IMPACTS OF SAND MINING ON WORLD'S RIVERS

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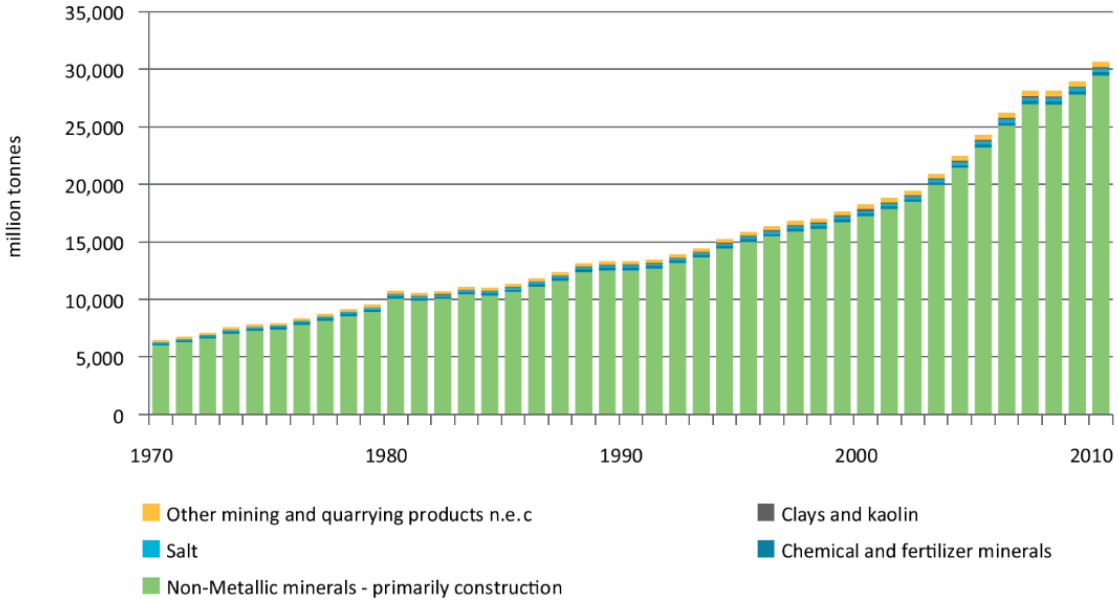
Rationale for research

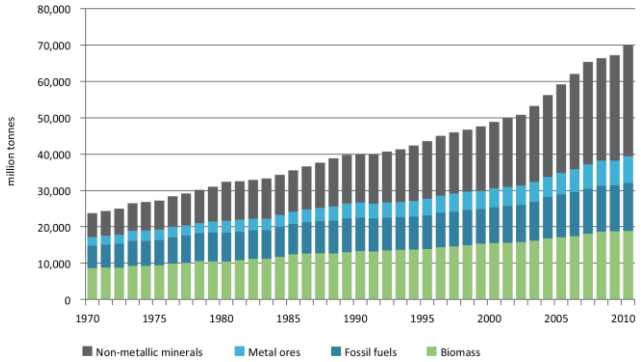
- Evidence based information on past, current and potential impacts of sand mining on rivers and ecosystems

- Three pronged approach:
  - Highly structured QSR review of scientific literature
  - Literature review of trends and governance in sand mining
  - Media and literature review

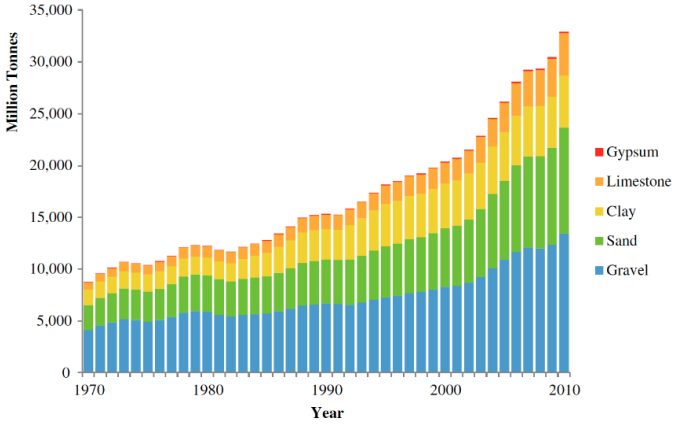
Global Extraction trends



Global extraction based on domestic extractions of non-metallic minerals by material subcategories, 1970-2010 ,UNEP (2016).

