SAND

The Sand Mafia – The Harvesting, Vanishing and Politicization of Crucial Grains

Bachelor Thesis

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Introduction

In the German language there is a phrase that is being used to emphasize that there is more than enough of something: *'Wie Sand am Meer'*, which translates to *'like sand at the sea'*. This stems from the misconception that sand is an infinite resource, always available.
Its tininess makes it easy to take it for granted. When we think about sand, most might have a picture of endless white beaches in their minds, sandboxes perhaps. Truth is – sand is everywhere and in almost everything that surrounds us. We walk on sand every day, it is in our roads and sidewalks, it is the foundation of our homes and an essential component in cosmetics, electronics and glass and even foods. Ultimately, it is an essential component of our modern lives - but we are running out of it. Sand is still a natural resource, which cannot renew itself at the rate at which it is being dismantled.

The demand for sand has increased enormously in the last decades and continues to do so. Now the demand is so high that the black market for sand is booming uncontrollably and the sand mafia is mining sand without considering the consequences.

The only sand usable for concrete and therefore the construction industry is marine sand. Desert sand grains are too round for the manufacturing of concrete. Therefore, only a small part of the sand deposits is eligible for sand mining and those deposits are being plundered at a higher rate than this resource could reproduce - it takes hundreds of years for rocks to erode to a point where they become sand. The consequences of the uncontrollably fast extraction of sand mean both dramatic damage of the environment and an enormous shortage of building material. Sand mining has already caused the disappearance of entire islands, beaches have been severely degraded and the habitat of many marine species and coral reefs have been destroyed, microorganisms are being disrupted and devitalized which leads to the interruption of food chains and thus the endangerment of countless animals and human systems alike.
If the plundering of sand resources continues at the current rate, half of the world's beaches will be gone by the year of 2100[1].

Tackling the problems surrounding sand poses an opportunity to reflect on how important sand really always was, is, and will be in the future. It is, after all, the key ingredient of our

[1] https://earth.org/sandy-beaches-could-disappear/

modern world. As the urbanization of the modern world continues, so does the need for more sand. It's a chance to rethink architecture and advance the research of alternatives.

Asphalt and concrete shaped the way we move around, how and where we live and work. The use of sand in the form of glass was soon added to the equation that makes up our contemporary world – without it, we would not have windows to look through or out of, lightbulbs to turn on, our computers, cameras, televisions, skyscrapers and maybe most importantly, our smartphones. Glass (mostly consisting of melted quartz sand) offered a way to dissect our world on a molecular level, discover DNA, and explore the world of viruses and bacteria[2]. Lenses made it possible for people to read up to a very old age (or at all) and revolutionized small-scaled detail-work as well as they allowed people to explore beyond our earth, to have a look into the vast space around it, the universe. Sand really had put things into perspective, thanks to Galileo Galilei, being the scientist who heard about small spyglasses in 1609 and then invented an enhanced version which made it possible to place the earth where it really was – not in the center of the universe but orbiting the sun[3].

So steadily growing cities need sand not only for concrete, but for glass. Buildings need huge windows, cars need windshields, and the people who live there need dishes, bottles, and cell phone screens. A little over a century ago, sand was a material that made many unprecedented things possible and was considered a useful accessory - today's modern world cannot be without sand, in fact, it depends on it.

In this thesis, I want to highlight how essential sand is and has always been for all of us. Why it is necessary, especially now, to think about its origins, the circumstances of its extraction and solutions - and to weave together stories about sand into an overall picture that makes us understand that with the shortfall of sand we are facing a global phenomenon. The crisis around sand is still seen as an ecological niche problem and treated accordingly. Global attention and recognition are needed to make appropriate adjustments in industries - e.g. construction, technology, glass-making - and to regulate sand mining while enacting restrictive environmental laws. As long as the problem is not widely recognized, it will continue to threaten the foundation of modern society and human livelihoods.

