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Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Workshop Report: Earth and Environmental Science for Sustainable Development (Dar es Salaam, September 2017)

BGS Global - Eastern Africa ODA Platform

Open Report OR/17/063



BRITISH GEOLOGICAL SURVEY

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Workshop Report: Earth and Environmental Science for Sustainable Development (Dar es Salaam, September 2017)

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Participants discussing the UN Sustainable Development Goals in Dar es Salaam, Tanzania.

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Foreword

This report describes the outcomes of a two-day interactive workshop in Dar es Salaam (Tanzania), in September 2017. The British Geological Survey (BGS) gathered 17 participants from 12 organisations in Tanzania to explore sustainable development priorities in eastern Africa and consider the role of Earth and environmental science. This workshop was an activity of the BGS Eastern Africa *Official Development Assistance* (ODA) Research Platform. We used a collaborative approach to foster dialogue and gather information to inform future planning of BGS ODA activities.

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Summary

This report describes the outcomes of a two-day interactive workshop in Dar es Salaam (Tanzania), conducted in September 2017. We gathered 17 delegates from 12 organisations in Tanzania to determine sustainable development priorities and consider the role of Earth and environmental science in addressing these. Delegates came from diverse disciplines (e.g., geology, agriculture, forestry, water management) and sectors (e.g., academia, civil society, commercial, government). Using the UN Sustainable Development Goals (SDGs) as a reference tool, participants identified primary development challenges and their research and data needs to help address these. Key themes included (i) sustainable land and water management, (ii) clean water and sanitation, and (iii) climate-smart agriculture, food security and nutrition. Participants co-designed a set of draft science-for-development projects relating to these themes.

BGS are using this information, together with the results of additional workshop activities, to inform the development of collaborative *science-for-development* activities in eastern Africa as part of our commitment to Official Development Assistance (ODA) in the region. We will further develop specific project ideas, using information gathered at this workshop, with appropriate regional and international partners. Information from this workshop provides supporting evidence of expressed development need and stakeholder expertise in eastern Africa. This information will guide future project applications to the *Global Challenges Research Fund*, and other appropriate research and innovation funding sources.

Key Results and Conclusions

During the workshop, small group discussions and group voting generated a collective ranking of SDG priorities. Participants also reflected on where they believe Earth and environmental science can make the greatest contribution to development impact. These rankings were:

Overall SDG ranking (eastern Africa) based on summing of small groups votes:

1. **Quality Education** (SDG 4)
2. **Life on Land** (SDG 15)
3. **Industry/Innovation/Infrastructure** (SDG 9)

Role for Earth and environmental science rankings:

1. **Clean Water and Sanitation** (SDG 6)
2. **Life on Land** (SDG 15)
3. **Climate Action** (SDG 13)
4. **Industry/Innovation/Infrastructure** (SDG 9)

Group discussions suggested that interconnectedness of SDGs and basic (immediate) development needs were likely to influence the prioritisation process. For example, participants noted that good health (SDG 3) was necessary to having decent work and economic growth (SDG 8).

We used these rankings to establish three thematic working groups, with each tasked to identify specific challenges, research priorities, information needs and potential projects. Groups were:

- **Sustainable land and water management.** This group developed ideas relating to reducing land degradation, implementing and strengthening strategic environmental assessments, ensuring more integrated policy, and enhancing geo-ICT capacity.
- **Clean water and sanitation.** This group identified ideas around water pollution and the re-use and safe treatment of water, natural water quality, and data awareness and availability.
- **Climate-smart agriculture, food security and nutrition.** This group explored ways to improve post-harvest management of agricultural products, and improve land resource quality.

Developing these activities will require effective science-for-development partnerships. Partnership characteristics of greatest importance to participants attending this Dar es Salaam workshop were (i) being treated as an equal by other members of the partnership, (ii) respectful dialogue between members of the partnership, (iii) access to training and capacity building, (iv) sharing of project outputs, and (v) access to funding/financial resources.

1 Introduction

1.1 BACKGROUND

The UN Sustainable Development Goals (SDGs) and the UK Aid Strategy (UK Government, 2015) emphasise the need to invest in strengthening resilience and response to crises, promote global prosperity, and help to tackle extreme poverty in the world's most vulnerable communities.

As part of the UK Government's commitment to the SDGs and its Aid Strategy, the British Geological Survey (BGS) is increasing the proportion of its budget spent on Official Development Assistance (ODA). BGS will deliver this via three research platforms, each of which will seek to develop new partnerships comprising a wide range of expertise to co-design and deliver a 3-year programme up to 2020.

In eastern Africa, exponential population growth, rapid urbanisation and economic development, confounded by the effects of climate change, are having an increasing impact on health and well-being, national security and the ability of governments and aid agencies to cope. Such changes present challenges and new opportunities for science to support delivery solutions in respect to the sustainable use of natural resources (e.g., soils, minerals, water), infrastructure and services, training and skills enhancement.

Our long-term ambition therefore is to develop a platform of research and capacity building that enables our partners in ODA-recipient countries to use their natural resources to maximum benefit in an environmentally acceptable manner. Here we report on an introductory workshop held in Dar es Salaam that aimed to explore development priorities and understand how geological research can help support sustainable development. This workshop used an approach presented in Gill *et al.*, (2017), a report outlining an initial workshop within this programme, in Nairobi (Kenya).

1.2 BGS ENGAGEMENT IN EASTERN AFRICA

BGS has worked extensively across eastern Africa for over 70 years on a variety of projects in support of governmental and non-governmental agencies. For example, national geological surveys, with projects focused on mineral resources, water supply, natural hazards, infrastructure and energy. Currently we have active projects in a range of countries, including Malawi, Zambia, Zimbabwe, Ethiopia, Kenya, and Uganda. Examples include:

- **Malawi/Zambia/Zimbabwe.** Funded by the Royal Society and UK Department for International Development, BGS is working with project partners in Malawi, the UK, Zambia and Zimbabwe to enhance spatial predictions of soil type and chemistry to help combat low agricultural productivity and micronutrient deficiencies (so called "hidden hunger") in vulnerable communities. In addition, BGS is the lead partner in a RCUK-funded project on Conservation Agriculture, through the UK Global Challenges Research Fund, and will contribute to an RCUK-funded project 'Geonutrition' in Malawi, Zimbabwe, Zambia and Ethiopia.
- **Ethiopia/Malawi/Uganda.** BGS are leading the Hidden Crisis consortium project as part of the international collaborative research programme Unlocking the Potential of Groundwater for the Poor (UPGro). The Hidden Crisis project aims to develop a robust evidence base of the large-scale status of rural groundwater supply functionality in Ethiopia, Malawi and Uganda, and understand the underlying conditions leading to poor functionality of boreholes fitted with hand pumps.
- **Kenya.** Funded by the UK Department for International Development, BGS are providing technical assistance to the Government of Kenya as they establish a National Geodata Centre. BGS is leading a Newton Fund project on 'Aquaculture – Pathway to Food Security in Kenya', working with the University of Nottingham (UK), University of Eldoret

(Kenya) and the Kenyan Marine and Fisheries Research Institute. This project will explore pollution pathways from geogenic and anthropogenic inputs, their influence on fisheries, and implications for ecosystems and human health. BGS is also contributing to an International Agency for Research on Cancer (World Health Organisation) led project evaluating the spatial links to incidences of oesophageal cancer in the Rift Valley, funded by the US National Institute for Health.

- **Uganda.** BGS are working with the African Union, International Geoscience Services, GeoSoft, and the Uganda Chamber of Mines to facilitate access to geological, environmental and social data to enhance inward investment.

This report synthesises the perspectives and input from 17 delegates from 12 organisations who attended a workshop in Tanzania. Diverse sectors (government, civil society, academia, industry) were also represented. Using interactive group exercises enabled BGS to listen and collate the views, thoughts, and ideas of the workshop participants that lead to a better understanding of the sustainable development priorities.

The workshop represents an activity of the BGS eastern Africa ODA Research Platform, informing the planning of a programme of *science-for-development*. Our work aims to build scientific collaborations, foster networks of scientists across the Global South, and support capacity building through focused training, research interactions, and applying for additional research funding (e.g., Global Challenges Research Funds).

1.3 WORKSHOP OBJECTIVES

Primary workshop objectives are noted below, with the sections of this report that provide evidence that these objectives were met:

<i>Stakeholder Mapping</i>	Better understand existing stakeholder networks, responsibilities, and research interests and capabilities.	Achieved by mapping out participating organisations and their activities (see Section 2).
<i>Needs Assessment</i>	Determine development priorities in eastern Africa at a range of scales (i.e., from broad overview development goals to specific challenges), and consider the Earth and environmental science research required to inform solutions.	Achieved by a set of activities aiming to prioritise and discuss development objectives (see Section 3), and potential solutions (see Section 4).
<i>Partnership Building</i>	Facilitate respectful dialogue between and across BGS and potential in-country partners.	Relationships enhanced during the workshop (see feedback in Appendix B), with information on participant-priorities helping to facilitate future strong partnerships (see Section 5).
<i>Consolidate Positive BGS Reputation</i>	Build trust and respect through delivering a workshop centred on meaningful engagement and listening.	Workshop feedback provides evidence that participants felt their perspectives were valued (see Appendix B).
<i>Multi-Disciplinary and Multi-Sectoral Perspectives</i>	Include diverse science and sectoral perspectives (e.g., academia, think tanks, NGOs, government).	Workshop participant list indicates diverse sectors and disciplines (see Section 2).

1.4 REPORT STRUCTURE

In this report, we first characterise workshop participants ([Section 2](#)), before proceeding to present the results of workshop activities exploring the UN Sustainable Development Goals ([Section 3](#)) and potential activities to support their delivery ([Section 4](#)). We finish by documenting the initial results of an exercise aiming to understand participants' perspectives on what makes a positive science-for-development partnership ([Section 5](#)). We outline next steps in [Section 6](#).

The Official Development Assistance (ODA) programme of the BGS will use this workshop information to inform future project planning and research development in eastern Africa. All workshop participants will receive a copy of this report.

2 Workshop Participants

2.1 OVERVIEW

Over the course of the two-day workshop, BGS engaged with 17 participants from 12 different organisations in Tanzania. Participants were recruited via emails to existing contacts, a search of relevant organisations in Tanzania, and through word-of-mouth. Some organisations or individuals attending the workshop operate internationally, engaged in research and/or activities in the wider eastern Africa region and beyond. **Table 1** gives a summary of participating organisations, with information on the organisation's purpose and activities. Information was collected through a survey completed by participants, and from organisational websites (where available).

Table 1. Participating Organisations in Tanzania.