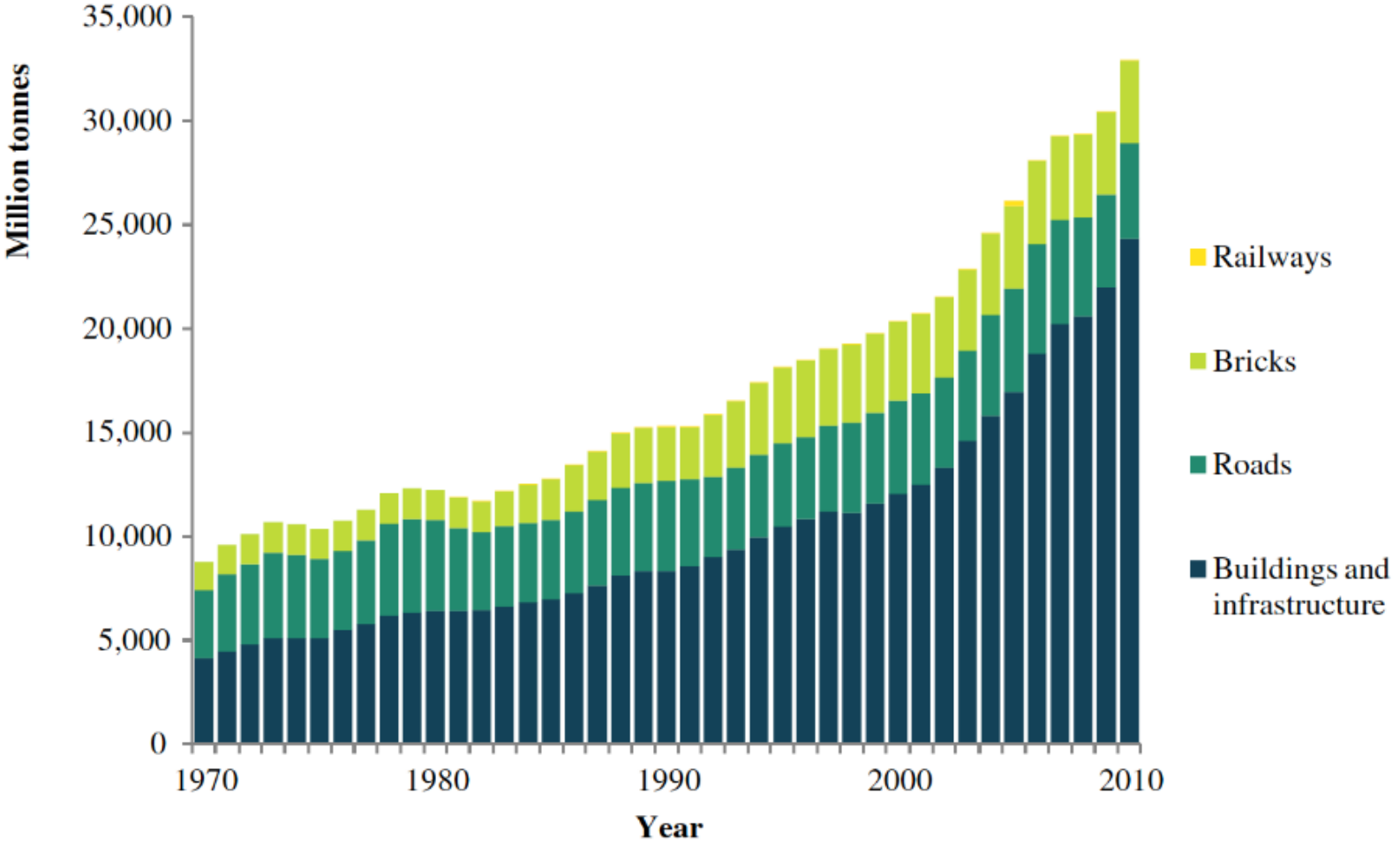


Global material extraction based on domestic extractions by four material categories, 1970-2010, million tonnes. UNEP (2016).



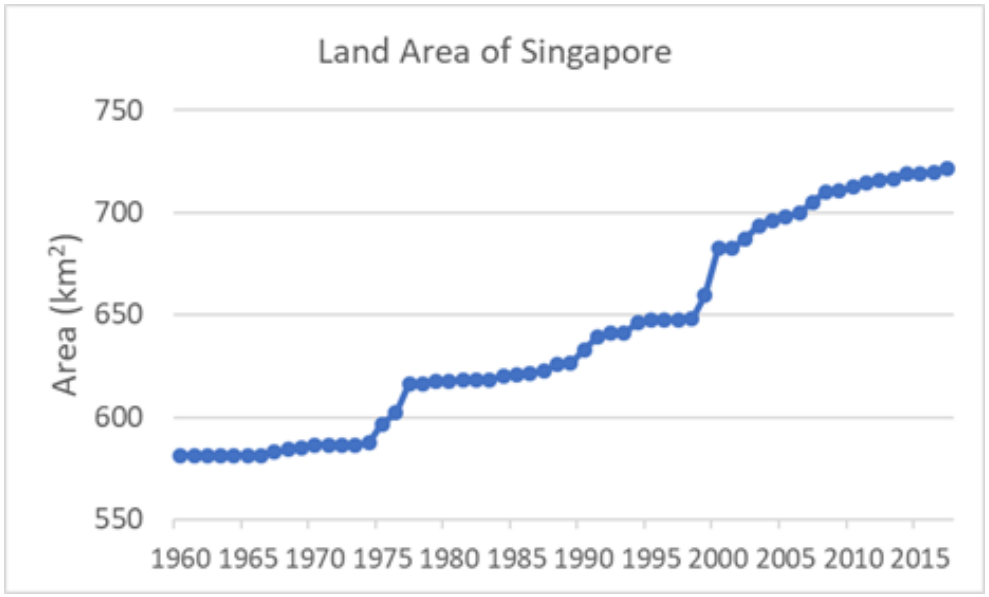
Global extraction of non-metallic minerals by type, 1970-2010, million tonnes. Miatto, et al. (2016).

Construction driving expansion



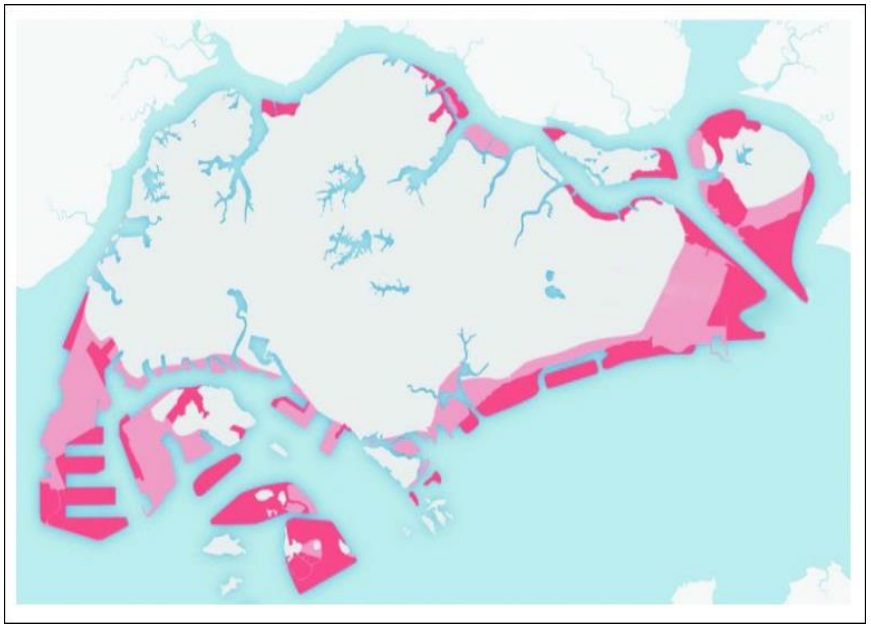
(Miatto, 2016)

