

News & Highlights

Adapting to Climate Change: What Might Be Needed?

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Increasingly, experts agree that the planet is poised to warm beyond the mitigation targets established by the Intergovernmental Panel on Climate Change (IPCC). In their 2018 special report, “Global Warming of 1.5 °C,” the IPCC warned that keeping temperatures within 1.5 °C of warming above preindustrial levels is critical to avoiding some of the worst impacts of climate change [1]. According to the 2019 United Nations (UN) Emissions Gap Report, global emissions would need to decline by 7.6% every year between 2020 and 2030 to avoid this temperature threshold [2].

Emissions reductions caused by the response to the coronavirus disease 2019 (COVID-19) pandemic illustrate the difficulty of this challenge. Pandemic-related reductions in travel and industrial activity could lead to a decline in global carbon dioxide emissions between 4% and 7% in 2020 compared to 2019 [3,4]. In other words, countries would need to take actions on par with this year’s widespread lockdowns and restrictions on economic activity every year through 2030 to keep the planet within a relatively safe level of warming.

A report by the Global Commission on Adaptation (GCA) published in late 2019 concludes that counting on such cuts in carbon emissions is unrealistic and that adaptation measures will be necessary to contend with the impacts of climate change [5]. The effects of the 1 °C increase in temperature humans have already generated are thought to be evident across the globe in the form of more severe heat waves, rising sea levels, and more intense storms [6]. These events are increasingly threatening lives, structures, and agricultural lands [7]. And not acting to ease these effects through climate adaptation measures, the report argues, is likely to result in even more massive human and economic losses.

Formed in 2018 to address a perceived need for greater awareness of climate change adaptation, the Netherlands-based GCA includes heads of state, leaders of international organizations, and philanthropists [8]. Its “Adapt Now: A Global Call for Leadership on Climate Resilience” report, prepared together with Washington, DC-based World Resources Institute (WRI), summarizes the research of the GCA, WRI, and partner organizations, which prepared background papers covering numerous topics, including finance, food security, cities, infrastructure, and water. “One of the starting points for climate change adaptation is to build an evidence base of the benefits, costs, and priorities for global adaptation,” said Richard Dawson, a professor of earth system engineering at Newcastle University in the United Kingdom who was not involved in the report. “That is what this report starts to do.”

Due to the formidable challenge and the expectation that the effects of climate change are already being felt, the GCA report makes the case that global leaders must start to focus on adaptation in addition to mitigation [9]. As part of its argument, the report suggests that investing 1.8 trillion USD in climate resiliency between 2020 and 2030 would bring about an estimated 7.2 trillion USD in net benefits (Fig. 1) [5], essentially savings associated with avoiding potential harm to people, structures, and agriculture.

As described in the report, climate change adaptation includes multiple strategies that could be implemented to increase the resiliency of human societies to climate change. The report identified five areas that could have particularly high returns on investment, providing much more value in costs averted than initial investments: early warning systems, water systems, dryland agriculture, infrastructure, and mangrove protections. “These areas generate extremely high returns,” said Carter Brandon, a senior fellow with WRI and one of the lead authors of the report. “You have to act early, predict what the risks are, and start climate proofing your infrastructure, agriculture, water, and cities before you have huge damages from death, disease, and economic disruption.”

Part of climate adaptation could involve simply protecting and restoring natural ecosystems. Mangrove shrubs and trees, adapted to growing in coastal salty water, function as buffers to storms and stabilize coastlines from erosion (Fig. 2). It is estimated that these forests help to avoid an estimated 80 billion USD in annual losses from coastal flooding [10]. Conserving them and restoring them where they have been lost would yield ten times the benefits as the initial costs, according to the GCA report.

The report also suggests that early warning systems provide a large benefit to society at relatively little cost. These systems include meteorological and hydrological monitoring systems that improve the ability for an affected region to pre-emptively respond to a natural hazard. According to the report, issuing a 24 h notice for a storm or heat wave can cut back on property damage by 30%. The report estimates that spending 800 million USD on early warning systems in developing countries that do not already have them could potentially avoid 3–16 billion USD in losses every year.