Sector	Organisation	Groups	Description of Work and Research Activities
Academia	University of Dar es Salaam	Geology	Established in 1974, they conduct research in different fields of Earth Sciences (e.g., hydrogeology, economic geology, gemmology, geochemistry, geophysics and environmental sciences). www.geology.udsm.ac.tz/
		College of Engineering and Technology (Chemical and Mining Engineering)	A semi-autonomous campus College of the University of Dar es Salaam, established in 2001 through the integration and transformation of the Faculty of Engineering and the Institute of Production Innovation. Serving industry, government, NGOs, and the wider community through a synergistic approach involving teaching and research, consultancy and services, and technology development and transfer. www.coet.udsm.ac.tz/
	Ardhi University	Environmental Science	Ardhi University is the only University in Tanzania and Africa which offers integrated training in the entire spectrum of land based disciplines namely Real Estate, Land Administration, Land Surveying Urban and Regional Planning, Architecture, Building Economics, Environmental Science and Housing under one roof complemented by Engineering, Finance, Accounting, Economics and Community Development Programmes. They aim to provide integrated teaching, research and public services that support sustainable social-economic development of Tanzania and the World at large. www.aru.ac.tz/
		Environmental Engineering	

Sector	Organisation	Groups	Description of Work and Research Activities
Government	Ministry of Natural Resources and Tourism		Responsible for management of Natural, Cultural and Tourism resources. Their mission is to conserve natural and cultural resources sustainably and develop tourism for national prosperity and the benefit of humankind through development of appropriate policies, strategies and guidelines; formulation and enforcement of laws and regulations; monitoring and evaluation of policies and laws. www.mnrt.go.tz/
	Tanzania Forest Services Agency		A semi-autonomous government Executive Agency, mandated to sustainably undertake conservation, development and utilization of national forest and bee resources so that they contribute to the social, economic, ecological and cultural needs of present and future generations. Aims to achieve efficient and effective management of forest and bee resources, promoting the potential for the continuous improvement of the quality and value for money on the delivery of public services. www.tfs.go.tz/en
	Ministry of Agriculture, Livestock and Fisheries (Environmental Management Unit)		Aims to deliver quality agricultural and cooperative services, provide a conducive environment to stakeholders, build the capacity of local government authorities and facilitate the private sector to contribute effectively to sustainable agricultural production, productivity and cooperative development. www.kilimo.go.tz/
Private Sector	Control Union Certification	Business Development	Works on cargo inspection, geomapping, collateral management and certification. Audits in relation to agricultural and environmental standards.
	Makazi Investment		Commercial development of infrastructure in Tanzania. www.makazirealestate.com/
	MAMA Activated Carbon		Start-up company, aiming to take organic waste (e.g., sawdust, food, coconut shells) and recycle to make other products such as biogas and activated carbon.
Civil Society	WWF-Tanzania		Their mission is to stop the degradation of our planet's natural environment, and build a future in which people live in harmony with nature. In order to do this, they focus on (i) protecting biodiversity, and (ii) reducing the negative impacts of human activity and ensuring natural resources are managed sustainably and equitably. wwf.panda.org/who_we_are/wwf_offices/tanzania/
	Association of Tanzania Water Suppliers		Aims to build capacity of water supply and sanitation providers to be able to offer adequate, affordable and sustainable services; to promote networking among stakeholders in the water supply and sanitation sectors; and to mobilize resources for the development of water supply and sanitation services. www.atawas.or.tz/

Sector	Organisation	Groups	Description of Work and Research Activities
International Organisations	African Minerals and Geosciences Centre		Established in 1977 principally to carry out regional geological surveying and to provide minerals exploration and consulting services. They aim to be a pioneer and leader in the provision of mineral services in Africa, and to promote socio-economic and environmentally responsible mineral development in Africa. www.seamic.org/
	World Agroforestry Center (ICRAF)		The World Agroforestry Centre (ICRAF) is a centre of scientific excellence that harnesses the benefits of trees for people and the environment. Leveraging the world's largest repository of agroforestry science and information, we develop knowledge practices, for farmers' fields to the global sphere, to ensure food security and environmental sustainability. www.worldagroforestry.org/

2.2 EXISTING NETWORKS AND COLLABORATIONS

Following brief introductions from representatives of each of the organisations in **Table 1**, multi-sectoral groups were established. Each group was tasked with identifying where existing collaborations exist, and describing the nature and strength of these relationships. **Figure 1** synthesises this mapping exercise. The network diagrams in **Figure 1** give a preliminary understanding of existing and absent collaborations, with further research needed to understand the detailed nature of these.

2.3 EXAMPLE PATHWAYS TO IMPACT

The final exercise in this section was a group discussion around three different scenarios:

- i. Connecting new research to policy-makers, informing policy development, and ensuring effective policy implementation,
- ii. Assimilating data and promoting a new geodata portal, and
- iii. Integrating perspectives from local communities into a new research programme.

Each group considered the organisations and collaborations that are necessary for their scenario to be successful. Groups considered which collaborations already exist and are mature, and which new collaborations need to be developed. Potential barriers to prevent collaborations were also discussed. These discussions provided a rich source of information on pathways to development impact in the particular political and social context of Tanzania.

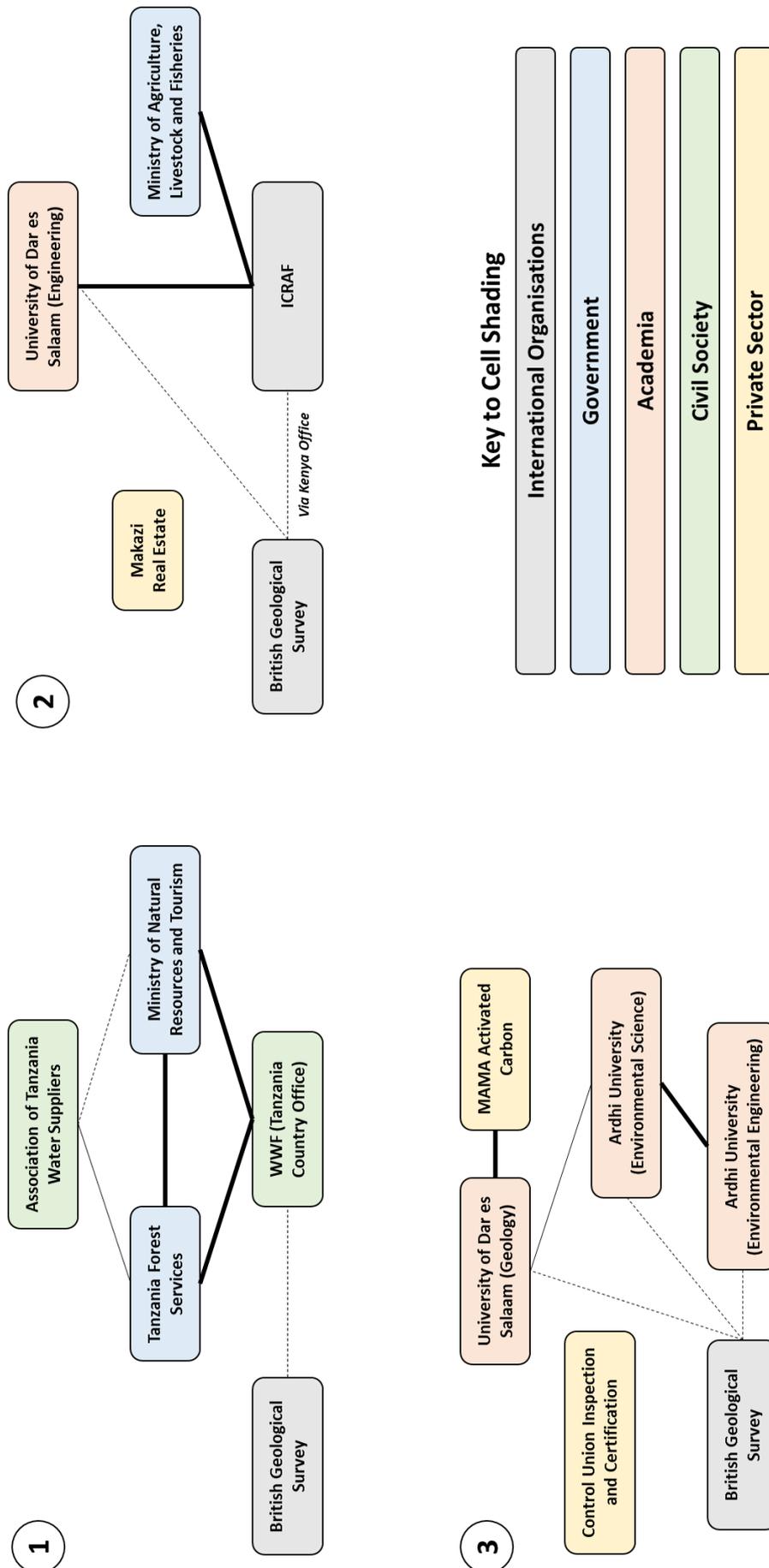


Figure 1. Mapping Existing Collaborations. A schematic to show the extent of existing collaborations between organisations represented at the workshop. Cell shading indicates the sector, and line thickness indicates the relative strength of collaborations (determined by the participants).

From Research to Policy

This team considered the uptake of research into policy, using the example of research into safer mining practices (**Figure 2**). Universities in Tanzania undertake such research, with the Ministry of Energy and Minerals responsible for policy on this theme.

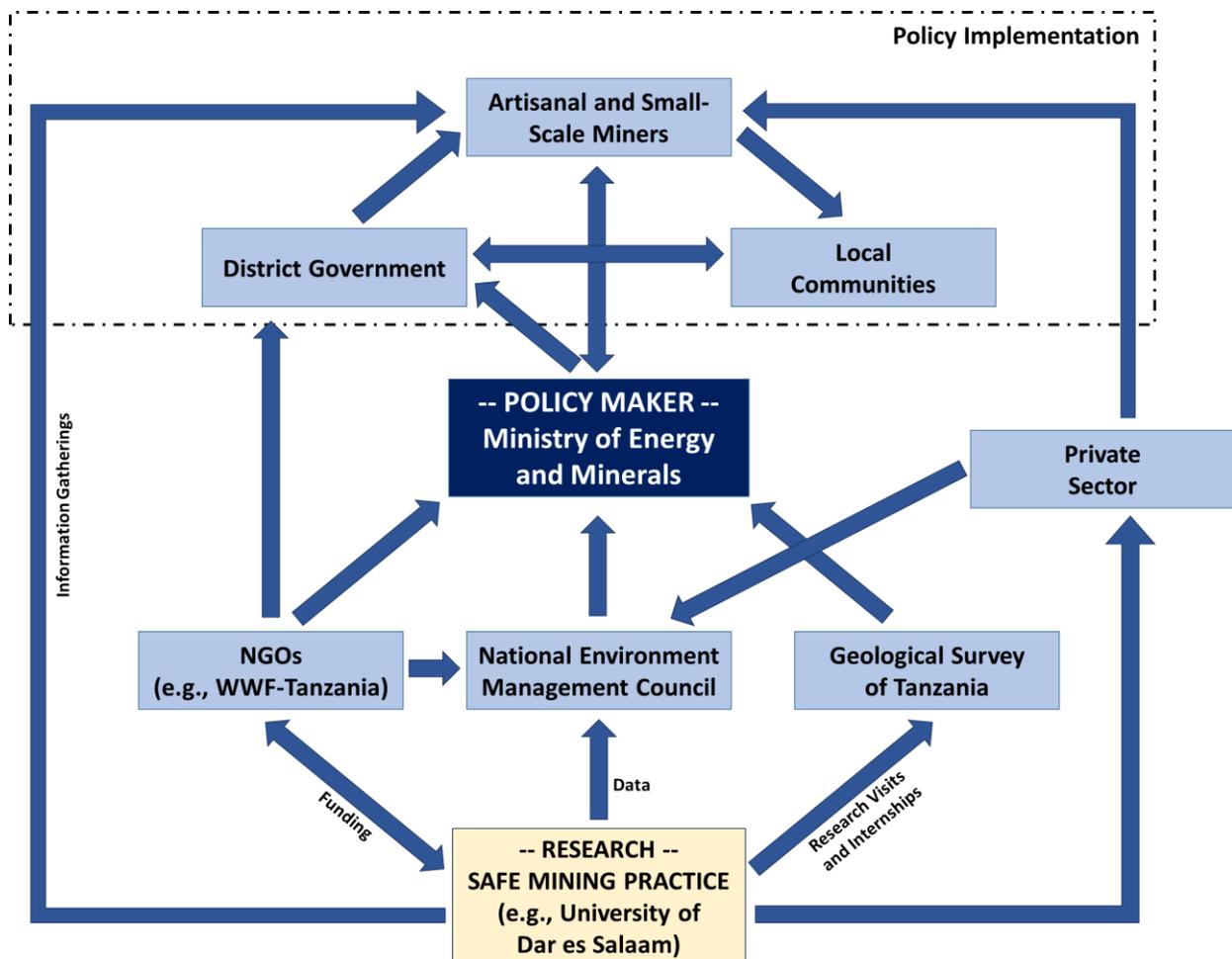


Figure 2. From Research to Policy. A schematic to show the groups involved in research uptake in Tanzania, using the example of research on safe mining practice.