[2] The Glass Bathyscaphe – How Glass Changed the World

[3] https://www.loc.gov/collections/finding-our-place-in-the-cosmos-with-carl-sagan/articles-and-essays/modeling-the-cosmos/galileo-and-the-telescope

The Sand Mafia

> *'The atomic substrate of our digital modern world is obscure but fundamental to the entire 'Stack' of the global economy. resources like water, sand, and rare earth materials will increasingly create geopolitical struggles, and benefit those that command large shares of these resources.'*[4]

Because the world is in need for more and more sand every year for the construction business or land reclamation projects, huge amounts of it are being extracted at a fast rate - often unregulated by authorities. Every year, the world consumes about 50 billion tons of sand (second only to fresh water[5]) – trying to meet such a huge demand, the problem of over-extraction is particularly severe in developing countries (especially because they supply sand to, for example, China, Australia, and Europe[6]). When mining is unregulated, environmental damage, coastal erosion and flooding quickly occur and cost people their homes and land. Meanwhile, the sand trade is taking on dangerous proportions and in some countries is run and managed by organized criminal organizations - in India they are known as the '*sand mafia'*. They do not stop at killing opponents, competitors, people who ask questions or environmental activists. Hundreds of people have already fallen victim to the sand mafia, including journalist Jagendra Singh, who investigated sand mining in northern India along the Garra River. Shortly before he was murdered, he wrote a social media post saying: '*Politicians, thugs, and police, all are after me. Writing the truth is weighing heavily on my life.*'[7] Similar incidents have also occurred in Indonesia, Gambia and Kenya.
In 2019, environmental activist José Luis Álvarez was shot dead after publicly denouncing sand extraction from the Usumacinta River in México.[8]

It does not stop at individual fates. Dense settlements near lucrative riverbeds pose one of the biggest problems. Along the Mekong River, dredging sand from the riverbed is responsible for the banks collapsing, sweeping homes, fields and everything else into the water. Thousands of hectares of important rice fields have already been lost, and thousands of

[4] https://freedomlab.org/we-are-running-out-of-sand/
[5] http://www.ejolt.org/2014/08/building-an-economy-on-quicksand/
[6] Chilamkurthy, Kowshik & Marckson, A & Chopperla, Krishna Siva Teja & Santhanam, Manu. (2016). A statistical overview of sand demand in Asia and Europe.
[7] https://www.theguardian.com/environment/2019/jun/17/writing-truth-weighing-heavily-on-my-life-murder-jagendra-singh
[8] https://www.telesurenglish.net/news/Mexican-Defender-of-Howler-Monkey-Sanctuary-KIlled-20190611- 0007.html

families have had to relocate. Others had to leave islands located on the river as they gradually disappeared under their feet. An official statement read that some 500,000 people living near the Mekong delta have already had to be evacuated from zones at risk of collapsing.[9]

The ecosystem is also suffering as sand mining churns up the water in the river, disturbing and killing fish, plants and small organisms. Where once one fish after another was pulled from the river, providing food and income for many people, now only a muddy broth without life is left. Even rice fields, which are the main source of food for many people living in the Mekong delta and surrounding countries, are flooded and lost due to both climate change-induced rising sea levels and the dredging of sand - something bigger than the size of a football field is lost every day.[10] According to a study, about 50 million tons of sand were drawn from the river in 2011 (enough to cover the entire city of Bremen with about 5 centimeters of sand). Normally, sand would steadily flow from the mountains of central Asia and replenish the river, but that is not happening fast enough – it is out of proportion to the rate at which it is being dug up. The erosion of the delta is progressing so fast that half of it will be gone by the end of the century.

Here, too, the problem is that sand mining - in Vietnam, for example - is hardly regulated. The trade with sand is such a profitable business that the black market for sand is now flourishing. Every year, thousands of people are caught pulling sand out of the water without a permit, often on unregistered boats.[11] Often these people are residents who just want to earn a little extra money. In Vietnam, there are constant cases of local authorities turning a blind eye or two and accepting bribes to bend or even ignore the rules concerning sand extraction. Here, too, mafia-like structures are formed among the illegal miners. Since the authorities can hardly get a grip on them, fishermen and residents themselves try to protect and preserve their livelihood and their habitat by using violence against the sand miners.[12]

The world is in need of better regulations and rules regarding sand mining. At the moment, too much of it is being consumed by the building industries of Singapore, Dubai and many more – which is not sustainable for people nor the environment. Up until now, 20 percent of landmass

[9] https://www.sixthtone.com/news/1858/the-environmental-costs-of-sand-mining-on-the-mekong
[10] https://www.nature.com/articles/srep14745
[11] https://www.nature.com/articles/s41598-019-53804-z
[12] https://www.rfa.org/english/commentaries/sand-dredging-04132018145940.html

has been added to Singapore through sand imports from countries that are in turn shrinking.[13] Much of this sand is imported from Indonesia, where more than 20 islands have sunk or disappeared into the sea since 2005 because of excessive sand mining in the surrounding area.

