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# Responsible Sourcing of Sand: Looking Ahead

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# *Responsible sourcing of sand : looking ahead*

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About this report: This report aims to raise awareness around the environmental and social impacts of the extraction of sand worldwide, giving insights into the supply chain and actors involved, in order to suggest potential ways forward to prevent further damage to ecosystems and people.

Cover Photo: [Sand, AMCSviatko] ©

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## Introduction

As ethical consumers, the responsible and sustainable sourcing of gold, cobalt or tin comes to mind when we consider purchasing a piece of jewellery, an electronic gadget or a new car. However, have you ever considered the responsible sourcing of sand? Do you ever think about the sand used to build your home? What about the construction and maintenance of public infrastructure by governments? Do you ever think about the electricity or gas that powers your home, and whether these are linked to fracking? When you look at your country's GDP, do you ever consider how much of its rise has been fuelled by increased construction?

In this white paper, we explore the sand supply chain and the risks related to it. We will propose key steps to encourage the industry to move towards more responsible sourcing of sand. Sand is among the most extracted minerals in the world and the significant volumes extracted at rapid rates are associated with social risks, including crime, as well as environmental risks. It is estimated that [the world's annual consumption of aggregates exceeds 40 billion tonnes](#), with other estimates reaching 50 billion tonnes a year. The extraction process engenders [negative impacts](#) on rivers, marine ecosystems and biodiversity, and is linked to greater risks of [enhanced salt-wedge intrusion](#) in delta channels, as well as coastal and delta erosion. Alongside these environmental impacts, the sand supply chain can attract criminal organisations which operate with impunity and in some cases [threaten, intimidate, injure and kill civilians](#). Several organisations described as 'sand mafias' have emerged in multiple locations around the world, stealing large quantities of the valuable commodity, reselling it to unscrupulous buyers and undermining efforts to use sand sustainably. Ordinary people can find themselves becoming unintended victims of the trade, as buildings built [with poor-quality](#), or too much, sand, all too often [collapse](#).

Sand is used in various industries, such as construction; the production of electronics, glass and solar panels; and fracking. This white paper will provide an overview of the risks related to sand extraction when it comes to construction, fracking and the transition to a green economy.

### What do we mean by sand?

We recognise that there is an international debate regarding what should and should not be considered sand. In this report, sand refers to both sands and aggregates. Aggregates is a generic term used for crushed rock, sand and gravel used in construction materials. Sands are granular materials composed of finely divided rock and mineral particles.



Figure 1. Different types of aggregates and sands. Credit: Jay Morrison



## Sand and aggregates in construction

Construction accounts for the greatest use of sand, as sand is a necessary ingredient in concrete and cement. In our current economic model, the success of a country’s economic development is determined by its Gross Domestic Product (GDP). Despite the development of other complex development indices (such as the Human Development Index), we continue to primarily evaluate countries according to their growth in GDP. We know that [nothing boosts GDP like construction projects](#). Governments have historically resorted, and still resort, to construction projects to bring certain economic benefits, including increased employment opportunities. For example, US President Roosevelt’s ‘New Deal’, which saw the construction of large infrastructure projects after the Great Recession, generated millions of jobs for the population. Today, if construction companies evaluate their level of environmental responsibility, they do so not by considering the impact of their sand use, but by focusing on their carbon footprint. They may assess their carbon management during the construction phase or aim to construct energy efficient buildings.

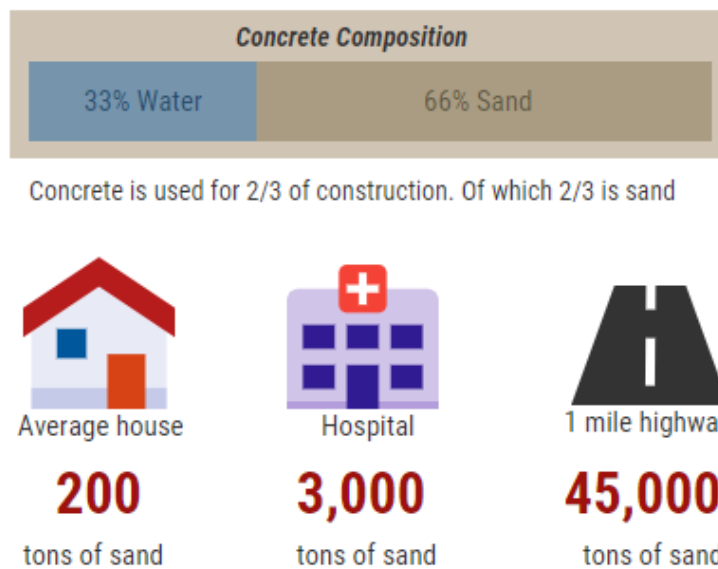


Figure 2. Infographic on the use of sand. Modified from: [trademachines.com/info/sand/](http://trademachines.com/info/sand/)

To measure the environmental impact of the construction sector, the industry must start including indicators that go beyond impacts at the site of construction, taking into account the full supply chain of the materials used. This approach would also reveal negative social impacts related to sand supply chains.