For research to influence policy, it needs to be communicated to the Ministry via NGOs (e.g., WWF-Tanzania), the National Environment Management Council (NEMC) of Tanzania (sitting within the Office of the Vice President), or the Geological Survey of Tanzania. Universities could engage with any of these three bodies, through directed/funded research (NGOs), providing data (NEMC), or through research visits and internships (Geological Survey of Tanzania). While national government would have lead responsibility for sharing subsequent policy, for example with artisanal and small-scale miners, this could be alongside district governments, private sector groups and NGOs.

Assimilating Data and Promoting a Geodata Portal

The accessibility and management of data was an important theme of previous workshops (e.g., see Gill *et al.*, 2017). This exercise encouraged participants to discuss the stakeholders and processes involved in the assimilation of relevant data into an open portal, and its promotion to relevant users. The group noted:

- *Diverse Stakeholders.* Academics and government ministries or bodies (e.g., National Bureau of Statistics) collect data that could be usefully published in an online portal. NGOs and the private sector would use this information (in addition to academics and

government). It is unlikely that communities would directly use this information, due to language, technical and access barriers.

- *Lack of Capacity and Integration.* There is not much spatial data infrastructure in Tanzania. There are currently portals for specific data sets, which are not integrated.
- *Lack of Communication.* A government data centre exists, but there was uncertainty as to its scope and purpose.

Integrating Perspectives From and Engaging With Local Communities

Recognising the frequent need to engage with local communities when undertaking science-for-development, this scenario explored relevant stakeholders and processes in a Tanzanian context. Examples of engagement discussed included:

- *Feedback of research results to communities.* This could be done by academics themselves, directly feeding information to groups such as farmers. It may also occur through the local government, with researchers liaising with them, and their extension officers working with community groups.
- *Participatory research.* In this scenario, communities are actively engaged in the research design and process. Local governments and NGOs (with the permission of local and national government) work with communities to understand their priorities and needs. This may influence the funding of research, and the support given by NGOs and governments to research undertaken by universities.

3 Prioritising the UN Sustainable Development Goals

The Sustainable Development Goals (SDGs) are an ambitious set of 17 goals and 169 targets, agreed by members of the United Nations in September 2015 (United Nations, 2017). Over a 15-year timeframe (2015–2030), the SDGs aim to: (i) eradicate global poverty, (ii) end unsustainable consumption patterns, and (iii) facilitate sustained and inclusive economic growth, social development, and environmental protection (United Nations, 2017).

This workshop used activities to determine stakeholder perspectives on development priorities in eastern Africa, using the SDGs as a reference tool. Activities were then used to help identify areas where Earth and environmental science could make a significant contribution to sustainable development.

Participants first shared their individual perspectives on high priority SDGs using a matrix worksheet ([Section 3.1](#)). Small groups then discussed the SDGs, coming to a consensus on their relative importance and the highest priority SDGs in an eastern African context ([Section 3.2](#)). Participants also documented specific challenges associated with priority SDGs ([Section 3.3](#)) and identified themes that they believe Earth and environmental science could make the biggest contribution to delivering, as well as stating what that science may be ([Section 3.4](#)). These results are discussed in the context of development needs assessment ([Section 3.5](#)).

3.1 INDIVIDUAL PERSPECTIVES ON PRIORITY SDGS

3.1.1 Overview and Method

Using a blank matrix ([Figure 3](#)), participants were asked to identify (i) four SDGs that they consider to be of highest importance in an eastern African context, and (ii) four SDGs that they consider to be of highest importance in a Tanzanian context (depending on their nationality). Participants were encouraged to do this individually, ensuring that every workshop participant had their perspectives recorded.

		Eastern Africa [Place one tick per column]				Tanzania [Place one tick per column]			
		1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
Please place one tick in each column!									
Partnerships for the Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development.								
Protect the Planet	Take urgent action to combat climate change and its impacts.								
Good Health	Ensure healthy lives and promote well-being for all at all ages.								
Reduced Inequalities	Reduce inequality within and among countries.								
Gender Equality	Achieve gender equality and empower all women and girls.								
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.								
Sustainable Cities & Communities	Make cities and human settlements inclusive, safe, resilient and sustainable.								
Good Jobs & Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.								
Innovation & Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.								
Quality Education	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.								
Clean Energy	Ensure access to affordable, reliable, sustainable, and modern energy for all.								
Responsible Consumption	Ensure sustainable consumption and production patterns.								
No Hunger	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.								
Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.								
Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.								
Clean Water & Sanitation	Ensure availability and sustainable management of water and sanitation for all.								
No Poverty	End poverty in all its forms everywhere.								

Figure 3. Workshop Matrix. A blank workshop matrix, used by participants to express their perspectives on high priority SDGs in eastern Africa and Tanzania.

3.1.2 Results

16 participants submitted completed worksheets for this exercise, with 15 (94%) of these including information on eastern Africa and Tanzania, and 1 (6%) being void due to it being incorrectly completed. **Figure 4** shows the results of this exercise for eastern Africa and Tanzania. Numbers in the columns labelled 1st, 2nd, 3rd and 4th relate to the number of participants selecting the SDG as a priority. The column labelled ‘*Weighted Total*’ sums the number of participants in each column, applying a weighting depending on whether participants selected it as their 1st, 2nd... choice. The formula expressed in **Equation 1** outlines this weighting. Orange shading is used in **Figure 4** to help visualise the relative *Weighted Total* values.

$$\text{Weighted Total} = 4[n_{1st}] + 3[n_{2nd}] + 2[n_{3rd}] + 1[n_{4th}] \quad \text{Equation 1}$$

UN Sustainable Development Goal	(i) Eastern Africa					(ii) Tanzania				
	1st	2nd	3rd	4th	Weighted Total*	1st	2nd	3rd	4th	Weighted Total*
1. No Poverty	2	3	1		19	1	3		3	16
2. Zero Hunger	2	2	2		18	2	2	2	1	19
3. Good Health and Well-Being	1		1	1	7	1	1	4	1	16
4. Quality Education	2	2	1	1	17	4	1	2	1	24
5. Gender Equality				1	1			1	2	4
6. Clean Water and Sanitation	2		2	1	13	2	3	2	1	22
7. Affordable and Clean Energy			1	1	3		1	1		5
8. Decent Work and Economic Growth		1	2		7		1			3
9. Industry, Innovation and Infrastructure	1		1	1	7				2	2
10. Reduced Inequalities				1	1				1	1
11. Sustainable Cities and Communities		1	1		5			1		
12. Responsible Consumption and Production		1	1	2	7			1	1	3
13. Climate Action		1	1		5	2	1		1	12
14. Life Below Water		1			3		1	1		
15. Life on Land	2		1	2	12	2	1			11
16. Peace, Justice, and Strong Institutions		3		2	11	1				4
17. Partnerships for the Goals	3			2	14				1	1

$$* \text{Weighted Total} = 4[n_{1st}] + 3[n_{2nd}] + 2[n_{3rd}] + 1[n_{4th}]$$

Figure 4. Sum of Individual Perspectives on Priority SDGs. A synthesis of 15 perspectives on the SDGs (Figure 3), with the ‘*Weighted Total*’ determined as expressed in Equation 1. Shading is used to visualise priority SDGs.

Using **Figure 4**, we can identify the SDGs with the highest *Weighted Total* (WT) values. This is indicative of the group collectively considering the SDG to be a high development priority.

Eastern Africa. **No Poverty** (SDG 1, WT=19) emerges as being the highest development priority, closely followed by **Zero Hunger** (SDG 2, WT=18), **Quality Education** (SDG 4, WT=17), **Partnerships for the Goals** (SDG 17, WT=14) and **Clean Water and Sanitation** (SDG 6, WT=13). Together these five

SDGs represent the first choice (highest priority) SDG of 73% of participants, and 47% of all possible selections.

Tanzania.

Quality Education (SDG 4, WT=24) emerges as the highest development priority for Tanzania, closely followed by **Clean Water and Sanitation** (SDG 6, WT=22), **Zero Hunger** (SDG 2, WT=19), and **No Poverty** (SDG 1), and **Good Health and Wellbeing** (SDG 3) both having a WT=16. Together these five SDGs represent the first choice (highest priority) SDG of 67% of participants, and 62% of all possible selections.

These results are a reflection of the expertise and experience of those attending the workshop, with perspectives from at least 13 diverse organisations included. We discuss these results in [Section 3.5](#).

3.2 GROUP PERSPECTIVES ON PRIORITY SDGS

3.2.1 Overview and Method

Another insight into development objectives in eastern Africa was documented by asking small groups of participants to discuss and form a consensus on SDG priorities. Mixed-sector groups determined the four SDGs that they believed to be of greatest importance in eastern Africa. Group discussions were prolonged and dynamic, with groups critically examining why they (and others) considered key SDGs more relevant and important than other SDGs (**Figure 5**).



Figure 5. Discussing the UN Sustainable Development Goals. Following dynamic discussions, groups selected the four SDGs they believed to be of highest priority in eastern Africa.

3.2.2 Results

Following small group discussions, each group had 10 voting stickers to allocate to their four priority SDGs. Voting was undertaken by placing stickers on appropriate SDG posters, with the 10 stickers being allocated in the proportion best suited to the group conclusion (e.g., 4-3-2-1, 3-3-2-2, or 4-2-2-2 were all allowed). The distribution of group votes is presented in **Table 2**, with different colours used to represent the four groups. From **Table 2**, we note that the SDGs ranked

highest are **Quality Education** (SDG 4, 9 votes) and **Life on Land** (SDG 15, 8 votes). **Industry, Innovation and Infrastructure** (SDG 9, 3 votes) ranks third, with six other SDGs receiving one or two votes. Together the top three ranked SDGs represent 20 of 30 (67%) possible votes.

Table 2. Group Prioritisation of the UN Sustainable Development Goals. Different colours (red, blue, and green) are indicative of different groups voting choices.

SDG	Summary	Votes	
1	No Poverty	2	
2	Zero Hunger	0	
3	Good Health and Well-Being	2	
4	Quality Education	9	
5	Gender Equality	2	
6	Clean Water and Sanitation	1	
7	Affordable and Clean Energy	0	
8	Decent Work and Economic Growth	0	
9	Industry, Innovation and Infrastructure	3	
10	Reduced Inequalities	2	
11	Sustainable Cities and Communities	0	
12	Responsible Consumption and Production	0	
13	Climate Action	0	
14	Life Below Water	1	
15	Life on Land	8	
16	Peace, Justice, and Strong Institutions	0	
17	Partnerships for the Goals	0	

These results differ from those presented in [Section 3.1](#). After opportunity for detailed group discussion, where participants had to justify their prioritisation of key SDGs, groups converged on some different priority SDGs than in [Section 3.1](#). While **Quality Education** (SDG 4) remains a high-ranked development priority (with votes from all three small groups), group discussions gave greater prominence to both **Life on Land** (SDG 15) and **Industry, Innovation and Infrastructure** (SDG 9) in this exercise.

This second exercise allowed the capture of narrative on why certain SDGs were prioritised over others. One group divided the SDGs into four objectives (basic needs, life support, economic growth and sustainable communities), using these to help organise the goals. They then proceeded to draw out those that were critical to delivering each objective, and examine interactions between the SDGs. Another group discussed each goal in turn, allowing dynamic discussion about its importance in Tanzania. A summary of comments justifying the selection of specific SDGs is provided in [Table 3](#).

Emerging themes are the interconnectedness of the SDGs (e.g., health supports economic growth), and differences between resources needed immediately for survival (i.e., short-term development) and activities relating to long-term sustainable development. Also of importance was the view that the land should be protected, as it is the ‘supplier of resources’ critical to delivering other SDGs. These results are further discussed in [Section 3.5](#).

Table 3. Summary of comments justifying selection of priority SDGs.