Countries such as Indonesia, Malaysia and Vietnam have stopped exporting sand to Singapore in response to worsening coastal and island erosion, but this only shifts the problem to other countries. The conflicts surrounding the mining and trading of sand were first brought to public attention with the production and release of the documentary 'Sand Wars' (2013)[14]. In response, a global environmental alert was issued on behalf of UNEP (UN Environment Programme) to encourage affected countries to regulate and educate more. Nevertheless, sand is still incredibly cheap and there is still little effort to curb its disproportionate consumption. Therefore, sand and exports should be hung with higher costs to make alternative and recycled building materials such as construction debris and glass more accessible and less expensive. Above all, it is important that sand dredging in international waters gets regulated - so far, there are too few, if any, regulations in place to address the global sand crisis.

Environmental activist Sumaira Abdulali has set up a foundation to tackle illegal sand mining in India, working with the UN[15]. The motivation for the foundation was Sumaira's observation that the beach on her own doorstep was disappearing bit by bit. At first, she could not imagine the reasons for this, but as her research progressed, she became aware of the corrupt politicians who tolerated the illegal sand mining and made money from it. With the foundation, she and others are entering the dangerous war for sand. Mumbai is another city that is in the midst of a never-ending construction boom. Other large cities are constantly growing - there are now more than 1.3 billion people living in India, and more and more are moving into the cities, taking up space, apartments, skyscraper after skyscraper. Child labor is also an issue that could be better controlled with the regulation of sand mining. Some children as young as 10 are forced to work for the sand mafia, hauling and shoveling sand. Sumaira has had to endure many lengthy court cases and threats of violence, but she is fighting for this right to the end. At the same time, a division of the foundation is researching possible alternative building materials for the construction industry, in order to reduce the illegal business and the consumption of sand to a certain extent.

[13] https://www.globalwitness.org/en/archive/environment-risk-cambodia-exports-millions-tonnes-sand-singapore-new-global-witness-report/
[14] http://sand-wars.com
[15] https://awaaz.org/sumaira-abdulali.html

If the illegal sand business continues unbothered and unregulated and sea levels keep rising at an alarming rate, human livelihoods and fauna are in danger. Also, as stated above, we can wave goodbye to half of the world's beaches.[16] The demand and extraction of sand needs to be reduced and adjusted drastically.

From Grains to the Industrialized World

Talking about the demand for sand means talking about one of the most important man-made materials in the modern world: concrete. Sand makes up about one-third of the mix that makes concrete. The long history of concrete's creation has been one of discovery and experimentation – it awarded leaders great popularity, inspired architects over the course of many centuries, and slowly but surely became indispensable. Today, our world is held together by concrete, both following and making up its form in the shape of roads, buildings of all kinds, bridges and huge dams. It all began with the Roman Empire starting to erect giant, impressive structures, which led to the everyday use of this most transformative material - even the word 'concrete' derives from the Latin word '*concretus*', which means '*condensed, solidified*'.[17]

Concrete owes its legendary prominence, among other structures, to the construction of the huge 'Sebastos Harbor' in Caesarea, Israel, in which creation this previously untried material was used.[18] Commissioned by Herod of Judea, who wanted to boost the economy of his country (then part of the Roman Empire), it was built for about 8 years starting in 23 BC. At the time it was the largest port in the world, next to the port of Alexandria. The docks and dikes were made of pure concrete - individual parts were lowered into the water piece by piece and adjusted underwater by divers.[19] Withstanding crashing wave after wave, more than 2,000 years later the harbor still stands, albeit partially submerged in the sea. The then flourishing harbor earned Herod the extension *the Great* to his name and was only the beginning of a series of world-famous structures to be built by the Romans.

