

# ReSToRE summer school: Bringing geoscience and society together for sustainable resource development

1-5 July 2019 at University College Dublin, Ireland



*ReSToRE International Summer School speakers and delegates touring Glendalough and the Sally Gap, Co. Wicklow.*

## Report for sponsors

*By Dr Jen Roberts (University of Strathclyde) & Dr Anthea Lacchia (Irish Centre for Research in Applied Geosciences in University College Dublin)*

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# ReSToRE Meeting Report

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## Introduction by ReSToRE Director, Dr. Geertje Schuitema

On behalf of the participants and organisers of the Researching Social Theories, Resources, and Environment (ReSToRE) International Summer School I would like to thank all our sponsors for your support. Your generous contributions enabled us to hold a truly international, interdisciplinary event for early career researchers and practitioners that examined vital issues at the intersection of the geosciences and social sciences. The rest of this report gives a detailed summary of the summer school so I would like to highlight just a few key points here.

We brought together 42 postgraduate students and early career practitioners from 28 nations, including 18 developing countries, with eight distinguished mentors to learn, share, and debate how best to provide the earth resources needed to support society and enable the transition to a low-carbon economy in a sustainable way. Through a series of participant-led workshops, the participants identified emerging research themes and questions that should be the focus of future research and in order to guide decision making about the sustainable development of earth resources. I believe that the immersive experience of the summer school has increased understanding between geoscientists and social scientists and has helped to create a global network among the participants that will foster future collaboration.

I was so impressed by the knowledge, enthusiasm, and energy of all the participants, every one of whom engaged openly and positively with their fellow participants and mentors. Here are a couple of quotes from participants that give a flavour of the event:

*"We had 10 different countries represented within my group and I found that things that I take for granted can be completely different in different countries,"* Emer Neenan, PhD student at Trinity College Dublin, and from Ireland.

*"I now recognise ... that we are surrounded by people in the mining industry who really want to do better. I found that inspiring,"* Claire Burch, MSc student, University of Oklahoma, where she is from.

*"It has been a great experience ... At the end of the week, I'm sure I will be a changed person from the way I look at things,"* Josephat Nguu, PhD student at the Free University of Brussels in Belgium, and who is from Kenya.

The enthusiasm, commitment and positive buzz that we all felt during the week has led to some impressive and concrete results. Each workgroup has produced a presentation with new insights on emerging research themes. They are summarised in the report. Also, a roadmap for mining companies to leverage the circular economy is nearly finished and will be shared on the [ReSToRE website](#).

I look forward to continuing all our efforts to develop interdisciplinary research and practice, to build technical capacity, and to create strong networks among early-career researchers and practitioners across the globe.

Thank you again for your support!

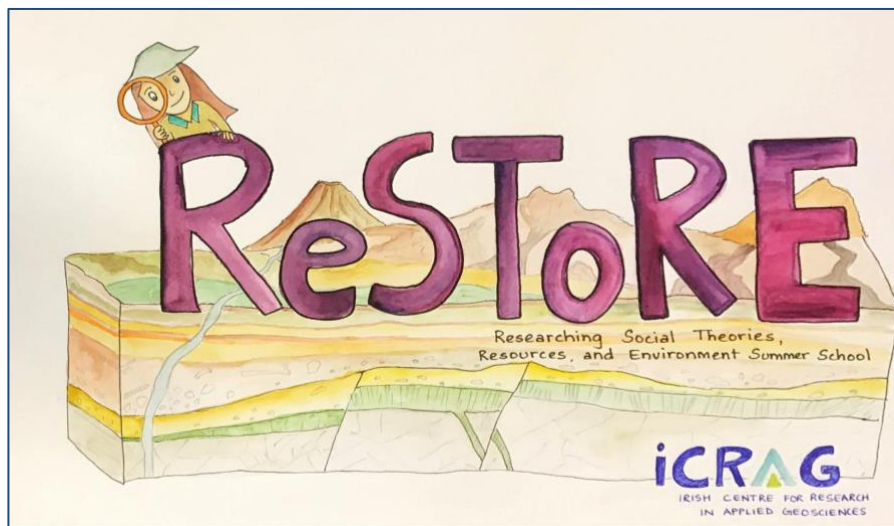
Geertje Schuitema, Director of the ReSToRE International Summer School

Dublin, 1<sup>st</sup> August 2019

## Resourcing our future: The ReSToRE international summer school

Immense and rapid societal and technical changes are necessary to achieve a low-carbon future. Globally, almost every nation has committed to meeting the goals outlined in the UN Paris Agreement<sup>1</sup>. The changes in technologies anticipated to achieve these goals, and the minerals and metals that are used in their manufacture, place new and unprecedented pressure on earth resources. Additional pressures arise from global population growth, rising standards of living, and potentially large shifts in the distribution of populations owing to the climate crisis.

Determining how we will resource present and future generations in a sustainable way is a complex and global endeavour of rising importance. The International Union of Geological Societies' (IUGS) Resourcing Future Generations initiative and the 2018 Resourcing Future Generations conference, held in Vancouver, have fostered research and discussions around this topic. The Researching Social Theories, Resources, and Environment (ReSToRE) International Summer School builds on these foundations.



*Fig. 1. ReSToRE painting by summer school participant and artist, Meenakshi Poti (PhD student at the Free University Brussels, Belgium).*

The inaugural ReSToRE International Summer School brought together a group of 42 early-career geologists and social scientists from 28 nationalities from around the world to tackle the question of how society should meet the challenge of providing water, energy, and mineral resources in a sustainable way. Highlights of participants' reactions to the summer school are presented in Appendix A and a list of participants' affiliations is in Appendix B.

The summer school was hosted by the Irish Centre for Research in Applied Geosciences (iCRAG) and took place in University College Dublin, Ireland, between 1-5 July 2019.

"Moving forward for sustainable development is very complicated," said Professor Murray Hitzman, Director of iCRAG. "There are challenges in terms of earth resources and energy, and also in terms of how people perceive these challenges and sustainable development more generally. These are critical

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<sup>1</sup> To this date 185 Parties have ratified of 197 Parties to the Convention: <https://unfccc.int/process/the-paris-agreement/status-of-ratification>

issues and this summer school is trying to help to tackle these, not just in one society, but in multiple societies".

The summer school aimed to nurture an interdisciplinary and experiential learning environment for early career geoscientists and social scientists to address cross-cutting topics, and to create a network for all participants and contributors. Specifically, the summer school sought to bring together people from developing and developed countries in the same space to foster these conversations.

## Sponsors and organisers

Dr Geertje Schuitema, Associate Professor in Consumer Behaviour and Technology Adaptation in UCD's College of Business, was Director of the summer school.

iCRAG, The International Union of Geological Sciences (IUGS) and Geological Survey Ireland (GSI) were the organising sponsors of the ReSToRE Summer School. The organising team included: Dr Maeve Boland (UCD), Prof Murray Hitzman (iCRAG), Edmund Nickless (IUGS), and Dr Aoife Braiden (Geological Survey Ireland). Dr Jen Roberts (University of Strathclyde, UK) and Dr Anthea Lacchia (iCRAG at UCD) reported on the summer school together with Elspeth Wallace (Education and Engagement Officer in iCRAG at UCD) who co-ordinated the blogs and media coverage. Background information on organisers is given in Appendix B.

The organising committee is very grateful for Dr. Siobhan Power (GSI) who led the field trip and Jessica Allen (Geoscience Ireland) who helped organised Monday's reception in Smock Alley.

ReSToRE was held under the patronage of UNESCO.

Sponsorship came from BHP, Boliden, Rio Tinto, Teck, with additional support received from the Irish Research Council and UCD College of Business. Three BHP employees and two Boliden employees took part in the summer school.



Fig. 2. Logos of sponsoring organisations.



## ReSToRE: addressing the need for interdisciplinary conversations

“Deposits of the metals that we need are irregularly distributed across the globe, and their value must be assessed with respect to sustainable development, alleviation of poverty and empowering of communities,” explained IUGS Councillor, Edmund Nickless, at the opening session of the summer school.

The summer school focused on bringing early career researchers and industry representatives into the interdisciplinary space, and all participants were within 10 years of their last degree. Edmund said: “I think the most important thing is to engage with younger people as flag carriers for the future and to motivate them. If, out of the 42 participants, half a dozen wants to do this as an area of research and want to be ambassadors, that in my mind would be a notable success.”



