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Society

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Sand and the Sandbank: is sand extraction a sustainable business?

30 Jan 2019

**The Geological Society
Burlington House, London**

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CONFERENCE PROGRAMME

Wednesday 30 January 2019	
09:00	Registration with tea & coffee
09:30	Welcome – Ian Selby (Sustainable Earth Institute)
09:40	KEYNOTE: 2014 UNEP report and an update on developments Pascal Peduzzi (UNEP)
10:00	Defining sand – characteristics, deposits, and origins and availability: a global view Andrew Bloodworth (British Geological Survey)
Session I: Looking to the future and the UN Sustainable Development Goals	
10:15	KEYNOTE: Cities, infrastructure and new places over the next 50 years – what will our world look like Matthew Free (ARUP)
10:35	KEYNOTE: Resources and the UN Sustainable Development Goals Iain Stewart (Sustainable Earth Institute)
10:55	Summary session
11:00	Refreshment break in the lower library
Session II: The Problem of demand – markets Facilitator: Mark Russell	
11:30	The economics of sand – valuing sand and its uses Aurelie Delannoy (Mineral Products Association)
11:50	Reclamation and placemaking – where to next? Will Shields (NewWaves Solutions)
12:10	The role of sand in building climate resilience through coastal adaptation Jaap Flikweert (RHDHV)
12:30	Built on sand: tracking material stocks and flows through the physical economy Mark Uwe Simoni (NTNU Industrial Ecology Program)
12:50	Summarising the markets Mark Russell
13:00	Lunch in the lower library
Session III: Management practices: coping and adapting Facilitator: Andrew Bloodworth	
14:00	Concrete and engineering fills in the built environment – sand use now and in the future Kristen Henson (KLH Sustainability)
14:20	Environmental impacts of sand extraction – management and mitigation Anne Dugdale (SLR Consulting)
14:40	New approaches to sand resource management – in a constrained environment Vera Van Lancker (Royal Belgian Institute of Natural Sciences)
15:00	Who cares? Stewardship and governance of sand Ian Selby (Sustainable Earth Institute)
15:20	Defining the key questions for the panel session Andrew Bloodworth
15:30	Refreshment break in the lower library
16:00	Panel discussion: Exploring themes and data gaps – resources, social licence, environmental impact, and governance
16:30	Panel discussion: Defining a common purpose and creating a process to address the challenges
17:00	Wine reception sponsored by the Mineral Products Association

KEYNOTE: 2014 UNEP report and an update on developments

Pascal Peduzzi (UNEP)

In 2014 UN Environment produced a report “Sand, rarer than one thinks” showing that sand is the second most used natural resource after water. The use of sand and gravels (aggregates) was multiplied by three in the last two decades to reach 40-50 billion metric tons per year.

This is enough to build a wall of 27 m high and 27 m wide all around the equator every year. Put another way: the global extraction of 50 billion metric tons each year is equivalent to every person on the planet using 18 kilograms of sand and gravels every day! This extractive sector triggers significant environmental impacts.

Our civilization is literally built on sand. We use sand for roads, dams, buildings and other infrastructures, land reclamation, beach refurbishment, as well as in agriculture, electronics, glass, even in cosmetics.

Obviously we cannot use such amount of material without generating significant environmental impacts. These impacts vary according to where sand is taken. UN Environment has initiated an experts’ consultation to see how we can lower the impacts from sand extractive sector, as well as how to decrease our demand from sand. There are many options, we will need to be innovative and be much more clever in the way we are using sand. Better use of this resource is part of our journey toward achieving sustainable development.

DEFINING SAND – CHARACTERISTICS, ORIGINS, DEPOSITS, AND AVAILABILITY: A GLOBAL VIEW

Andrew Bloodworth (BGS)

Sand is a very familiar material to geologists, civil engineers, and the general public. But do we share a common understanding of what sand is? This talk will discuss what processes form, move and concentrate sand and how these processes influence the availability of sand from both static and dynamic deposits.

THE ECONOMICS OF SAND: VALUING SAND AND ITS USES

Aurelie Delannoy (Mineral Products Association)

Sand is a controversial resource. This is not because of the riches and political influence it may bring to a few nations across the world where it is mostly distributed like for oil and gas, or because there is a unanimous understanding of its essentiality to life like for water. More often than not, controversy tends to focus on the costs of its extraction and uses: the environmental impact of extraction on the marine and inland ecosystems, the environmental sustainability of materials derived from sand such as cement, and the scale of the demand, which in some geographical settings can put pressures on seemingly infinite resources. Yet, as for many issues of significance, the full story is rarely black or white; for sand, the economic and political context matters. Looking at the contribution of sand to the economy as a whole can bring some balance to the debate, fleshing out not only the costs but also the benefits of its extraction.