SDG	Summary	Votes	Justification for Selection
4	Quality Education	9	Education is critical, and links to other SDGs. It improves access to jobs, which enables investment in health.
15	Life on Land	8	This is the source of primary natural resources, essential to delivering the SDGs, and therefore needs to be understood.
9	Industry, Innovation and Infrastructure	3	<i>None stated.</i>
1	No Poverty	2	This is an important, ultimate aim.
3	Good Health and Well-Being	2	Good health is necessary to progress with other goals (e.g., decent work and economic growth). Without good health, people will not have the ability to work or develop infrastructure.
5	Gender Equality	2	<i>None stated.</i>
10	Reduced Inequalities	2	This would help to improve gender equality, and peace and justice.
6	Clean Water and Sanitation	1	Clean water and sanitation will improve health, and help to avoid disease and death.
14	Life Below Water	1	There is a high dependency on marine resources in the region (e.g., tourism), and therefore protecting life below water is very important.

3.3 CHARACTERISING SPECIFIC CHALLENGES

This exercise asked individuals and groups to add notes to SDG posters on specific challenges in eastern Africa associated with priority UN Sustainable Development Goals. **Table 4** outlines the challenges identified for each SDG. While groups were encouraged to focus on priority SDGs (see [Section 3.2](#)), they were free to add comments on specific challenges to any of the SDG posters.

Table 4. Specific challenges in eastern Africa associated with the UN Sustainable Development Goals (SDGs).

SDG	Summary	Specific Challenges
1	No Poverty	Unemployment
2	Zero Hunger	Climate conditions; rainfall dependence; game reserves use productive land; value chain and lack of stable markets (no buyers); land use conflict
3	Good Health and Well-Being	Low quality medical services in rural areas due to high poverty; poor nutrition; poor water quality; rural groundwater containing fluoride; lack of information regarding where fluoride is; lack of treatment facilities and medicines; lack of trained personnel, lack of working tools for doctors/nurses; lack of national health insurance/subsidised services.
4	Quality Education	Lack of innovation in teaching by teachers; early marriages and girls finish school too young; education costs; lack of science teachers; lack of teacher training; poor teaching facilities; education is focused on training people to be labourers rather than innovators and entrepreneurs; lack of opportunities for secondary and higher education; lack of books and teaching materials; need for practical education; lack of buildings and teaching infrastructure (e.g., schools, laboratories, toilets); gender inequalities; need for more specialisms within curricula; lack of vocational training.

SDG	Summary	Specific Challenges
5	Gender Equality	Culture and traditions; poor school toilets can cause girls to drop out; patriarchal societies cause problems; lack of awareness of the importance of gender equality; negative perceptions of gender equality.
6	Clean Water and Sanitation	Lack of access results in disease; lack of hygiene knowledge; people live in remote areas; non-functional water sources (e.g., dry, broken); cultural barriers to supporting projects; lack of a viable and sustainable financial structure for rural water supplies – communities need to contribute something; pit latrine contamination; water loss due to seepage – how do we monitor this?; open defecation; need for increased urban water supply.
7	Affordable and Clean Energy	Open burning pollutes the air; slow implementation of and communication regarding renewable energy sources; inadequate trained personnel to implement projects; lack of funding.
8	Decent Work and Economic Growth	<i>None stated.</i>
9	Industry, Innovation and Infrastructure	Poor networking and technical knowledge; low education quality; lack of investment; focus on economic and social development with less regard to the environment; growth of private water supply companies (e.g., drillers and pump manufacturers); high constructions costs; poor planning and lack of infrastructure innovation; substandard constructors; lack of storage facilities; lack of processing industries; need to empower local scientists; need to take nature into account when developing infrastructure.
10	Reduced Inequalities	Implementation of existing policies; traditional beliefs.
11	Sustainable Cities and Communities	<i>None stated.</i>
12	Responsible Consumption and Production	Plastic bags are killing fish, with a ban needed.
13	Climate Action	Economic growth is resulting in pollution; lack of climate-smart agriculture; air pollution; lack of community empowerment; variability leads to increased vulnerability of crops to extreme weather events.
14	Life Below Water	Lack of sustainable conservation; lack of sustainable marine industries; lack of early warning systems; lack of knowledge on utilising marine resources; less technology for marketing and development; human activities are conducted below standards and affect life below water.
15	Life on Land	Lack of means to utilise land resources effectively; insufficient resources and personnel to monitor illegal activities; unsustainable farming; soil erosion and degradation; deforestation; land tenure systems limit initiation of development due to lack of proper land use planning; increasing climate variability leading to unpredictable crop yields and outputs; over-utilisation of land; climate change; unfair resource distribution; population growth; balancing development of agriculture and environmental regulation; lack of community awareness on environmental degradation effects; disturbing of wetland areas and water sources; mercury use in artisanal and small scale mining; lack of comprehensive management plan for potential resources; soil pollution (e.g., heavy metals from industry).
16	Peace, Justice, and Strong Institutions	Poor governance; lack of awareness of the role of law, regulations and rights.
17	Partnerships for the Goals	Government policies that hinder development of partnerships.

Comments presented in **Table 4** (together with the information in **Section 3.4**) were a starting point for designing Earth and environmental science activities to support the delivery of the SDGs (**Section 4**). Further discussion of these challenges, in the context of other results in this section, is included in **Section 3.5**.

3.4 EARTH AND ENVIRONMENTAL SCIENCE

In addition to identifying priority SDGs in eastern Africa and Tanzania (**Sections 3.1–3.2**) and specific challenges associated with these (**Section 3.3**), participants also reflected on where Earth and environmental science can make the greatest contribution to development impact. Many of the SDGs require geological research and practice. Each workshop participant was given four voting stickers to place on the SDG posters they considered had a high requirement for Earth and environmental science research. The distribution of votes can be seen in **Table 5**.

Table 5. Earth and environmental science and the SDGs in eastern Africa. Sum of individual perspectives on where Earth and environmental science can have the biggest development impact in eastern Africa.

SDG	Summary	Votes
1	No Poverty	1
2	Zero Hunger	3
3	Good Health and Well-Being	0
4	Quality Education	4
5	Gender Equality	2
6	Clean Water and Sanitation	13
7	Affordable and Clean Energy	0
8	Decent Work and Economic Growth	1
9	Industry, Innovation and Infrastructure	6
10	Reduced Inequalities	0
11	Sustainable Cities and Communities	4
12	Responsible Consumption and Production	0
13	Climate Action	8
14	Life Below Water	4
15	Life on Land	12
16	Peace, Justice, and Strong Institutions	0
17	Partnerships for the Goals	1

From **Table 5**, we note that the SDGs ranked highest in terms of a role for Earth and environmental science are **Clean Water and Sanitation** (SDG 6, 13 votes), **Life on Land** (SDG 15, 12 votes); **Climate Action** (SDG 13, 8 votes); and **Industry, Innovation and Infrastructure** (SDG 9, 6 votes). Together these four SDGs represent 66% of all possible votes.

In addition to voting, participants added further notes to SDG posters on specific ways in which Earth and environmental science can support the delivery of the SDG in eastern Africa. **Table 6** outlines these areas of Earth/environmental science input for each SDG. Further discussion of these results is included in **Section 3.5**.

Table 6. Potential Earth and environmental science inputs required to support the delivery of the UN Sustainable Development Goals (SDGs) in eastern Africa.

SDG	Summary	Potential Earth and Environmental Science Inputs
1	No Poverty	Research could help identify geographic regions suitable for planting different crop types.
2	Zero Hunger	Environmental management for more sustainable production; mature irrigation systems; sharing of agricultural knowledge; technologies for adapting to climate change; drought resistant crops; climate resilient agriculture; poor nutrition due to deficiencies in the soil.
3	Good Health and Well-Being	<i>None stated.</i>
4	Quality Education	Support teaching of environmental issues; prepare geological maps for teaching; improve practical teaching within geosciences and field courses; seminars and workshops to help educate people involved in extractive industries (including improving safety); develop resources and improve facilities for teachers; teaching resources (Earth system sciences).
5	Gender Equality	Programmes to encourage and support female students; create women in geology networks.
6	Clean Water and Sanitation	Improve understanding of available groundwater resources; research issues of water reuse; implement practices of water treatment; permeability maps for pit latrine control; collect/interpret/disseminate key groundwater information to support sustainable development, management of groundwater; improved data management and sharing; improved collaboration between stakeholders; use of rainwater harvesting; surface water and groundwater monitoring; monitoring industrial activity associated with pollution; decentralised waste water treatment; incentives on efficient water use.
7	Affordable and Clean Energy	<i>None stated.</i>
8	Decent Work and Economic Growth	<i>None stated.</i>
9	Industry, Innovation and Infrastructure	Provide financial support; provide technical support to encourage export growth; introduce environmentally friendly technologies; use of ICT for easy transfer of information and work processes; support understanding of sustainable development requirement in each project; responsible supervision of ongoing projects to ensure high quality of work.
10	Reduced Inequalities	<i>None stated.</i>
11	Sustainable Cities and Communities	Understanding of natural hazards through education about tectonically active areas, flood-prone areas and other geological hazards; increase integration of geological features into the planning and construction processes; understanding of weather dynamics to improve sustainable cities.
12	Responsible Consumption and Production	Maximise opportunities for recycling materials.

SDG	Summary	Potential Earth and Environmental Science Inputs
13	Climate Action	Earth monitoring and modelling; development of clean energy and technologies; reconstruction of past climates to improve understanding of how the environment has behaved and help predict future changes; education on use of organic waste to reduce reliance on fossil fuels; climate pollution control measures (regulation); afforestation and improved management incentives; promote research and practice which support Tanzania's contribution to United Nations Framework Convention on Climate Change; improved understanding of adaptation and preparedness in the context of Tanzania; improved public communication.
14	Life Below Water	Need integrated water resources management, environmental conservation and hydrological modelling; research into coral reefs, their bleaching and possible restorative actions.
15	Life on Land	Sustainable conservation; responsible utilisation of resources; ecosystem restoration projects; payment of ecosystem services; advice on the creation of policy to support environmental sustainability; soil quality maps; follow the movement of elements/chemicals through the environment (water, soil, air); climate services; soil investigations; research to better understand the challenges; forest restoration; research on smart agriculture; conservation; technologies to reduce pollution; promote land-use planning; monitor nutrient flow from agricultural land; increase awareness of the effects of environmental degradation.
16	Peace, Justice, and Strong Institutions	<i>None stated.</i>
17	Partnerships for the Goals	<i>None stated.</i>

3.5 DISCUSSION AND LIMITATIONS

3.5.1 Summary of Key Observations

From [Sections 3.1–3.4](#), we can make the following observations and conclusions:

- **Priority SDGs**

Across both prioritisation exercises ([Sections 3.1](#) and [3.2](#)), the only SDG consistently selected as being of high importance (ranked in the top five) in eastern African and Tanzania was **Quality Education** (SDG 4). Other SDGs selected as being of high importance in *either* individual or group exercises were **No Poverty** (SDG 1), **Zero Hunger** (SDG 2), **Clean Water and Sanitation** (SDG 6), and **Life on Land** (SDG 15).

- **Consistency of Results**

The results presented in ([Section 3.1](#)) differ significantly from those arising from the group discussion exercise ([Section 3.2](#)). This is indicative of people changing their mind after reflecting on the group discussion. The group discussions provided an opportunity for participants to confront their pre-existing ideas of principal development priorities with information from other sectors and disciplines. This resulted in **Quality Education** (SDG 4) rising from third to first, with votes from all three groups. **Life on Land** (SDG 15) rose from sixth in the individual rankings to second in the group rankings, allocated a high share of votes by two groups. In contrast, **Zero Hunger** (SDG 2) was ranked second in [Section 3.1](#), but received no votes in [Section 3.2](#), the group exercise.

- **Interconnectedness of SDGs**

During the group discussions ([Section 3.2](#)), an emerging theme was the interconnectedness of the SDGs. For example, actions to support one SDG could help reinforce or support another. Participants highlighted how **Quality Education** (SDG 4) can help improve access to **Decent Work and Economic Growth** (SDG 8), **End Poverty** (SDG 1), and **Reduce Inequalities** (e.g., SDG 5 and SDG 10). Development interventions or research projects could feasibly support multiple SDGs. For example, projects related to water could relate to SDGs on poverty, health, and gender. In their discussions, many groups were considering which SDGs could support the implementation of other SDGs. For example, groups selecting the **Life on Land** goal (SDG 15) noted that this would help to protect diverse natural resources (e.g., freshwater) relating to other SDGs.