*Fig. 3. ReSToRE participants from all over the world: in this from left to right, in back row: Emilio Castillo (from Chile), Halleluya Ekandjo (from Namibia), Muhammad Tahir (from Afghanistan), Geertje Schuitema (Director of ReSToRE). Front row: Laura Berdi (from Hungary), Josphat Nguu (from Kenya) and Sarah Caven (from Northern Ireland).*

“This course is asking the right questions at the right time and the mix of social scientists and geoscientists and environmental scientists together is a triangle we really need,” said Dr Ozlem Adiyaman Lopes from UNESCO’s Earth and Ecological Sciences division.

“Workshops like this summer school are the things that will actually move us forward, by defining the gaps, the research opportunities, the themes to pursue, and the policies that we might need to consider or advocate for; all of these can lead to action, potentially new programs, and different ways of collaborating,” said Professor John Thompson, Emeritus Professor in Environmental Balance for Human Sustainability at Cornell University, USA, (2013-18) and now Adjunct Professor, and Principal, PetraScience Consultants, Vancouver, Canada).



*Fig. 4. Summer school participants admiring the Irish landscape during the ReSToRE fieldtrip, Sally Gap, Co. Wicklow.*

## The summer school programme

ReSToRE was held at the University College Dublin Business School. The week-long summer school followed a mixed programme which aimed to harness the diverse experience and skills of the participants by creating a space for interdisciplinary and visionary collaboration, as well as knowledge sharing. This was achieved through:

- *Plenary lectures and discussions.* These were given by a mix of leading academics and practitioners from different disciplines—all with expertise and interest in the summer school topic. The lectures were typically 30 minutes, with 15 minutes for discussion. All lectures were open to the public and live streamed; the slides as well as video recordings of the talks are available on the [ReSToRE website](#). The speakers, who joined the summer school for the full week, also acted as expert mentors for the participants. In line with the summer school ethos, the speakers themselves were diverse, representing six different nationalities and including two developing countries.
- *Group work.* Participants were assigned to one of four teams, and each team worked together for the week to address a key challenge around sustainable resourcing. The challenges were selected in consultation with sponsors. Each group's task was to define the problem, prioritise needs and identify emerging research themes to develop a research agenda to help derive solutions across a given theme. The group work was participant-led, and each group was guided by two expert mentors.
- *Field trip.* A half-day field trip to Glendalough, 50 km from Dublin in Co. Wicklow, led by Dr Siobhán Power from Geological Survey Ireland, allowed participants to admire some of Ireland's scenic landscapes and learn about the local geology, while continuing the critical summer school conversations and introducing social scientists to geological fieldwork.
- *Social events.* A series of evening social events included an ice-breaker evening reception on the day of arrival, a formal reception co-hosted by Geoscience Ireland in Smock Alley Theatre and

dinner in Dublin city centre on the first day of the summer school, events associated with the field trip to Glendalough, and a closing reception on the UCD campus on the final night.

- *Shared social spaces.* Breakfast, lunch, and afternoon coffee breaks were all held in an open plan area with easy access to benches and grassy spaces outside the building. This facilitated networking and mixing amongst participants, mentors, workshop organisers, sponsor representatives and other contributors. Students were housed in dormitories on the UCD campus. The individual rooms had shared kitchen and social spaces which also provided opportunities for interaction.

Participants worked together to prepare a series of [blogs](#) throughout the week, supported by iCrag Education and Engagement Officer and summer school participant Elspeth Wallace.

The full programme of events is provided in Appendix C.



*Fig. 5. Dr. Ozlem Adiyaman Lopes (UNESCO; fourth from left) with ReSToRE International Summer School participants from developing countries.*

## Who was involved?

### The participants

The summer school united participants from 28 different nationalities, the majority of which (18) were developing countries; participants represented institutions from nine developing and 12 developed countries. An overview of the participants' affiliations and countries of origin is provided in Appendix B.





*Fig. 6. Summer school participants and mentors came to Dublin from all over the world (grey shading shows the countries that they came from).*

Attendance at the summer school was competitive, and financial support was available for half of the delegates due to sponsorship from global organisations such as UNESCO and the IUGS, as well as industry sponsors. A quarter of the delegates were from the extractive industries (i.e., mining, petroleum and related services) and the remainder from academia and government. Collectively, participants brought together expertise in geology, economics, ecology, business, law, engineering, and communications. Women constituted over a third of participants.

### **Expert mentors**

The expert mentors were a diverse mix of leading academics and practitioners representing expertise from different disciplines relevant to the summer school topic. The eight speakers joined the summer school for the full week. As well as giving one plenary talk each, they acted as expert mentors for the participants during their group work. Profiles of the mentors are provided in Appendix B.

“It’s really exciting to be here with all these young people, very bright, very sharp people,” said Dr Ian Thomson, Principal of Shinglespit Consultants Inc. and summer school mentor.

“Bringing people together makes things happen. For me, one of the strengths of this summer school is that it puts a spotlight on the social relevance of these big societal challenges; it encourages the students and the mentors to really consider this side of the problem,” said Professor Wouter Poortinga, environmental psychologist at Cardiff University and summer school mentor.

### **Other contributors**

The Director, organisers, reporters and the field trip leader also contributed to the week. Profiles of the organisers and reporters are provided in Appendix B.



## Workshop A: Public acceptance of the extraction industry

### Overview

Sponsor: Geological Survey Ireland (GSI)

Expert Mentors: Dr Hazel Gibson (University of Plymouth) and Dr Goda Perlaviciute (University of Groningen)

Challenge topic: All goods and services rely on mineral and energy resources extracted from the Earth. With increasing populations, and the high demand for new technologies, the need for materials such as metals, energy resources and clean water is rising. This demand cannot be met simply by recycling or improved processes in the 'circular economy'. Geological Survey Ireland is supporting research to better understand people's connection with natural resources. In particular, what is the perception of where resources come from, are their uses fully understood, and how are they valued? Does a better understanding of these uses alter our support/rejection of, for example, mining projects? Do we understand the positive and negative consequences of resource usage – economic, environmental, quality of life? Does this differ between developed and developing countries?

Participants: (8) Anmol Barla, Joaquin Copaja, Cecilia Forsell, Emer Emily Neenan, Manuel Nopeia, Lloyd Singura, Byamungu Mayange Tomple, Buruk Kitachew Wossenyeleh.



*Fig. 8. Participants and expert mentors discussing societal perceptions of the extraction industry during one of the workshop sessions.*

## Workshop outcomes

### Key messages

In the summer school, Dr Goda Perlaviciute spoke about how people's values affect their attitude towards energy alternatives. "Influence and trust also play a role in acceptability", she said.

Similarly, "it is important to realise that information alone does not change behaviour," pointed out Prof Wouter Poortinga.

In this context, a key take-away from the summer school was the notion that it is not enough to provide publics with information about resources, but that it is necessary to consider people's values, emotions, perceptions and attitudes to geoscience and resource extraction, and engage in a dialogue with communities and different publics.

**Edited extract from the ReSToRE [blog](#) from Day 1, written by Workshop A Participant, Emer Neenan.**

*Emer is a PhD student at Trinity College Dublin, working in geoscience education.*

If you read or hear "*public acceptance of the extraction industry*", what do you picture? If I say "public," do you imagine the same thing I'm imagining? Just because we're all speaking English doesn't mean we're all speaking the same language.

Our group spent a considerable amount of time on Day one simply defining words.

The *public*, we discussed, is not a monolith, it is comprised of many "publics". It means local communities and it means national identities. It means people who care and people who don't.

*Public acceptance* means whether the public accept something and also how much the public accept something (and "not at all" might be the answer). It means whether they care about it, or even know about it. It means if they agree with it, or if they're satisfied with it, or if they agree with it now because they have been satisfied with it. Maybe sometimes it just means they're not actively protesting it.

The *extraction industry* might mean a zinc mine to one person, and a global network of rich and amoral corporations to another person. It might encompass everything from old quarries, to modern deep high-tech mines, to huge offshore drilling projects, to small artisanal seasonal mines.

We found it was vitally important to find or make a common language for us to be able to tackle the complex challenge topic that we were discussing.