The pace of construction around the world shows no sign of slowing down. As such, we believe that the demand for sand will increase, which may provoke tension within or between certain countries. Numerous construction projects are being carried out as part of China’s [Belt and Road initiative](#) and brand new cities are springing up all over the world, such as [Port City Columbo](#) in Sri Lanka. The top [10 construction projects](#) globally raise questions about where the sand used will originate.

**Can desert sand be used for construction?**

Desert sand is not usable for construction because its wind-smoothed grains are not adhesive; buildings would be highly unstable.

## Sand in other sectors

Construction is not the only sector to explore if we want to assess the responsibility of sand sourcing. Sand is also very valuable for [fracking and the petroleum industry](#), as well as for transition to the green economy. Fracking, for instance, uses huge quantities of quartz-rich sand as a proppant to open the cracks from which natural gas is extracted ([around 1,800 tonnes of sand are used to dig one well](#)). In the green energy sector, photovoltaics need sand for their production, and the transition to a greener economy will mean producing more solar panels to generate clean energy. Similarly, if we want to start replacing plastic bottles with glass bottles, we will need more sand as well. Minerals extracted from sand are also used to develop [microchips, used in mobile phones, laptops and tablets; toothpaste, sunscreen, cosmetics, and even in wine production](#).



*Figure 3. Fracking activities. Credit: Simon Fraser University*

## Sand supply chains

Sand is one of the most illegally traded substances (by volume) in the world, the most extracted material worldwide, and the [second most consumed resource after water](#). Estimates from the UN state that at least 40 billion tonnes of sand is consumed every year, which is [twice the yearly amount carried by all the rivers in the world](#). Sand mining activities involve dredging in riverine, coastal or inland areas.

Although sand supply chains tend to be mainly regional, their impacts are felt far beyond regional borders. For instance, Singapore is the largest importer of sand, from [Vietnam, Cambodia, Malaysia, Myanmar, Indonesia, the Philippines and Thailand](#), which the country primarily uses for land reclamation. Dubai, the second largest sand importer, and Qatar are using sand to build two (hu)man-made islands: The Pearl and Palm Islands. Dubai's Palm Islands were constructed with over 150 million tonnes of sand. Qatar's Pearl Island saw the import of sand largely from Saudi Arabia, China, India, United Emirates and Egypt. Although most of the supply chains are regional, informal conversations with specialists held by Levin Sources revealed that the extraction of sand in East and West Africa may not cover the growing demand for development projects in the region, and it is alleged that sand is being imported from Asia, Europe or Latin America.



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In recent years, China has produced 10 times more cement than the second biggest producer of cement (India), and 30 times more cement than the third, fourth, and fifth largest producers (USA, Iran, and Turkey). As cement production requires sand consumption, it is arguable that China is driving most of the demand for sand. The most substantial sand mining operation is found in the Poyang Lake in China, where approximately 980,000 tonnes of sand are extracted daily. The operation allows China to meet most of its demand for sand by exploiting domestic resources.

Sand demand has increased significantly worldwide over the past 30 years. [Coastalcare](#), an organisation campaigning and raising awareness about coastal sand mining, has recorded cases of [coastal sand mining](#) (legal and illegal) in 73 countries, on five continents, though the number could be much higher as not all sand extraction activities are reported. Moreover, a study from The Sandshed revealed that [the majority of the global locations where most sand is mined are near protected areas](#).

### What are 'sand mafias'?

The term 'sand mafias' has been used by a variety of NGOs, civil society and advocacy organisations and others to designate criminal or illicit practices in the sand supply chain, typically referring to organised criminality involved in the excavation or trading of sand. Unfortunately, the term is also often used interchangeably with 'illegal mining', which does not differentiate the scale, sophistication and organisation that characterise 'sand mafias' activity. Organised crime in sand supply chains is not connected solely to ASM extraction and in many cases also involves the use of large-scale mining equipment and sophisticated criminal networks. As in other commodities, the informality of ASM sand extraction and trade makes the sector easy prey for criminal groups or exploitative business practices.

- One example of the use of the term 'sand mafias' is the reporting on the so-called "Mumbai Mafia" whose operations have led to fatal accidents. For example, their extraction of sand under the Savitri River Bridge in Mumbai caused the bridge to collapse [resulting in more than 40 deaths](#).
- The term has also been used by [the Awaaz Foundation](#) when calling attention to the issues with sand mining in India.
- [Italy](#) is another example where so-called 'local mafia groups' are engaged in illegal extraction and trade of sand. These groups are alleged to use low quality sand or [excessive proportions of sand in cement production](#), which reduces the durability of buildings and in turn puts the lives of many people at risk.