- **Immediate vs. Long-Term Development**

Many of the SDGs identified in [Section 3.1](#) as being high-priority SDGs are ‘basic needs’ and critical for survival (e.g., food and water). These are likely to be of immediate importance to participants; necessary for daily survival. The results of [Section 3.2](#) indicate a transition to broader aspects of development, recognising the longer-term investments required in **Quality Education** (SDG 4), **Industry, Innovation and Infrastructure** (SDG 9), and **Life on Land** (SDG 15).

- **Earth and Environmental Science**

In the context of eastern Africa, SDGs ranking highest in terms of a role for Earth and environmental science ([Section 3.4](#)) were **Clean Water and Sanitation** (SDG 6), **Life on Land** (SDG 15), **Climate Action** (SDG 13), and **Industry, Innovation and Infrastructure** (SDG 9).

- **Overlap of Priority and Science Needs**

SDGs identified as being both a high priority and having a significant role for Earth and environmental science ([Sections 3.1](#), [3.2](#) and [3.4](#)) were therefore **Life on Land** (SDG 15) and **Industry, Innovation and Infrastructure** (SDG 9), with **Clean Water and Sanitation** (SDG 6) and **Climate Action** (SDG 13) also having overlap when focusing on Tanzania.

The information gathered during this two-day workshop provides additional context to the implementation of the UN Sustainable Development Goals, and other records of development priorities. For example, the [African Agenda 2063](#) and [Tanzania’s five-year development plan \(2016/17 to 2020/21\)](#) offer regional and national scale visions for sustainable development. The latter aims to ‘*nurture industrialisation for economic transformation and human development*’, with a focus on education and industrialisation that is ‘pro-nature’. The priorities identified and discussed by participants through [Section 3](#) relate to these themes. In [Sections 3.3](#) and [3.4](#), we provide additional context about the specific challenges associated with these priorities, and the role of Earth and environmental science in tackling these challenges.

3.5.2 Uncertainties and Limitations

The perspectives discussed through [Section 3](#) are a function of the sectors, disciplines, personal expertise, and experience of individuals attending the workshop. While a high diversity of sectors and disciplines were present, some key groups were under-represented. For example, while more junior scientists and recent graduates were well represented, there were fewer more senior participants from relevant ministries and the Geological Survey of Tanzania. There was also limited diversity in terms of nationality, with most of the participants understandably being from Tanzania. We can confront the perspectives presented in this section with perspectives from workshops outside of Tanzania to explore if there is a regional consensus on development priorities, challenges and solutions.

4 Thematic Working Groups

The information collected in [Section 3](#) was used to establish three thematic working groups at the end of the first day of the workshop. Three themes were proposed and agreed by the workshop participants, and used throughout the second day of the workshop. The themes, and the reasons for their inclusion, were:

- **Sustainable Land and Water Management.** *Focus on a range of SDGs, particularly SDG 15, but also SDG 6, 7, 9, 11, 12, and 13.* **Life on Land** (SDG 15) was emphasised to be a priority development challenge in [Sections 3.1](#) and [3.2](#), with a significant role for Earth science ([Table 5](#)). Multiple complex challenges were identified ([Table 4](#)). Other SDGs relate to effective land and water management, and this group reflected a group desire to explore these interactions and determine how geoscience can help to improve sustainable land and water management.
- **Clean Water and Sanitation.** *Focus on SDG 6.* This SDG was emphasised to be of high importance in individual expressions of development priorities ([Section 3.1](#)), with a significant role for Earth science ([Table 5](#)). Multiple complex challenges were identified ([Table 4](#)), with links between SDG 6 and health, education, and gender equality emphasised.
- **Climate-Smart Agriculture, Food Security and Nutrition.** *Focus on SDGs 2, 13 and 15.* Zero hunger ranked highly in individual expressions of development priorities ([Figure 4](#)), with life on land and climate action also being of importance through [Section 3](#).

Each working group was also asked to recognise the importance of **Quality Education** (SDG 4) and tackling **Poverty** (SDG 1), given the emphasis placed on these goals during earlier exercises ([Section 3.2](#)).

4.1 METHODS

A modified theory of change approach was used to help frame the group discussions. Groups were encouraged to consider the broader development objective and steps required to bring about that change, reflecting on the pathways to impact discussed in [Section 2.3](#). Groups initially reviewed the specific challenges ([Section 3.3](#)) relating to their working group theme, considering which challenges were the greatest priority. High priority challenges were rephrased to reflect the desired positive change (e.g., a challenge of ‘contaminated water’ would be rephrased as a goal ‘reduce contamination of water sources’). Groups then considered the Earth and environmental science interventions that could help to deliver this goal, mapping out the pathway from ‘project’ to ‘impact’. While groups were encouraged to work backwards to get to the intervention ([Figure 6](#)), many found it easier to consider the science projects and pathways to impact at the same time.

The approach presented in [Figure 6](#) is a simplified theory of change approach, and as such includes a number of limitations. The actual change pathways may be non-linear, involving multiple branches. The approach used in the workshop, however, encouraged groups to focus on one potential chain of events in detail. Furthermore, the change pathway may differ from one region or discipline to another, but ideas were integrated from our diverse participants into one generic change pathway. We used this approach to emphasise the importance of understanding context and desired development objectives prior to designing environmental science projects.

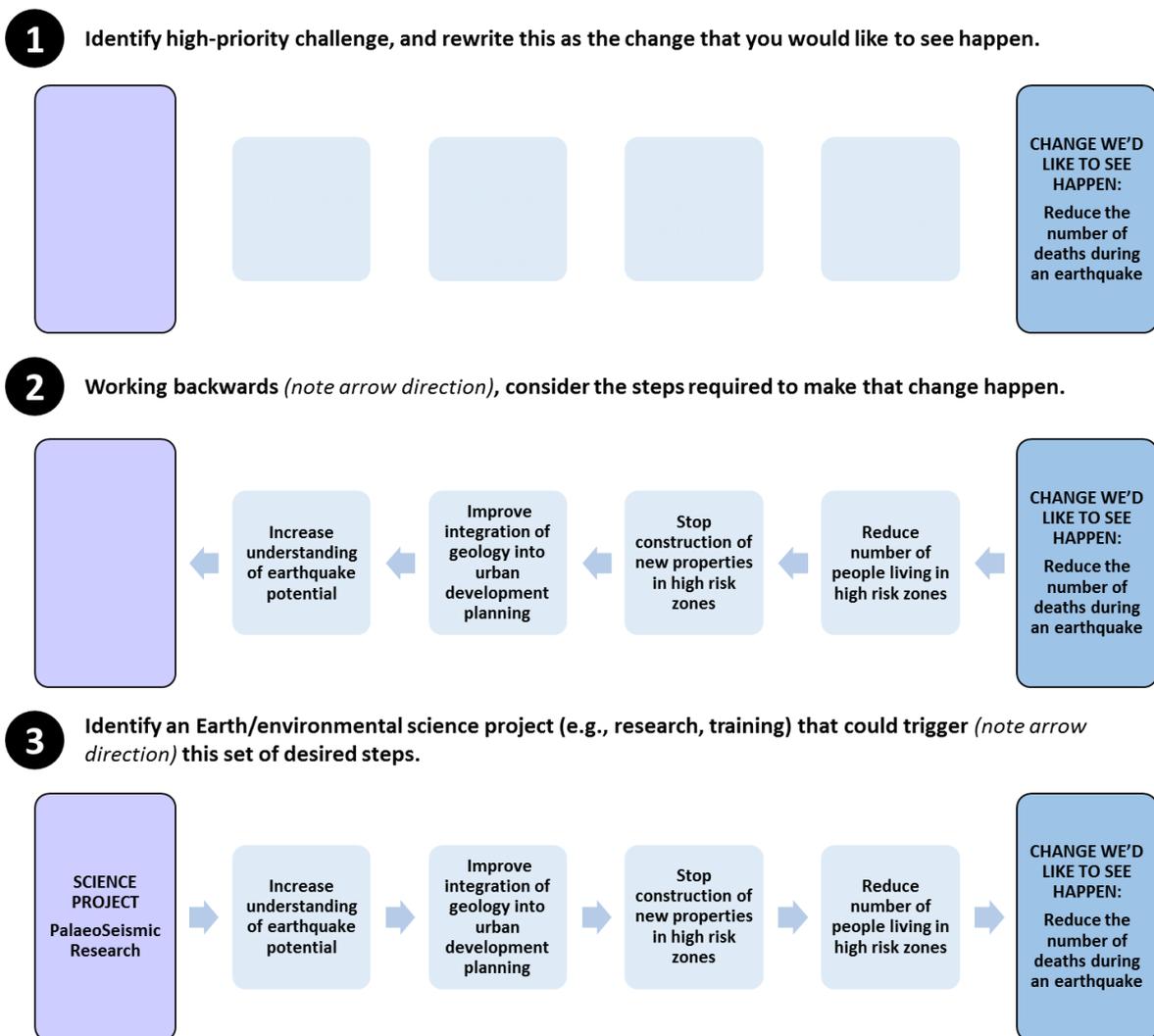


Figure 6. Identifying Earth/environmental science projects to support development priorities. An example of a simple ‘Theory of Change’ approach to identifying science interventions to help address high priority development challenges.

We present a summary of the discussions in each working group in [Sections 4.2–4.4](#). These summaries are based on notes taken by members of each group and the feedback presented during summary sessions. The notes below, therefore, offer a record of the conversations had by groups but these conversations have not been edited or checked to remove errors.

4.2 SUSTAINABLE LAND AND WATER MANAGEMENT

This group included contributions from: Tanzania Forest Services Agency, WWF-Tanzania, Ardhi University, African Minerals and Geosciences Centre, University of Dar es Salaam, MAMA Activated Carbon, and the British Geological Survey.

This group integrated perspectives from diverse organisations in Tanzania to explore what Earth and environmental science interventions are required to improve sustainable land and water management.



Figure 7. Sustainable land and water management thematic group. Exploring the science, innovation and technologies relating to support sustainable land and water management.

The group started by reviewing relevant challenges, identified in **Table 4**, and selecting four as being examples of high priority challenges. These were rewritten as project goals, and are listed below:

- **Reduce land degradation.** Land is used for a variety of purposes (e.g., mineral extraction, oil and gas extraction, agriculture, forestry), each with associated impacts on the quality of land. This goal brings together and aims to tackle a set of challenges associated with the use and pollution of land. Examples include: use of mercury in artisanal and small-scale mining; abandoned mines; poor waste management; deforestation; soil pollution.
- **Implement and strengthen strategic environmental assessment and spatial planning.** Infrastructure development does not take into account information relating to existing land use, for example important wildlife corridors or national forest areas. This results in poor and unsustainable land use management. Implementing existing policies regarding strategic environmental assessment, and strengthening these policies to take into account the latest scientific innovations, would help to improve sustainable land and water management.
- **Improve the integration of policy interventions.** There is currently a lack of harmonisation between key policy frameworks (e.g., land use policies and mining policies). This goal would aim to develop more integrated policies, by better understanding the data requirements to inform policy.
- **Enhance the use of Geo-ICT (e.g., new technologies and data information handling).** Enhanced datasets can inform policy and practice. Addressing current data and technology limitations will require access to new technologies for data capture, capacity building in new technologies, and more open-access data.

These four themes were derived by examining and synthesising the challenges relating to sustainable land and water management. The group was encouraged to focus on developing interventions that helped to achieve the four goals set out above, considering the pathway from Earth/environmental science intervention to development impact.

The group initially focused on the challenge of land degradation, and the goal of reducing degradation. **Figure 8** gives a visual summary of this discussion, highlighting four first-order ways to tackle degradation, with additional actions that feed into these. The group discussed reducing

the impact of deforestation, increasing data handling for improved infrastructure development, improving the extraction of minerals, and enhanced implementation of policies.