Analysing the economics of sand point to a simple, yet perhaps misunderstood, conclusion: there is not one global market for sand, but multiple markets, each with their own demand and supply challenges, at scales ranging from the local and regional through to national and international. First, it is important to remember that the demand for sand is not just about fancy sky-scrapers and artificial islands, it is also (and one may argue more importantly) about safe, robust and resilient housing and infrastructure, vital for any economy and the society it supports to function. In addition, demand is not only driven by population growth and urbanisation, an important feature in the developing world; in the developed world, it is also about the much-needed replacement and upgrading of existing capital stock for future productivity and economic growth.

The economics of sand show that with good policy and regulation in place, extraction can generate significantly more economic value than the sector itself, whilst also helping to achieve policy goals in areas such as sustainable development. In the UK, a study published by the CBI Minerals Group showed that minerals extraction (excluding oil and gas) generated £235bn in gross value added in 2013, representing 16% of the total UK economy. It directly employed 34,000 people and supported another 4.3m jobs through the supply chain. Similarly, focussing on construction mineral products, including the extraction of aggregates and related manufacturing activities such as cement, the MPA estimates that the industry had a turnover of £18bn in 2016, employing 74,000 people directly and supporting 3.5m jobs in its supply chain. The UK is also a leader in using recycled and secondary sources of aggregates as part of the supply mix, has a relatively low aggregates production per capita whilst being largely self-sufficient with marginal imports, and has driven efficiencies in cement manufacturing, reducing carbon emissions by 25% between 1998 and 2016.

Irrespective of which side of the cost-benefit analysis is being considered, one common issue emerges: the lack of comprehensive data is not only a problem for environmental impact assessments, but also to evaluate the overall socio-economic contribution of sand and the wider extractive industry. This issue is not confined to the developing world either, even in the UK, although some data is available, the commitment to data collection is wavering and inconsistent, depending on political agendas and policy considerations. Yet, sand – or more generally aggregates – is a long-term industry by nature. A clear understanding of the dynamics of demand and supply today and over the next 10-15 years, underpinned by robust data, is essential to ensure sustainable supply is available to meet the needs of our nation.

RECLAMATION AND PLACEMAKING – WHERE TO NEXT?

Will Shields (NewWaves Solutions Ltd)

This presentation will be a fly through several topics from a contractor's perspective, including:

- Sand Sources – The Bad & The Good!
- Reclamation examples
- Investment in equipment
- Client sourced material in the UK
- Reducing demand on sand sources

The reclamation examples will include details of a major land creation programme in Singapore. Since independence in 1965, total area of the city of Singapore has increased more than 20 percent, by reclamation. As a global commercial hub and one of the biggest ports in the world, finding suitable space for industry is an on-going challenge. Since the early 1990's the Singapore government has been developing a major oil and chemical platform on Jurong Island, in the southwestern part of the island country. Adjacent is the Tuas View, a peninsula and part of Singapore mainland.

Between 1995 and 2012 the western extension of Singapore was carried out in four consecutive phases, and the size of every new phase was at least twice the size of the previous contract. Dredging International and its subsidiary for the South-East Asia region (DIAP) together with partners, have been involved in each of these four phases. The reclamation at Jurong Island was executed simultaneously with expansion works at Tuas View.

THE ROLE OF SAND IN BUILDING CLIMATE RESILIENCE THROUGH COASTAL ADAPTATION

Jaap Flikweert (RHDHV)

Sand nourishment can be a flexible, adaptive and multifunctional solution for coastal zones at risk of flooding and erosion – but this does require good design, robust impact assessment and clear communication about its pros and cons. The presentation will provide context about the climate change challenges for coastal management; give a global overview of beach nourishment practices; and then focus on the specific policy approaches in the Netherlands and the UK, including recent trends and a forward look.

BUILT ON SAND - TRACKING MATERIAL STOCKS AND FLOWS THROUGH THE PHYSICAL ECONOMY

Mark Uwe Simoni (NTNU Industrial Ecology Programme)

To understand the implications of geological resource depletion, we have to be able to measure it, and need quantitative models for outlining possible future development scenarios and intervention options. However, this endeavour is challenged by data fragmentation, our failure to untangle relevant linkages, and the lack of an international framework and standards for the description and monitoring of material and energy systems.

A wide range of stakeholders including the International Resource Panel, EUROSTAT, national geological surveys, as well as industry associations and companies increasingly recognise Material Flow Analysis (MFA) for its ability to monitor material stocks and flows through what industrial ecologists call the “physical economy” or “industrial metabolism, and for helping them anticipate future challenges related to raw materials, energy and emissions.

