Geology and the UN Sustainable Development Goals

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The Sustainable Development Goals (SDGs) are an ambitious set of 17 goals that aim to eradicate poverty, ensure universal access to basic services, tackle inequality, end unsustainable consumption patterns, and facilitate inclusive economic growth, social development and environmental protection.

On 25 September 2015 world leaders gathered at the United Nations Sustainable Development Summit to formally adopt the Sustainable Development Goals (SDGs), building on the success of the Millennium Development Goals. At their launch, then UN Secretary-General Ban Ki Moon declared:

"The new agenda is a promise by leaders to all people everywhere. It is an agenda for people, to end poverty in all its forms – an agenda for the planet, our common home."

The 17 SDGs (illustrated below) include 169 targets, together aiming to end poverty, ensure universal access to basic services (e.g., water, food, education, healthcare), tackle diverse economic and social inequalities, ensure sustainable consumption patterns, and facilitate inclusive economic growth, social development and environmental protection.

Achieving the SDGs by 2030 will require a concerted and sustained effort from many communities and sectors across the globe. The SDGs are science intensive, emphasising research, innovation, capacity building and technology transfer. This includes geological science, with understanding, monitoring, protecting, managing, and enhancing the natural environment central to many of the SDGs.

Geoscientists are therefore critical to delivering the SDGs. Their knowledge of the Earth's structure, the processes by which Earth is shaped, and Earth resources, together with the ability to translate this knowledge into tools to inform policy and practice, can inform many key aspects of sustainable development. Engagement will be needed by geoscientists in academia, industry, government and civil society, working across sectors and in close partnership with other disciplines (e.g., engineering, ecology, social sciences, anthropology, psychology, health).

The matrix shown in Figure 1 (Gill, 2017) includes the 17 SDGs in the vertical axis, and 11 different areas of geological science (materials, processes, management, skills and practice) on the horizontal axis. Examples of the latter include engineering geology, hydrogeology and contaminant processes, and minerals and rock materials. From this matrix, a role for geological science and/or action by geological sectors in all of the 17 SDGs is apparent.

The Geological Society of London supports the Sustainable Development Goals.

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The current challenge for all sectors and disciplines is to develop coherent, effective and engaging programmes of work to deliver the SDGs. This will require a systems approach to sustainable development, and the development of strong and equal international and interdisciplinary partnerships.

All nations have a responsibility to engage with the SDGs, with partnerships (SDG 17) key to delivering all the SDGs. The global geological community, spanning all countries and specialisms, can and should be equipped to contribute in the most effective way to supporting and facilitating sustainable development.

The SDGs provide impetus for greater action within the geoscience community to tackle social, economic and environmental injustices. They represent a valuable opportunity for scientists at all stages of their career to foster international and innovative collaborations beyond geoscience, allowing for greater interdisciplinary solutions to global development challenges. The UK Global Challenges Research Fund (GCRF) are one means by which researchers in the UK, together with partners from countries receiving Official Development Assistance, can help deliver the SDGs.

The activities required of geoscientists to deliver each SDG are different. Some will require the application of core geoscience knowledge, unique to the discipline. For example, ensuring access to water and sanitation for all (SDG 6) requires significant engagement by the geoscience community (e.g., hydrogeologists, geophysicists, hydrogeochemists) to understand and manage freshwater resources. Current knowledge, future research and many of the practical skills required to meet this goal are significant strengths of the geoscience community. For other SDGs, geoscientists will need to look at what actions they can take within their places of work. For example, geoscientists should take responsibility for championing and delivering gender equality (SDG 5) in those spheres we can influence. It is imperative that the geoscience community recognises its important role in the sustainable development agenda and commits to evaluating its existing structures and practices to ensure a positive and effective contribution to the SDGs. Changes to educational programmes, professional development and training, research agendas, industry practice, and engagement with governments, NGOs and other intergovernmental organisations (e.g., the UN) may be necessary if we are to best serve society.

The SDGs have the potential to transform society, giving human beings everywhere dignity and equality, meeting the needs of present and future generations while protecting our planet from degradation. To achieve this positive vision, the geoscience community must seize this opportunity, take responsibility for ensuring ready access to our science, and refresh our engagement with business leaders, politicians, scientists, development practitioners and civil society. Only by putting sustainable development at the centre of geoscience can we fulfil our mandate to serve society.


