POLICY

Thumbs down for 'Common Rule' revisions

Panel nixes US government changes to research ethics.

BY SARA REARDON

The US government's proposed overhaul of regulations that govern research with human participants is flawed and should be withdrawn, according to a review by the US National Academies of Sciences, Engineering, and Medicine.

The regulations — known collectively as the Common Rule — address ethical issues such as informed consent and storage of study participants' biological specimens. In their 29 June report, the academies said that the government's suggested changes are "marred by omissions and a lack of clarity" and would slow research while doing little to improve protections for patients (see go.nature.com/29afkwd). Instead, the panel recommends that an independent commission craft new rules for such research.

"This is a total smack-down," says Ellen Wright Clayton, a bioethicist and lawyer at Vanderbilt University in Nashville, Tennessee, of the academies' report.

The Common Rule, which was introduced in 1991, seeks to ensure that research with humans is ethical by minimizing patient harm and maximizing the benefit to society. Over time, achieving these goals has become more complex because of technological advances such as the rise of DNA identification, which can make it harder to maintain patient privacy.

The reforms, proposed in September by the US Department of Health and Human Services (HHS), attempt to address such emerging concerns. For instance, the HHS proposal would require participants' consent to use stored samples, such as blood or tissue, for future research. Even if samples are anonymized, the HHS says, it is fairly simple to re-identify people on the basis of their DNA.

But the US academies' panel says that the proposed consent requirements would slow research unnecessarily, because little harm is likely to come to a person as a result of the use of stored biospecimens. And if the specimens are de-identified, the extra consent forms themselves would further link the specimens to the person's name and therefore increase the risk that the person would be identified.

An HHS spokesperson says that the government is still mulling the new report and more than 2,000 public comments on its reforms. ■

Most fires in the Amazon are started by landowners trying to clear fields and forests for cultivation.

ECOLOGY

Amazon set for record fire season

Warm oceans presage intense blazes in rainforest.

BY JEFF TOLLEFSON

The Amazon is ready to burn. After an unusually dry rainy season, the southern section of the rainforest is heading into winter with the largest moisture deficit since 1998. This has set the stage for an unusually intense fire season, according to a forecast issued on 29 June that is based on sea-surface temperature trends in the Atlantic and Pacific oceans.

"The region is primed to have record fire activity," says forecast co-author Douglas Morton, a remote-sensing expert at NASA's Goddard Space Flight Center in Greenbelt, Maryland. More broadly, a team led by Morton and James Randerson, a biologist at the University of California, Irvine, says that it can predict fire risk across much of the globe — based in part on the influence of the weather pattern El Niño and its counterpart, La Niña.

The Amazon burn predictions stem from the epic El Niño weather event that emerged last year. El Niños warm the tropical Pacific Ocean, which tends to reduce rainfall during the rainy season, and the warmer temperatures in the tropical Atlantic Ocean can suppress rains during the dry season.

The El Niño that emerged last year also helped to spawn devastating forest fires in Indonesia, the researchers say. Their work reveals that sea-surface temperatures in the Atlantic and Indian oceans foreshadow fire trends in Central America, Africa and some boreal forests in Earth's high northern latitudes.

In each case, Morton and Randerson say, ocean conditions can provide a hint of precipitation trends in key forested areas on land several months in advance. "All of these processes are contributing to both the build-up of fuels and the moisture level of those fuels going into the dry season," Randerson says. "That's what leads to a predictability in global fire regimes."

FORECASTING VULNERABILITY

Other teams are looking to include fire risk in short-term and seasonal weather forecasts by incorporating independent fire models. These models attempt to account for factors such as vegetation type and the likelihood of lightning strikes or agricultural fires. Eventually, such forecasting systems could integrate more complex phenomenon such as the dynamics of vegetation growth, the way that fire tends to propagate across a landscape and the gases and particles that are emitted during a fire, says Allan Spessa, a

MARIO TAMA/GETTY

fire modeller at the Open University in Milton Keynes, UK.

The European Centre for Medium-Range Weather Forecasts in Reading, UK, plans to soon make public its prototype system to forecast fire risk about six weeks in advance, and the centre's modellers are working to include fire risk in their seasonal forecasts. Florian Pappenberger, who heads the centre's work on extreme-weather forecasting, says that the statistical approach used by Morton and Randerson is solid and can serve as an independent check on model forecasts, which come with their own uncertainties. Forecasts for water availability in rivers, reservoirs and agricultural systems operate in such a manner today.

"I don't think one method replaces the other," he says. "I expect that merging both will be quite beneficial."

However, whether forests actually go up in smoke depends on a host of factors, including law-enforcement and fire-suppression efforts that vary from region to region. For instance, almost all fires in the Amazon are started by landowners clearing fields and forests for cultivation and livestock. But once the humidity drops and the vegetation dries out, those agricultural fires can run wild.