Demand for Land Reclamation



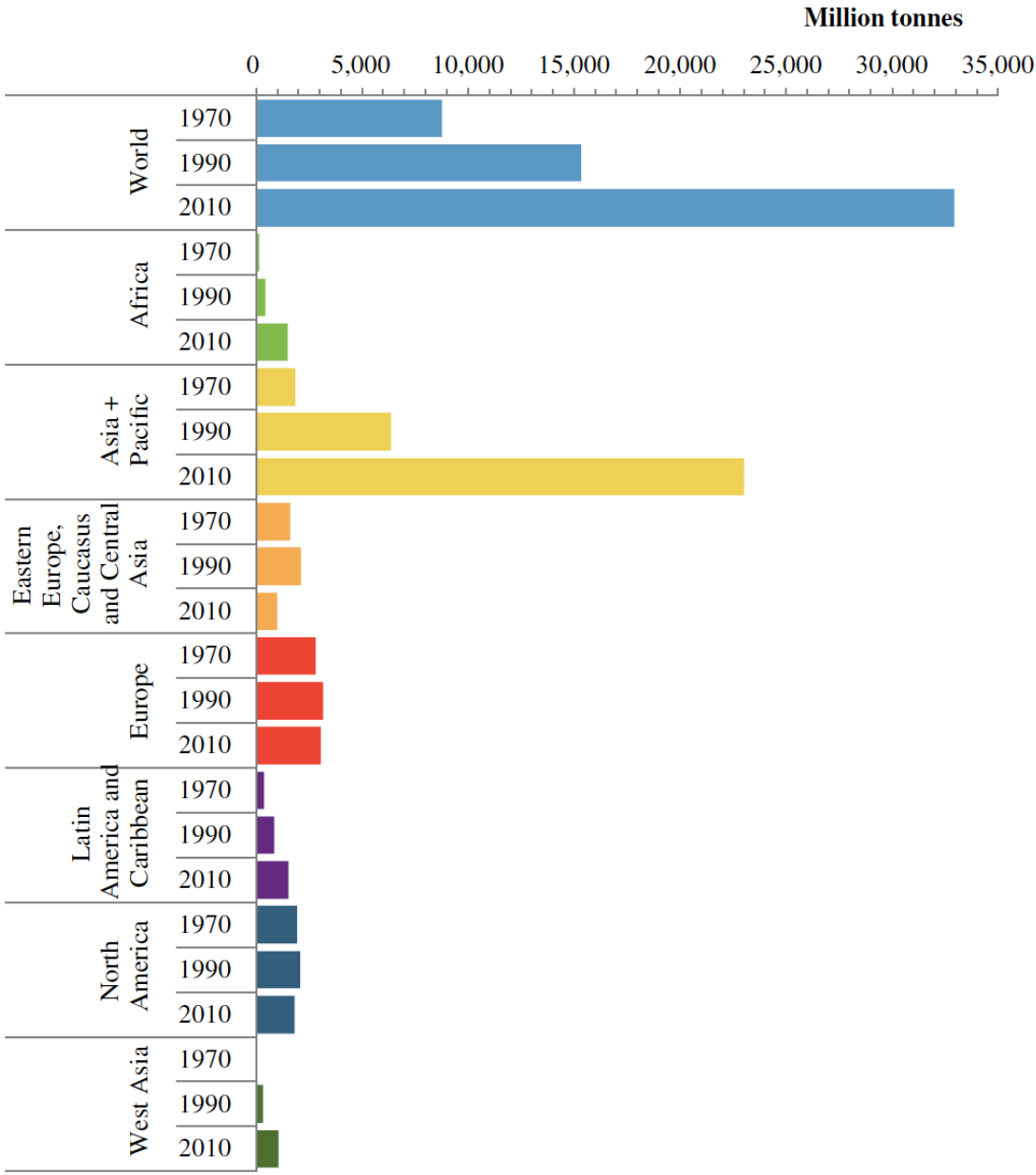
(Data.gov.sg)

Expanding Singapore

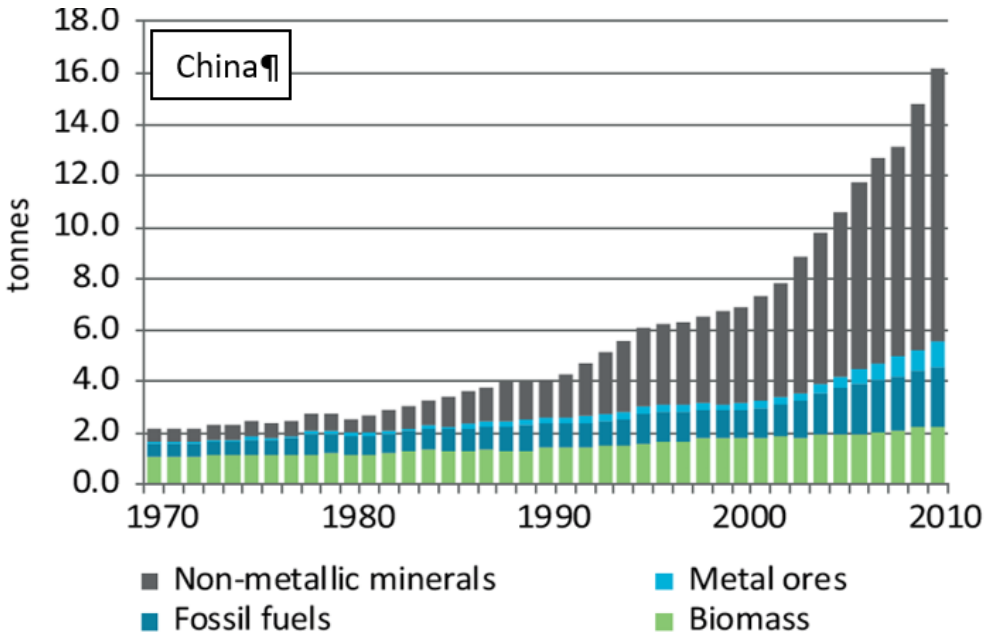


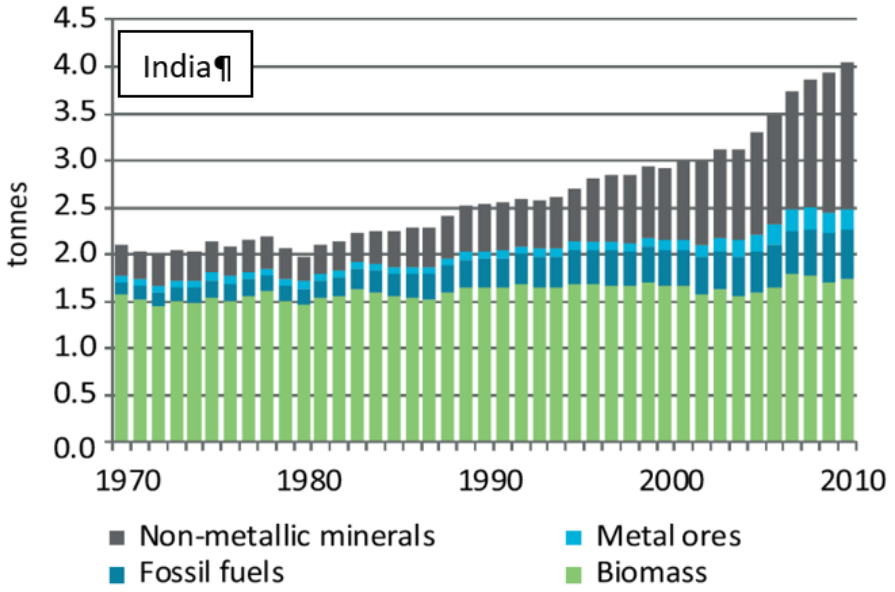
(Seng, 2017)