### Issues going forward

Four topics that need to be considered and explored in further detail were identified. These focus on understanding how knowledge and understanding, narrative and framing, and contextual factors affect public acceptance of the extraction industries.

- *Current awareness and attitudes.* In order to consider whether publics understand the importance of mineral resources in resourcing the future, and whether the level of understanding affects their views towards the extraction industry, there is a need to know more about:
  - (a) Public awareness of and attitudes towards the extraction/use of different resources.



- (b) How different publics access information on earth materials, and in particular, to assess whether, when and how the formal education system provides understanding of natural resource extraction and use.
- (c) Public trust in different sources of information about resource extraction/ use.
- (d) Whether the source of information about natural resource extraction and use affects attitudes towards or preferences regarding the industry and regarding consumer responsibilities.
- *Narrative and framing.* We should investigate how the narrative of public information and communication formats and platforms affects public awareness of and attitudes towards resource extraction and use. What is the most effective way of communicating the importance of mineral resources in daily life and on the impact the extraction industry can make to achieve social and economic development?
- *Changing practice – from mine site to product use.* What is the rationale for the strongest or most common negative perceptions of the extraction industries? Are these well founded? If so, what needs to change in order to enable development of the mineral extraction that is necessary to sustain future generations? If not, what issues need better framing?
- *Context dependent factors.* How do the research questions above differ for different countries, and particularly for developed / developing countries, or countries with a strong mining industry and countries that have few mineral resources?

Better understanding of these issues will allow for more effective engagement with publics (from communities to consumers) around the resourcing of future generations. This may help to initiate or develop effective dialogue around resource extraction and the supply chain. Such dialogue could then enable changes in practices that may satisfy current and future publics.

## Workshop B: Community engagement in earth resource extraction and use

### Overview

Sponsor: Rio Tinto

Expert Mentors: Dr Judy Muthuri (Nottingham University Business School) and Dr Ian Thomson (Shinglespit Consultants Inc.)

Challenge topic: The availability of natural resources and potential for renewable energy are geologically constrained to locations where they naturally occur. Community opposition to activities to source these resources have often become a key factor in the development of projects. Therefore, a careful exploration of new developments and engaging communities from the start of projects is important. What are the best strategies to engage communities in projects? How can effective interaction with local, regional and national communities be developed? What are the best practices in engaging communities in land-use decision making in the short term and in the long term? And how does this depend on the level of governance and political situation of countries?

Participants: (11) Laura Berdi, Claire Burch, Michael Calder, Rajarsi Chakravarti, Halleluya-Naantu Ekandjo, Sariful Islam, Michaela Keßelring, Mira Kyllästinen, Josphat Nguu, Meenakshi Poti, Elspeth Wallace.

## Workshop outcomes

### Key messages

Workshop B considered what is meant by community engagement, what is meant by *good* community engagement, the importance of good community engagement, and the mutual benefits it brings.

They defined community engagement as “a continuous process whereby different parties involve in dialogue to generate and maintain a mutual agreement satisfactory to all parties”.

They recognised that while there is no one recipe for successful community engagement, for so many of the factors that influence the engagement and communication process and the relationship are context specific, some aspects are fundamental to good engagement:

1. It's not what you do, it's *how* you do it
2. Nobody is too small to be important
3. Transparency is authenticity
4. It is really important to do due diligence
5. Community engagement is a process, not an event

A key part of good engagement was deemed to be continuity and flexibility: the engagement plan should constantly change based on the situation.

**Edited extract from the ReSToRE [blog](#) from Day 3, written by Workshop B Participant, Claire Burch** *Claire is an MSc student in environmental sustainability at the University of Oklahoma*

Public acceptance of decisions is hugely affected by (1) trust in the entities involved (whether this be the government or the industry) and (2) the ability to impact decisions. But it is not necessary to have both: you need one or the other. If trust in the entities involved is lacking, you need to be sure to allow stakeholders to engage in the decision-making process actively. If allowing stakeholders to be involved in decision-making is not feasible, you need to be sure there is a strong sense of trust. For achieving or resolving either, you need good community engagement.

### Issues going forward

While the group grappled with their problem question: *How do we effectively engage communities when developing a resource or environmental activity?* they identified the following research questions to consider or explore:

- How can community engagement be high-quality and continuous from discovery to ongoing development?
- How do (a) globalization, (b) technological developments, (c) social media, and (d) “green” initiatives e.g. circular economy, impact effective stakeholder engagement and the methods in which we do it?
- How do you balance differing values in communities to ensure perspectives are respected but the project is not hindered?
- How can imbalance in power in stakeholder engagement be accounted for appropriately or effectively?

- What does the role of gender play in stakeholder engagement? How do we effectively include gender and gender norms in strategic plans?

## Workshop C: Earth resources and the circular economy

### Overview

Sponsor: Boliden

Expert Mentors: Prof Wouter Poortinga (Cardiff University) and Prof John Thompson (Cornell University and PetraScience Consultants)

Challenge topic: Earth's resources are scarce, discovery is difficult, and responsible development and extraction present many challenges. Given societal needs and imperatives, how do we improve mining and metal producing practices, reduce waste, and make use of the waste that we generate? Once resources enter the market, traditional 'take-make-(use)-dispose' models of consumption are inherently wasteful of resources. More 'circular' models aim to design out waste from this process, by extracting the most value out of resources and materials whilst in use. This can be done through increasing the lifetime and the recovery of materials, components or products. What are the opportunities within the circular economy to create value from waste, developing new products or returning waste into the resource production cycle? But also: how can the circular economy become more efficient in its use of resources, e.g., by changing the design of products (and services)? And what is the role of the consumer therein? What is the uptake of such products and how are they disposed of? How can companies engage in responsibly waste management, from those at the front-end in primary production to those interacting directly with consumers? Can we fully integrate the resource to consumer relationship in order to drive change at both ends?

Participants: (9) Nic Bilham, Sarah Caven, Alejandro Delgado Jimenez, Brittney Marshall, Vanja Medugorac, Cretus Joseph Mtonga, Mizanur Rahman, Benjamin Van Roozendaal, Mark Simoni.

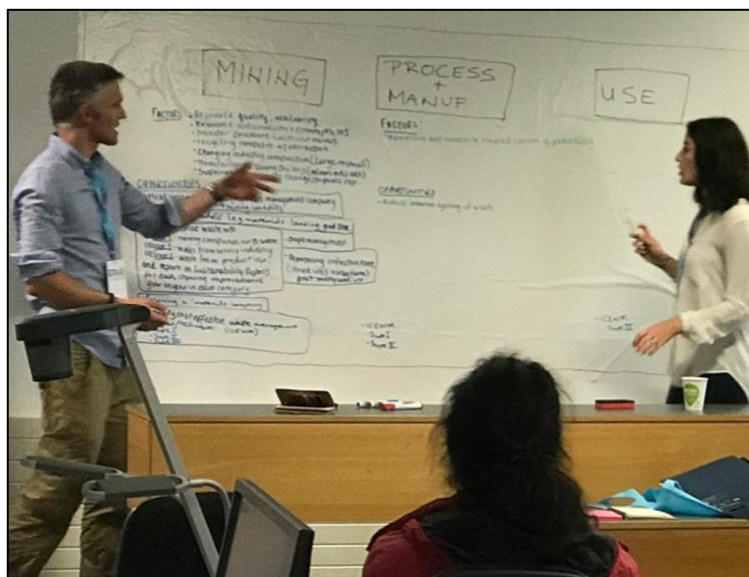


Fig. 9. Active debate about the circular economy in workshop C.

## Workshop outcomes

### Key messages

Workshop C concluded that there is great potential for mining industries in the circular economy. They developed a **roadmap for mining companies**<sup>2</sup> to leverage the circular economy, in which they propose that mining industries re-emerge as ‘materials companies’ or ‘resources companies’.

Speaking about the circular economy, mentor Prof Wouter Poortinga pointed out, “the circular economy is inherently interdisciplinary - this forces us to think beyond disciplinary boundaries.”

"The circular economy should be the ultimate goal of everything we do," said Prof John Thompson. The mine of the future will embrace the circular economy, according to John, with new discoveries of quality deposits, improved processing, and new ways to include recycled feed material. "We want to aim for responsible mines that are clean and efficient, with reduced, managed and possibly reused waste, and we will have to accomplish this by being transparent and collaborative in all respects," he said.