Projects like the H2020 MinFuture Coordination and Support Action provide fundamental expertise and recommendations that is not only highly useful but indispensable for understanding the sand, gravel and crushed rock (construction aggregate) system and for communicating the implications of human resource consumption.

However, to be able to model future geological resource pathways, evaluate their consequences, and provide policy advice, a lot of work remains to be done to integrate physical and systemic parameters into quantitative models that integrate the whole material value chain.

CONCRETE AND ENGINEERED FILLS IN THE BUILT ENVIRONMENT – SAND USE NOW AND IN THE FUTURE

Kristen Henson (KLH Sustainability)

Kirsten will explore historic patterns of use of aggregates in the UK construction industry and consider how and why use has changed over the years. She will introduce some recent research work undertaken on behalf of The Crown Estate which set out to challenge the perception that recycled aggregates are always environmentally preferable to virgin aggregates. The research has led to the adoption of new assessment criteria in BREEAM 2018, the UK's most widely used environmental assessment methodology for buildings. Kirsten will conclude with a review of some recent trends around marine aggregate use in London's large infrastructure projects, and the potential implications for land based and marine based resources.

ENVIRONMENTAL IMPACTS OF SAND ABSTRACTION – MANAGEMENT AND MITIGATION

Anne Dugdale (SLR Consulting)

The presentation provides a UK perspective on the environmental impacts of extraction of both land won and marine dredged sand deposits. For land won deposits, the nature of the geological formation including thickness of the deposit and presence of unwanted materials may affect certain environmental impacts. Many of the key principles outlined are consistent with best environmental management for the sector in Europe and internationally.

The presentation discusses how proposals for sand extraction can be designed to avoid environmental and cultural assets, and so minimise conflict. GIS mapping tools can be used to provide initial data on potential conflicts with assets that would be directly or indirectly affected by proposals for sand extraction. It is noted that higher status assets may not preclude sand extraction but require more sensitive design, management and mitigation.

All sand extraction activities have the potential to generate environmental impacts which may be significant, even if the impact is only short term. Potential environmental impacts are identified and categorised according to key characteristics including the permanence of the impact.

A brief overview is provided of the system of environmental controls that applies in the UK, including land use planning and marine licensing, both of which may be accompanied by Environmental Impact Assessment. The system is set up to minimise environmental impacts and, in the case of land won deposits, to achieve a beneficial after use. The UK system of regulation includes the ability to refuse consent to extract the sand, and to impose mitigation measures that will make otherwise unacceptable proposals acceptable.

Progressive working and restoration of land won sand is highlighted as a key means of avoiding long term effects, and providing opportunities for beneficial enhancement with regard to biodiversity, public access and other environmental and socio-economic legacy benefits. Community engagement is likely to be key to avoiding conflict with local communities and achieving best after use outcomes.

Marine dredging is shown to create environmental benefits with regard to direct delivery to large urban centres of demand. Operational controls including minimising the areal extent of dredging are secured through the licensing system to minimise environmental impacts.

For both land won and marine sand extraction, controls are supported by monitoring and enforcement through administrative procedures and using criminal sanctions as a backstop.

NEW APPROACHES TO SAND RESOURCE MANAGEMENT – IN A CONSTRAINED ENVIRONMENT

Vera Van Lancker (Royal Belgian Institute of Natural Sciences)

Mineral and geological resources are non-renewable on time-scales relevant for decision-makers. The sustainable management of these invaluable resources requires a thorough and careful balancing of available quantity and quality versus rapidly changing societal and economical needs. The need for such an approach is recognized in the EU's Raw Materials Initiative, which highlights the optimization of the geological knowledge base as a key element in ensuring sustainable supplies from within the EU borders. Comprehensive knowledge on the distribution, composition and dynamics of geological resources therefore is the backbone of long-term strategies for resource use in a rapidly changing world.

As a world premiere a transborder geological knowledge base is now available for the Belgian and southern Netherlands part of the North Sea comprising volumetric 3D pixel ('voxel') models of its subsurface, environmental impact models accounting for geological boundary conditions, a geological data portal and a voxel-based resource decision support module. The newly developed tools assist in the preparation of long-term adaptive management strategies, as well as in scientifically underpinning new legally binding measures to optimize and maximize long-term exploitation of aggregate resources within sustainable environmental limits. These proposed measures feed into policy plans that are periodically evaluated and adapted (e.g., Marine Spatial Planning and the Marine Strategy Framework Directive, the environmental pillar of Europe's Maritime Policy). More info on this Belgian Science Policy project: <https://odnature.naturalsciences.be/tiles/>

TILES Consortium: Royal Belgian Institute of Natural Sciences (coordinator); Ghent University, Department of Geology and Department of Telecommunications; TNO Geological Survey of the Netherlands; and FPS Economy, Continental Shelf Department

WHO CARES? STEWARDSHIP AND GOVERNANCE OF SAND

Ian Selby (Sustainable Earth Institute, University of Plymouth)

Around the world, the governance of sand resources around the world is generally underdeveloped or non-existent and supply is a response to market demand. Effective governance -the process of decision-making and delivery – which includes rights, policies, planning and regulation, requires well developed knowledge, legal systems and structures which rarely exist.