Regional trends

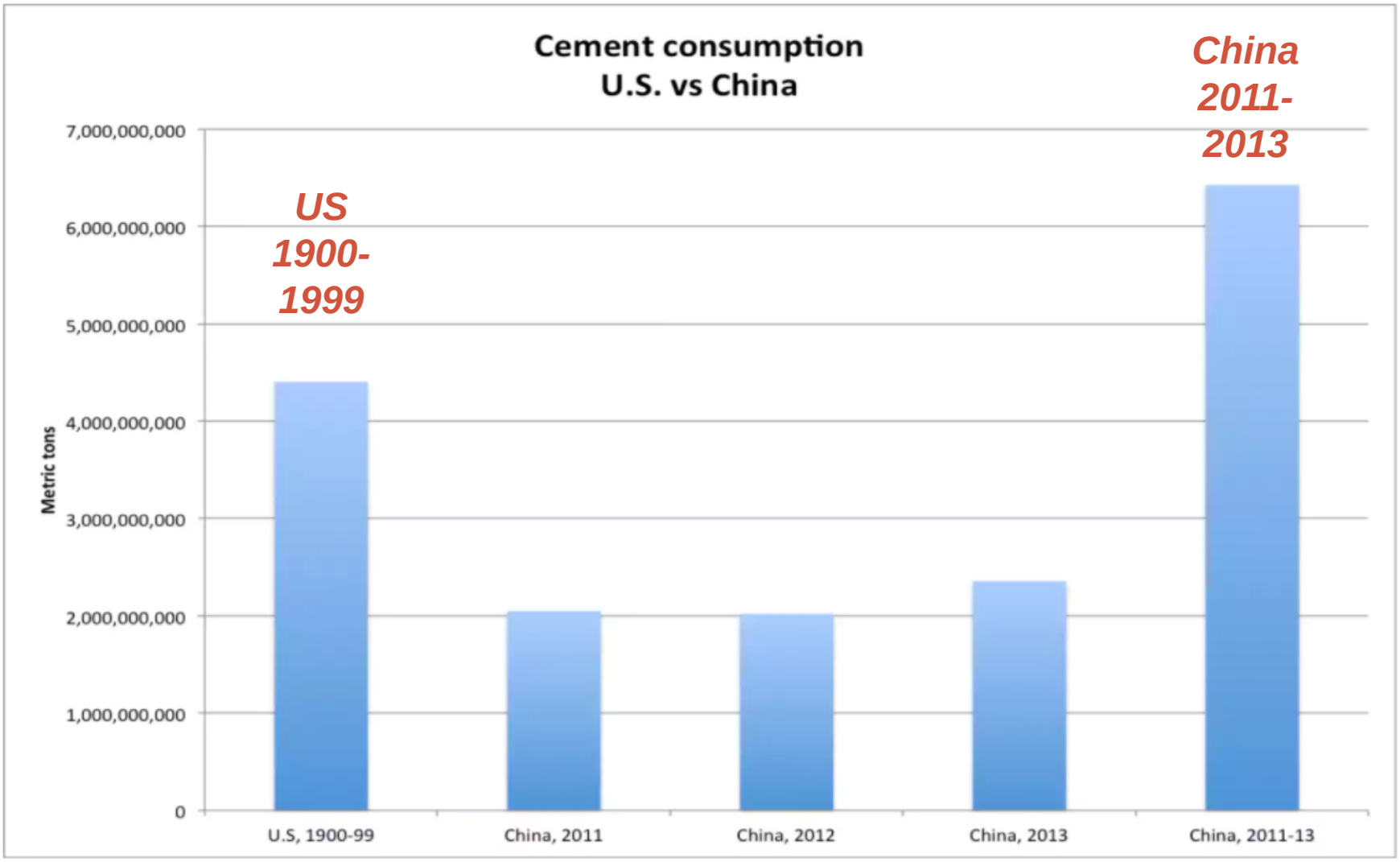


Per capita Domestic Extraction 1970-2010



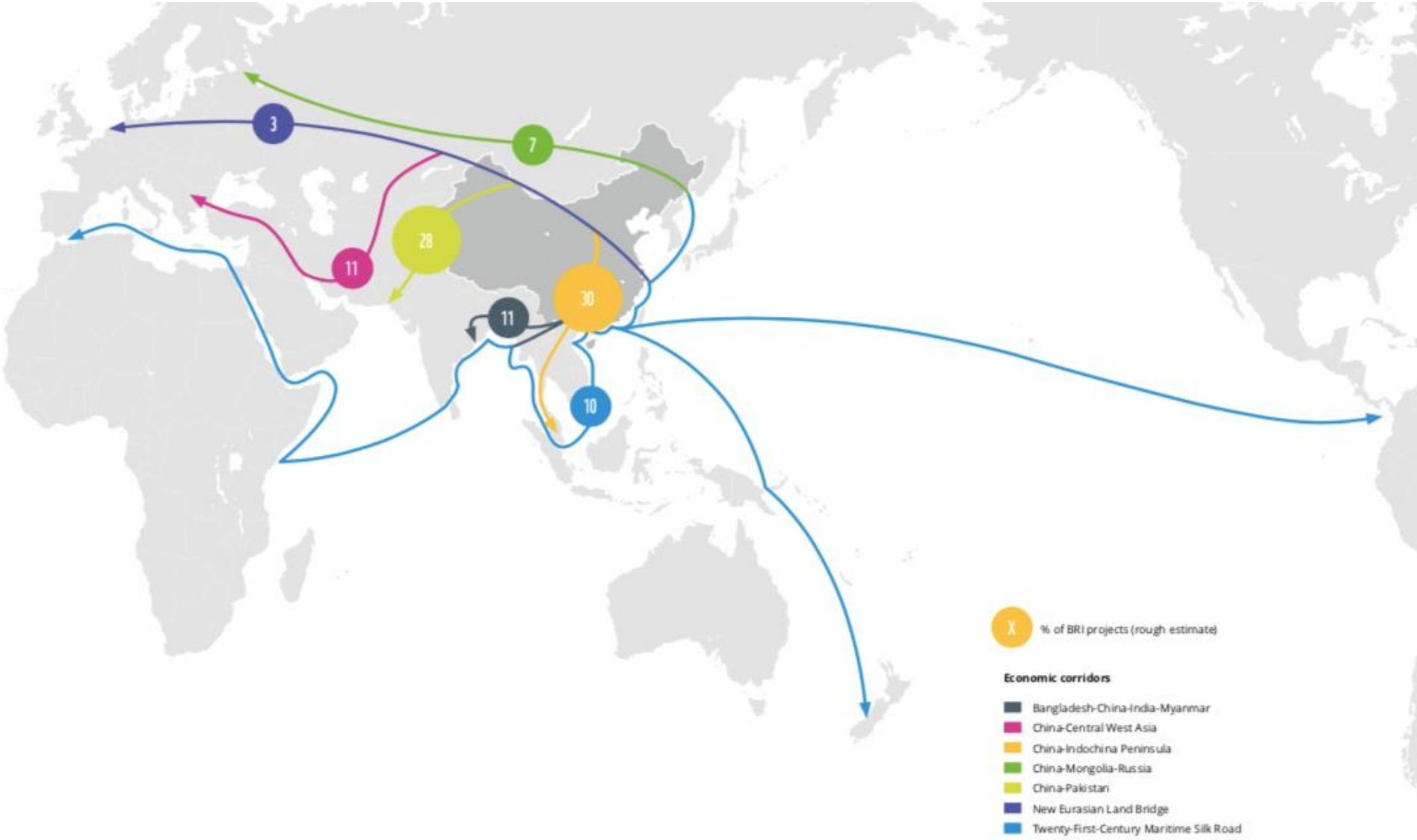