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[16] https://earth.org/sandy-beaches-could-disappear/

[17] https://worldofdictionary.com/dict/latin-english/meaning/concretus

[18] Hohlfelder, Robert & Oleson, John & Raban, Avner & Vann, Robert. (1984). Sebastos: Herod's Harbor at Caesarea Maritima, The Biblical Archaeologist

[19] Bergin, Barbara. (2018). The Innovative Genius of Herod at Caesarea Maritima. Journal of Cultural and Religious Studies

Emperor Vespasian, who reigned 9 years from 69 AD, commissioned the world's largest theater, initially called the Flavian Amphitheater, which held 50,000 spectators and was the world's first stadium - today we call it the Colosseum.[20] Built about 2,000 years ago, it still stands as a symbol of both the Roman Empire and the durability of Roman concrete.
After two millennia of earthquakes, weathering and lightning strikes, about a third of the original structure can be seen today.[21]

The most unaffected concrete structure to this day is the formidable Pantheon in Rome, Italy. It was built by order of emperor Hadrian 1,800 years ago and was intended as a kind of offering to the gods - to this end, the Pantheon is adorned with the world's highest and widest dome ever built. With the concrete we use today, the construction of such a dome would be unthinkable; moreover, no architect today would dare to build a structure of such a magnitude without significant supporting measures.[22] Only the popes, when building St. Peter's Basilica, wanted to claim the glory of having the largest dome for themselves and the church and commissioned the architects to build a larger one. The project failed - 1.40 meters were missing to exceed the diameter of the dome of the pantheon.[23]
The Roman architects' secret was to strongly reinforce the walls the dome was later put on – the dome itself was not. It was cast in one piece in a huge mold made of wood and consisted of a concrete mixed with larger proportions of volcanic ash than usual to make it a little lighter.[24] The definite 'recipe' for Roman concrete perished with the downfall of the empire - all that remained and pointed to concrete was Marcus Vitruvius' '*De architectura*', '*On Architecture*'[25], however, this text was written many years before the construction of the Pantheon.

After that, it took about 1000 years for the use of concrete to be resumed and refined - '*On Architecture'* was studied by engineers during the Renaissance. A monk named Giovanni Giocondo was to discover that concrete could harden under water and was extremely durable. He soon went on to conceive and build large structures, all according to the recipe and instructions of Vitruvius. The resulting construction of the Pont Notre-Dame in Paris was the

[20] https://www.italygram.com/colosseum-in-rome/
[21] https://www.history.com/topics/ancient-history/colosseum
[22] Mark, Robert & Hutchinson, Paul. (2014). On the Structure of Roman Pantheon. The Art Bulletin
[23] http://www.roma-antiqua.de/antikes_rom/marsfeld/pantheon
[24] http://www.sustainableconcrete.org.nz/page/the-pantheon-rome.aspx
[25] https://www.hup.harvard.edu/catalog.php?isbn=9780674992771

first and only large-scale attempt to establish concrete during the Renaissance. The bridge eventually collapsed under the weight of the many buildings that were built on top of it - the concrete mixture had not withstood the test of time.[26]

The final refinement of the recipe took place several decades later in Andernach, Germany. A local mason mixed lime with trass which behaved similar to the volcanic ash which was used in the original recipe. The concrete worked well and was further refined until it was the modern concrete we still use today. At one point, sand replaced trass in the recipe, and the result was even more durable and harder concrete.[27] In the course of the industrialization, steel was simultaneously used as reinforcement in concrete structures in several countries - for this purpose, the concrete was poured over iron bars. The proven method of reinforcing concrete with steel beams or iron bars and casting it into any desired shape was the literal cornerstone of skyscrapers. The world's first concrete skyscraper was built in Cincinnati in 1903.[28]

The famous architect Frank Lloyd Wright went on to ensure that the reinforced bar method became the standard. He took on the experiment and realized the previously unimagined possibilities that concrete offered. Concrete family houses, roads, bridges, canals, dams, and, during World War II, bunkers, factories and office buildings followed. The largest and most complex buildings are built with concrete. Reinforcing steel and concrete have made the modern world possible and helped shaping it. Nevertheless, even this form of concrete cannot compete with that of the Romans - it is nowhere near as durable. After several decades, the steel inside the structure begins to rust, expanding and eventually cracking the concrete. The tremendous strength of buildings made of concrete is anything but infinite, and today it must be constantly maintained by repairs that are very expensive. Near salt water, concrete is even more vulnerable, no comparison to the still standing ‘Sebastos Harbor’.