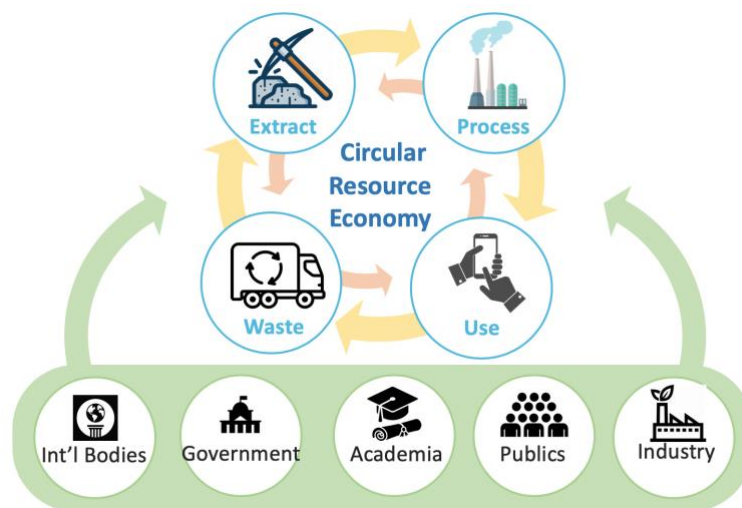


Fig. 10. A circular economy model for the resources sector in which the mining industry is rebranded to become the resources industry.

### Edited extract from the ReSToRE [blog](#) from Day 3, written by Workshop C Participant, **Brittney Marshall**

*Brittany is a petroleum geologist at BHP and is based in Houston.*

Sarah Caven asked one simple question that carried the weight of one-thousand implications:

“If circular economy is the answer - why aren’t we doing it?”

This question kicked off a week of defining the ins and outs of the physical supply chain, the people system that surrounds it and the ways we could challenge status quo to make a positive change.

<sup>2</sup> The participants are currently finalising the road map. When it is ready, it will be circulated to all participants and sponsors and contributing organisation, and it will be available on the [ReSToRE website](#).



We divided the supply chain out into its key actors and stakeholders - mining, processing/manufacturing, consumers, waste management, government, international bodies, etc. - and defined the trends, needs and opportunities for each. Clear links developed across supply chain opportunities and trends, and an opportunity for consumers became an equally opportune action for the mining industry. We began putting a story together around the mutual benefits of a circular economy - for the environment, for society and for the economy (in the frame of the mining company). We plan to develop a road map, and (equally) a call for action for mining companies to leverage the circular economy for a more sustainable and profitable future.

### *Key issues going forward*

Workshop B developed a roadmap for mining companies to leverage the circular economy. This will be openly shared when it is completed.

Some of the key messages include that:

- In the resources sector, a circular economy is not necessarily circular; the resource flow pathways can be complex.
- Mines/metal producers' input into the circular economy must improve to reduce and recycle waste, recycle water, maximise recovery of value, and potentially to process new sources. It was felt that adopting the emissions framework to apply to all mining waste and reporting on these wastes would drive positive progress.
- Mines/metal producers must be connected to consumers / market. This creates a need for exploring the role of consumer production companies, new business models (e.g. lease metals?), and collaboration
- All stakeholders hold and should take responsibility for delivering a circular economy.

## **Workshop D: Ethical and responsible sourcing of earth resources**

### **Overview**

Sponsor: BHP

Expert Mentors: Edmund Nickless (IUGS) and Prof Natalia Yakovleva (Newcastle University London)

Challenge topic: Sourcing of earth resources in developing countries have a negative reputation: How does it influence climate change? Is there an excess of land and water use? However, such questions should not only be asked to developing countries. The Western world uses these earth resources too. This raises questions of what ethical and responsible sourcing is. Can we authenticate the sources of each component of manufactured goods? Can we authenticate the working and environmental conditions along the supply chain of each component of manufactured goods? And how are resources distributed across their users? How can the sourcing of materials demonstrate accountability and transparency in the supply chains? What types of reporting and indicators can be applied for production and consumption of Earth resources? How to shape responsible production and consumption for earth resources in the future?

Participants: (10) Emilio Castillo, Mary Bingham Chee, Melissa Crowley, Vicky Hough, Alex Russell, Daniel Sidwell, Muhammad Tahir, Larona Sethna Teselethso, Luke Viljoen, Bunting Kayode Williams.

## Workshop outcomes

### Key messages

**Edited extract from the ReSToRE [blog](#) from Day 3, written by Workshop D Participant, Emilio Castillo**

*Emilio is a PhD student in mineral economics at the Colorado School of Mines*

The concept of responsible sourcing flows directly from the sustainable development goals, but there is a lot discussion within our workshops about what we should expect from people (consumers) and from companies (producers/manufacturers).

In practice, consumers and producers play different roles that are magnified when it comes to minerals: should we focus more on countries rather than individuals? Metals consumption and production are not taking place homogeneously in the world. Consumption challenges appear mostly in the global north and production challenges in the global south. Questions arise, like: Are they consuming too much? Should they limit their production? How can we achieve an efficient level? Who will bear the cost and benefits of restricting metals? Are we willing to give up comforts of modern life? Is it the right thing to do?

Responsible consumption of metals deals with informed decisions. For example, labelling and rankings help consumers to weight values not always reflected through the market price. However, it is difficult to leave everything to final consumers and we should be more interested in manufacturers. Do they have at least a conflict minerals policy?

Responsible primary production, however, is less clear. The resource itself and local contextual factors and conditions differ. Water, energy and land use are not clearly comparable, and efficient production standard does not seem something that regulation needs to further push. This is where our discussions were focussing this afternoon.

### Key issues going forward

Workshop D grappled with the definitions of and differences between what is meant by ethical, what is meant by responsible, and how this translates into earth sciences and specifically into consumers and companies. There is no single answer. However, the group felt that it was important to consider ethics through the supply chain, and identified there is a need to:

- Develop international guidelines for mineral consumption
- Raise awareness of the impacts of mineral consumption from source to product. Make individuals and nations accountable for their resource use
- Develop global best practice for responsible mineral resource development

Meanwhile, there is a need to also consider:

- What are the definitions for ethical and responsible sourcing, and who/what determines what can be considered as an ethical product?
- How do we communicate what is ethical or sustainable? Who will people trust to do this?
- Multiple stakeholders have the ability to drive more ethical and responsible sourcing of Earth's resources, but who holds the greatest power and influence?

- How can social marketing to be used to shape ethical & responsible resource production & consumption? Ethical resource extraction can be shaped by leveraging marketing concepts and theories to inform and influence consumers, thus influencing both manufacturers and producers to ensure ethical behaviours.

## Other outputs from the group work

The blog articles and the participants' highlights from the summer school, shown in Appendix E, show how valuable the participants found the group work. Further, there have been thousands of tweets tagging the ReSToRE twitter hashtag [#RESTORESummerSchool](#), which continues to be active.

The summer school team (including participants, mentors, organisers, contributors and reporters) are currently preparing abstract contributions to the upcoming International Geological Congress in New Delhi in 2020, specifically for a symposium proposed by UNESCO-IGCP-IUGS: Session 1.12 The roles of UNESCO, IGCP and IUGS in realizing the UN Sustainable Development Goals.

Future outputs, including press articles, participant blog posts and news items will be listed on the [ReSToRE website](#).

## What's next? Keeping the ReSToRE conversation going

ReSToRE's discussions highlighted the necessity for a multi-faceted, long-term, adaptive and continuous program of activity addressing issues around the sustainable resourcing of future generations. This activity must involve all stakeholders, since it was felt that all stakeholders share responsibility for changing current practices in resource extraction and consumption and the related waste and environmental and societal challenges. Academic and other researchers and practitioners have a critical role to play in conceptualising, documenting, analysing, and disseminating information about these activities, in addition to playing an appropriate role in the activities. In fact, towards the end of the summer school discussions, there were clear indications that participants had fostered a strong sense of responsibility for action and a deeper understanding of some of the challenges, and the immense rewards, of interdisciplinarity and diversity.

A key message is that the different actors necessary for resourcing a sustainable future cannot be considered in isolation. Consumer demand, business practices, environmental and societal impacts, community involvement in decision-making and development are all intrinsically interlinked in a non-linear chain which interweaves resource supply use and reuse. Failure to consider resourcing issues through a collective lens may help to solve individual issues but will not support progressive change effectively and efficiently.