Recent trends compared to historic usage

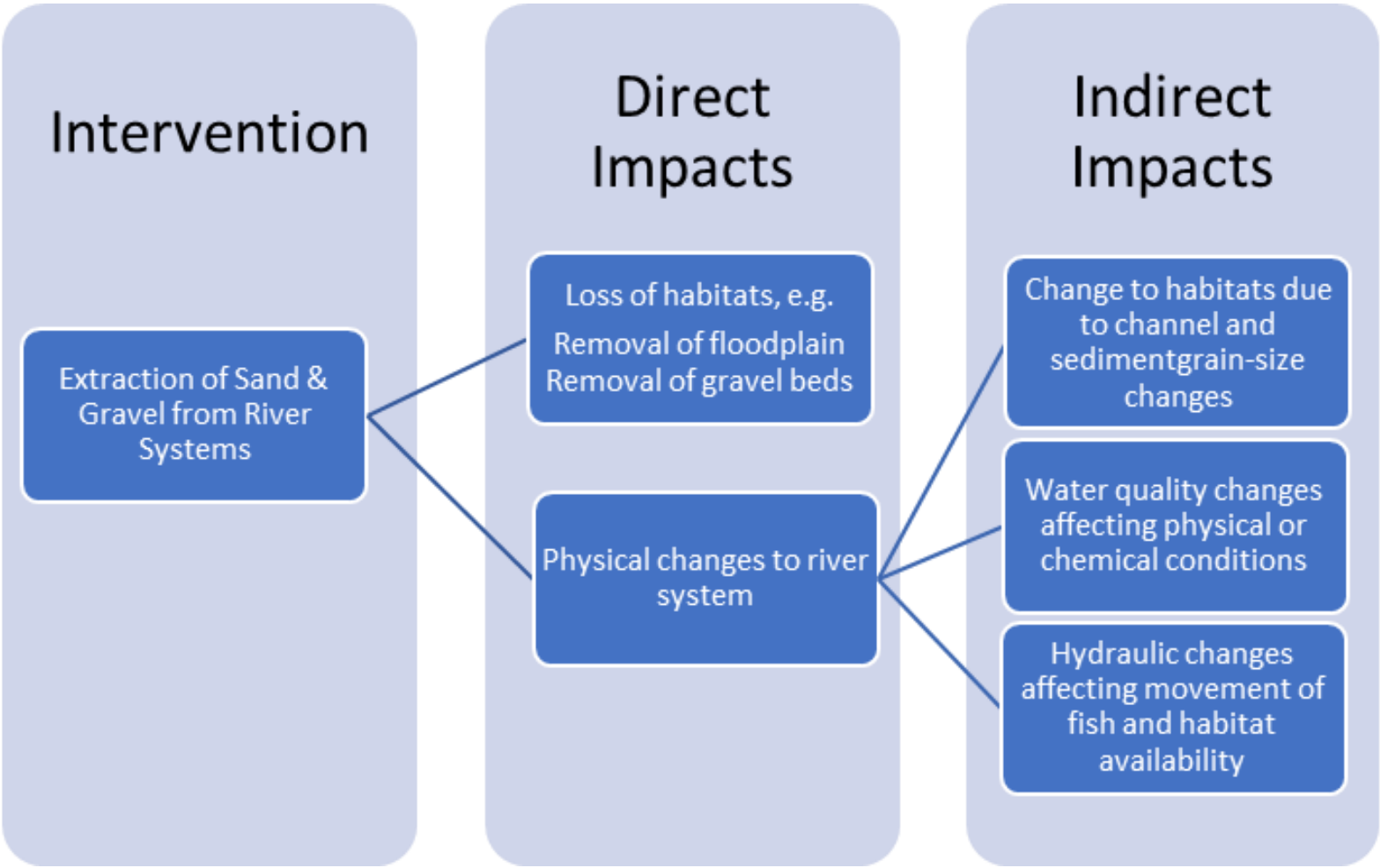


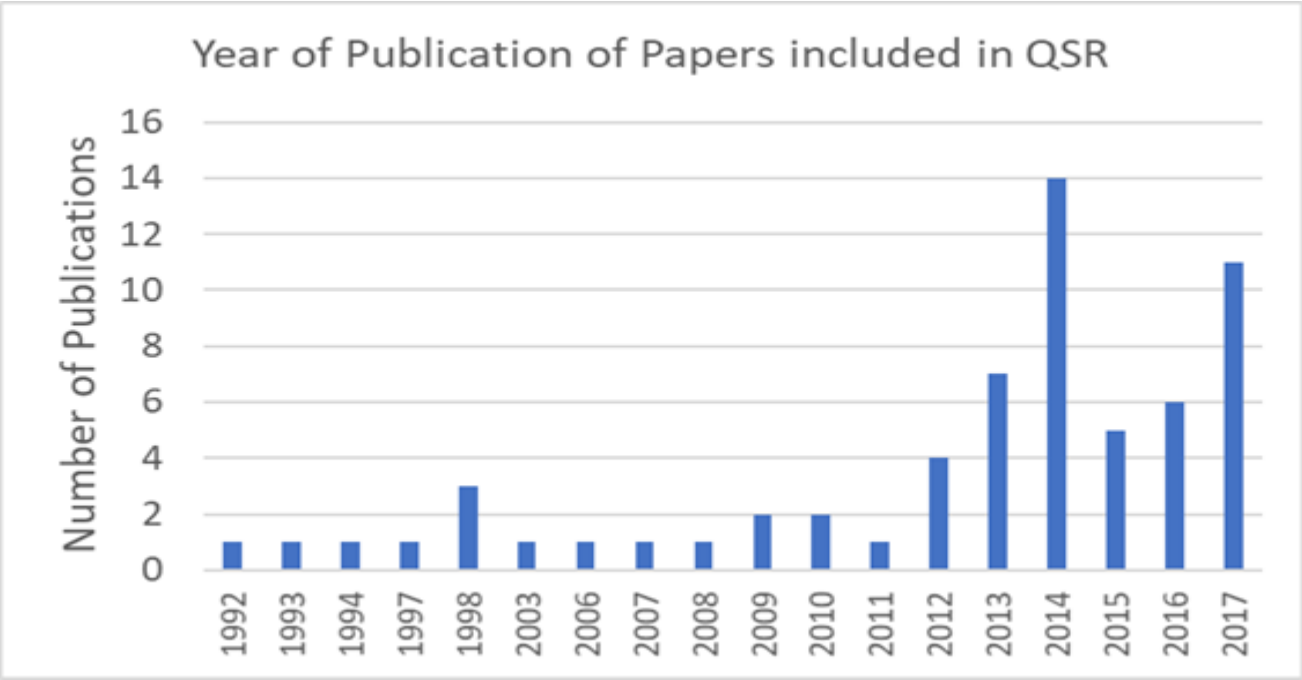
U.S. Geological Survey and International Cement Review