There are many emerging methods for improving concrete, including special treatments to prevent water from getting through to the steel. Other advancements respond to the increasing global attention being paid to sustainability: ‘Self-healing’ concrete contains bacteria that are able to reseal occurring cracks.[29] A mix for ‘self-cleaning’ concrete is infused with titanium

[26] https://www.arct.cam.ac.uk/Downloads/ichs/vol-2-2223-2240-mislin.pdf
[27] https://ethz.ch/content/dam/ethz/special-interest/arch/idb/holzer-dam/images/Lehrveranstaltungen/Vorlesungen/2020_HS/Master_Konstruktionsgeschichte/Unterlagen/2020_HS_VL07__Beton_I.pdf
[28] http://www.concretecontractor.com/concrete-construction-projects/ingalls-building/
[29] https://precast.org/2020/08/self-cleaning-concrete/

dioxide, which breaks down smog, keeping the concrete sparkling white.[30] Improved versions of this technology may even give us street surfaces that clean out the exhaust from cars.

Also, researchers suggest that it's possible for us to replicate the recipe for Roman concrete, (which, despite its lower tensile strength, has unrivaled durability).[31] Roman concrete is not just waterproof, it has the ability to become stronger when in contact with seawater. Scientists assume that microscopic crystals grow in the ancient concrete when it's plunged into water, making it even less vulnerable to weathering.[32]

Although the exact recipe is still unknown, researchers are certain that the use of volcanic ash (pozzolana) makes the crucial difference and results in the unmatched strength of the Roman concrete. A similar ash found off the coast of California will now be used to recreate the recipe and replicate the process piece by piece.[33] The result would be the most durable concrete in history yet. In combination with reinforcing techniques, this concrete would offer the possibility of revolutionizing the use of concrete and thus both infrastructure and architecture. That being a possible big step towards a more sustainable modern world and counteracting the excessive demand for sand, we're still in need of better alternatives and especially recycling techniques.

Concrete remains one of the most important inventions in modern times – but let us not forget that it is also the cornerstone of an industry that swallows roughly 40 to 50 billion tons of sand every year.[34]

[30] https://www.sciencedirect.com/topics/engineering/self-healing-concrete
[31] https://www.popularmechanics.com/technology/infrastructure/news/a27186/ancient-roman-concrete-mixture-seawall/
[32] https://blogs.zeiss.com/microscopy/en/ancient-concrete/
[33] https://news.stanford.edu/2015/07/10/concrete-roman-volcano-071015/
[34] https://www.cnbc.com/2021/03/05/sand-shortage-the-world-is-running-out-of-a-crucial-commodity.html

'The World' and Man-Made Territories

To this day, more and more housing complexes are needed and being built for the ever-swelling growing population of earth – that effort seems at least reasonable. But then, there are exuberant building projects that have not only nothing to do with offering a solution to a global challenge, but are merely a ridiculous vision of wealthy people, which cannot be surpassed in exaggeration and excessiveness. Just outside Dubai, right next to the famous '*The Palm Jumeirah'*, another huge construction project has been lying fallow for several years. Six artificial islands are slowly being piled up there, each copying a European city or country - the main islands are called *'Main Europe'*, *'Germany', 'Sweden', 'St. Petersburg', 'Switzerland'* and '*Monaco'* and are all part of *'The World'*- a cluster of about 300 islands that together should resemble a literal map of our world. Ironically, this development is being promoted as one of the most innovative, sustainable construction projects ever. All of these islands are made of countless tons of sand dredged from the marine floor. In fact, The Palm Jumeirah alone consist of enough sand to build a wall two meters high around the whole globe.[35]

Real estate worth billions of euros is being created, all made of 'nothing more' than piles of sand. '*The World*' is just one of many sprawling, so-called land reclamation projects. The power to create new land where none has been before is being used everywhere. Where before there was only water, coastlines are changing, countries are deforming beyond their borders. Mark Twain once said, *'Buy land, they're not making it anymore.*'[36] That has not been true for decades, although it sounds clever.

Many of the world's largest cities are located near the coast and continue to grow. Not necessarily inland, because since the 1970s, not only have houses made of concrete and glass been built for the many people coming to live there, but so has the land on which they stand. What applies to the construction of houses – desert sand is not useful here – goes for land reclamation as well. It requires sand which contains quartz and is capable of cohesion. In addition, it is much cheaper to create new land than to buy existing land. For example, starting in the late 1970s, the coasts of Amsterdam, Singapore, Taiwan and Hong Kong have all been

[35] https://sites.psu.edu/wethepeople/page/2/
[36] http://content.time.com/time/business/article/0,8599,1874407,00.html

artificially expanded[37], and many airports around the world have already been built on reclaimed land. Singapore leads the way, with about 130 km² of artificially added landmass added in the last 40 years. As mentioned earlier, neighboring countries around Singapore have already stopped exporting sand there because of the unsustainable consequences of drilling. Artificial land and islands are increasingly being piled up in front of the coasts of growing metropolises and now stand for participation in urban economic progress and become spectacular signifiers of global involvement.