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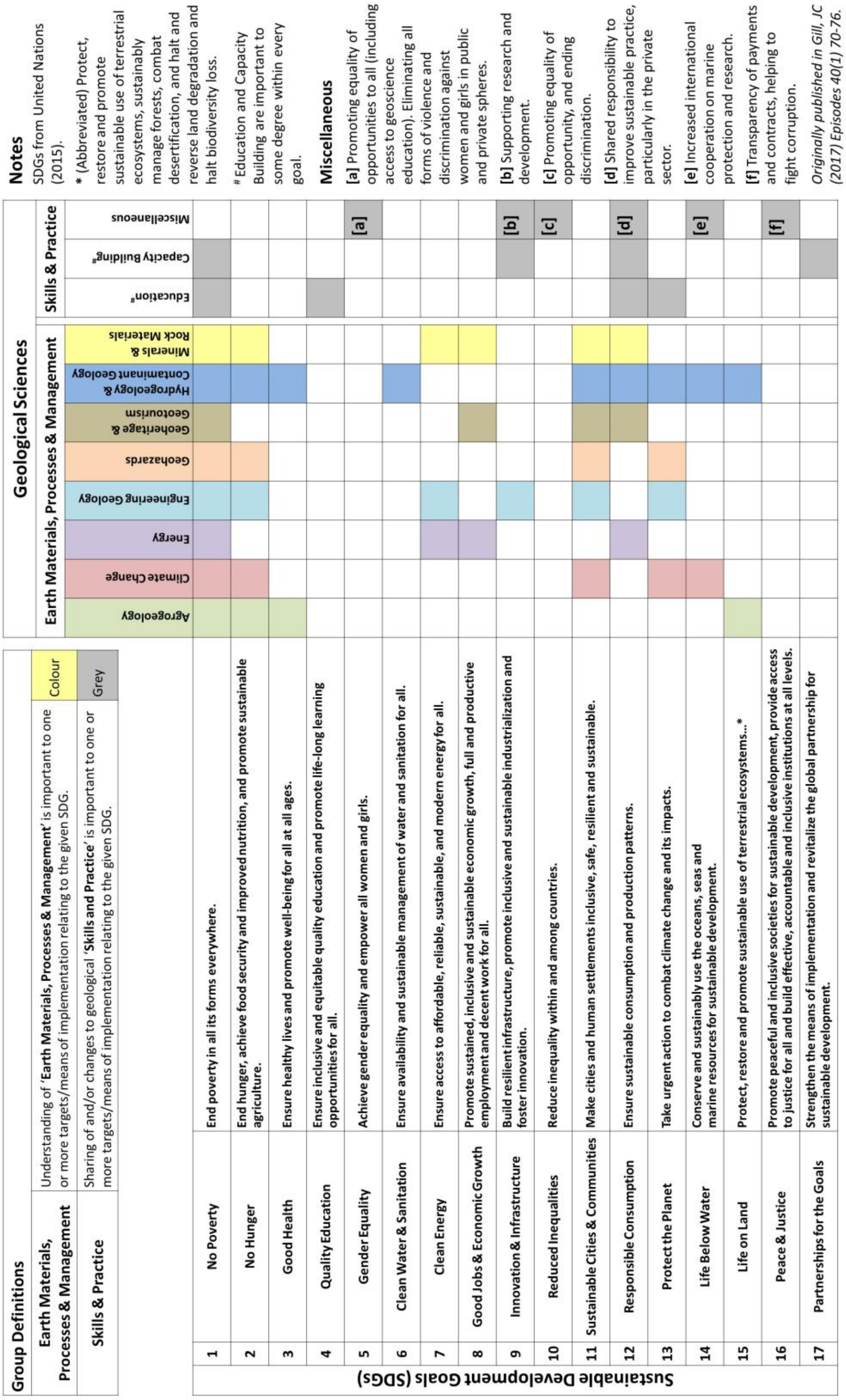

Group Definitions		
Earth Materials, Processes & Management	Understanding of '**Earth Materials, Processes & Management**' is important to one or more targets/means of implementation relating to the given SDG.	Colour
Skills & Practice	Sharing of and/or changes to geological '**Skills and Practice**' is important to one or more targets/means of implementation relating to the given SDG.	Grey