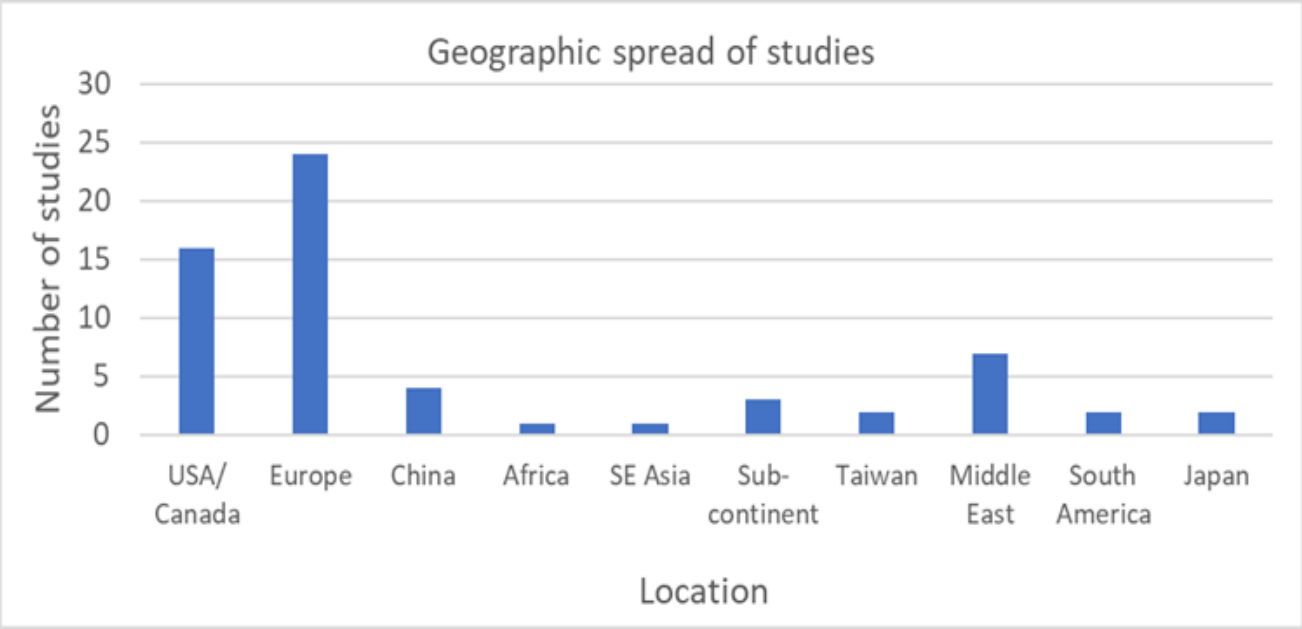
BRI

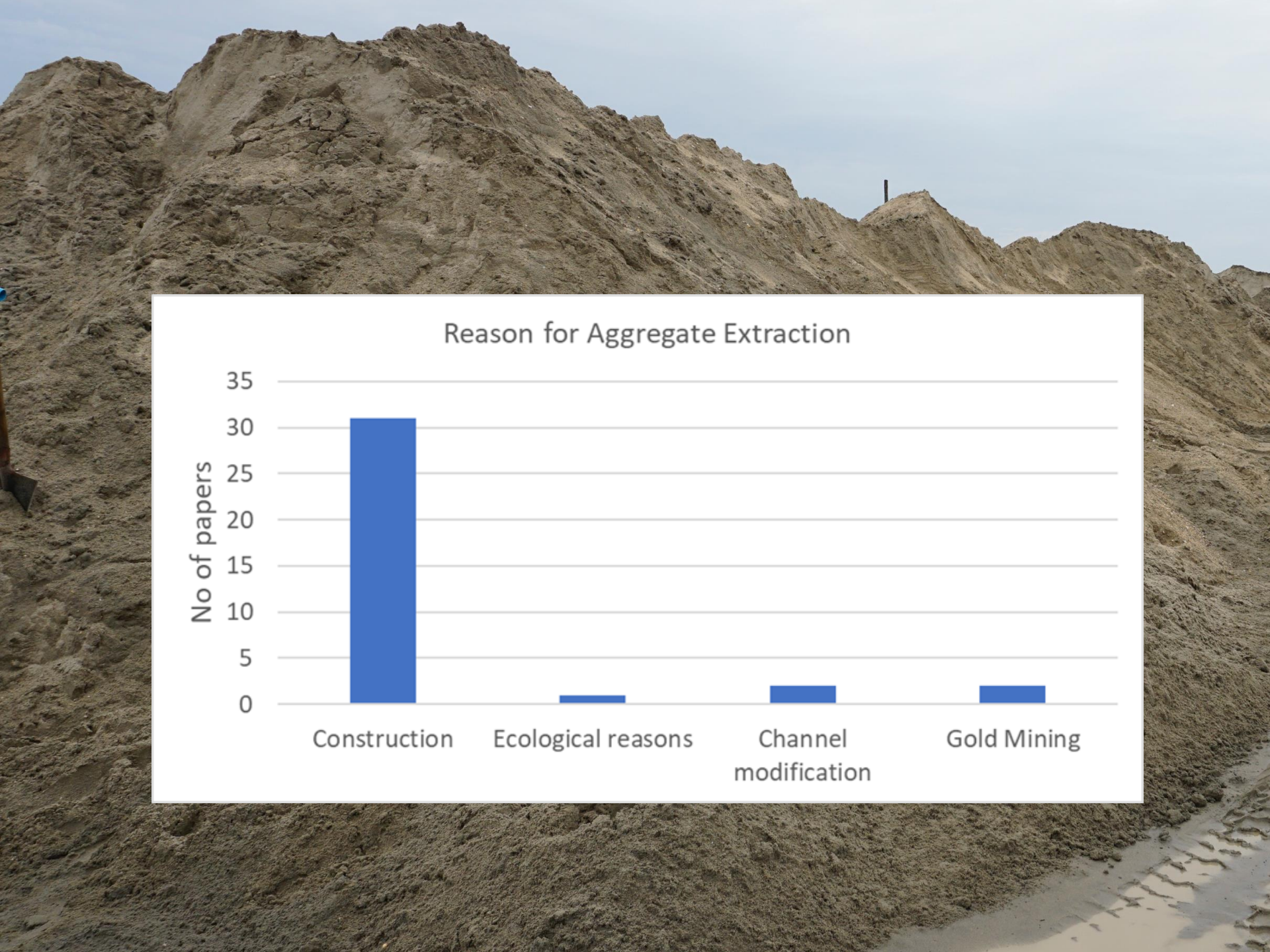

3
7
28
11
30
11
10
X % of BRI projects (rough estimate)
Economic corridors
Bangladesh-China-India-Myanmar
China-Central West Asia
China-Indochina Peninsula
China-Mongolia-Russia
China-Pakistan
New Eurasian Land Bridge
