

THIS WEEK

EDITORIALS

COMICS Happy birthday
2000 AD, a science-policy
great **p.6**

WORLD VIEW More
scientists should dip
into public data sets **p.7**



MIGRATION Ancient skulls
shed light on entry to
New World **p.9**

Troubled waters

President Trump's regulatory-reform agenda threatens the US government's Clean Water Rule. This regulation is grounded in science and should be strengthened, not repealed.

Last week, US President Donald Trump signed another executive order to advance his “regulatory reform” agenda. Building on an earlier demand that agencies dump two regulations every time they issue a new one, the policy requires government officials to assess federal rules and recommend ways to repeal, replace or modify them. What all this actually means is anybody's guess at this stage. One of the first major environmental regulations to be singled out, however, is the Clean Water Rule, a policy developed under former president Barack Obama to clarify which water bodies receive federal protection under the 1972 Clean Water Act.

The Waters of the United States rule, as it is also known, was designed to provide something that Republicans often say they want: regulatory certainty. And although it does definitively protect many wetlands, ponds and seasonal streams, it also excludes some that have been covered in the past — which helps to explain why many environmentalists have objected to it. If a sign of a good policy is that both sides complain about it, then this was excellent. The rule attracted dozens of lawsuits claiming that it exceeded the federal government's authority, and it was blocked by a federal appeals court pending the outcome of litigation.

At issue is an old political question with deep roots in science: where does the US government's authority to regulate water resources give way to that of the individual states? Interstate commerce falls under the purview of the federal government, and the courts have interpreted this to mean that the federal government has jurisdiction over navigable waters. The Clean Water Act rightly extended this coverage to water bodies such as wetlands, but the courts have ruled that there are legal limits to this: not all waters are waters of the United States.

Where this fluid line is drawn has real-world consequences for everything from farms and golf courses to energy exploration and housing developments. Where the US government is in charge, landowners and companies need permits for a host of activities. The US Environmental Protection Agency (EPA) and the Army Corps of Engineers — a federal agency involved in civil engineering and environmental regulation — have been processing these permits for decades, but new questions arose when the US Supreme Court waded into the debate more than a decade ago. The court said the agencies needed to prove that there was a “significant nexus” between landlocked waters and navigable waters in order to claim jurisdiction, but no clear definition was provided. As a result, lawsuits challenging the agencies' decisions kept coming.

Under Obama, the EPA and the Corps of Engineers attempted to create regulations to settle the issue. In January 2015, the EPA released a 400-page assessment documenting the full array of hydrologic, biological and chemical interconnections between isolated water bodies and their adjacent streams and rivers. Examples abound: contamination at the surface can migrate into shallow groundwater and re-emerge in a stream or pond somewhere else. Even seasonal water bodies can be crucial resources for plants and wildlife, and wetlands can provide protection from flooding and erosion.

The agencies issued their final rule in May 2015, creating simple criteria to determine which waters are covered by the Clean Water Act. For instance, water bodies within about 30 metres of a high-water mark of a tributary are included, as are any waters within about 450 metres of the high-tide line in tidal regions. In all cases, these limits are conservative; if anything, they should be increased. The Corps of Engineers made this quite clear when it raised concerns with the EPA about losing jurisdiction over water bodies it has long governed.

“The rule was designed to provide something that Republicans say they want: regulatory certainty.”

It's clear that, under Trump, the Clean Water Rule's future is murky at best. One of the parties who sued the EPA to block the rule was none other than Scott Pruitt, the former Oklahoma attorney-general who now heads the agency. As *Nature* went to press, Trump was expected to sign an executive order clearing Pruitt to begin the long process of rewriting the rule. The administration would be within its rights to do so, but cannot change the science. Tampering with wetlands and other inland waters has downstream impacts that must be addressed when making decisions about land use, and the government has a role in this. To pretend otherwise would be to sell the US public — and its environment — down the river. ■

Counting people

All involved should acknowledge that global migration statistics are a mess.

Data and statistics must be handled with care. The pages of this journal — and thousands of others — are filled with reports and analyses that are only as strong as their weakest data set. So when the European Union's border guards issued an exaggerated estimate of migration figures for the first nine months of 2015, it's perhaps no surprise that it was an academic who called them out.

The headline “710,000 migrants entered EU in first nine months of 2015” blared from a press release that year by Frontex, the European Border and Coast Guard Agency in Warsaw. Not so, said social scientist Nando Sigona, an expert on refugees and migration at the University of Birmingham, UK. Frontex, he pointed out, had been counting the same people two or three times or more — for example, a person who was recorded on arrival in Greece and left the EU by going to Albania was again counted on re-entering the bloc by a different route. Frontex has since made this caveat clear in its releases

of cross-border data. But it is often the headline numbers that are retained by the media, and by the many populists and politicians who abuse data on refugees and migrants for political ends. We simply do not know the true figure.

Similar uncertainty surrounds data on asylum applications. Around 1.2 million people applied for asylum status in the EU in 2015, but the true total is unknown, because individuals often register in multiple countries across the continent.

Misinterpretation and misrepresentation of data on population movements is rife. Official numbers are often mistakenly taken at face value, when further examination shows the underlying data are a mess. The UNHCR, the United Nations' refugee agency, states for example that the world is "witnessing the highest levels of displacement on record". However, as we outline in a News Feature this week (page 22), that claim doesn't stand up to scrutiny — particularly when global population growth is taken into account. That article is part of a special issue of *Nature* this week that examines migration.