Expanding, Untouched Desert Lands

For several centuries, the earth's deserts have always expanded and retreated, influenced by atmospheric changes. Today they behave differently, and that is of course linked to the climate crisis. The land adjacent to the deserts is drying out, which is linked on one hand to rising temperatures, but above all to rising populations. For example, the population of Inner Mongolia, an autonomous region of China largely consisting of desert, has quadrupled in the last 50 years to 24 million[38]. As a result, more trees are being cut down, more water and resources are needed for industries and are being tapped, and livestock is taking up more and more space, grazing remaining green grounds. Groundwater reservoirs get depleted and as a result, the land dries up. This results in more and more fertile land mass being lost to desert sand and drought, while it is urgently needed for the next 9 billion people (estimated for the year 2050) and to provide them with food and shelter. Adding expanding deserts to shrinking shorelines and the crumbling foundation of modern cities are a promise for disaster.

Small Excursus

Trendy Nomadism

For many centuries, nomadic families have led their cattle across the Mongolian steppes, a life that has been lived for generations. Severe environmental changes such as desertification and extreme weather due to climate change are hitting Mongolia among the hardest - the average temperature has risen 2.1 degrees in the last 70 years.[39] In addition, the country relies heavily

[37] https://www.deltares.nl/en/projects/singapore-to-adopt-dutch-polder-concept-as-new-land-reclamation-method-at-pulau-tekong/
[38] https://knoema.com/atlas/China/Inner-Mongolia
[39] https://de.climate-data.org/asien/mongolei-180/

on livestock and pastoral nomads are vulnerable when it comes to these drastic changes. Nearly 30 percent of the population lives below the poverty line and cannot afford weather damage or similar radical changes. The nomads are eventually forced to migrate to other districts, putting a strain on other fragile systems and communities. Many herders have to move to the cities. While living conditions for pastoral nomads generally have deteriorated worldwide in recent decades as a result of open political discrimination and structural disadvantage, land conflicts, changing economic conditions, and, as previously mentioned - climate change, nomadism in the Global North, especially in Western Europe, developed into an important reference point. In numerous discourse and practice contexts of (post-) industrial societies in which mobility plays a prominent role, references are now made to 'the nomadic', 'the nomad', or 'nomadism'.[40]

Introduced by the French philosophers Gilles Deleuze and Felix Guattari in the 1980s, the nomad has since established itself as a central theoretical figure that stands for a high degree of mobility as well as for freedom, transgression of boundaries, and nonconformism.[41] The nomad has also found great resonance in the field of art, where it has long since become a standard reference. In addition, today representatives from numerous, very different professional milieus refer to the nomad in their self-designation - from the so-called creative class to the media and IT sectors to management and business consulting. Nomadic self-references also enjoy particular popularity among backpackers, lifestyle migrants and the 'super-rich'. And last but not least, it has become a popular label in architecture and design, which is reflected in a growing number of corresponding product names ranging from sofa beds to headphones, to wallets, mousepads and fancy coffee-table books with titles such as '*New Hotels for Global Nomads*'.

It would be practical if the earth's eternally vast desert landscapes could offer us what sand deposits near the coast and the ocean floor can. However, desert sand cannot be used for the construction industry - the sand grains are too round due to erosion by wind so that they do not have enough binding capacity and are therefore unusable for the production of concrete. However, this long-lasting assumption may no longer be true. Since 2018, a team of researchers from the UK has been working on a construction material that is supposed to be as stable and malleable as concrete, but cheaper to produce and with fewer emissions during production (now, the main binder in concrete is responsible for about 8% of global CO2

[40] http://hist-soz.de/voyage/JB10_IA.pdf

[41] https://transversal.at/transversal/0307/raunig/de

emissions[42]).[43] In addition, it is designed to be reusable and - this is the main selling point - consist of granulated desert sand. A raw material that has so far remained untouched, left lying next to sand from riverbeds, beaches and the marine floor. The material is called 'Finite', inspired by the fact that sand is an extremely depleted resource and an alternative is needed more than ever.

