Sand Shortage in Desert

The problem in a nut shell -

- desert sand, shaped by wind, is unsuitable for construction (as its grains are too smooth and too small); only sand shaped by water has the strong binding capacity required of concrete
- 2/3 of its usage goes into our construction industry, in making concrete
- we consume twice as much sand annually than nature is now able to produce
- up to 90% of our beaches world-wide are being eroded
- sucking sand from the bottom of the oceans is more environmentally damaging than fishing with dragnets

What is sand -

- Loose granular material blanketing the beaches, riverbeds and deserts of the world
- Mainly silicon dioxide, or quartz
- Plus feldspar and quartz
- Quartz rock is broken down, "weathered", over time, to gravel and sand by the actions of wind, water, freezing and thawing, the crushing effect of glaciers
- Sand in the ocean is also formed from calcium carbonate produced by the breakdown of corals, shells, molluscs and micro-organisms called foraminfera

What are the main uses of sand -

- concrete in the construction industry (2/3 of every building using reinforced concrete consists of sand)
- manufacture of glass
- in computers, mobile phones, circuit boards
- in cleaning materials
- in cosmetics

Some Consumption Numbers -

- A 3 or 4 bedroom house built with concrete requires 200 tonnes of sand
- Every kilometre of a motorway requires 30,000 tonnes
- A nuclear power station requires 12 million tonnes
- Total annual consumption of sand is 15 billion tonnes
    - which equals a convoy of trucks 7 x to the moon and back, or
    - would build a wall 27m wide x 27m high circling the globe
- annual concrete production equals 2 tonnes per head of the global population
- among the most wasteful and damaging projects ever are the artificial islands off the coast of Dubai (The Palm - requiring 150 m tonnes of sand, and The World - 450 m tonnes) and vanity buildings like the Burj Khalifa (which remains to 90% empty) and others in Dubai : the sand for the artificial islands was dredged from the sea; the sand for the Burj Khalifa was imported from Australia amounting to the equivalent of a convoy of lorries circling the planet 5 times
- the biggest users of sand are governments' public works
- hundreds of ships carrying enormous quantities of sand are constantly crossing the seas creating enormous sand-miles and environmental costs
- Sand is the most heavily traded building material, annual turnover is estimated at $70 billion
- Australia alone has around 350 sand merchants generating $5 billion in sales p.a.

Sourcing of Sand -

- the bulk of usable sand originates from the beaches and oceans of the world
- 90% of our beaches and coastal sands have become eroded

- An estimated 1,000 huge ships powerfully vacuum up as much as 400,000 cubic metres each from the bottom of the sea : Vacuum ships find it more rewarding to suck up sand closer in-shore than at greater off-shore depths - this means that the support base for sandy beaches that typically reaches out to sea for around 100 m, is removed so that the beach progressively slips into the ocean
- Attempts to dry-mine sand from on-shore and inland quarries has run into enormous resistance due to heavy scarring of the landscape and noise and dust problems

Facts of nature ignored -

- sand represents the foundation for much of the ocean's life; removing this sand causes greater damage to marine life than fishing with dragnets
- beaches are natural barriers against flooding from the sea; which adjust their thicknesses between 5 & 10 m, depending on the seasons
- sea defences and shore-proximity construction around the world prevents sand from being self-levelling as it can no longer be washed further inland by the tide and storms, instead is forced to go out to sea
- this is expected to be exacerbated by 2025 when ¾ of the world's population is expected to live close by the sea
- In an attempt to preserve their tourist-revenue generating beaches various controls have been put in place by governments, which has resulted in a black market in sand
- Lakes and rivers are also dredged for sand - inhibiting life in the lakes and making rivers flow faster with dire consequences (e.g. around 100 lorry loads of sand are extracted from Lake Geneva alone)

Effect of sand recovery from beach and sea -

- 80% of the world's beaches are collapsing and shrinking
- In North Carolina beach houses that have stood for decades are collapsing into the sea as their sand underpinning is washed away (the first row of houses has gone, the second is expected to go within 5 years) - formerly the width of the beach equated a football pitch
- 9 out of 10 beaches in Florida need to be artificially maintained : how - by dredging sand from off-shore and pumping it back on to the beaches, so undermining its stability even further - this costly cycle needs to be repeated every 2-years
- On average 80% of the Maldive Islands is less than 1 m above sea level - the removal of sand from the sandy beaches of some of the smaller islands and the dredging of sand from off-shore is contributing to the further sinking of these islands, several hundred of the smaller ones have already had to be evacuated, formerly 60 m wide beaches have shrunk to nothing
- Most of the sand from the Maldives goes to Singapore for its ambitious plans to increase the size of its land
- 92% of all Indonesian fishing is handled by small fishermen - the harvesting of sand is destroying their traditional fishing grounds, so wiping out the livelihood of entire communities
- this erodes the smaller Indonesian islands, 25 of which have disappeared : which shrinks the map of Indonesia as the loss of outlying land reduces its sovereign foot print, spelling geo-political consequences
- a 'sand-Mafia' has illegally denuded many of Morocco's beaches in order, ironically to build its hotels intended to welcome the tourists attracted by its (now vanished) sandy beaches; ocean and beach sand is corrosive unless properly washed with clean sweet water