Fig. 11. At the end of the week, ReSToRE participants were invited to give words that came to mind when thinking about the summer school. The size of the word represents how many times the word or phrase was submitted. Key words that stand out relate to sustainability, diversity, and working together.

This requires interplay between the technical and non-technical worlds, bridging policy, industry, practitioners and academia, and uniting geoscience and engineering, and social and political science. This isn't easy. For many, working at the edge of one's discipline, and stepping into the space of others, can be challenging and uncomfortable. Building collaboration across divides needs resourcing and support. Thus, interdisciplinary and cross-sectoral fora are fundamental for future resource development in line with our global sustainability goals.

Professor John Thompson pointed out that there is a need to create the space for knowledge sharing and interdisciplinary work to take place. "Meetings like this - when you don't have an agenda for who you're going to meet and how you're going to collaborate - are the ones that I think are more productive; you're already out of your comfort zone a little, so you are more receptive to different views and perspectives," he said.

"I love having mixed, diverse people to work with and audiences with different backgrounds; it's what makes things happen. The fun and the really innovative ideas happen when you're at the edge of your expertise working with somebody else who's also on the edge of their expertise, then common ideas can emerge and evolve," he added.

Participants recognised the importance of finding a shared language at the start of the summer school. As Edmund Nickless pointed out, "One of the challenges when you have a multidisciplinary group is saying 'I didn't quite understand that' to whoever you are talking too, because all disciplines find safety in talking in their own technical language. So, you've got to make time and effort to find that common ground of language."

Above all, in order to move forward in addressing the issues uncovered by the summer school, a global network is necessary, and is now in being put place. Dr Maeve Boland, of University College Dublin's School of Earth Sciences and GSI, said: "One of the goals of the summer school was to facilitate the



development of a global network of people working in this interdisciplinary area, and I don't just mean interdisciplinary from an academic point of view but interdisciplinary in the sense that people from industry, NGOs and community perspectives were involved".

"We would like to build a community that will strengthen individual actors in whatever they are doing, advance how we do things, and share experiences," Maeve added.

And there is appetite amongst the participants to stay connected. There is a very active twitter account #restoresummerschool and ongoing discussion on a Whatsapp Group that was initiated by the participants. The lively discussions that are ongoing after the summer school finished show how the group continues to be active all around the world.

These conversations are not limited to the participants alone. The summer school has struck up collaboration and conversations and reflection within and between the organisers, contributors and mentors, as well as with the participants. The ReSToRE twitter hashtag continues to be active, also, reaching communities well beyond those involved in the summer school itself, and inviting others to join the conversation, too.

Based on observations at the summer school and review of other capacity-building programmes, some of the lecturers and the organising group are preparing a proposal that includes continuation of the ReSToRE model of intensive networking and interdisciplinary study and the development of additional structures to foster mutual knowledge exchange and capacity-building both within and at the intersection of the geosciences and social sciences.

Abstract contributions to the 2020 International Geological Congress in New Delhi and other conferences are being prepared by ReSToRE participants, mentors, organisers, and reporters. See Appendix E.

## **Further Information**

A suite of summer school resources, including live-streamed videos of the presentations and blogs from the delegates can be found on the [ReSToRE website](#).

## Appendix A: Highlights from participants

We asked participants about their experiences at ReSToRE: highlights included hearing different perspectives on the issues examined, an appreciation for the international quality of the summer school, career ideas, and a sense of fun!



**Laura Berdi, PhD student working in geoscience at iCRAG (DIAS and UCD)**

Nationality: Hungarian

*I really love the international environment and people sharing their real-life experience as it's something that we can all use in the future and implement in our jobs. The most important thing for me was to get a wider perspective and see what the career options are out there if I would like to leave academia. The summer school was really interesting in that context, I have a lot of ideas about what I'd be interested in doing with my career after I finish the PhD.*

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**Claire Burch, MSc student in environmental sustainability at the University of Oklahoma, USA**

Nationality: American

*Over this week I've come to have a much softer and more accepting opinion of mining. I now recognise the necessity of earth resources and understand that we are surrounded by people in the mining industry who really want to do better. I found that inspiring.*



**Sarah Caven, living and working from British Columbia, Canada as a minerals and sustainability consultant and on the Impact Facility for Sustainable Mining Communities**

Nationality: Northern Irish and citizen of the world!

*My highlight has been the people – it has been such an inspiring group of passionate, driven and fun individuals. A lot of the lectures have been delivered by people who are leaders in this space, I really respect and admire their work and so was thrilled to see them included in the program. When I look around the room, I see a truly diverse and global group aligned to the same vision - resourcing future generations within environmental and social constraints. What is really exciting is this is the next generation of leaders, when they get into management roles they will be making decisions aligned with these concepts and values. We now have this network for life and I hope we can continue to collaborate as we progress throughout our careers, be it in academia, government, industry or elsewhere.*

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**Halleluya Ekandjo, Exploration Geologist at the Vedanta Skorpion Zinc Mine, Namibia**

Nationality: Namibian

*Putting yourself in the shoes of the communities is the only way to understand what they are going through, and this actually gives you different opinions on how things should be done.*



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**Vicky Hough, mining engineer with BHP in Perth, Australia**

Nationality: British

*For me, it was quite important to have perspectives from across the resource supply chain represented at the summer school because while this is a geoscience problem around sustainability, a lot of the decisions around sustainable extraction are made by the mining engineers and by the processing engineers. It's been really great just to meet different people at different stages of their careers and to understand what are different people's drivers and thoughts. I think that really helps to contribute to the solutions because everybody brings a different perspective for different reasons.*

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**Vanja Medugorac, PhD student researching the social acceptance of decentralised energy systems at Business School of University College Dublin, Ireland**

Nationality: Croatian

*I was afraid that there would be a lot of talk of chemistry, rocks and those kinds of issues, but it was very easy for me to take part in the workshops.*

*Our group had people from very different backgrounds and cultural experiences, so we had a nice conglomerate of perspectives and ideas.*

*I enjoyed the collaboration going on in the group – we had a very good dynamic. The highlight was working together on our task. I also enjoyed linking big issues with local, small scale challenges. We were covering the whole spectrum, and tackling a single problem from different perspectives.*

*People are usually trained in their own discipline, but since the problems we are facing require multiple perspectives we should get used to and be trained to cooperate with different disciplines. Monodisciplinary approaches are limited; we need to see problems from different angles to understand that they are complex.*

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**Emer Emily Neenan, PhD student in Earth Science Education at Trinity College Dublin, Ireland**

Nationality: Irish

*The international meeting of different stories was probably my favourite aspect of the week; we had 10 different countries represented within my group, and I found that things that I take for granted can be completely different in different countries.*



**Josphat Nguu, MSc student in marine and lacustrine ecosystems in Free University of Brussels, Belgium.**

Nationality: Kenyan

*It has been a great experience for me. I can link between marine ecology and geoscience.*

*At the end of the week, I'm sure I will be a changed person from the way I look at things and how we can link the two.*

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**Meenakshi Poti, PhD student at the Free University of Brussels, Belgium**

Nationality: Indian

*I'm studying conflicts between conservation and development in tropical islands.*

*For me, it's really important to understand the social aspects of conservation or natural resource management or whatever we may call it in our languages.*

*I don't know much about the technical side of geosciences, but we speak the same language when we are talking about social science because we use the same methods in both our ways of approaching conservation or mining.*

*I like the dialogue and the exchange of ideas that we had here, and how international the group was - it wouldn't be the same if you were sitting in a room with people from only one country.*



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**Alex Russell, PhD student on arsenic in groundwater in Irish Centre for Research in Applied Geosciences (iCRAG), University College Dublin, Ireland**

Nationality: Northern Irish

*The summer school has shown me that there are so many research questions and things still to be done in terms of social science meeting geoscience and that there is a whole world outside of geochemistry, so it has opened my mind about the many routes I can take as a career.*





**Lloyd Singura, geologist and researcher at the University of Papua New Guinea, Papua New Guinea**

Nationality: Papua New Guinean

*I applied to the summer school for the chance to learn about the connection between science and social science. For me, it's very educational - learning from different presenters from social science and science or people with experience in both.*