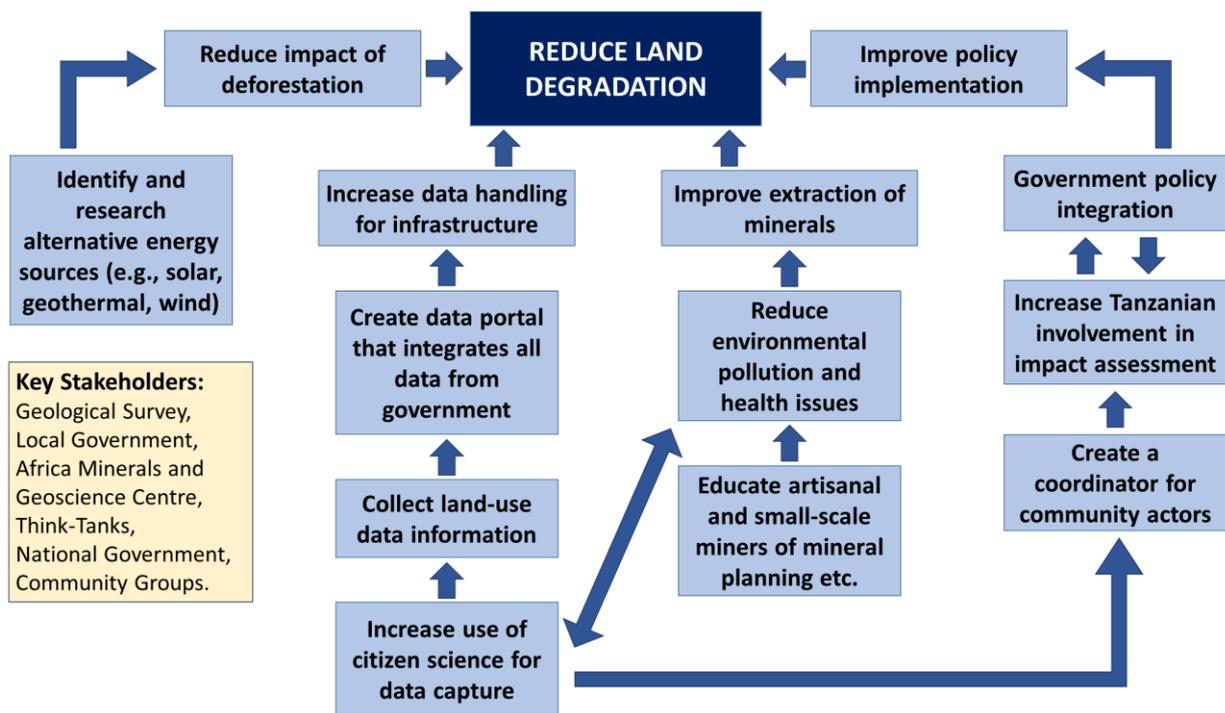


Figure 8. Interventions to Reduce Land Degradation. A schematic summary of the key interventions the group thought could help to reduce land degradation. This included aspects related to the other challenges (e.g., integrated policy, improved data management).

In order to reduce deforestation, often a result of the need for wood as fuel, the group explored alternative energy sources such as solar, geothermal and wind. Each of these would require changes in land-use, and would therefore require effective strategic environmental impact assessment. Underpinning energy, infrastructure and minerals development is the need for enhanced data collection and integration, using data portals to present this data. Some data already exists, and can be brought together within such a portal (e.g., existing national datasets from Government ministries and international data from Earth observation). Other data would need to be collected, and citizen science could be an innovative approach to fill gaps in data and engage with communities at a village level. This would improve the quantity of data available to reduce land degradation, but also help increase engagement of community-level stakeholders in impact assessment. Citizen science tools would allow data to be disseminated back to communities to help raise their awareness of environmental issues. Policy integration and coordination between sectors is a major challenge, but was recognised as being critical to help improve policy implementation.

In summary, this group identified four principal development challenges, and highlighted interactions between these that would help to improve sustainable land and water management. Potential future projects contributing to this set of goals include:

- **Geo-Data Portal.** The development of a geo-data portal, integrating existing datasets with new citizen science derived data, and an environmental science/impact awareness campaign. This could be generic in its application, or be focused on utilisation of alternative energy resources, improving data infrastructure, or improving the extraction of minerals.
- **Geo-Education.** Opportunities for training, capacity building, and knowledge sharing focused on engagement with artisanal and small-scale miners, and community understanding of environmental science and impacts of different activities.

- **Research.** Opportunities for research were highlighted in the context of alternative energy sources in Tanzania, the effectiveness of citizen science for data capture, and improved methods of mineral extraction. It is anticipated that advances in the collation of geo-data would identify additional research questions, through the identification of data gaps and subsequent novel data analysis.

4.3 CLEAN WATER AND SANITATION

This group included contributions from: Makazi Investment Limited, the University of Dar es Salaam, the Association of Tanzania Water Suppliers, and the British Geological Survey.



Figure 9. ‘Clean Water and Sanitation’ thematic group. Exploring the science, innovation and technologies required to tackle specific challenges relating to clean water and sanitation (SDG 6).

This group explored the challenges associated with delivering improved water and sanitation facilities (SDG 6), and considered the Earth and environmental science interventions required. The group started by reviewing relevant challenges, identified in **Table 4**, and selecting three as being examples of high priority challenges. These were rewritten as project goals, and are listed below:

- **Optimise wastewater treatment and reuse.** There are many anthropogenic sources of pollution affecting the integrity of water resources. Example include open defecation, poor siting of pit latrines, industry, mining, and poor sewage systems in urban areas. Poor treatment of wastewater results in reduced availability of potable water supplies. The first goal of this thematic group was therefore to optimise wastewater treatment and reuse.
- **Reduce exposure to fluoride.** There are challenges associated with fluoride in groundwater in Tanzania. While there exists knowledge of where high fluoride areas are, there needs to be enhanced research into low cost treatment of water.
- **Improve data awareness and availability.** Improved collaboration between stakeholders would help facilitate better awareness of what data exists and encourage data sharing. Data awareness may translate into enhanced understanding of data gaps and potential future research programmes.

Secondary challenges noted by this group to be of importance were regarding current lack of access to improved water sources in Tanzania, with the challenges of reaching remote areas; the need for improved toilets in schools; and the need for enhanced community involvement and buy-in to water and sanitation projects. This group proceeded to explore the three primary challenges and goals, noted in the bullet points above, determining potential Earth and environmental science interventions.

4.3.1 Optimise Wastewater Treatment and Reuse

The first challenge addressed related to the **optimisation of wastewater treatment and reuse (WWTRU)**. This included two interlinked strands of work (i) improve access to and use of sewage systems, through research into new technologies that could be used by small businesses, and (ii) improved cultural acceptance of WWTRU, through an education programme. These are outlined in **Figure 10**, showing the steps supporting each of these strands of work.

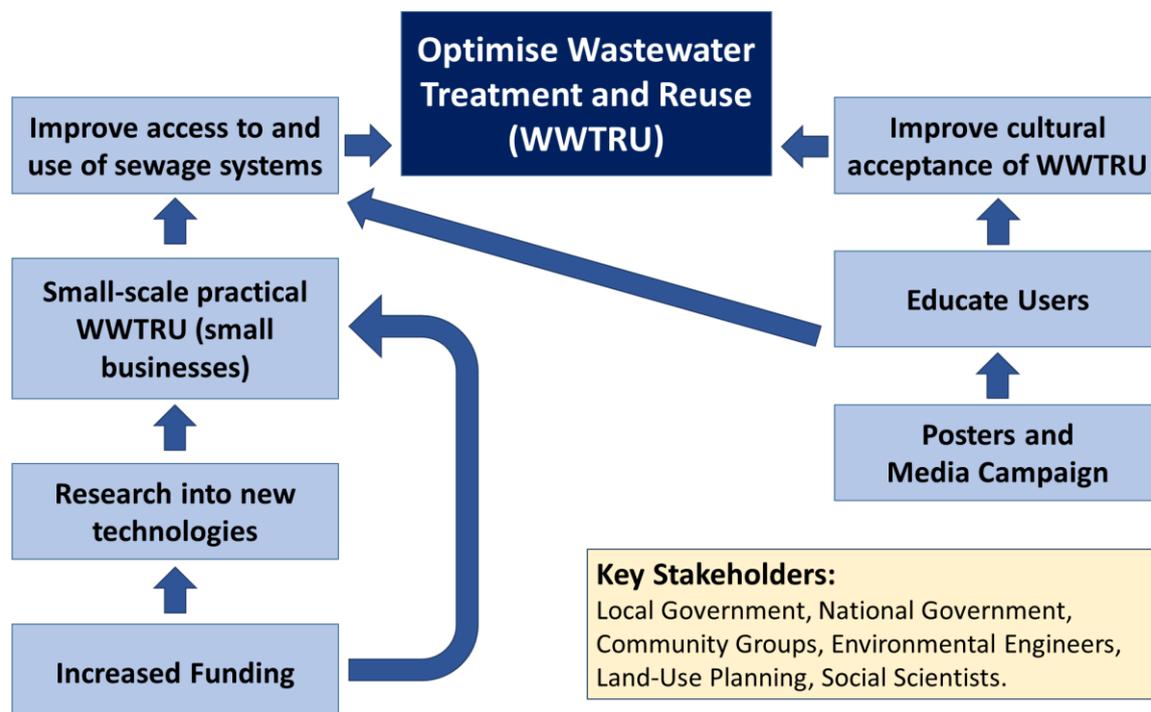


Figure 10. Interventions to Optimise Wastewater Treatment and Reuse. A schematic summary of the key interventions the group thought could help to optimise the treatment and reuse of wastewater.

As demonstrated by the connection of the two strands in **Figure 10**, enhancements in community understanding of why wastewater treatment and reuse is necessary and can be done safely is essential, and would underpin the uptake of new technologies.

4.3.2 Reduce Exposure to Fluoride

The second challenge related to natural water quality, with aim of reducing exposure to fluoride by reducing the number of people drinking fluoride-rich water. The group identified four ways by which this could be achieved: (1) testing for fluoride in groundwater; (2) encouraging people to use low-fluoride alternative water; (3) implementation of existing technologies for treatment; and (4) research into new technologies. This multi-faceted approach would bring together capacity building, community engagement, policy support and research to tackle this development challenge. We briefly explore each of these factors:

- 1) **Testing for fluoride in groundwater.** Government and university laboratories (e.g., the Ministry of Water, Geological Survey of Tanzania, and University of Dar es Salaam) need increased capacity to test for fluoride in groundwater. Water testing would help to identify

at a finer resolution regions with high fluoride and regions with low fluoride. Testing needs to be affordable.

- 2) ***Encouraging people to use low-fluoride alternative water.*** Alternative technologies including rainwater harvesting and spring protection schemes could be encouraged. These may be more vulnerable to climate variability, but will likely have lower fluoride levels. Stakeholders involved would include university engineering departments, government research institutes, and water institutes. Social science and community engagement specialists would be necessary to encourage behaviour change and support communities in their transition to alternative water sources.
- 3) ***Implementation of existing technologies for treatment.*** In urban areas, centralised treatment of water would be the easiest way to reduce exposure to fluoride. In rural areas, a more decentralised approach will be needed with small-scale treatment of water. This provides an opportunity for entrepreneurship, with small businesses helping to treat water. This depends on the expansion of existing technologies, and a desire to uptake technologies, with any associated costs at a household level.
- 4) ***Research into expanding existing and new technologies.*** Understanding the expansion of existing technologies for treatment would require research, as would the development of new technologies. Research would require a diverse set of partnerships, including NGOs, local government, village committees, scientists, socio-economists, and the private sector.

Funding for this programme of activities could come from international donors, central government, research-funding organisations in Tanzania, and NGOs. A potential case study region is Arusha and the surroundings.

