Sand: rarer than one thinks

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Glaciers & rivers move 24 billions tonnes per year
Humans are extracting and moving btw 47 and 59 billions tonnes per year (2009)
Cement: China uses more in 4 years than USA in one century

4’180’000’000 x 7 = ...

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30 billions t. of sand & gravels (2014)

30’000’000’000

• Equivalent to a wall of $20 \text{ m} \times 20 \text{ m}$ around the equator!
What are we doing with sand?
Roads
Buildings

828 m
Dams

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Glass
Electronics and other industrial uses
Land reclamation

1'200'000'000 t.

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Land reclamation

Singapore: + 20%

Remote sensing, GIS analysis and cartography, Pascal Peduzzi, UNEP/GRID-Geneva 2013
Beach nourishment
Where is it from?

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Where is it from?
Quarries
What are the impacts?

- Impacts on landscape
- Lowering the ground
- Lost of soil
River beds
Impacts from river extraction.

• Pollution and changes in levels of pH
• Lateral instability
• Can change the riverbed itself
• Incision can drain to a lower level resulting in reduced aquifer storage
• May increase flood frequency and intensity by reducing flood regulation
• Can lower the water table, thus exacerbating drought occurrence.
Lake shores

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Lake Poyang, the largest source of sand in China: 
236 million m³ / year
Coastal and beach
Impacts from coastal extraction.

- Erosion occurs either directly or indirectly
- Reduce protection from storm surge
- Destroy habitat from beach fauna (e.g. turtles, crabs,...)
- Reduce protection from sea level rise
Marin sand dredging
Impacts from Marin extraction

Direct and indirect impacts

1. Increased turbidity
2. Far field changes in tides and currents
3. ‘Passive’ sediment plume
4. Plume dispersal
5. Seabed sediment veneers
6. Deposition from sediment plumes
7. ‘Active overflow plume
8. Ship/Machinery noise
9. Seabed removal: bathymetric change
10. Draghead noise
11. ‘Active’ screening plume
12. Base of deposit

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Impacts from Marin extraction

- On seabed flora and fauna
- Destroys organisms, habitats and ecosystems
- Affects the composition of biodiversity
- Usually leading to a net decline in faunal biomass and abundance
- Or a shift in species composition
- Too fine particles are rejected by dredging boats... changing water turbidity.
Once trapped into concrete, the sand is lost.
<table>
<thead>
<tr>
<th>Impacts on</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Biodiversity</td>
<td>Impacts on related ecosystems services (e.g. fisheries)</td>
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<tr>
<td>Land losses</td>
<td>Both inland and coastal through erosion processes</td>
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<tr>
<td>Hydrological function</td>
<td>Change in water flows, flood regulation, or on marine currents</td>
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<tr>
<td>Water supply</td>
<td>Through both lowering of the water table and pollution</td>
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<tr>
<td>Infrastructures</td>
<td>Damage to bridges, river embankments and coastal infrastructures</td>
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<tr>
<td>Climate</td>
<td>Directly through transport emissions, indirectly through cement production</td>
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<td>Landscape</td>
<td>Coastal (e.g. beach) erosion, quarries, pollution of rivers</td>
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<tr>
<td>Extreme events</td>
<td>Decline of protection against extreme events (flood, drought, storm surge)</td>
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</tbody>
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SOLUTIONS?

We need:

• Monitoring
• New legislations
• Optimize the use of existing buildings and infrastructures
• Incentives (taxes and subventions)
• Recycling concrete and glass
• Use ashes from wastes
• Building with alternative material
• Sound environmental impacts assessment prior mining, quarrying and land reclamations be authorized.
Linear economy

Mines → Industry → Consumers → Waste / Dump
Circular economy

Industry

Consumers

Waste as resource
Sand: rarer than one thinks

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