*I was also really looking forward to the fieldtrip, because in Papua New Guinea we only have younger rocks.*

**Muhammad Tahir, mining geologist at Core Drillers in Kabul, Afghanistan**

Nationality: Afghan

*I am a technical person – we do exploration – but dealing with people in the area was a big problem for me.*

*Now, for example, I have some ideas about how to involve the community and about mining ethics.*

*That's what I wanted to know and when I go back I have to apply it practically. The summer school really helped me a lot.*



**Byamungu Mayange Tomple, PhD student at Daegu University, South Korea**

Nationality: Congolese (DR)

*The workshop included people from social science and geoscience backgrounds and it was really wonderful. I know more than I did before. I am trying to see how to add the information I got here into my future research, especially in Congo.*

## Appendix B: Who was involved in the summer school?

### Participants

Amongst participants, **28 different nationalities** were represented, including from Afghanistan, Australia, Bangladesh, Belgium, Botswana, Chile, Colombia, Congo DR, Croatia, Ethiopia, Finland, Germany, Hungary, India, Ireland, Kenya, Mozambique, Namibia, Northern Ireland, Papua New Guinea, Sierra Leone, South Africa, Sweden, Switzerland, Tanzania, UK, USA, and Zimbabwe.

Participants came from **28 organisations** including Akita University, Aqua-Farms Organisation, BHP, Boliden, Colorado School of Mines, Core Drillers Kabul, Deagu University, Dublin Institute for Advanced Studies, The Dragonfly Initiative, East Carolina University, Fraunhofer Society, Free University of Brussels, Geological Survey of Norway, Indian School of Mines Dhanbad, James Cook University, Norwegian University of Science and Technology, Trinity College Dublin, University of Cape Town, University College Dublin, University of Exeter, University of Leuven, University of Paris, University of Oklahoma, University of Oxford, University of Papua New Guinea, University of Sierra Leone, Vedanta Resources, Virginia Polytechnic Institute and State University.

### Expert Mentors



#### **Dr Hazel Gibson (Plymouth University, UK)**

Dr Hazel Gibson is a researcher of the public perception and communication of geothermal power at Plymouth University. Having started her career working as an Engineering Geologist in a geotechnical firm in Australia, she moved into science communication, working in the USA and UK; eventually ending up at the Natural History Museum in London. This combination of experience in industry and public engagement led to an interdisciplinary PhD at Plymouth University, examining public perceptions of geology in the South West of England. Covering science communication, psychology, geology and geography, this research has led to a whole new understanding of how expert and non-expert geoscientists conceptualise the geological subsurface and how that understanding can be used to improve the effectiveness of our communications.

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#### **Prof Wouter Poortinga (Cardiff University, UK)**

Wouter Poortinga is Professor of Environmental Psychology at the Welsh School of Architecture and the School of Psychology, Cardiff University. His research interests are in environmental risk perception, sustainable behaviours and lifestyles, and human-environment interactions. Recent work includes a field trial to reduce the use of disposable coffee cups, the behavioural and attitudinal implications of plastic bag charges, the health impacts of energy-efficiency improvements, and European perceptions of climate change.





**Dr Judy Muthuri (Nottingham University Business School)**

Judy is an Associate Professor of Corporate Social Responsibility at Nottingham University Business School (NUBS). She has extensive expertise in the area of business and social development. Her current research covers a range of topics including corporate social responsibility and sustainability, multi-stakeholder partnerships and social innovations for sustainable cities and communities, and future foods both in Europe and in Africa. Judy is a Board Member for Voluntary Services Overseas in United Kingdom (UK), coordinates the Africa Diaspora Academic Network in the UK and is the founding executive member of the Africa Academy of Management. Judy is Chair of the Social and Environmental Responsibility Group at NUBS leading the UN Principles for Responsible Management Education work.

**Edmund Nickless (Chair, International Union of Geological Sciences, Councillor 2016-2020)**

Edmund is a geologist by training and has worked extensively on assessment of industrial mineral resources. From 1997 until his retirement in September 2015 he was Executive Secretary of The Geological Society of London. Previous to that, he held senior posts within the British Geological Survey, the then Science and Technology Secretariat of the Cabinet Office where he was environmental adviser, and the Natural Environment Research Council where he was responsible for research grants, training awards and UK participation in international programmes, principally the Ocean Drilling Program and its successors. Since 2013, he has chaired a group on behalf of IUGS promoting a new initiative, Resourcing Future Generations. He is a Fellow of the Geological Society of London, a Fellow of the Geological Society of America, a Chartered Scientist, Chartered Geologist and European Geologist.



**Dr Goda Perlaviciute (University of Groningen, Netherlands)**

Goda Perlaviciute is associate professor in Environmental Psychology at the University of Groningen, the Netherlands. Her research focuses on public acceptability of energy sources, systems, and policies. She focuses on theory development and applying theory in addressing acute environmental and energy problems. Goda is teaching in multiple undergraduate and graduate courses on Environmental psychology and energy, and gives courses and trainings to practitioners and decision-makers in the energy domain. She coordinates the master programme Environmental psychology at the University of Groningen.

**Dr Natalia Yakovleva (Newcastle University London)**

Natalia is a Senior Lecturer in International Business Strategy at Newcastle University London. Natalia specializes in research on sustainable and responsible business. She developed expertise in the field of corporate social responsibility and corporate-community relations, especially in the extractive industries. Natalia has conducted research on management of social and environmental implications of small- and large-scale mining in Argentina, Ghana and Russia. Natalia is an Associate Director of the Institute for Sustainability at Newcastle University since November 2017. She has a PhD in Environmental Studies, and a BSc in Economics.



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**Prof John Thompson (Cornell University and PetraScience Consultants)**

John has been dividing his time between Cornell University, where he has been the Wold Professor of Environmental Balance for Human Sustainability, and Vancouver, BC where he consults on exploration, mining and sustainability. John has worked in the mining industry and related research for 35 years, including Chief Geoscientist and VP Technology and Development for Teck Resources, and Director of the Mineral Deposit Research Unit at the University of British Columbia. He has had diverse leadership roles in many organizations – Chair, Resources for Future Generations 2018; Chair, Genome BC; Past-President Society of Economic Geologists; Co-Founder and Chair, Geoscience BC; Co-Founder and Chair, Canada Mining Innovation Council; and member of two councils for the World Economic Forum. He is on the Boards of exploration and technology companies, and participates in advisory groups for clean technology and sustainability.



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**Dr Ian Thomson (Shinglespit Consultants Inc.)**

Dr Ian Thomson has more than 40 years of experience in the mining industry, working for the last two decades to advance and refine the management of social issues in resource development projects. He has led the development of new standards and guidelines for good practice management of social issues during mineral exploration, facilitated construction of the Principles and Guidance for Responsible Exploration for the Prospectors and Developers Association of Canada, and has been a prime mover in developing both the concept and metrics of the Social License to Operate.



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## Organisers

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**Dr Geertje Schuitema (Director of ReSToRE. UCD School of Business)**

Geertje is Associate Professor in Consumer Behaviour and Technology Adoption at UCD's College of Business. She works with scholars from many different disciplines and with industry on issues around consumer behaviour, public engagement and policy acceptance. Her work has always been applied and interdisciplinary in nature, as she is interested in complex societal issues, for example around energy, the use of raw materials, and transportation. Hence, I work with scholars in many different disciplines such as engineers, economists, mathematicians, geographers, and political scientists, as well as with industry in these areas. I am interested in the research processes in interdisciplinary projects in general, and the role that social sciences in particular play in them.



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**Dr Maeve Boland (University College Dublin/ Geological Survey Ireland)**

Maeve is a Senior Geoscience and Policy Specialist based in the UCD School of Earth Sciences and at Geological Survey Ireland. She holds B.A. and M.Sc. degrees in geology from Trinity College, Dublin, and a PhD from Colorado School of Mines. She worked in mineral exploration, the petroleum sector, and at Geological Survey Ireland before moving to the United States. She spent a year as the AGU Congressional Fellow working on energy policy in the U.S. Senate, followed by two years as a policy fellow at the U.S. Geological Survey. Maeve was Director of Geoscience Policy at the American Geosciences Institute from 2013 to 2018, representing and serving AGI's 52-member societies in Washington, DC.

