Status of Sand Mining in North America – A Review

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Abstract

Sand is an essential material in construction industry. It is available throughout the world and from various environments. Excess exploitation of sand lead to so many environmental disasters in almost all the continents. The present paper reviewed the problems encountered in various cities of North America. It is found that sand mining has been effected Coastal, River dune, and lake environments. Tourism suffered in some parts of North America. The sand mining controlling measures shall be continued to check the effects of sand mining.

Keywords - *Sand mining, North America, Environment impacts. Rivers, Beaches, Dunes, lakes.*

I. INTRODUCTION

Sand is one type of sediment, composed of mineral grains ranging from 0.0625 to 2mm diameter. The main component of sand is silica (silicon dioxide, SiO_2), usually in the form of quartz mineral. It is an extremely hard and slow-wearing substance.

Most of the sand is a product of the weathering of pre-existing rocks- Igneous, Sedimentary or Metamorphic. The product transports down slope and deposit in low lying areas by running water. The geomorphologic agents like wind, running water, ice ocean waves and currents. Three important processes are involved in sand origin – Weathering, Transportation and Deposition.

'Sand mining' is a practice that is used to extract sand, from various environments. The sand is mining from beaches, inland dunes and dredged from ocean beds, and river beds of deltaic regions. Currently the mining is occurring in more than 60 countries.

Environmental problems occur when the rate of extraction of sand, gravel and other materials exceeds the rate at which natural processes generate these materials. The morphologies of the mining areas have demonstrated the impact of mining with the prowess to destroy the cycle of ecosystems. Based on the sand composition/mineral present sand mining/using activities such as silica sand mining, radioactive mineral sand mining and sandblasting require precautions. Bags of silica sand used for sandblasting now carry labels warning the user to wear respiratory protection to avoid breathing the resulting fine silica dust.

In areas of high pore water pressure sand and salt water can form quicksand, which is a colloid hydrogel that behaves like a liquid. Quicksand produces a considerable barrier to escape for creatures caught within, who often die from exposure. Sand is also using in hydrofracking, a process in which highly pressurized chemicals and water are pumped into existing oil and natural gas wells, thousands of feet deep into shale, and then turned horizontally, sometimes as wide as a mile, fracturing existing cracks in the shale and allowing oil and natural gas to flow at a higher rate into the wells. To keep the fractured shale from closing up, water and frac sand are packed into the cracks. Weaker proppants (particles which hold fractures open) could crumble amid the pressure, and less porous ones would not allow a maximum flow of oil or gas.

This paper reviewed the impact of sand mining in various parts of the North America. Area wise impact shown in table 1.

Table 1.Impact of Sand Mining in North America

Sl. No.	Place	Environment/Purpose	Impact
1	California	Dune	Erosion Vamishiras
2	Canada	Oil Sand	Health Problems
3	Caribbean Islands	Beach	Damage to Ecosystem
4	Jamaica	River	Lost Agricultural land
5	Mary Land and Delaware	Lagoon	Damage to Ecosystem
6	Mauritius	Fracking Sand	Damage to

			Ecosystem
7	Missouri	Silica Sand	Silicosis
8	Manroe Country	Beach, Dune	Natural Heritas, Tourism
9	Morocco	Beach	Erosion
10	Montserrat	Beach	Ecosystein
11	Portland	Beach	Tourism
12	Sierra Leon	Beach	Ecosystem
13	Tobago	Dune	Vamishing
14	United States	Beach	Erosion
15	Wisconsin and Minnesota	Land	Silicosis Tourism

A. California

Southern Monterey Bay is characterized by some of the highest dunes in California that extend back almost to Salinas River[1]. The dune edge is the shoreward limit of useable land. Throughout the year beach sand loaded into large dump trucks. It caused heavy erosion along the Bay.

B. Canada

The oil sands industry releases the 13 elements (Alberta University Report, 2010). In the 2008 snowpack, all PPE except selenium were greater near oil sands developments than at more remote sites. Bitumen upgraders and local oil sands development were sources of airborne emissions. Concentrations of mercury, nickel, and thallium in winter and all 13 PPE in summer were greater in tributaries with watersheds more disturbed by development than in less disturbed watersheds. Canada's or Alberta's guidelines for the protection of aquatic life were exceeded for seven PPE—cadmium, copper, lead, mercury, nickel, silver, and zinc—in melted snow and/or water collected near or downstream of development.

Increased incidence of respiratory and cardiovascular diseases, multiple sclerosis and rare types of cancer were reported. Arsenic, at 33 times the acceptable level, was found in game meats as well as some animals which found with tumors and mutations.

C. Caribbean Islands

For many decades the removal of sand has been taking place in many Caribbean island beaches. The volumes removed were more a populations and economies grown in the region Construction materials were changed from wood to concrete. As there are insufficient accessible, inland deposits, sand mining had increased along beaches and shorelines, as well as in rivers. Remote beaches became targets for illegal mining.

