign a confidentiality agreement, and I was not aware that I had implicitly agreed to the journal's policies," he says.

IMPLICIT GUIDELINES

Elsevier does have peer-review guidelines on its website, notes Thomas Algeo, a geochemist at the University of Cincinnati in Ohio and co-editor-in-chief of *Palaeogeography, Palaeoclimatology, Palaeoecology*. According to the guidelines, reviewers "must not share information about the review with anyone without permission from the editors and authors".

"Reviewers should not need to dig around for terms and conditions."

"These are general community standards for peer review, of which all experienced science professionals should be aware," says Algeo. But Tennant says he was never explicitly pointed to Elsevier's guidelines.

Charles Oppenheim, a consultant in Aberdeen, UK, who specializes in copyright issues and scholarly publishing, thinks Tennant has a point. "Reviewers should not need to dig around for terms and conditions," he says. Scholarly publishers, he adds, shouldn't assume confidentiality; they should make it explicitly clear upfront if their policy is to restrict dissemination of reviews. "If they don't, they are heading for difficulties as the idea of open peer review is becoming more common."

POLICY RETHINK

The growing popularity of open peer review is prompting journals to rethink both their policies and the way in which they communicate these to reviewers, says Andrew Preston, the London-based co-founder and chief executive of Publons. Many journals are making clear on Publons what they do — and don't — allow in terms of sharing reviews, he says.

"We're caught in the middle of people who want very different things," Preston says. "And while the community will need to find middle ground, it's good that some people are pushing at the edges." ■