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**Edmund Nickless (Chair, International Union of Geological Sciences, Councillor 2016-2020)**

See list of speakers, above, for biographical details.

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**Prof Murray Hitzman (Director of iCRAG)**

Murray is Director of iCRAG and a Science Foundation Ireland Research Professor. Murray has B.A. degrees in geology and anthropology from Dartmouth College (1976), an M.S. in geology from University of Washington (1978), and a Ph.D. in geology from Stanford University (1983). He worked in the petroleum and minerals industries from 1976 to 1993 primarily doing mineral exploration worldwide. Dr. Hitzman served in Washington, D.C. as a policy analyst in the U.S. Senate and the White House Office of Science and Technology Policy (1994-96). In 1996, he was named the Fogarty Professor in Economic Geology at the Colorado School of Mines (CSM) and served as head of the Department of Geology and Geological Engineering from 2002-07. His research in economic geology at CSM was focused on the Central African Copperbelt. In 2016 he joined the U.S. Geological Survey as the Associate Director for Energy and Minerals. In 2018, he was appointed SFI Research Professor in the School of Earth Sciences and Director of iCRAG, based at University College Dublin.



**Dr Aoife Braiden (Geological Survey Ireland)**

Aoife completed her degree in Earth Science in NUI, Galway and a PhD in Palaeobiology in UCD. In 2006 she began coordinating research activities for the UCD Geophysics Research Group. Following 9 years' experience managing national and international research projects (pre- and post-award), and a qualification in Business Studies, Aoife moved to the Geological Survey of Ireland where she is responsible for managing the Geoscience Research Programme. Her roles includes building collaborations with industry, academia and other research partners, overseeing GSI involvement in large scale national and international research programmes and managing the GSI research funding calls.

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## Reporters

Two reporters, Dr Anthea Lacchia (iCRAG at UCD) and Dr Jen Roberts (University of Strathclyde) joined the summer school specifically to capture key questions, messages and outcomes from the week. The reporters aim to maximise the impact of the summer school, and so spread the ReSToRE messages and outcomes far and wide.



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**Dr Jen Roberts (University of Strathclyde, UK)**

Jen is a Chancellor’s Fellow in Energy at the University of Strathclyde. Her research is interdisciplinary and applied, and addresses the social and environmental risk of geological resources – often relating to energy. Jen uses her technical background in geology to tackle questions relevant across geoscience, environmental science, environmental psychology, environmental engineering and political science. These questions relate to the perception, assessment and communication of risks relating to low-carbon energy technologies, which, for many, the subsurface plays a vital role. Ultimately her work aims to inform how the necessary transition to a net zero carbon future can be implemented in a way that is acceptable to society and to the environment.



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**Dr Anthea Lacchia (iCrag at University College Dublin, Ireland)**



Anthea grew up in northern Italy, in a town at the foot of the Alps. Having studied Classics in high school in Italy, she moved to Ireland and obtained a BA in Geology from Trinity College Dublin. During her undergraduate studies, she developed a keen interest in thinking about the lives of ancient animals preserved in rocks – fossils – which led her to pursue a PhD in palaeontology, specifically looking at extinct relatives of squid and cuttlefish called ammonoids. She spent many seasons of fieldwork perusing the rocks of Co. Clare, in western Ireland. In parallel with her research, she gained experience both in science writing and newspaper editing. Following completion of her PhD, she spent a year working as a press officer for Springer Nature in London.

She then returned to Ireland to start postdoctoral research in iCrag, the Irish Centre for Research in Applied Geosciences, in University College Dublin, where she is studying public perception and understanding of geosciences, with a focus on the geology and communities of Co. Clare. Her postdoc allows her to combine her passion for geology with that for science communication and public engagement.

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## Media coverage and outreach



**Dr Fergus McAuliffe, iCrag**

Fergus manages all of iCrag’s communications, education and public engagement activities. He holds a PhD in environmental science from University College Cork. Alongside his research experience, Fergus also has a wide range of experience in science communication, through winning FameLab International in 2013, delivering workshops and conference talks on science communication around Europe, and is currently a presenter on “The Science Squad/10 Things to Know About” on RTE1 television. As part of his role, Fergus works closely with the Public Perception and Understanding of geoscience platform in iCrag.

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**Elspeth Wallace (iCrag)**

Elspeth Wallace manages two public engagement programmes: [Earth Science Education](#) and [Geocareers](#) in iCrag, including [Girls into Geoscience Ireland](#). Elspeth is an experienced science communicator, with a passion for promoting women in science and works closely with the [Public Perception and Understanding of Geosciences](#) platform as part of her role.



## Field trip leader

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### **Dr Siobhan Power (Geological Survey Ireland)**

Siobhán Power, Geological Survey Ireland, did a PhD on the Dalradian of Connemara at NUI, Galway, before doing post-doctoral work on ultrahigh metamorphism in NE Greenland at the University of Iowa. She then taught geology at Liverpool John Moores University for seven years as well as volunteering with the youth development organisation British Exploring, first as a science leader and then as chief scientist, on Arctic expeditions. With a growing interest in leadership, youth and community development, and science communication, she moved back to Ireland, first as geologist with a cross-border geotourism project and finally moved to Geological Survey Ireland in early 2016.

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## Appendix C: ReSToRE programme



### MONDAY 1 July

08.30 – 09.15	Registration, coffee and breakfast
09.15 – 09.30	Welcome and opening
09.30 – 10.00	Introduction ReSToRE by Edmund Nickless
10.00 – 11.30	Presentation of “workshops”
11.30 - 13.00	Workshops
13.00 – 14.00	Lunch
14.00 – 15.15	Workshops
15.15 – 15.45	Coffee
15.45 – 16.30	Talk by Dr Hazel Gibson
18.30 – onwards	Reception at Smock Alley

### TUESDAY 2 July

08.30 – 09.15	Coffee
09.15 – 10.00	Talk by Dr Ian Thomson
10.00 – 12.30	Workshops
12.30 – 13.30	Lunch
13.30 – 14.15	Talk by Dr Natalia Yakovleva
14.15 – 15.00	Workshops
15.00 – 15.30	Coffee
15.30 – 17.00	Workshops

### WEDNESDAY 3 July

09.00 – 09.15	Coffee
09.15 – 10.00	Talk by Dr Goda Perlavicuite
10.00 – 12.00	Workshops
12.00 – 12.30	Lunch
12.30 – 17.00	Field trip to Glendalough
17.00 – 21.00	Dinner and return “home”

### THURSDAY 4 July

09.00 – 09.15	Coffee
09.15 – 10.00	Talk by Dr Judy Muthuri
10.00 – 10.45	Talk by Prof Wouter Poortinga
10.45 – 12.30	Workshops
12.30 – 13.30	Lunch
13.30 – 15.30	Workshops
15.30 – 16.00	Coffee
16.00 – 17.00	Workshops

### FRIDAY 5 July

09.00 – 09.15	Coffee
09.15 – 10.00	Talk by Prof John Thompson
10.00 – 12.30	Workshops
12.30 – 13.00	Lunch
13.00 – 14.00	Workshops
14.00 – 14.30	Coffee
14.30 – 16.00	Presentation outcome workshops
16.00 – 17.30	Reception
17.30 – 21.00	Barbeque in the Court yard (on campus)

## Appendix D: Abstract of public lectures

All public talks were recorded and can be viewed on the [ReSTORE website](#). The slides can be downloaded there as well.

### **The public understanding of and communication about geological resources between diverse communities by *Dr Hazel Gibson, Plymouth University, United Kingdom***

More and more often discussions of the extraction, development and use of geological resources in the UK are happening in the public sphere. From mining for resources like tungsten and aggregates, to developments connected to the UK's burgeoning geothermal power industry, to the controversy surrounding gas and oil extraction, carbon capture and storage and the deep geological disposal of radioactive waste; complex geological issues are being constantly reframed in local, regional and national conversations. Key to these conversations is the issue of how different groups communicate these ideas both internally (within their own group) and externally (outside their group), which depends on how they conceptualise geological issues. By examining how geological concepts are understood differently by expert and non-expert groups, how values and framing affect communication and the difference between communication and engagement this talk will demonstrate how the answers to complex issues of future development and sustainable resource use, lie at the intersection of natural science, social science and communication practice.