Twenty-First-Century Maritime Silk Road

Quick Scoping Review (QSR)

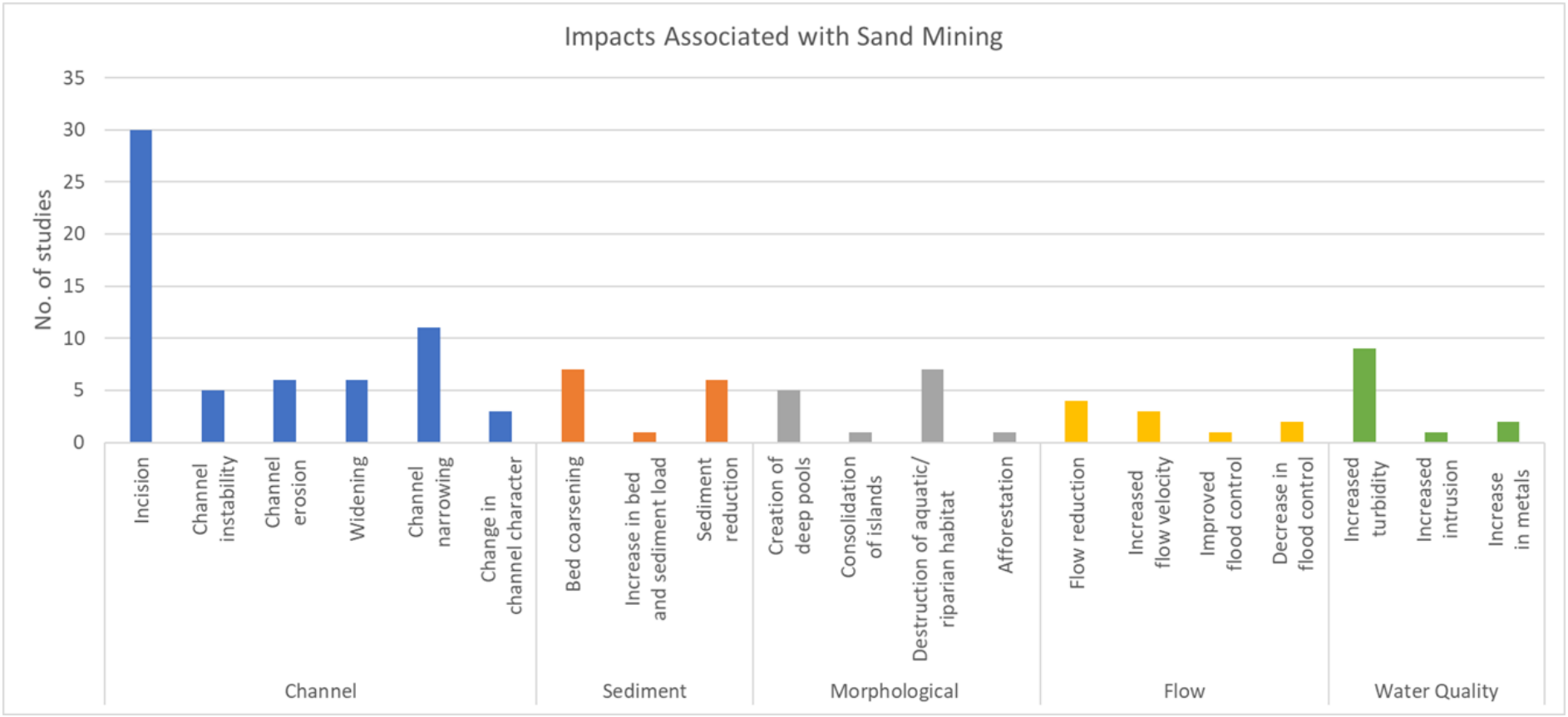



Year of Publication of Papers included in QSR
Number of Publications
16
14
12
10
8
6
4
2
0
1992
1993
1994
1997
1998
2003
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017


