Increasing drought in the Middle East will jeopardize farming throughout the region.

CLIMATE CHANGE

U.N. panel warns of warming's toll and an 'adaptation gap'

Impact of climate change will be worst for the natural world and humanity's most vulnerable

By **Paul Voosen**

Over the past 70 years, humanity has made great strides on a number of metrics: increasing life expectancy, cutting hunger and disease, boosting education levels. But a prime engine of these gains—the burning of fossil fuels—now threatens to slow down global development, according to a report released this week by the United Nations's Intergovernmental Panel on Climate Change (IPCC).

With temperatures already 1.2°C warmer than in preindustrial times, some ecosystems are nearing a hard limit on their ability to adapt, including warm water coral reefs, coastal wetlands and rainforests, and the frigid mountain and polar realms, the report warns. And although humanity can adapt to warming more easily than the natural world, it needs to move faster, says Michael Oppenheimer, a climate scientist at Princeton University and one of 270 report co-authors. "We're not keeping up. The rate of climate change is faster than our ability to figure out how to deal with climate change."

The report is part of IPCC's sixth assessment of climate science, a process its volunteer scientists undertake every 7 to 8 years. A first report, released in August 2021, documented the evidence of climate change: rising seas, extreme heat, severe storms. The new report looks at its impacts on humans and nature—and our ability to adapt to it. (A third report, on reducing emissions, is due in April.)

The report recounts a familiar litany of present-day impacts. Half of the more than 4000 plant and animal species studied have shifted poleward or to higher elevations. Corals are bleaching, forests are burning, and marine heat waves are killing swaths of species. Yet the severity of the ecosystem impacts still surprised the report's authors, says Camille Parmesan, an ecologist at the University of Plymouth. Particularly alarming, she says, are the thawing of permafrost and drying of tropical peatlands, which are, in some years, turning these natural absorbers of carbon dioxide into emitters that could accelerate climate change. "We have an increased risk of irreversible impacts," Parmesan says.

Humans aren't immune. Rising heat and humidity are increasing the number of days where outdoor exertion is nearly impossible and worsening pregnancy outcomes, the report finds. Disease vectors such as mosquitoes have benefited from longer warm seasons and expanding ranges. Worsening fires have increased smoke exposure and incidence of respiratory disease. "People are now suffering and dying from climate change," says Kristie Ebi, a co-author and epidemiologist at the University of Washington, Seattle.

Drought has slowed the global growth in farming productivity, needed to feed growing populations. Ocean warming and acidification have damaged fisheries and shellfish aquaculture. Storm surge and flooding, worsened by rising seas, are damaging coastal cities. Although the influence of climate on migration and human conflict is murky, severe weather is already displacing populations. "It's a red flag for the future," says Brian O'Neill, director of the Joint Global Change Research Institute and a report co-author.

Across the board, the effects will get worse. Even if global warming can be held to 2°C by later this century—which might be feasible if nations stick to emissions pledges made last year at the U.N. climate meeting in Glasgow, U.K.—up to 3 billion people could face water scarcity. Snowmelt for irrigation could decline by 20% in many river basins; ocean saltwater could displace fresh groundwater on small islands. Food insecurity will worsen, with malnutrition increasing in the global south. Exposure to dengue fever will grow.

No matter the scenario, 1 billion people will be exposed to chronic flooding from rising seas. If warming reaches 3°C or higher, it's possible that in some locations, sweating will no longer be enough to keep the human body from overheating. The Persian Gulf will be the first to reach that threshold, but "It's going to become a problem in many places of the world, including, eventually, the United States," Oppenheimer says.

The magnitude of the effects will depend heavily on underlying social conditions such as poverty, health, and governance, the report emphasizes. For example, O'Neill notes, the number of people forced into poverty over a span of 15 years by climate change could range from 10 million to 100 million depending on their vulnerability and that of their lands. Preparing for climate change, the report concludes, is not simply a matter of building seawalls or irrigation systems. "Equally important is improving living conditions across the world," O'Neill says.

Most projects to adapt to this future are small, fragmented, and focused on near-term risks, the report finds. "There's an adaptation gap," Oppenheimer says. "Governments are paying much more lip service than actually doing a lot." So far the adaptations mostly focus on water: levees and flood warning systems, coastal wetland restoration, soil moisture conservation for farming, and armoring of coastlines.

Bolstering access to health care or establishing heat emergency plans would also make societies more resilient. And the report calls for adaptations to preserve the natural world: restoring the diversity of forests, aiding the migration of species, and protecting more lands and waters to give species space to adapt.

Still the natural world will suffer. But for humanity, IPCC sees some hope, projecting that living conditions will continue to improve under many scenarios—just more slowly than they have in the past. "We're trying not to jeopardize the progress we've made," O'Neill says. "Though that can be hard to keep in mind when you look outside the window." ■

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