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### **Stakeholder engagement - the key to managing social risk factors in the mining industry by *Dr Ian Thomson, Shinglespit Consultants Inc., Hornby Island, Canada***

For more than 20 years managing social risk, avoiding community opposition and/or social conflict, has been the principal challenge facing the mining industry globally. In 2019, international accounting firm Ernst and Young rated the need to gain and then maintain the acceptance of the local community and other stakeholders – to earn a social license to operate – as the number one risk for miners. For Ernst and Young, “underestimating the power of even one stakeholder would be a mistake”. Similarly, Deloitte consider that social license is “becoming a pivotal strategic issue that will either differentiate companies or derail them”. Drawing on the extensive case history of the San Cristobal mine, where there is now 23 years of information on stakeholder relations, it is possible to show how the character of relationships have changed over time and demonstrate the application of various tools and techniques in the management of community and stakeholder relations. Particular attention will be given to the significance of effective stakeholder engagement; transitioning critical relationships from transactional interaction to collaboration, and; the power of stakeholder mapping in revealing critical structural features that impact on the quality of relationships and provide a base for strategic and tactical decision making.

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### **Salience and institutional analysis and design (SIAD) framework and the investigation of the relationship between mining companies and external stakeholders by *Dr Natalia Yakovleva, Newcastle University London, United Kingdom***

The presentation will focus on conflict over the use of natural resources between mining companies and local communities. The framework combines stakeholder salience of power, urgency and legitimacy with institutional analysis and design to investigate possible strategies adopted by mining



companies when they come across conflicts with local communities over natural resource use. In developing countries, where informal institutions and rules are prevalent and state authorities struggle to enforce statutory rights of resource users, cooperation strategy has clear benefits for both mining companies and external stakeholders to maintain stability in the governance of natural resource use. The presentation will be bringing examples from Ghana and Argentina in the talk to highlights how the framework can be applied for design of appropriate governance solutions.

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**Public acceptability of energy sources, systems, and policies by Dr Goda Perlaviciute, University of Groningen, the Netherlands**

Various energy projects are being proposed to promote a sustainable energy transition. Examples are geothermal, wind, solar, and hydro-energy projects, biomass, some fossil fuels such as natural gas, nuclear energy, and carbon capture and storage. Public acceptability influences whether and to what extent these different projects can be implemented. But what determines public acceptability of energy projects? Individual values play an important role here. People accept energy projects that support their core values, whereas they oppose energy projects that threaten their core values. I will present my research on public acceptability of energy projects, including the longitudinal study on public perceptions of gas production and the resulting earthquakes in the Netherlands. I will discuss the role of values in developing sustainable energy projects that are socially acceptable.

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**Community engagement and development: the role of business by Dr Judy Muthuri, Nottingham University, United Kingdom**

In this session, we challenge ourselves to rethink the meaning of 'community' and 'development' and critically interrogate the implication of our definitions to the practise of community engagement in development. We frame our discussions within the context of business organisations engaging in community development, and therefore, investigate the popular corporations' mechanism of engaging in community development mainly through their social investments. We conclude by identifying some possible avenues for future research in corporate community engagement and sustainable community development.

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**Of policies, behaviour and single-use plastics by Prof Wouter Poortinga Cardiff University, United Kingdom**

Single-use plastics have clearly caught the public's attention after Blue Planet II highlighted the problems of plastic pollution. This has followed a few examples of behaviour change policies to reduce litter and waste, sometimes in the face of initial public resistance. From banning microbeads to charges on plastic bags, how have these policies succeeded in shifting what is socially acceptable? This presentation will report on two projects, one on the English plastic bag charge and one on disposable coffee cups, to see how policies change attitudes and behaviour related to single-use plastics and packaging.

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**Exploration, mining and sustainability by Prof John Thompson, Cornell University and PetraScience Consultants, Vancouver, Canada**

Understanding the sources of energy, water, and the materials that make everything from planes to cars and mobile devices is challenging. For many people, the increasing global population and related demand for energy and metals suggests that shortages are imminent. For others, new technologies

based significantly on the use of metals will help to mitigate climate change and will solve other global issues.

The energy and transportation markets are changing rapidly, with the options and costs for renewables, grid storage and electric vehicles all moving with implications for metal demand. For example, a recent study by the World Bank concluded that significant increases in the production of major and minor metals would be required to produce sufficient renewable energy, battery storage and electric cars to minimize climate change-related temperature increases by 2050. Even with some uncertainty behind the assumptions in this study, significant increase in demand for metals seems likely.

Increasing the supply of metals over the next forty years will require more mines, and therefore the use of more energy and water, and the potential for more issues related to permitting, community support and the environment. Clearly, addressing energy and water sources and use in mining is fundamental to best practices and future supply. Simply put, if we are going to produce more metals in order to make the world a better place for humans, we must do it more efficiently and responsibly, or else we will be no further ahead.

In parallel, efforts must increase to minimize waste, reprocess or use waste, and recycle materials and metals from products. Increasing the efficiency of recycling poses many problems in an increasingly complex material-intensive world. The primary resource sector can play an important role in recycling, addressing both technical and societal issues, as we drive towards the circular economy.

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## Appendix E: Press coverage and other publicity

This is not comprehensive. Other future outputs are expected.

### Press coverage

#### Newspapers (print)

- 2nd July Irish Examiner. Crystal Clear Vision. <https://www.pressreader.com/ireland/irish-examiner/20190702/282587379525908>)
- 16<sup>th</sup> July Wicklow Times (North Edition, p.14; South Edition) Glendalough hosts early career researchers aiming to solve environmental and social issues

#### Newspapers (online)

- 3<sup>rd</sup> July irishtimes.com Rare metals needed but social and environmental issues must be resolved (<https://www.irishtimes.com/news/environment/rare-metals-needed-but-social-and-environmental-issues-must-be-resolved-1.3945273>)

#### Broadcasters (online)

- Under review: RTE' Brainstorm (*prepared by ReSToRE reporters*)
- 5<sup>th</sup> July Live interview on Phoenix Radio FM's "D15 Today Show", a radio station in Dublin area.

### Geoscience news outlets

- In press :The Geoscientist: Meeting Report (i for next issue) (*prepared by ReSToRE reporters*)
- In preparation: European Federation of Geologists (EFG) E-bulletin (*prepared by ReSToRE reporters*)
- Under review: IUGS newsletter. Submitted 15<sup>th</sup> July (*prepared by ReSToRE reporters*)

### Blogs

- 1<sup>st</sup> -5<sup>th</sup> July: several [blogs](#) written during the summer school by participants.
- 17<sup>th</sup> July: European Federation of Geologists (EFG) blog: <https://eurogeologists.eu/restore-summer-school-bringing-geoscience-and-society-together-for-sustainable-resource-development/> (*prepared by ReSToRE reporters*)
- July 19<sup>th</sup> InFACT project blog <https://www.infactproject.eu/restore-summer-school/> (*prepared by participant*)
- 25<sup>th</sup> July Loop: <http://www.loopng.com/png-news/bringing-geoscience-society-together-sustainable-development-85895> (*prepared by participant*)
- In preparation: EGU blog GeoLog: The ReSToRE summer school on the sustainable development of Earth resources: reflecting back (*prepared by ReSToRE reporters*)

## Conferences

The visibility of the summer school will be increased via a series of presentations at meetings and conferences.

International Geological Congress, New Delhi, India. March 2020.

Abstract contributions to the upcoming 36<sup>th</sup> International Geological Congress (IGC) in New Delhi in 2020 are being prepared amongst the summer school team; including participants, mentors, organisers, contributors and reporters. The abstracts will be submitted to the symposium proposed by Dr Ozlem Adiyaman Lopes (UNESCO) and Edmund Nickless (IUGS): *The roles of UNESCO, IGCP and IUGS in realizing the UN Sustainable Development Goals* (Session 1.12).

Attendance of summer school participants at the 36<sup>th</sup> IGC may be supported by the IGC GeoHost programme (which support travel to IGC for applicants from developing countries) and additional funds may be available for a limited number of ReSToRE participants.

Other conferences:

Abstracts are also being prepared for American Geophysical Union (AGU) Fall Meeting in San Francisco in 2019. This conference attracts more than 20,000 attendees each year.

## Other outputs

We have asked summer school participants and mentors to report back on other outputs from the summer school.