Figure 4. Silica sand mining, Minnesota. Credit: MPCA

## Sand mining impacts

### Environmental impacts

Poorly managed sand mining can cause severe effects, which in some cases are not perceptible until it is too late to act. Key detrimental effects include:

- Increased or decreased downstream sedimentation. Dredging activities interfere with sedimentation processes, affecting habitat quality and occasionally exacerbating downstream erosion.
- Destruction of natural habitats, ecosystems and biodiversity. Dredging activities, for instance, can impact the integrity of coral reefs, seagrass meadows, seaweeds and other habitats directly or indirectly by disturbing the surrounding seafloor. Ways in which extraction activities can disturb the seafloor:
  - Deposition of sediment plumes
  - Changes in water flows, flood regulation and marine currents
  - Increased turbidity
  - Plume dispersal
  - Ship and machinery noise
  - Alteration of the channels (in rivers)
  - Increased water salinity (in rivers)
- Increased shoreline erosion rates, changes in deltaic structures and pollution. Land losses are observed both inland, while coastal extraction activities have an erosive impact.
- Lowering of water tables, which together with pollution, impact hydrological functions.





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- Increasing global carbon emissions, during the transportation process of sand or through cement and concrete production

## Social impacts

Social impacts are underpinned by the effects on the natural environment and by the engagement of organised criminal groups. Key detrimental effects include:

- Social and political turmoil due to illegal sand mining, which can lead to corruption, organisations described as 'sand mafias', human rights violations and child labour.
- Dredging in riverbeds reduces rivers' resilience to extreme events and natural hazards, such as flooding, storm surges or tsunami events.
- Impacts on infrastructure (such as bridges, coastal infrastructures and river embankments), due to the destabilisation of the banks and alteration of the channels.
- Social impacts from mafia groups profiting from sand extraction, evidenced by construction material being produced with low-quality sand or higher amounts of sand than recommended. Construction projects and public infrastructure developments can collapse, leading to deaths.
- Loss of economic revenue due to tourist displacement and impact on infrastructure.
- Induces cascading effects, such as impairment of water and food security and the spread of infectious diseases.

## What next?

### Initiatives for Responsible Production

[UNEP](#) states that current legal frameworks for sand extraction are not sufficient. There are a few cement and concrete initiatives, such as the [NRMCA Sustainable Concrete Plant Certification](#), the [Concrete Sustainability Council](#), the [Global Cement Emissions Standards](#), the [Cement Sustainability Initiative](#) and the [Global Cement and Concrete Associations](#). However, these international treaties, standards and best practices are partial and only provide a foundation for future action.

### Recommendations

For responsible sand sourcing, it is urgent that governments and companies change the way they operate by first understanding that it is worth improving the management of sand supply chains and recognising their responsibility to address current practices. Key recommendations:

- Governments need to start mapping where sand extraction is taking place and cooperate to map extraction sites worldwide. While it is fairly easy to identify a mine for any other mineral, it is not that easy to spot the impacts of a sand mine until environmental consequences are severe. When extraction targets marine sources, it's even harder to detect, as the cumulative impact is more difficult to assess.



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- Local governments and municipalities should include in their public contracts a requirement to disclose information on sand extraction. Questions that should be considered include: How much sand is used? Where does it come from? How are risks identified and managed? How are they working towards reducing sand extraction?
- Governments must evaluate sand trading at a broader regional level. Banning sand extraction in one country can have unexpected consequences in neighbouring ones. It is important to understand that the extraction of sand in a neighbouring country can still have significant environmental negative impacts.
- Governments need to assess the real need for housing and invest in better land-use planning. We have seen new luxury condos being built all over the world, many being used as a means of investment rather than as a housing option for people with genuine need of accommodation. Old buildings are being demolished while new luxurious buildings take their place. "Regeneration" should include the "regeneration" of old buildings, in addition to the construction of new ones. Though this may be a costly solution, research should be conducted to assess the environmental cost of continued sand extraction at the current rate. As such, key methods to address over-extraction of sand are to avoid overdesign,<sup>1</sup> optimise the use of existing buildings and use alternative sustainable materials.
- Governments should put forward legislation to prevent harm to ecosystems and people, including sound environmental impact assessments and strategic environmental assessments.
- Construction companies should extend the life of existing buildings, avoid overdesign and adopt more sustainable approaches to infrastructure, using alternative materials that do not compromise the environment such as recycled or alternative materials, demolished concrete and bottom ash from waste incineration, where possible. Construction companies should also implement existing legal and voluntary standards of best practice.
- Companies using sand must start monitoring their needs for sand and start asking where sand comes from. Such companies should report using indicators that are not merely related to their carbon footprint but that also consider the social and environmental impacts along the full supply chain.
- All companies using sand must be engaged in the discourse on the responsible sourcing of sand to address the scale and urgency of the problem, ensuring no sector is singled out.
- International efforts should be made to regulate sand mining at a global level. International efforts to monitor how much sand is being extracted, traded and used could be a useful starting point to generate international and political attention, and provide the foundation for an international framework to improve sand extraction governance. Newly created "smart cities" such as Masdar City in Abu Dhabi, Suzhou eco-city in China and Songdo in South Korea, could be targeted to implement best practices and show leadership in this space.

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<sup>1</sup> Here we refer to overdesign as complex design which exceeds the normal use of materials and the re-designing of buildings after a short period of time.



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### Key Readings

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