The Sustainable Development Goals need geoscience

To the Editor — The United Nations 2030 Agenda and its 17 Sustainable Development Goals (SDGs) represent the global strategy for achieving a better future for all. Yet, the Earth subsystems required to support the SDGs have been largely ignored. The agenda overlooks the spatial boundaries and geophysical processes of Earth subsystems such as river basins and coastal deltas, and the consequences of environmental feedbacks on the SDGs remain a key knowledge gap[1]. The problem stems in part from the national-level focus of SDG monitoring and reporting, which is of course a matter of pragmatism in global policy, but it is compounded by the lack of geoscience in the SDG debate.

While excellent progress has been made in evaluating how the pursuit of certain SDGs (for example, climate action) might affect others (for example, energy access) globally[2] and across different socio-economic contexts[3], these assessments are invariably performed with countries as the units of analysis instead of Earth subsystems. Recent research has expanded to account for the SDG interactions between countries that are embedded in global trade[4], but the interactions among SDGs, as well as the overall success of the 2030 Agenda, may look very different if we consider different environmental contexts, different system boundaries, longer timescales, or indeed other indicators beyond those defined by the 2030 Agenda[5].

Take, for example, river basins and coastal deltas. Coastal deltas are hugely important places to focus on in order to meet the SDGs, being home to more than 5% of the world's population despite accounting for less than 0.5% of the world's land area[6]. Such high population density leads to substantial pressure on environmental resources, as well as challenges in providing adequate housing, ensuring good sanitation, and maintaining health and well-being. Deltas are also hugely important for global food production because of their flat lands, fertile soils and historically abundant freshwater resources. But deltas are precariously positioned between upstream basin development pressures and rising sea levels, and consideration of this Earth-system context will be key to any successful implementation of the SDGs in these places.

The river basins that drain to coastal deltas often span multiple countries, and downstream inhabitants depend on upstream freshwater and other resources provided by the river. But within the structure of the 2030 Agenda, upstream countries are free to — indeed, even encouraged to — pursue their own SDG targets. These can include, for example, increasing renewable energy by constructing hydropower dams[7], or water-resources development to improve human well-being through increased irrigation capacity or water supply for inland cities.

Such water-resources development in pursuit of SDGs by upstream countries places pressures on downstream deltas that could counteract or entirely cancel SDG implementation in delta countries. Hydropower dams hold back sediment — the lifeblood of deltas — meaning deltas cannot naturally maintain their elevation above sea level, which is an increasing problem around the globe[6]. Reductions in river discharge because of upstream development place increasing pressure on groundwater resources within deltas, driving up local groundwater extraction and accelerating land subsidence[8]. As a result, relative sea-level rise is exacerbated and delta agriculture, livelihoods and infrastructure (all central to the SDGs) are placed at risk of salinization and flooding.

We as geoscientists must communicate the importance of considering Earth-system context, boundaries and feedbacks to policymakers and stakeholders charged with implementing the 2030 Agenda. We must raise concerns to highlight whether policies and jurisdictions align with the Earth subsystems they intend to govern (the 'institutional fit').

In 2015 a group of geoscientists called for greater inclusion of geoscience to help guide the 2030 Agenda[9], but the call has not been heeded. Instead the debate remains dominated by other (largely social) sciences (Fig. 1). The 2030 Agenda must consider what we know about vulnerable systems that cross national boundaries, such as coastal deltas and river basins, in order to support tailored SDG implementation in these places. We need to identify and explore the remaining key knowledge gaps on how Earth-system processes could affect the SDGs in order to meet the aim of a sustainable future.

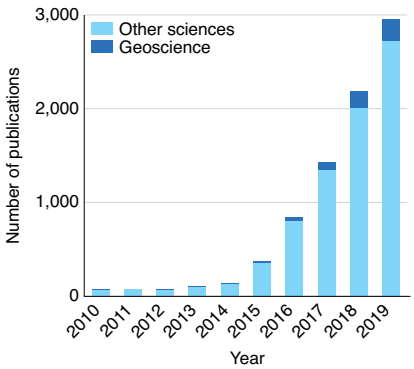

Fig. 1 | The explosion of SDG research since 2015. Geoscience makes up only a small fraction of the research, which is largely dominated by social sciences. Data based on a Scopus search on 28 July 2020 using SDG-related search terms ("SDGs" OR "2030 Agenda" OR "Sustainable Development Goals" OR "Global Goals") in title, abstract and keywords, and isolating those publications classified as being within the "Earth and Planetary Sciences" subject area.

We must encourage policymakers to think longer term and across scales. The processes relevant for Earth systems span national borders and play out over timescales well beyond the 2030 horizon of the SDGs. Focusing on SDG interactions in the here and now could blur important future implications, both 'here' and in other places.

Limitations to the national-level structure of SDG monitoring and reporting must be addressed. Better spatial and temporal resolution of SDG indicator data will help[5], but this alone will not suffice. New or alternative indicators that capture the essence of environmental systems are required[10] (for example, changes in river basin water and sediment discharge), as well as SDG implementation plans that are fit for purpose in different environmental contexts and across scales.

The excellent SDG research conducted at the national level, as well as that focused on socio-economic aspects of the 2030 Agenda, must certainly continue, but I urge geoscientists to contribute as well, wherever they can. There is significant potential to make geoscientific

contributions through collaborating with social scientists, engaging with users of information, partnering with civil society and communicating existing research to policymakers[9]. Geoscientists have a crucial role to play in implementing the SDGs and guiding a more sustainable future. ❐

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Published online: 26 October 2020
https://doi.org/10.1038/s41561-020-00652-6

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Competing interests

The author declares no competing interests.