Sustainable Development Goals (SDGs)			Agrogeology	Climate Change	Energy	Engineering Geology	Geohazards	Geoheritage & Geotourism	Hydrogeology & Contaminant Geology	Minerals & Rock Materials	Education[#]	Capacity Building[#]	Miscellaneous
			Geological Sciences										
			Earth Materials, Processes & Management								**Skills & Practice**		
1	No Poverty	End poverty in all its forms everywhere.	■	■	■	■	■	■	■	■	■	■	
2	No Hunger	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	■	■		■	■		■	■			
3	Good Health	Ensure healthy lives and promote well-being for all at all ages.	■						■				
4	Quality Education	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.									■		
5	Gender Equality	Achieve gender equality and empower all women and girls.											[a]
6	Clean Water & Sanitation	Ensure availability and sustainable management of water and sanitation for all.							■				
7	Clean Energy	Ensure access to affordable, reliable, sustainable, and modern energy for all.			■	■				■			
8	Good Jobs & Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.			■			■		■			
9	Innovation & Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.				■						■	[b]
10	Reduced Inequalities	Reduce inequality within and among countries.											[c]
11	Sustainable Cities & Communities	Make cities and human settlements inclusive, safe, resilient and sustainable.		■		■	■	■	■	■			
12	Responsible Consumption	Ensure sustainable consumption and production patterns.			■			■	■	■	■	■	[d]
13	Protect the Planet	Take urgent action to combat climate change and its impacts.		■		■	■		■		■		
14	Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.		■					■				[e]
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems...*	■						■				
16	Peace & Justice	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.											[f]
17	Partnerships for the Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development.										■	

Notes

SDGs from United Nations (2015).

* (Abbreviated) Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

[#] Education and Capacity Building are important to some degree within every goal.

Miscellaneous

[a] Promoting equality of opportunities to all (including access to geoscience education). Eliminating all forms of violence and discrimination against women and girls in public and private spheres.

[b] Supporting research and development.

[c] Promoting equality of opportunity, and ending discrimination.

[d] Shared responsibility to improve sustainable practice, particularly in the private sector.

[e] Increased international cooperation on marine protection and research.

[f] Transparency of payments and contracts, helping to fight corruption.

Originally published in Gill, JC (2017) Episodes 40(1) 70-76.

Figure 1: A matrix characterising the role of geologists in achieving the SDGs (from Gill, 2017)[1]

[1] Joel C. Gill (2017) Geology and the Sustainable Development Goals. Episodes. 40 (1), 70-76

Table 1: Descriptions of eight aspects of geological science identified within Figure 1 (from Gill, 2017).

Geological Sciences (Earth Materials, Processes and Management)[2]	Description[3]
Agrogeology	The use of rock and mineral resources to improve agriculture through improving soil fertility and water retention, and reducing soil erosion.
Climate Change	Using the geological record to understand past changes to the climate and applying this knowledge to understand how the climate may change in the future.
Energy	Identifying and advising on potential energy sources (e.g., geothermal, hydrocarbons) and raw materials required for energy supply and infrastructure (e.g., uranium ore for nuclear energy, iron ore for wind turbines, cadmium for photovoltaic cells). Contributing to the safe extraction and storage of resources and the development of energy infrastructure.
Engineering Geology	The application of geological sciences to engineering, supporting the design and construction of infrastructure at all scales (e.g., dams, roads, tunnels, airstrips, ports, pipelines, shelters).
Geohazards	Understanding the physical science underlying the generation of natural hazards, including landslides, earthquakes, tsunamis and volcanic eruptions. Assessing exposure through producing hazard maps. Supporting efforts to reduce vulnerability through geoeducation and capacity building initiatives.
Geoheritage & Geotourism	Using geology and landscapes within tourism, aiding the conservation of geodiversity and building a greater understanding and appreciation of the geological sciences by tourists and those communities living and working around geological features.
Hydrogeology & Contaminant Geology	Understanding and sustainably managing groundwater resources. Using geological sciences to assess and monitor and remediate contamination, including understanding the origin, transportation and fate of contaminants.
Minerals and Rock Materials	The use of geological sciences to identify and develop mineral and rock resources, for a variety of uses (e.g., ores for metal production, limestone for building stone or glass).

Table 2: Select Case Studies of Geoscience Engagement in the Sustainable Development Goals (SDGs).

SDG and Targets	Case Study
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	Strengthening Resilience in Volcanic Areas (STREVA) is an interdisciplinary project that works collaboratively across different disciplines to generate plans that will reduce the negative consequences of volcanic activity on people and assets. Led by the University of East Anglia (UK), the STREVA project brings together diverse researchers from universities and research institutes from within the UK and from those areas affected directly by volcanic activity.
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.	Groundwater Relief is a charity working to prevent and relieve poverty by developing capacity to sustainably use and develop groundwater resources. They are supported by a volunteer membership of over 200 hydrogeologists and groundwater professionals, working in diverse sectors across the globe.

[2] Key aspects (areas of geological science application) taken from Figure 1
[3] A description of the eight key aspects, used within the grouping 'Earth Materials, Processes and Management'.