CRISPR–Cas9 system, that allow researchers to make targeted changes to the genome. The USDA has already determined that its regulations do not apply to several genome-edited crops. Van Eenennaam says that it is still unclear how the FDA will regulate animals that have been engineered using that technology.

"There is a lot going on these days," says Greg Jaffe, director of biotechnology at the Center for Science in the Public Interest in Washington DC. "But obviously, up until the decision about the salmon, people were mostly focusing on the crop side."

AquaBounty Technologies, based in Maynard, Massachusetts, filed its first application to the FDA for approval of the salmon in 1995. The agency completed its food-safety assessment in 2010, and released its environmental-impact statement at the end of 2012. The long delay between the completion of those steps and a final decision led to rumours of political interference.

But Laura Epstein, a senior policy analyst for the FDA's Center for Veterinary Medicine, says that the approval took so long because it was the first of its kind. "With most products that are the first of its kind, we are very careful," she says. The agency also had to wade through many public comments before it could issue a decision, she adds.

It is unclear how the salmon will fare on the market. AquAdvantage fish produce extra growth hormone, allowing them to grow to market size in 18 months, rather than the usual 3 years. In the time since AquaBounty first filed for approval, fisheries have bred conventional salmon that grow just as fast, says Scott Fahrenkrug, chief executive of Recombinetics, an animal-biotechnology firm in St Paul, Minnesota.

"It opens up the possibility of harnessing this technology."

Then there is the matter of consumer acceptance: several grocery chains have said that they will not carry the salmon, which, even at full production, would amount to only a tiny fraction of total US salmon imports. "It's a drop in the bucket," says Jaffe. "Consumers would have to hunt to find salmon that are genetically engineered, as opposed to avoiding them."

Still, the FDA's approval met with swift opposition from some environmental and food-safety groups. Although AquaBounty uses physical and biological safeguards to reduce the chance that its salmon will escape into the wild, opponents fear that an accidental release could alter natural ecosystems. They are also unhappy that the FDA will allow the fish to be sold without any label to indicate that it is genetically engineered.

"Huge numbers of people have said, 'Yes, we want it labelled'," says Jaydee Hanson, a senior policy analyst at the Center for Food Safety, an environmental-advocacy group in Washington DC. "If this is such a good product, the company itself should be saying it will label it."

The FDA declined to comment on whether other applications for genetically engineered animals are in the regulatory pipeline. But Fahrenkrug says that his company is developing several such animals, including cattle that do not have to be dehorned and pigs that do not need to be castrated.

Recombinetics' animals are engineered using genome-editing techniques that Fahrenkrug argues do not require FDA approval. The agency regulates animals that are engineered using a "recombinant DNA construct", but his animals are modified by injecting protein and RNA into embryos. "It's a treatment, not a transgene," he says.

The FDA has yet to announce how it will view such animals, but Fahrenkrug takes approval of the salmon as a sign that the agency is willing to allow them onto the market. "I'm feeling optimistic now," he says. ■

PARIS CLIMATE TALKS

Pledges raise hopes ahead of climate talks

Momentum builds for a new treaty as world leaders prepare to descend on Paris.

BY JEFF TOLLEFSON

The road to a new global climate treaty has been slow and plodding. But years of delicate negotiations have given way to cautious optimism as more than 190 nations prepare for the marathon climate talks that begin in Paris on 30 November.

Some long-running disputes remain, such as the debate about what cuts in greenhouse-gas emissions can be expected of developing nations compared with their developed counterparts. But there are many signs that the summit, convened by the United Nations, will succeed in crafting a global climate agreement. These include significant commitments by several major players, including the United States and China, to reduce emissions of greenhouse gases.

"We are in for some tense negotiations, but I think we'll come out of the other end with an agreement," says Saleemul Huq, director of the International Centre for Climate Change and Development in Dhaka, Bangladesh, and adviser to a negotiating bloc of the least-developed countries.

And although Paris is still reeling from the deadly terror attacks of 13 November, which led the authorities to increase security for the meeting and cancel a big climate march, more than 130 heads of government and state are still expected to attend the two-week summit.

The last major push for a climate treaty faltered in Copenhagen six years ago over whether developing countries should be asked to match developed countries and make voluntary commitments to reduce emissions. The political situation has evolved since then and more than 165 countries have submitted pledges to combat climate change. Although these pledges would not cut greenhouse-gas emissions enough to meet the UN goal of limiting global warming to 2 °C above pre-industrial levels, they show a level of commitment that was missing in Copenhagen.