Infrastructure is another major area for climate change adaptation. Examples of vulnerable structures include roads, water conveyance, ports, power plants, and sanitation systems. As the climate warms, it is predicted that intense precipitation events will become more frequent in some regions, posing an increased threat to infrastructure [11]. In addition, the predicted increase in heat

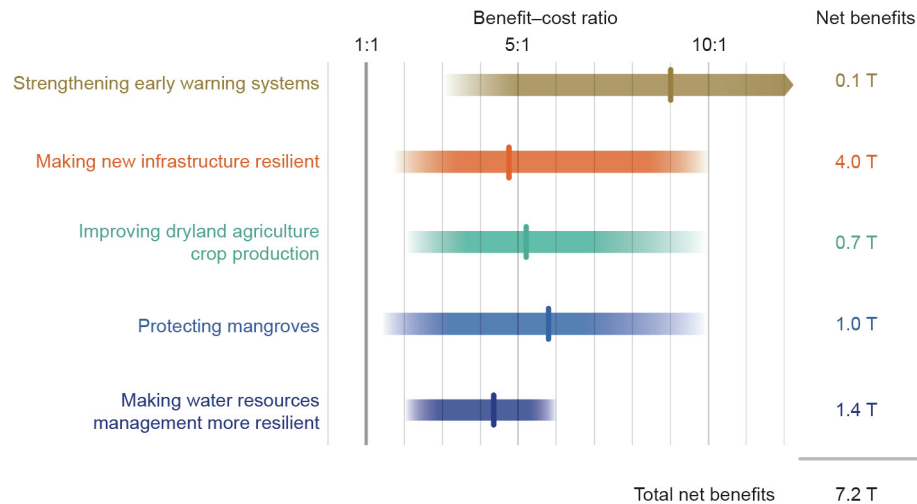


Fig. 1. The GCA's Adapt Now report suggests that the potential benefits of these specific climate change adaptation strategies could greatly outweigh their costs. The report estimates that investments in these areas over time could avoid losses of more than 7 trillion USD from lost lives and damages to property [5]. T: trillion.



Fig. 2. The Adapt Now report recommends protecting and restoring natural ecosystems as an important activity for climate adaptation, specifically identifying mangroves, salt-tolerant intertidal forests such as the one shown here in Honduras, as critical for stabilizing shorelines and buffering the impacts of storms. The report estimates that conserving them and restoring them where they have been lost would yield ten times the benefits as the initial costs. Credit: Wikimedia Commons (CC BY 2.0).

could melt pavement, thawing permafrost could rupture buildings, and coastal erosion could topple structures. Much of the 80 trillion USD in new or upgraded infrastructure estimated to be needed globally over the next 15 years [12] will likely be exposed to climate change hazards; the GCA report recommends that engineers should account for this in their designs. According to the report, climate resilient structures can cost 3% more, but their benefits are estimated to average more than four times greater than their costs.

Most clearly, engineering expertise is essential for designing resilient infrastructure, tackling water security, and building sustainable cities. And Dawson points out that such developments also play a supporting role in the dryland agriculture identified by the GCA as an area of focus. Without reliable roads and bridges, transporting food becomes problematic. “There are important roles everywhere for engineers,” said Dawson. “If we do not have good infrastructure, then we cannot get food from agricultural land to processing plants, cities, and markets before it goes bad.”

Among the conclusions of the GCA report was that governments should invest in and incentivize climate resilient strategies. Clinton Andrews, professor of urban planning and director of the Rutgers Center for Green Building at Rutgers University in New Brunswick,

NJ, USA, said that the construction industry tends to build to existing standards that are not innovative from a climate resilience perspective. “That is true for the vast majority of people who are building buildings. There is only a relatively small number of innovators who are trying to lead change,” said Andrews. “And the biggest constraint is not people’s ideas—it is actually getting approvals from risk-averse financiers.”

The report notes that priorities for climate adaptation will vary geographically. In many places, for example, establishing reliable and safe water supplies will be a first step. Billions of people around the world currently lack access to clean water and sanitation, basic necessities that will likely become all the more urgent in the hotter world most experts are predicting. To illustrate next steps, the GCA prepared eight action tracks, which outline the planning and financing steps behind major areas of climate adaptation [13]. For infrastructure, for example, the GCA plans to work with governments and businesses to facilitate climate-resilient planning, design, and methods of financing.

Overall, the actions recommended by the report call for increased planning up front, but also greater flexibility. Even with on-going disagreement about predictions for the local and regional impacts of climate change, engineers should be performing more robust decision making, said Lisa Dilling, an assistant professor of environmental studies at the University of Colorado, Boulder. This means considering how a range of probable future climate scenarios might impact structures like buildings, dams, and roadways. It also means designing infrastructure that can withstand a broader range of impacts than might have previously been considered or are specified in current building codes. The answers may not always be ready at hand, said Dilling, who directs the Cooperative Institute for Research in Environmental Sciences’ Western Water Assessment Project, a research group, also based in Boulder, CO, USA, that focuses on climate change resilience in water resources in the western US states of Colorado, Utah, and Wyoming. “There will be cases where we are not going to know exactly how to design efficiently,” she said. “In this changing world, we are also going to have to think more about how we allow for experimentation and for learning.”

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