READY TO BURN

The likelihood that this will happen increases as the dry season wears on, but scientists can already see El Niño's impacts. Morton and Randerson's team analysed rainfall measurements from gauges and satellites during the rainy season, and used data from NASA's Gravity Recovery and Climate Experiment (GRACE) satellites to provide an estimate of the cumulative water storage on land — in soils, aquifers and rivers — going into the dry season. Randerson says that the situation in the Amazon is worse than it was during the major droughts of 2005 and 2010 and on par with 1998, after the last major El Niño.

"All of these processes are contributing to both the building up of fuels and the moisture level."

As well as forecasting risk in the Amazon, Morton and Randerson are tracking and mapping fires there using infrared measurements collected by the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors aboard NASA's Terra satellite. The device has detected almost 12,500 fires in the Mato Grosso region of Brazil this year alone — making 2016 the third-worst year in the MODIS record, which stretches back to 2003.

In the Amazon, the question now is whether Atlantic storm systems will bring much-needed relief during the dry season. Morton and Randerson have identified a link between Atlantic hurricanes and Amazon fires: when the tropical Atlantic is warm, cyclones are more likely to form, and those cyclones pull the rain bands that often flow into the Amazon northwards. The US National Oceanic and Atmospheric Administration's hurricane forecast currently calls for a neutral season, but the tropical Atlantic has been cooling, which bodes well for the Amazon.

"If there were to be a shift in north Atlantic sea-surface temperatures, that could short circuit this fire forecast," Morton says. ■

SPACE

CubeSats queue up for deep-space rides

Tiny craft face a wait to be propelled beyond Earth's orbit.

BY ELIZABETH GIBNEY

CubeSats — spacecraft built from 10-centimetre-sided cubes, often with off-the-shelf parts — are already ubiquitous in near-Earth orbit, doing everything from Earth observation to studies of bacterial proteins in space. Now scientists are itching to send them farther afield, and more than a dozen deep-space CubeSats are in the pipeline.

The cost — typically no more than US$10 million for an interplanetary mission — means that the mini-craft can take risks that a more costly venture could not. They can also work in swarms, which allows new kinds of experiments. CubeSats generally piggyback on the launch of other missions, and whereas trips to low-Earth orbit, such as the cargo ships that shuttle to the International Space Station, are relatively common, missions to other parts of the Solar System are much rarer.

Lifts are so hard to come by that the first interplanetary CubeSat — NASA's twin INSPIRE mini-spacecraft, intended to test key technology for future missions — has been waiting for almost two years. "We still have to find a ride," says Anthony Freeman, who manages the Innovation Foundry at NASA's Jet Propulsion Laboratory in Pasadena, California.

CubeSats were originally conceived as a teaching tool in 1999. Today, they carry out both commercial missions and near-space science. But deep space poses a much bigger challenge (see 'Miniature explorers'). Their diminutive size cannot accommodate standard propulsion and long-range communications equipment, let alone complex scientific instruments.

Engineers are starting to overcome these problems, says Roger Walker, who oversees CubeSat development at the European Space Agency (ESA). To solve the communications problem, ESA's first interplanetary CubeSats will talk to Earth through a mothership. CubeSats will take part in the joint ESA–NASA Asteroid Impact and Deflection Assessment (AIDA) mission, planned for 2020, where they will take on risky jobs such as up-close data collection as a larger probe plunges into an asteroid.

NASA's planned mission to Europa, currently under development, would also use the mother–daughter model, deploying a fleet of CubeSats to make close fly-bys of the Jovian moon. Scientists think that Europa could harbour life under its icy surface.

Lone deep-space CubeSat missions are also on the horizon. NASA has developed a miniature radio-communication system capable of talking directly to Earth from Mars and beyond. The agency will test the system on INSPIRE — which has a side-mission of mapping interactions between Earth's magnetic field and the solar wind — and on Mars Cube One (MarCO), twin communication satellites scheduled to fly on the InSight mission to Mars when it launches in 2018 after a two-year delay. NASA has also developed tiny, cold-gas firing thrusters for propulsion, and radiation-resistant electronics that can survive beyond the protection of Earth's magnetic field.

Meanwhile, firms in Europe are developing high-efficiency ion engines, and a company in Rome called IMT is looking at ways to power such engines with deployable solar panels that can turn to constantly face the Sun. Together, all these technologies make solo CubeSats missions feasible, says Walker.

Freeman predicts that more than a hundred CubeSats could be dispatched throughout the Solar System by the end of the next decade — but only if they can get into space. He is calling on all space agencies to agree to carry at least one CubeSat on each major planetary mission. Walker agrees: "It would really stimulate the area. Ultimately, that's the main problem to overcome for interplanetary CubeSats, alongside communications." This would mean forging plans for a CubeSat tag-along early in the mission's design phase.

To cope with the large number of CubeSat proposals, NASA also wants to see more ▶