4.3.3 Improve Data Awareness and Availability

The group also briefly explored the goal to improve data awareness and availability. For example, fluoride in groundwater data in Tanzania is held by the Ministry of Water and Irrigation. This data is not stored properly, being in both paper formats and on individuals' laptops and computers (vs. secure and backed-up servers). Data is often considered confidential and not shared. This could be improved by implementing a consistent data collection plan in Tanzania. Information collected in field logbooks, which is used to inform paper maps, could then be further processed to develop digital maps (e.g., ArcGIS) and associated digital databases. These would be stored on a secure office network, and integrated into a web resource so that everyone can use them. This would require enhanced ICT skills, including database management and software expertise.

Across these projects, there is significant scope for capacity building of students. They could support geological and geochemical mapping, helping to train students in the effective collection of data. Students could get involved in community education programmes, and be funded to lead small research projects (e.g., directed dissertations and theses). Students with skills in GIS and ICT could also help to train others in themes such as data management.

4.4 CLIMATE-SMART AGRICULTURE, FOOD SECURITY AND NUTRITION

This group included contributions from: Control Union Certification, Ardhi University, Ministry of Natural Resources and Tourism, Ministry of Agriculture, Livestock and Fisheries, the World Agroforestry Center (ICRAF), and the British Geological Survey.

Access to sufficient and nutritious food (SDG 2) and climate-smart agriculture (SDG 2 and 13) were the primary themes for this group, integrating perspectives from diverse organisations operating in and beyond Tanzania. The group started by reviewing the challenges associated with these goals (outlined in **Table 4**) and identified three high priority challenges. These were rewritten as project goals, and are listed below:

- **Enhance socio-economic management of agricultural products.** Of particular importance within this goal is the need to improve post-harvest management of perishable agricultural products (e.g., fruit, vegetables, fishery products), including how they are preserved, marketed and distributed. This would ensure the maximum economic and social benefits from agriculture in Tanzania are realised.
- **Improve land and soil resource quality.** Land degradation occurs because of overgrazing and diverse anthropogenic processes. Deficiencies in soil result in poor nutrition, and depreciation of land quality leads to poor yields and rural seasonal starvation. Tackling the quality of land and soil resources would therefore help to improve the availability of sufficient and nutritious food.
- **Improve awareness of climate-adaptation.** Climate variability increases the vulnerability of crops to extreme weather events. There is a lack of understanding regarding how the climate change, and what steps need to be taken (at all scales) to adapt to this change.

This group focused on developing appropriate Earth and environmental science interventions to support the first two of these goals.



Figure 11. Climate-smart agriculture thematic group. Exploring the science, innovation and technologies relating to climate-smart agriculture, and enhancing access to sufficient, nutritious food.

4.4.1 Enhance Socio-Economic Management of Agricultural Products

The first project aimed to improve post-harvest management of agricultural products, identifying three key steps in this process. The initial step was to map perishable agricultural production across Tanzania, integrating photos, maps and soil data within a GIS framework. While this could be done within the timeframe of an MSc project, it would require input from groups such as the Ministry of Agriculture (crop promotion services), the Tanzania Horticultural Association, and the Southern Agricultural Growth Corridor of Tanzania. The next step would be to map suitable locations for processing industries, recognising the land, energy, water and other resources required for specific sectors. This would require comprehensive engagement with the Ministry of Land, Ministry of Industry and Trade, and the private sector. The final step to this project would be advocacy for uptake of post-harvesting technologies in Tanzania, through the development of policy briefs, workshops and media campaigns. Partners at this stage could include civil societies, the Agricultural Non-State Actors Forum, Tanzania Farmer Network, the International Institute of Tropical Agriculture, those doing research on seeds in Tanzanian universities, and private sector

organisations. Project managers could seek funding from the Food and Agriculture Organisation, World Food Programme, UK Department for International Development, World Bank, Government Development Fund, or UN Development Programme. Participants noted that the first project step could form a tangible MSc project.

4.4.2 Improve Land and Soil Resource Quality

The second project aimed to improve land resource quality, and in doing so help to improve access to sufficient, nutritious food. The initial steps in this project would be for a university academic, the ministry of land, or external experts to (i) map the extent of degradation, and (ii) collate and update existing land, soil, crop and climate maps, in Tanzania. This would integrate in a GIS available data such as aerial photographs, topographic maps, and soil maps. This data is currently held by a range of organisations (e.g., the Ministry of Land, Sokoine University of Agriculture, Ardhi University, and the Agricultural Research Institute). The project would proceed to use these maps to:

- Identify where implementation of specific practices to reduce land degradation could occur. Extension officers, based within local and regional governments, would work directly with farmers to help them to reduce land degradation. Other stakeholders would include university researchers, agronomists, and the Ministry of Agriculture.
- Create land-use plans at a village scale, integrating perspectives from village committees, and district land-use planners.

Examples of initiatives to help reduce land degradation include (i) research into appropriate agricultural diversification and education on current methods, (ii) policy and education to help regulate grazing, (iii) implementation of breeding programmes in new areas, (iv) workshops and training for extension officers and farmers groups, and (v) an online data platform with soil/crop/climate information for use by extension officers.

The group prepared presentation sheets (Figure 12) on these projects, and identified UNEP, WWF and the national government as potential funders for this work, with Tabora an appropriate location for pilot trials.

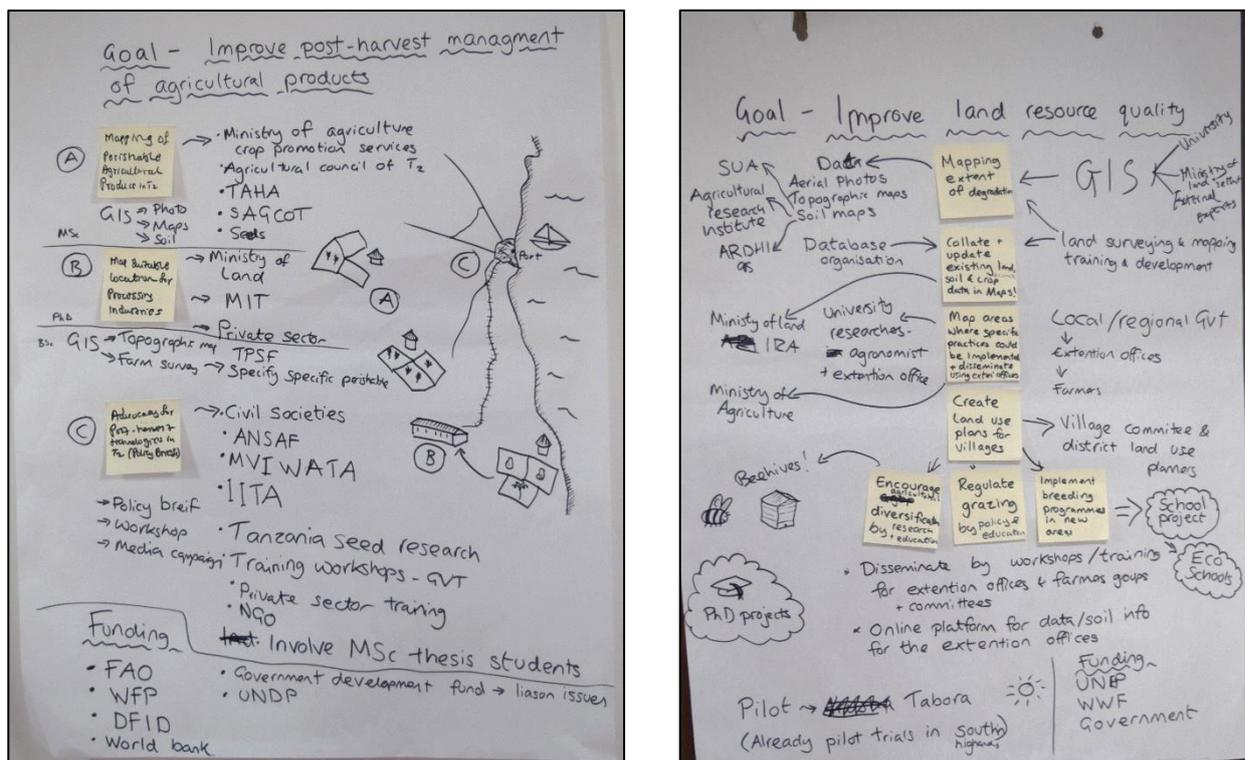


Figure 12. Initial Project Plans. Examples of the project plans determined by the food security and nutrition working group in Tanzania.

4.5 AREAS OF PROJECT OVERLAP

Across the three thematic working groups, some common themes emerged.

- *Data management.* Each group emphasised the collation and integration of data to support future project steps. Data was noted to be in diverse formats, across multiple different organisations, and sometimes held by individuals at those ministries. The full potential of this data can only be realised when appropriate data management systems are in place, and data is integrated. This will help to identify where data gaps exist, explore future research questions, and conduct more sophisticated analyses of existing data.
- *Resource degradation, pollution and environmental protection.* Each group noted resource (land, soil, water) degradation as being a high priority challenge, with two groups exploring potential projects to help address this challenge. Future urban development and industrialisation could exacerbate these problems.
- *Engagement with common stakeholders (e.g., policy makers, local governments, communities).* Across the various projects, the steps to development impact require engagement with relevant national ministries (e.g., water, health, natural resources and tourism, agriculture), local governments (e.g., district and regional governments and extension officers), and community groups.

5 Science-for-Development Partnerships

5.1 CHARACTERISTICS OF EFFECTIVE PARTNERSHIPS

Using a questionnaire methodology, participants were invited to characterise good *science-for-development* partnerships. Here we note a summary of initial results. Data will be analysed further in the context of additional workshops, and published in a peer-review journal.

In this context, we consider ‘*science-for-development*’ to be research, application and/or communication of science directed towards efforts to tackle poverty, improve economic and human development, manage the natural environment, and reduce risk and increase resilience. Science and research that supports sustainable development may require collaborations that are

- i. **International** (i.e., people and organizations from multiple countries),
- ii. **Multi-sectoral** (i.e., people from diverse sectors, such as the public and private sectors),
- iii. **Multi-disciplinary** (i.e., people from diverse disciplinary backgrounds).

Questionnaires were completed independently by participants, and they were anonymous.

Participants were initially asked to comment on previous experience of *science-for-development* partnerships. They then proceeded to explore what characteristics they think are most important in developing positive and effective partnerships. Fourteen characteristics were presented, with participants asked to rate on a 7-point Likert scale (from *Strongly Agree* to *Strongly Disagree*) how important they believe each factor to be in the formation of positive ‘*science-for-development*’ partnerships. One test characteristic (*members of the partnership are all the same nationality*) was also added to check that participants were evaluating each statement carefully and not simply giving the highest ranking to each statement.

Based on 21 responses, the characteristics of *science-for-development* partnerships ranked as being of most importance are listed below.

1. Being treated as an equal by other members of the partnership.
2. Respectful dialogue between members of the partnership.
3. Access to training and capacity building.
4. Sharing of project outputs across the partnership (e.g., reports, journal articles).
4. Access to funding/financial resources.
6. Frequent e-mail communication between members of the partnership.
7. Opportunity for all members of the partnership to contribute to project design.
7. Access to expertise of other organizations.
7. Sharing of data across the partnership.
10. Co-authorship of research outputs (e.g., journal articles, reports).
11. Access to facilities of other organizations.
12. Understanding of cultural differences across the partnership.
13. Regular face-to-face meetings between members of the partnership.
14. Frequent telephone communication between members of the partnership.
15. Members of the partnership are all the same nationality [*test characteristic*].

The rankings presented above suggest that characteristics associated with **equality**, **resources**, and **process** are all of importance to participants.

- Two of the top five ranked characteristics relate to the affirmation of partners as equals in any science-for-development collaboration. Being treated as an equal by other members of the partnership (#1) and sharing of project outputs across the partnership (e.g., reports, journal articles) (#4, joint) are highly valued by those questioned.
- Two of the top five ranked characteristics relate to the resourcing of partners during science-for-development collaborations. Access to training and capacity building (#3) was prioritised more than access to funding and financial resources (#4, joint).
- One of the top five ranked characteristics related to the partnership process. Respectful dialogue (#2) was the ‘process’ characteristic valued most by participants.