What creates the sand suitable for construction -

- 90% originates in mountain ranges - the higher the originating mountains the greater the gravitational force crushing rock into sand; glaciers with their enormous weight, act as great stone grinders

- Streams wash down the increasingly finer stone until part of it has become sand; this sand gets deposited on calmer stretches of the streams and rivers until floods wash them into the sea and lakes; sea currents distribute the sands across the bottom of the world's oceans
- EXCEPT - 850,000 dams world-wide are preventing this natural flow of sand by collecting this silt at the bottom of these dams : the differences in quantities of sand found in dammed rivers v. the few undammed ones remaining is enormous
- In the ordinary course of nature's cycle it takes centuries and more to convert rock to sand, we humans have interrupted this cycle with potentially disastrous consequences
- Current annual consumption of sand is estimated to be twice that of nature's capacity to produce more

Economic issues -

- A focus on profits at any cost, coupled with our human ingenuity to design processes and machines, has made building with concrete the preferred and dominant method of construction - this has forced out traditional and more sustainable building materials previously prevalent in different regions - timber; bamboo; mud; straw; etc.
- Our vanishing sand beaches, apart from creating unattractive rock-strewn shores, are reducing tourism revenues for some of the countries most reliant on this source of income - 1/3 of all holidays taken are at the seaside
- Other countries simply cannot afford the cost of maintaining sandy beaches by pumping back it in, on an endless cycle
- Others simply do not have the resources to prevent the plundering of their beaches and littoral sand banks by black-marketers
- Faster flowing dredged rivers add to costly environmental disasters
- Silting up dams represent growing hazards
- The destruction of vast swathes of the sand that represents the bedrock of ocean life has a wide range of knock-on effects
- 100 million people live on land below 1 sea level - almost every grain of sand is required to prevent their homes from being washed away
- Speculation ties up sand in concrete by investing in flats and houses remaining empty (e.g. 50% in Mumbai, 56% in China (which uses 25% of the world's concrete), 30% in Spain, Europe's major sand consumer with a record housing shortage, and 90% of Burj Khalifa remains empty
- Sand is rapidly becoming as valuable as oil, each grain now almost counts
- The moral / ethical issue as to who owns the sand that is being harvested to the detriment of many and is being sold for growing profits accruing to the few has not been addressed

Consequent New Approaches -

- Recycled glass is being finely ground to replace sand on beaches, but remains mostly unsuitable for concrete; generally where there is naturally no longer any sand, artificial created ones will not last beyond 1 or 2 years
- Rubble from knocked down buildings is being recycled : while gravel can be recovered, sand cannot
- Devices are being developed to check concrete structures and spot potential problems in time for repairs so that the life of concrete structures can be extended, even doubled, so that sand consumption is reduced
- Better attention is being paid to the longevity of concrete buildings and structures
- The opportunities to re-discover the use of traditional and recyclable materials is accelerating, led by the Swiss who acknowledge their responsibility in making concrete so universally popular and for damming some of Europe's great sand-producing rivers flowing from the High Alps to their lakes and the sea
- Multiple-story timber buildings are being shown to be as fire resistant as concrete and to have better earthquake resistance

Epilogue

My name is Peter Rae. I have just been made aware of the issue here described. I had not ever given much thought to it, and certainly have not seen much information on it anywhere.

My aim here is to get the bare facts about yet another environmental problem out into the open, others are invited to create the missing illustrations and film clips which will help bring this issue fully to life.

I have not had the time to independently check the figures in this presentation, they are wholly extracted from the 3 sources I mention at the end and on whose overall accuracy I have no difficulty in relying.

I am a former international banker. Those who know me, know that I know much about a lot, so much so that I have committed the rest of my life to identifying and developing new ways of living and being on planet Earth.

Echoing Buckminster Fuller, I believe that we need new models for a harmonious existence on this planet. Existing short-sighted interests are so firmly entrenched that going up against them would take more time than we have and would require Herculean efforts without any assurance of success.

While highlighting the issue of sand is of course an important task in itself, it also serves particularly well to help illustrate how interconnected so much on our planet is and how destructive it is to serve narrow commercial interests without evaluating the potential negative impact on the environment, the globe and ultimately all life on this planet. It is clearly of vital importance that we learn to think-in-the-round, to think interconnected systems.

I write these lines caught in a strange place between deep, desperate sadness and an optimism that with the problem identified, and more widely aired, we at least have a chance to accelerate our hunt for alternatives. We at the LightLiving Project are already focusing on sustainably building our laboratory-village with minimal use of concrete (see http://lightlivinglaboratory.com).

Sources -

My thanks go to my brother Michael and the videos he brought to my attention and from which I extracted the information for this quick summary of our Sand dilemma (all films are in German) -

“Sand, the New Gold” shown on Swiss National Television
https://www.youtube.com/watch?v=5x_lASi4kkw

‘EF’ in his YouTube Series for ‘Seekers After Truth’, under the deliberately provocative heading “Does Anybody Really Need Sand?”
https://www.youtube.com/watch?v=nie4qA8r_SU

“Sand, The New Environmental Time Bomb” produced by the German TV service 3sat
https://www.youtube.com/watch?v=CPbdL1WVAcA&list=PLTYU4yo6sz3IHU6lglbCFQDCHfLiRmdeD