Numbers are both diplomatically and economically sensitive — influencing, for example, distribution of aid — and so reported data can be vulnerable to political influence. Subjectivity also enters the equation — different countries often have different definitions of refugees and varying assessment procedures to decide how many people fit the bill. In short, collecting reliable data on refugees and migrants is hard.

This does not stop the frequent appearance of data in headlines for the purposes of advocacy, with the caveats in the small print, if at all. The UNHCR relies on voluntary contributions, mostly from governments, and is chronically underfunded — last year it received only around half of the US\$7.5 billion it said was needed. The agency therefore has an understandable interest in trying to capture the attention of funders to address this neglect, with the noble goal of helping those in need.

Newspapers, border-control agencies and security contractors also have vested interests in heightened public anxiety. And increasingly, governments playing to domestic audiences use refugee numbers not to help refugees, but to justify restricting the numbers seeking asylum.

A body of social-science research has characterized this as amounting to a 'moral panic' — a phenomenon in which widespread societal fears emerge or are framed as perceived threats, but are unsubstantiated and disconnected from reality. This is not to play down the serious humanitarian tragedies facing refugees from Syria and other conflict hotspots. But numbers matter, and their use and abuse even more so.

Data on economic migrants have flaws too. The UN declared last year that there were 244 million migrants (refugees and economic migrants) worldwide in 2015, and that this was a 41% increase compared with 2000. But these data try to count everyone who lives in a country other than that in which they were born — so a biologist who left the United Kingdom 25 years ago to work in the United States, and who stayed and became a US citizen, is still counted as a migrant in the UN figures.

“Analyses of actual migration flows paint a very different picture.”

Finer analyses of the actual migration flows over five-year periods paint a very different, and often counter-intuitive, picture. Global migration has fluctuated at around 0.6% of the world's population for the past 50 years, peaking at around 0.7% in the early 1990s and falling to its lowest levels from 2010 to 2015.

Many of the largest flows in the second half of the 2000s were migrant workers from India, Bangladesh and Pakistan to oil-rich countries in the Middle East, for example. A November 2015 study by the Pew Research Center also found that more Mexicans were returning home from the United States than were arriving (see go.nature.com/2jrm8it).

But migrant data is often so sub-standard that no one truly knows the global picture. A paper published last December by Frank Iaczo, director of the International Organization for Migration's (IOM's) Global Migration Data Analysis Center (GMDAC) in Berlin, describes a long list of shortcomings (see go.nature.com/2jkewbd). Census data provide key migration information, but nothing more recent than 2005 was available from 17% of countries in Africa, or from 8% of nations in Latin America and the Caribbean. Only one in four countries worldwide can provide data on migration flows. And only 10 of 48 countries in Asia could supply flow data for 2005–14.

The GMDAC was created by the IOM last year with support from the German government, and aims to create a data portal to unify and analyse disparate available data on economic migrants and on refugees. Meanwhile, the IOM, the Organisation for Economic Co-operation and Development and the UN Department of Economic and Social Affairs intend to organize a regular international forum on migration statistics, the first of which will be held in Paris next January. There is growing awareness of data shortcomings, and that can only be welcomed. Accurate and timely data, and their apolitical interpretation, are crucial for setting evidence-based policy. When it comes to migration, we have some distance to travel. ■

Thrill power

After 40 years, sci-fi comic 2000 AD deserves to be known for more than Judge Dredd.

The counter-culture British science-fiction comic *2000 AD* has inspired and enthralled generations of the young and not-so-young over recent decades. Many of them gathered in London last month to celebrate the 40th birthday of the self-proclaimed Galaxy's Greatest Comic. The link between science fiction and science fact is well trodden, and strips and stories from the pages of *2000 AD* have long reflected and heralded discussion on issues such as the recreation of extinct species for entertainment, face transplants, genetically engineered babies and the dubious wisdom of beaming our coordinates and technological capacity to whoever may be out there listening in space.

The extreme violence and politics of the flagship story Judge Dredd tends to grab most of the casual observer's attention, but the comic has a sharper mind — and presents a more-knowing satire on issues that still dominate scientific agendas — than many people give it credit for. Example: long before DNA-ancestry firms exploited the overlapping

mesh of shared relatives to sell customers a fascinating past, the writers of *2000 AD* saw and poked fun at the potential in a short story. Those writers, as regular readers will know, are themselves part of a knowing vision of the future. Long before web crawlers and online bots lurked behind computer screens, *2000 AD* was famously said to be the work of a series of robots — art, script and lettering droids — who toiled together to churn out the weekly pages.

Nature, of course, is still staffed by standard-issue humans — but for how long? Bots already spew out social-media messages and passively observe most online adverts. They write and sort the news. These little pieces of computer script — as a paper revealed this week (M. Tsvetkova *et al.* *PLoS ONE* **12**, e0171774; 2017) — even engage in time-consuming and largely futile online arguments with rival bots about the correct way to edit a Wikipedia article.

Duelling droids is a tale straight from science fiction, and exploring the worlds of robots, radiation-exposed mutants and the far future is one reason why the *2000 AD* of the 1970s and '80s was able to push boundaries and explore territory considered off-limits in mainstream cultural and political debate. In doing so, it engaged more than most with the societal implications of science and technology, and the plans drawn up and suggested for dealing with them by politicians, special-interest groups and researchers. *2000 AD*, in other words, is an influential science-policy publication. And from one such publication to another: happy birthday. ■