Other characteristics associated with the ‘equality’ theme are opportunities for all members of the partnership to contribute to project design (#7, joint), sharing of data across the partnership (#7, joint), and ensuring opportunities for co-authorship of research outputs (#10). These were generally given greater importance than the remaining values relating to resources (e.g., access to expertise and facilities) and partnership process (e.g., frequent email communication, regular face-to-face meetings, and frequent telephone communications).

This preliminary data synthesis can help to inform partnership development in a Tanzanian context. These results provide BGS with an understanding of key values to embed within research partnerships, supporting ongoing monitoring and evaluation of whether partnerships remain mutually beneficial. Replication of this research in other countries can help to develop a multi-national perspective on characteristics for effective science-for-development partnerships.

5.2 EXPLORING POTENTIAL REGIONAL COOPERATION

The UN Sustainable Development Goals emphasise opportunities for South-South collaboration, and so a short exercise was used which asked participants to reflect on expertise that Tanzania could share with the eight bordering neighbours (Kenya, Uganda, Rwanda, Burundi, Democratic Republic of Congo, Zambia, Malawi and Mozambique), and expertise that would be useful to get support from their neighbours.

Suggested examples of expertise available to share with neighbours included: wildlife management expertise, forest management plans, natural resource management policies and

implementation, mining extraction techniques, livestock keeping, cultural integration for peace and harmony, growth and development of tourism sectors.

Suggested examples of neighbours' expertise that would benefit Tanzania included: (Kenya) development of tourism, water resources management, management of transboundary wildlife, alternative energy resources, business (Zambia) best mining practice of heavy metals, (Rwanda) effective use of the internet, hygiene and health practices in cities (General) forest research using genetics, sustainable and safe mineral management, mining technologies.



Figure 13. Partnerships. SDG 17 emphasises the importance of positive partnerships if the SDGs are to be successfully delivered.

6 Conclusions

6.1 SUMMARY

Through this workshop, and subsequent analysis, we have undertaken, understood and demonstrated the following:

- **Section 2.** Characterised the organisations involved in this workshop, identifying key stakeholders from academia, government, and the private sector. The workshop adopted a bottom-up approach, with those attending demonstrating a high level of enthusiasm, engaging positively, with a willingness to share their expertise and experiences. Participants developed and enhanced their own networks, with the potential for future collaborative activities.
- **Section 3.** Explored development priorities in eastern Africa and Tanzania, and the role of Earth and environmental science in addressing these, identifying quality education, life on land, access to clean water and sanitation, ensuring food security, and improving industry, innovation and infrastructure as recurring priorities. This report allows all workshop participants (including the BGS) to understand development priorities in eastern Africa and Tanzania, using the SDGs as a reference tool. The approaches used to understand these priorities demonstrated an interactive pedagogy, and raised awareness of the SDGs as a global development strategy.
- **Section 4.** Summarised the discussions of three working groups, exploring potential ideas relating to sustainable land and water management, water and sanitation, and climate-smart agriculture, food security and nutrition. From these groups we identified thematic projects that

could support sustainable development in a Tanzanian context (with applications to the wider region). For example, emerging from the sustainable land and water management thematic group (**Section 4.2**) was a set of research, capacity building and innovation ideas aiming to reduce land degradation. Examples include, enhanced use of citizen science for data capture and community education, research into alternative energy potential in Tanzania, and improved mineral extraction through enhanced engagement with artisanal and small-scale miners. At the end of **Section 4** we also highlight some crosscutting project priorities (e.g., enhanced data management). The approaches used to develop projects demonstrated an interactive pedagogy, and raised awareness of a theory of change process by which projects can be determined.

- **Section 5.** Documented the characteristics that workshop participants considered to be of greatest importance in *science-for-development* partnerships, identifying those characteristics associated with equality, resourcing partners and the process by which partners work together as being of importance. Being treated as an equal by other members of the partnership, respectful dialogue between members of the partnership, and access to training and capacity building were the three highest ranked characteristics. All of the activities identified in **Section 4** will require multi-sectoral and multi-disciplinary partnerships.

In the following section, we outline the next steps, to be explored with project partners, which will advance these ideas.

6.2 NEXT STEPS

This workshop report discusses development challenges in eastern Africa (particularly Tanzania), and presents several ideas where Earth and environmental science will support sustainable development. *We will send this report to all workshop participants, and encourage their active engagement in reflecting on the conclusions and refining the proposed next steps.* Through externally funded activities, BGS staff are actively engaged in work in Tanzania. We will proactively continue discussions with many of those who were present at the workshop, and discuss the following actions to advance and enhance the outputs from this workshop:

- Co-produce project proposals (aims, objectives, background context, pathways to development impact) for ideas generated in this workshop.*** Workshop participants identified a set of potential projects that could be developed through (for example) BGS ODA or GCRF funding. For example, the water and sanitation group identified activities that could help to optimise wastewater treatment and reuse. Through meetings with stakeholders in Tanzania, *we will co-produce with in-country colleagues outline proposals for these projects in preparation for relevant funding opportunities.*
- Bring in stakeholders from additional disciplines.*** While the workshop attracted 12 organisations, key groups were missing, particularly those from national ministries (e.g., water, land, geological survey). Many of the pathways to development impact identified in previous sections will need engagement and input from ministry level officials. *We will pro-actively work to build relationships with appropriate ministries, map out stakeholders, and ensure enhanced engagement at future workshops.*
- Connect stakeholders in Tanzania with BGS (and external) expertise relevant to emerging projects.*** Having identified relevant expertise and research/project interests in Tanzania, *we will use the extensive BGS network of researcher links from across eastern Africa and the UK to catalyse new interactions.*
- Explore eastern African priorities by contrasting this workshop with the results of workshops in Kenya and Zambia.*** Having coordinated three workshops in eastern Africa (Kenya, Tanzania and Zambia), we will proceed to contrast the results of these. *We will write and publish a peer-reviewed paper that examines similarities and differences*

between development priorities across the region, and discuss emerging themes of common interest.

- v. ***Improve our understanding of effective international partnerships to support science-for-development.*** During this workshop, we collected data to understand partnership priorities in a Tanzanian context. *We will supplement this data with semi-structured interviews, and aim to publish a peer-reviewed journal article on science-for-development partnerships.*

Appendix 1 Workshop Programme

The two-day workshop programme is included below, with detail of the sessions planned.

DAY 1 (18 SEPTEMBER 2017)

	Session	Activities	Purpose
08.30-09.00	Registration & Refreshments		
09.00-09.45	Welcome/ Introduction	<ul style="list-style-type: none"> Formal welcome Context and objectives of the workshop Overview of the workshop structure/activities Participants' expectations 	
09.45-11.10	Participant Introductions and Mapping	<p>10.00-10.15 Icebreaker</p> <p>10.15-11.10 Group Activity (Stakeholder Mapping)</p> <ul style="list-style-type: none"> Introductions: Each person introduces them self (name, where from, organisation, type of activities included in their work, where these activities take place). Nodes and Linkages: Explore sectors, disciplines, collaborations. All Together: Identify how organisations influence each other (i) connect research to a new policy; (ii) approach communities about participating in research; (iii) encourage use of a new data information website. 	This exercise acts as an icebreaker, catalyses dialogue between participants, and generates data to support effective stakeholder mapping. It helps all participants know what groups are represented at the workshop, and what work they are doing.
11.10-11.30	Tea and Coffee Break		
11.30-12.30	Plenary Talks		Set the scene and give useful context to the SDGs, as well as the work of the British Geological Survey.
12.30-14.00	Lunch		
14.00-15.30	Regional Development Needs <i>(Big picture, high-level problems)</i>	<p>14.00-14.10 Session Introduction</p> <p>14.10-15.30 Sustainable Development Goals</p> <ul style="list-style-type: none"> Individual Exercise. Populate a matrix with information about priority SDGs. Group Exercise. Rank the SDGs in terms of their relative importance. All together. Identify specific challenges for priority SDGs. 	Explore stakeholder perspectives on development priorities, using the Sustainable Development Goals (SDGs) as a reference tool.
15.30-16.00	Tea and Coffee Break		
16.00-16.30	Regional Development Needs <i>(Big picture, high-level problems)</i>	<ul style="list-style-type: none"> All together. Explore the role of Earth and environmental science by identifying: (i) which SDGs require input from Earth/environmental scientists, and (ii) what that input is? 	
16.30-17.00	Open Discussion and Questions and Answer Session with BGS Team	An opportunity for comments reflecting on the information discussed in Day 1. Participants can also ask questions to the BGS team about their intentions, experiences and work.	Promote transparency and honest discussion.
17.00-17.15	Summary	<ul style="list-style-type: none"> Reflection and Summary of Day 1 Plan for Day 2, including selection of three thematic working groups. 	

DAY 2 (19 SEPTEMBER 2017)

	Session	Activities	Purpose
08.30-09.00	Arrival & Refreshments		
09.00-09.30	Welcome/ Recap	<ul style="list-style-type: none"> Recap Objectives Recap key outputs from Day 1 Structure Day 2 	
09.30-10.00	Example Project Planning: <i>What changes need to happen?</i>	Session Introduction	
10.00-11.00		Discussion Groups (<i>themes determined at the end of Day 1</i>). <ul style="list-style-type: none"> What needs to change? Groups identify the specific challenges associated with the group theme, and rank these into high/medium/low priority. How does change happen? What are the steps needed for this change to occur? 	Explore priority development challenges, and determine what changes need to happen.
11.00-11.20	Tea and Coffee Break		
11.20-12.30	Example Project Planning: <i>Earth and Environmental Science Solutions</i>	<ul style="list-style-type: none"> Earth/environmental science solutions? Groups work to develop example project outlines that would help to tackle high-priority challenges. Who needs to be involved? Identify those people who need to be involved if the project is going to result in change? Where does the funding come from? Local and International sources of funding for projects 	Identify the role of Earth and environmental science in addressing identified challenges, and consider example projects to develop this science.
12.30-14.00	Lunch		
14.00-15.00	Example Project Planning: <i>Group Feedback</i>	Feedback from group discussions, with time for questions and answers.	
15.00-15.20	Tea and Coffee Break		
15.20-16.20	Building Good Partnerships	What are the characteristics of good international partnerships? We will explore this theme through: <ul style="list-style-type: none"> Questionnaire Group Discussion Exercise The data generated may be published (in an anonymous form) and used to inform BGS future planning, enable effective monitoring and evaluation of our partnerships.	Characterise good science-for-development partnerships, from the perspective of workshop participants.
16.20-17.00	Concluding Remarks	<ul style="list-style-type: none"> Review Reflections on ways forward Formal close/thank you Feedback Forms 	

Appendix 2 Workshop Feedback

How would you rate your overall experience as a participant at this workshop?

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
					3	12

How would you rate each of the following aspects of this workshop? (n =14)

Communication before the Workshop:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
		1	1		4	8

Workshop Programme:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
					4	10

Venue:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
				2	4	8

Catering/Refreshments:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
		1		1	4	8

Quality of Discussion:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
					3	11

Opportunity to Contribute to Activities:

<i>Very Negative</i>	<i>Fairly Negative</i>	<i>Slightly Negative</i>	<i>Neither</i>	<i>Slightly Positive</i>	<i>Fairly Positive</i>	<i>Very Positive</i>
					2	12

Consider your overall experience at this workshop. Please indicate the extent to which you agree/disagree with the following statements (n =14, 1 person did not complete the final three questions):

I received the communication I needed to play an effective part in the workshop.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
		1			8	5

I felt comfortable getting involved in the table discussions.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
					3	11

I felt comfortable getting involved in the larger (whole-workshop) discussions.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
					4	10

The workshop proceeded at a pace I felt comfortable with.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
				1	5	7

I understood how each session linked to the objectives of the workshop.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
					8	6

I felt my opinions were valued by other workshop participants.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
					7	7

I felt my opinions were valued by the workshop facilitators.

<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>
					5	9

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