Geographic spread of studies
Number of studies
30
25
20
15
10
5
0
USA/ Canada
Europe
China
Africa
SE Asia
Sub-continent
Taiwan
Middle East
South America
Japan
Location


Reason for Aggregate Extraction
No of papers
35
30
25
20
15
10
5
0
Construction
Ecological reasons
Channel modification
Gold Mining

Summary of Physical Impacts



Ecosystem impacts of sand mining

Wide range of impacts, but based on very few papers :

- Reduction in diversity and abundance of fish in mined areas
- Change from lentic to lotic populations due to removal of riffle sequences
- Increase in invasive species in disturbed areas
- High mortality during embryonic stage due to suction dredging
- Temporary and reversible change to abundance and diversity of invertebrates in small scale mining
- Change in food web dynamics in mined areas
- Impacts on larval drift due to increased turbidity
- Changes to riparian vegetation,
- ....

Loss and destruction of habitat is number 1 stressor cited by IUCN on Red List

Link between physical changes to river and impacts on ecosystem often inferred, but limited number of studies demonstrate a direct linkage

- Loss of gravel substrate impacting fish spawning
- Channel alterations affecting migratory patterns
- Decline in native fisheries
- Water quality changes affecting biota
- Decline in deltaic ecosystems and coastal fisheries

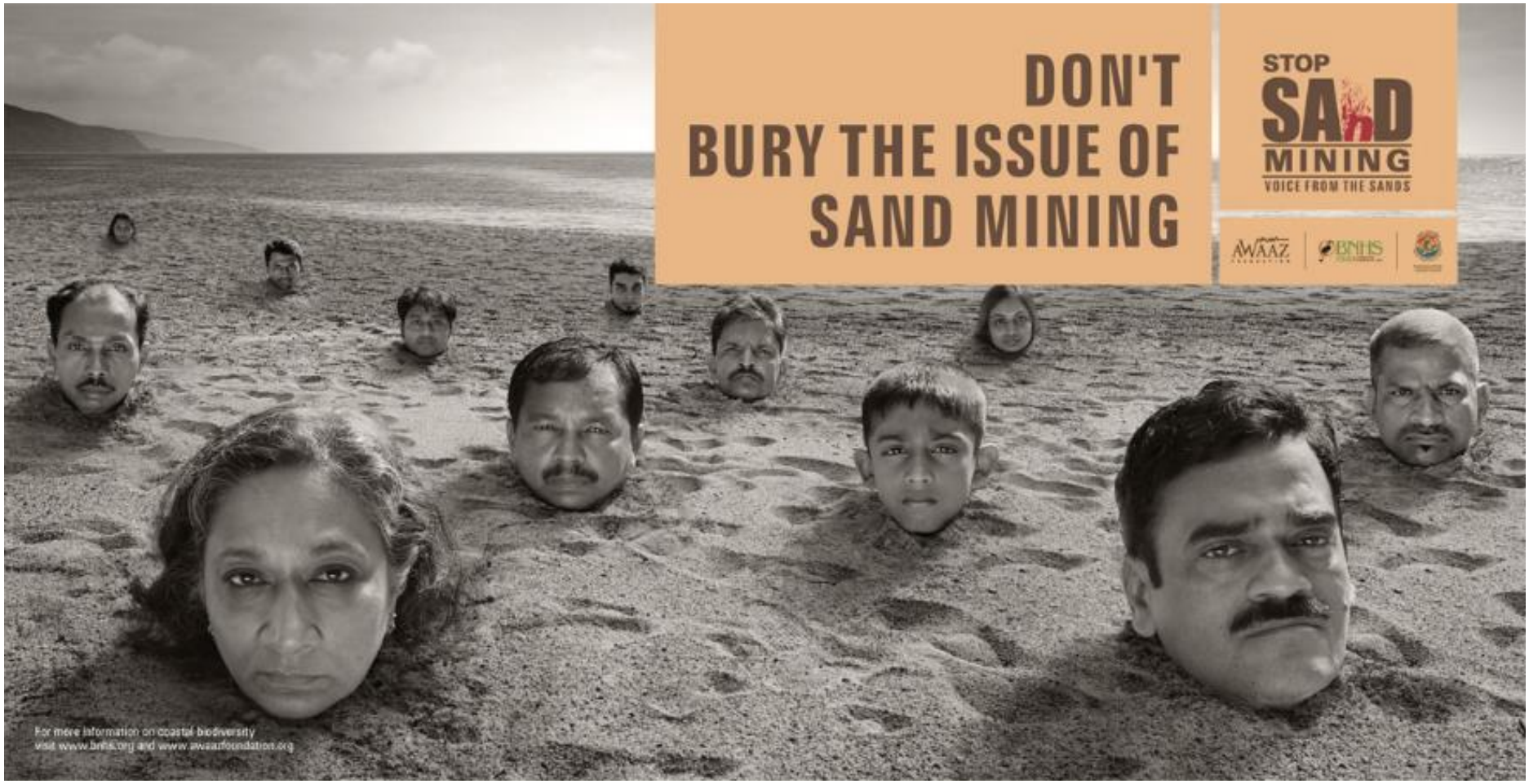
Summary of QSR investigation

- Wide range of physical impacts on rivers
- Ecosystem impacts inferred due to physical changes due to sand mining
- Few papers directly document impact on ecosystem. Why?
  - Complex interactions not well understood; long time-scales; requires inter-disciplinary approach; other factors (dams, land use change etc.) make demonstrating cause–effect difficult

Governance of Sand Mining

- Remarkably similar throughout the world
- Regulation tends to be based on State or National laws, but responsibility devolved to local governments
- Regulatory gaps contribute to poor governance, but main issue is **widespread occurrence of unregulated, illegal sand mining activities in many countries**

Sand mining in the media



Illegal extraction reported in over 70 countries

Synthesis

- The world's economy is based on sand
- Demand is increasing
- Unprecedented pressure on rivers, floodplains & deltas to provide sand
- Illegal extraction is widespread
- Lack of scientific investigation

Hope for the future?

- **Need to recognise sand is not limitless or low value product**
- **Short term – improved governance can save rivers**
- **Longer term – alternative materials being developed**
- **BUT change would require acceptance by consumers and overhaul of construction industry**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