Caribbean round grains, favored in creating smooth surfaces for plastering and finishing. Due to mining some islands are now exposed to tidal surges and rough seas.[2]

Mining also affected the nesting activities of endangered sea turtles. Furthermore, baby turtles follow the beach slope down to the sea.

D. Jamaica

Jamaica has been grappling with the problem of illegal sand mining Lakes like Pen, Grange Lane, Dunbeholden and Harkers Hall were badly affected. Rivers, flood plains and channels were also damaged due to sand mining. More than 100 hectares of prime agricultural land has been lost due to illegal quarrying.

E. Mauritius

Mineral resources are less in Mauritius. Negative impacts are noticed from coral sand mining on coastal lagoons.

F. Missouri

Fracking process needs sand. Fracking is a stimulated process that is used to maximize extraction efforts of oil, natural gas, geothermal energy and water[3].

Sand is in large demand among energy producers who rely on the tiny granules to proper open the cracks in shale rock after pressurized water and chemical solutions burst the earth apart[4] . The excavation of sand caused environmental problems.

G. Monroe County

Sand comprises silica mineral, quartz. Silicosis noticed in countryside.

H. Morocco

Extraction of beach and dune sand for constructions is destroying the nation's natural heritage. The Mining near major coastal cities, has created lunar-like landscapes on the coast[5].

Many mining sites on the coast of Morocco are remote, but fabulously beautiful. While maintaining a healthy ecosystem, hotel complexes could readily be constructed within the coastal sand dunes. The seasonal dry, sunny weather, warm coastal ocean with excellent surfing and swimming opportunities represent an extraordinary condition favorable to tourism. Sand mining has resulted ugly moonscapes that no tourist

would want to visit. The beaches are too hard for lounging on and even difficult to walk on.

Total destruction of the coastal ecosystems had noticed due to sand mining. The removal of beach sand shown its impact on the near shore distribution of sand. Organisms adapted to a particular substrate-effect due to change in shore bottom.

I. Montserrat

Beach sand mining had been a common practice in Montserrat. Construction boom, associated with tourism, starting in the 1960's, led to a huge demand for sand. The sand mining resulted the beach erosion. Hurricanes in 1979 and 1989 compounded the problem, caused serious beach erosion. More sand required to rebuild the infrastructure. Later steps somewhat controlled the sand mining[6].

J. Maryland and Delaware

Sand mining caused major change of wave height at Fenwick and Isle of Wight Shoals. The increase is as much as two times. As a consequence, erosion and shoreline recession possible[7].

K. Portland

Farmers of Grants Level and Berrydale are affected from the damaged of the roadway from sand mining. The farmers are worried that their produce could spoil, as they would not be able to transport them to the market. The road way also connects tourist spots. There is no other road for farmers and tourists [8].

L. Sierra Leone

The sand mining activity is providing informal work for people, but is destroying the natural beauty of the area. So the activity driving away tourists, business owners and residents. It also contributing to coastal erosion, proceeding up to 6 meters a year.

With a distance of about 16 km from the heart of the capital city of Freetown, here lies the Lakka community hosting more than four thousand people. The Lakka community construction works is under threat due to repeated visit of heavy trucks for sand[9].

M. Tobago

Sand mining on beaches is going on in Crown Point, Kilgwyn, Lowlands, Milford Road Minsky Bay, Hope, King Peters, Courland Bay, Black Rock, Back Bay areas. Negative impacts were recorded[10].

N. United States

Fresh water sand dunes are present in Michigan. Sand mining vanishing the dunes. Dunes were created during the last ice age and have grown for thousands of years. Once destroyed the dunes cannot be replaced[11]. Inland dunes and costal dunes are noticed at Great Lakes shore, the eastern UP and the Saginaw Bay area. Coastal dunes are found predominantly along the eastern shoreline of Lake Michigan the Straits of Mackinac. Silver Lake State Park, Warren Dunes State Park, and in the Sleeping Bear National Lakeshore.

O. Wisconsin and Minnesota

Oil companies require silica sand for hydraulic fracturing. Wisconsin producing nearly 2/3 of the nation's silica. According to the Wisconsin Department of Natural Resources (WDNR), there are currently 34 active mines. The boom in silica sand mining has caused impact on quality of life and the threat of silicosis. According to the WDNR (2012) these issues include noise, lights, hours of operation, damage and excessive wear to roads, annoyance resulting from blasting, regarding aesthetics and land use changes[12]. The mining also affected tourism.

CONCLUSION

Sand mining became common in almost all the continents and environmental effects are observed throughout the world. As it is very much difficult to reestablish the natural conditions the Governments should take stringent steps to curb this illegal sand mining.

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