"Countries are bringing more political will than ever before, and so we'll see if the process can deliver," says Elliot Diringer, executive vice-president of the Center for Climate and Energy Solutions, an environmental think tank in Arlington, Virginia. "This agreement has the potential to be a significant turning point."

Despite a lingering — and potentially volatile — debate about whether those commitments will be legally binding under international law, they are expected to remain voluntary. One of the biggest obstacles to a binding agreement is the US Senate. On 17 November, Republican senators pushed through legislation seeking to block regulations to limit greenhouse-gas emissions from power plants. US President Barack Obama can veto these bills, but he cannot force the Senate, which has the power to reject or approve treaties, to endorse a climate agreement that includes binding limits on greenhouse-gas emissions.

As a result, much of the debate will centre on creating mechanisms that allow governments — and civil society — to monitor progress, build trust and ensure accountability.

Environmentalists and many governments are pushing for a five-year review period that would begin immediately after the Paris talks end; governments would need to return to the table with new commitments in 2020.

Huq says that this exercise is particularly important for poor and vulnerable countries, which are pushing for a long-term goal of limiting warming to 1.5 °C. The world is likely to cross a landmark threshold, the 1 °C mark, for the first time in 2015, and Huq admits that stabilizing at 1.5 °C would require emissions reductions so drastic as to be politically impossible at this point. But world leaders should acknowledge that even 2 °C of warming comes with significant impacts on the world's poorest citizens, he says. "We know we are not going to get everything we want in Paris, but it's symbolic."

Samantha Smith, leader of environmental group the WWF's Global Climate and Energy Initiative in Oslo, says that the biggest debate in Paris will be over financial aid to help poor countries to reduce their emissions and cope with the impacts of climate change. In 2010, wealthy nations established a Green Climate Fund and committed to increase climate aid to US$100 billion annually by 2020. Developing countries will be looking for details about that commitment and what comes next.

The good news, Smith says, is that the conversation about climate action has changed, not just within the negotiations but among faith groups, the general public and businesses, many of which will make their own voluntary emissions commitments in Paris. But she cautions that a new global treaty is just a first step. "When we walk out of there, we are still going to have a lot of work to do." ■

ENVIRONMENT

Green Climate Fund faces slew of criticism

First tranche of aid projects prompts concern over operations of fund for developing nations.

BY SANJAY KUMAR

Major questions are swirling around the operations of a United Nations fund that is supposed to channel billions of dollars to help developing nations adapt to climate change and slow its pace.

The Green Climate Fund (GCF) was established at UN talks in Cancún, Mexico, five years ago, and developing nations see it as one of their prime hopes for financial assistance in tackling a warming world.

Yet the fund, which is administered by a small team in Incheon, South Korea, is struggling to raise cash from rich nations. And although it approved its first aid commitments on 6 November at a meeting in Livingstone, Zambia, observers say they are concerned that the GCF has cut corners so as to announce handouts before international climate talks in Paris in December.

"We are worried about the fund's social and environmental safeguards, consultation processes, accountability mechanisms and transparency," says Brandon Wu, a policy analyst who focuses on climate finance at the non-governmental organization (NGO) ActionAid in Washington DC and who attended the Zambia meeting.

The Cancún agreement recommended that climate aid total US$100 billion a year by 2020, but the balance between private and public money, and how much of it would flow through the GCF, has not been made clear.

In the world of climate finance, the GCF is a tiny player. If funding for renewable energy and energy-efficiency programmes is included, hundreds of billions of dollars already flow round the globe each year, says the Climate Policy Initiative (CPI), an international think tank. Still, the GCF is the largest international public climate fund.

ESPEN RASMUSSEN/PANOS

Flood barriers in Bangladesh could find support from a United Nations climate fund.

The fund's initial target was to collect $10 billion before it started handing out cash, which it intends to divide equally between mitigation and adaptation projects. By October, it had received pledges of $10.2 billion — which foreign-exchange rate variations have reduced to $9.1 billion. But only $5.83 billion had been formally agreed, and just $852 million had reached the fund's pocket. The United States is the most significant missing name from the list of donor countries: last year it promised $3 billion, but it has yet to sign an agreement to contribute money.

"At this pace we will not be able to do anything much," says Dipak Dasgupta, an economist and India's representative on the 24-person GCF board. The proposals ▶