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The next seven years

As we approach the half-way point in the implementation of the Sustainable Development Goals, we discuss how computational science could help in reaching some of these goals by 2030.

In 2015, the United Nations (UN) Member States adopted the 2030 Agenda for Sustainable Development, which established a plan for achieving peace and prosperity for all people and the planet. As part of this agenda, 17 broad and interconnected Sustainable Development Goals (SDGs) were proposed to serve as a global development framework to achieve a better and more sustainable future. Each SDG has specific actionable targets with indicators to measure the targets' progress. As most targets are set to be achieved by 2030, September 2023 marks the half-way point for realizing the SDGs. Unfortunately, progress in many areas has been slow and inconsistent, which raises the question of whether more can be done in the next seven years.

As we highlighted in our recent Focus issue, computational science can contribute to addressing challenges related to several of the SDGs. In this issue, we invited some experts to reflect on the progress towards achieving some of the SDGs and to highlight future intervention strategies — based on computational methods, tools, and technology — to address these goals.

According to the UN, over half a billion people will still be living in extreme poverty in 2030 given current trends in the progress towards SDG 1 (no poverty). This goal is also closely linked to SDG 11 (sustainable cities and communities), which aims to ensure access to safe and affordable housing for all, as well as to protect the poor and people who live in vulnerable situations from the impacts of disasters. The relationship between poverty, urbanization and climate change is discussed in a Comment from John McCloskey and colleagues, where they emphasize the opportunities for computational science in reducing disaster risk for low-income communities in cities. As they note, rapid urban expansion can contribute to an increase in natural-hazard-induced disaster risk, which is amplified by accelerating climate change (covered by SDG 13), particularly for the economically poor and politically marginalized, who have historically been disproportionately affected by disasters (S. Hallegatte et al. *EconDisCliCha* **4**, 223–247; 2020). The UN estimates that, since 2015, the number of countries with national disaster risk reduction strategies has more than doubled, but more efforts must be made to focus on strengthening future planning of urban development. McCloskey and colleagues argue that, to avoid progression towards a harmful future, computational scientists will need to take a forward-looking approach to help build cities that reduce vulnerabilities and increase resilience.

The need to make cities more sustainable, as highlighted by SDG 11, was echoed by Perrine Hamel in a Q&A, where she discussed making cities more resilient by incorporating green infrastructure into urban environments. Hamel noted that computational science can help with planning more sustainable cities via two ways: "novel modeling approaches and better datasets." On the modeling side, tools such as InVEST can help to map ecosystem services and provide users with answers to 'what-if' scenarios, allowing them to gain an understanding of the benefits or consequences of future actions. On the data side, low-cost environmental sensor networks, citizen-based science, and remote sensing can be used to collect data more affordably and fill in existing data gaps. Nevertheless, the science is not the main missing factor, as stated by Hamel: "it is not the model or the data availability — but actually getting things to change on the ground."

In another Comment, Elisa Omodei discusses the need to improve access to safe drinking water and nutritious food. Although the right to food is universally recognized, some estimates indicate that over a quarter of a billion people were acutely food insecure in 2022 for a variety of reasons. Additionally, the UN noted that reaching universal access to clean water by 2030 will "require a 6-fold increase in current global rates of progress on drinking water, a 5-fold increase for sanitation, and an 8-fold increase for hygiene." Computational science can help us move towards SDG 2 (zero hunger) and SDG 6 (clean water and sanitation) by, for example, providing farmers with personalized advice to improve farming practices, tracking provenance of food to ensure trustworthy food supply chains, mapping regions with limited access to quality food, and forecasting water demand to improve access. Omodei emphasizes that progress towards improving food and water security will require multiple computational strategies and close collaborations across stakeholders at the local and international levels.

Access to inclusive and equitable quality education is yet another important requirement to achieve a better future for all, and according to an estimate from the UN, only one in six countries will meet this goal by 2030. Additionally, it is estimated that it will take 140 years for women to be represented equally in positions of power and leadership in the workplace. In a Q&A, we spoke with Cristina Villalobos, the director of the Center of Excellence in STEM education at The University of Texas Rio Grande Valley, about what needs to be done to achieve SDG 4 (quality education) and SDG 5 (gender equality) from her point of view. Per her suggestions, one way that we can move forward is by empowering teachers and students with technology: "during the COVID-19 pandemic, it became apparent that there are many homes across the US and certainly across the world that do not have WiFi access and the devices to enable remote learning, such as laptops, tablets, and webcams," said Villalobos. Moving forward, these technologies and access to online tutoring should be made more affordable to make education more equitable. Increasing investments on infrastructure and technology will also help to make education more equitable, according to her: "I am hopeful that if we can get more funding to improve primary and secondary education, we can have more girls interested in considering a career in STEM."

Computational tools and technology have the ability to aid in accelerating progress and providing unique insights that can lead to beneficial intervention strategies. While it is evident that, across the board, there is still much work to be done, we believe that — with a concerted and multi-disciplinary approach — we can better move towards reaching these goals in the next seven years, and ensure a more prosperous, equitable and sustainable future for all.

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