Weak governance is a consequence of historically unconstrained resources and market led supply of sand. Recent significant increases in demand for sand have exposed the weaknesses in an unmanaged system which is now not fit for purpose and has led to concerns over access to resources in the future.

Stewardship offers an approach to sustainably managing sand resources at a time when the assumption of continuity of supply no longer applies. Stewardship requires oversight of the resources and embraces governance, resource and demand management, economic incentives and technological development. In particular, it identifies a role with responsibility for the resource – the steward. The steward role sits comfortably with the mineral owner – acting in the interests of the mineral which is recognised as a national asset.

GSL CODE OF CONDUCT FOR MEETINGS AND OTHER EVENTS

INTRODUCTION

The Geological Society of London is a professional and learned society, which, through its members, has a duty in the public interest to provide a safe, productive and welcoming environment for all participants and attendees of our meetings, workshops, and events regardless of age, gender, sexual orientation, gender identity, race, ethnicity, religion, disability, physical appearance, or career level.

This Code of Conduct applies to all participants in Society related activities, including, but not limited to, attendees, speakers, volunteers, exhibitors, representatives to outside bodies, and applies in all GSL activities, including ancillary meetings, events and social gatherings.

It also applies to members of the Society attending externally organised events, wherever the venue.

BEHAVIOUR

The Society values participation by all attendees at its events and wants to ensure that your experience is as constructive and professionally stimulating as possible.

Whilst the debate of scientific ideas is encouraged, participants are expected to behave in a respectful and professional manner - harassment and, or, sexist, racist, or exclusionary comments or jokes are not appropriate and will not be tolerated.

Harassment includes sustained disruption of talks or other events, inappropriate physical contact, sexual attention or innuendo, deliberate intimidation, stalking, and intrusive photography or recording of an individual without consent. It also includes discrimination or offensive comments related to age, gender identity, sexual orientation, disability, physical appearance, language, citizenship, ethnic origin, race or religion.

The Geological Society expects and requires all participants to abide by and uphold the principles of this Code of Conduct and transgressions or violations will not be tolerated.

BREACH OF THE CODE OF CONDUCT

The Society considers it unprofessional, unethical and totally unacceptable to engage in or condone any kind of discrimination or harassment, or to disregard complaints of harassment from colleagues or staff.

If an incident of proscribed conduct occurs either within or outside the Society's premises during an event, then the aggrieved person or witness to the proscribed conduct is encouraged to report it promptly to a member of staff or the event's principal organiser.

Once the Society is notified, staff or a senior organiser of the meeting will discuss the details first with the individual making the complaint, then any witnesses who have been identified, and then the alleged offender, before determining an appropriate course of action. Confidentiality will be maintained to the extent that it does not compromise the rights of others. The Society will co-operate fully with any criminal or civil investigation arising from incidents that occur during Society events.

Geological Society **Fire Safety Information**

If you hear the Alarm

Alarm Bells are situated throughout the building and will ring continuously for an evacuation.

Do not stop to collect your personal belongings.

Leave the building via the nearest and safest exit or the exit that you are advised to by the Fire Marshall on that floor.

Fire Exits from the Geological Society Conference Rooms

Lower Library:

Exit via main reception onto Piccadilly, or via staff entrance onto the courtyard.

Lecture Theatre

Exit at front of theatre (by screen) onto Courtyard or via side door out to Piccadilly entrance or via the doors that link to the Lower Library and to the staff entrance.

Main Piccadilly Entrance

Straight out door and walk around to the Courtyard.

Close the doors when leaving a room. **DO NOT SWITCH OFF THE LIGHTS.**

Assemble in the Courtyard in front of the Royal Academy, outside the Royal Astronomical Society.

Please do not re-enter the building except when you are advised that it is safe to do so by the Fire Brigade.

First Aid

All accidents should be reported to Reception and First Aid assistance will be provided if necessary.

Facilities

The ladies toilets are situated in the basement at the bottom of the staircase outside the Lecture Theatre.

The Gents toilets are situated on the ground floor in the corridor leading to the Arthur Holmes Room.

The cloakroom is located along the corridor to the Arthur Holmes Room.

Ground Floor Plan of The Geological Society