Conclusions and Solutions

It is easy to demonize large corporations for their devastation of our planet. But when it comes to resources such as oil and sand, we cannot deny that we are heavily dependent on the product of those companies. No one born into the modern world and its comforts would willingly and voluntarily give up all that makes it what it is. Without sand, there are no modern cities, no modern life. It is impossible to ensure this life without harming the environment at *least* a little. It is only honest to admit that a large proportion of people enjoy their standard of living because the earth is simultaneously being damaged. So how much damage to the natural world are we willing to allow? And above all: where and at what cost?

In human history we have been warned several times before that overpopulation will affect humans and the earth and put it in danger, because certain resources will rapidly no longer be available in accustomed, large quantities. At the same time, one could argue that these kinds of warnings had been uttered over and over since the 18th century[44] and that this case has not yet occurred. Technological progress, political change, new discoveries and newly set guidelines have so far averted the biggest crises - that is true, but it does not have to remain true. Globally relevant issues have often been averted or at least successfully tackled. But that presupposes that the problem is recognized worldwide and considered relevant. 30 years ago, when scientists found that holes in the ozone layer were opening up above the earth, appropriate measures were taken, and the use of chlorofluorocarbons was banned[45].

[42] https://www.bbc.com/news/science-environment-46455844
[43] https://urbannext.net/finite-concrete-replacement/
[44] http://www.esp.org/books/malthus/population/malthus.pdf
[45] https://www.nytimes.com/2019/12/07/opinion/sunday/ozone-climate-change.html

The problem has not been fully resolved to date, but it is a good example of how disasters that are urgently warned about globally can be avoided or mitigated - the nations of the world have recognized and addressed the problem.

Fact is that with more and more people and therefore consumers added to the earths' population (at an ever-growing rate)[46], the need for raw materials, manufactured items, minerals and food rises drastically. Sand is just one of many threatened resources and a factor in overconsumption. If quartz sands were ever to run out, a massive rethink would be needed. However, it is not a matter of completely abandoning material possessions, moving back into the forest, and deserting from modern life because it leads to countless crises. It is rather about becoming aware of where we over-consume, own too much, live in too big a house with too many machines, cars and generally too many useless things, which seems to be the norm in the 21st century. One approach to counteracting this is the 'sharing economy', a model in which things are lent and rented rather than being produced over and over again. Among other benefits, this is a good measure to curb some of the consumption of sand. For example, car sharing companies make it easier for consumers to give up their cars and only use and pay for one when they really need it - instead of owning one or more cars that just sit around taking up space. Not owning cars can counteract the overuse of sand in several ways: there is less reason to build architectural complexes for cars, be it garages, i.e. extensions of houses, parking garages or wide-ranging parking lots - this saves a lot of concrete and thus sand.

Similar advantages are offered by concepts such as Airbnb or other services alike[47], which make it possible to reside in vacant houses, apartments and rooms instead of booking into a hotel - the consequence would be that it would become less necessary to dig new hotels out of the ground. Among many other saved resources, tons of sand would remain in the ground instead of ending up as a huge hotel parking lot or yet another unappealing high-rise building. If the constant construction of new buildings were to be reduced, the expansion of cities would also be reduced and slowed down. This means that less sand would have to be taken from the marine floors to create artificial land. The calculation is actually quite simple: fewer cars and buildings result in less use of resources and energy.

[46] https://ourworldindata.org/future-population-growth

[47] Airbnb arguably causes increasing rents, reduces the housing supply, and exacerbates segregation. I'm talking more of the general and idealized version of the initial idea.

We are running out of time. Sand is our floors, our ceilings, the fabric of modernity. We have built an economy and society dependent on sand. The days of sand as a useful accessory are long gone. Nevertheless, sand remains a resource whose persistence and accessibility continues to be highly overrated. We hardly think about what sand is needed for and where it comes from. In this world, where more and more people want to live in apartments, shop in big malls, drive around in a car and own a cell phone, that can't continue to go unthought of. At some point in history it has seemed to us that there are endless trees, oil, water, and land available on this planet. We are starting to realize that these resources are not infinite and overstraining them comes at a prize. We have to learn to manage them, to think of alternatives and new, smarter ways to use these natural resources – and now is the time to think about sand that same way.

But above all, we need to understand that it's not just about being smarter about handling it or more careful about how we use individual important resources. It's about how we use *all* those resources. It's about finding a way to build a life for 7.8 billion people on a foundation that is more stable than sand.

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