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RESEARCH NOTE - AN OPINION

In the absence of a robust controlling mechanism Sand mining will be more disastrous compared to Global warming

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ABSTRACT
In almost all the international conferences associated with Pollution, monsoon aberrations, environmental issues scientists invariably present their studies covering "Global warming and Climate change". We hardly come across an international conference that covers studies on sand mining. While fully agreeing that global warming and climate change impacts the land and ocean ecosystem and resultant ill effects on life it is presented in this small write up the necessity to give due importance to steps that would curb illegal sand mining. If we continue to ignore introduction of robust controlling mechanism we will irrevocably suffer due to sand mining resultant permanent negative impact on our environment.

Key words: Sand mining, Global warming, Instream mining, Channel Morphology, National Building Codes

PREAMBLE:

All of us at one time or the other might have come across a situation where in choosing between one set back over the other has become a necessity. Many of us, who have limited capability to wriggle out of the crisis, might have weighed options and chosen one or the other believing the Almighty would save us.

Presently majority of those who are exposed to the existing camouflaged reality (influenced by never ending media hype and business options` based global politics), finding difficult to weigh the options, are coming to the conclusion that global warming is more disastrous. However, in reality sand mining is as disastrous if not more due to various reasons. If global warming is a devil sand mining is the deep blue. Devil can change its decisions depending on its moods and preferences and can leave one by just making him sweat. In case of the deep blue neither we know its depth nor can change its set behaviour. And as such when someone falls in the deep blue sea, irrespective of his swimming expertise, he will not be sure where he would move and when he would be saved. While global warming scenario is expected to be reversed, during mini ice age expected to surface during 2030-2040 period (at least for a limited period) due to the Sunspot minimum impact, sand mining resultant setbacks can never be reversed as sand accumulated over thousands if not millions of years cannot be replenished through any means. Even though these options have some setbacks experiments to lessen global warming through hard and soft Climate engineering exercises have shown some good results in arresting the coastal belt erosion due to global warming resultant rising of sea levels. Also in the recent past carbon dioxide removal (CDR) method or a solar radiation management (SRM) method have yielded some useful results. CDR methods address the warming effects of greenhouse gases by removing carbon dioxide (CO2) from the atmosphere. CDR methods include ocean fertilization, and carbon capture and sequestration. SRM methods address the climate change by increasing the reflectivity of the Earth's atmosphere or surface. Aerosol injection and space-based reflectors are examples of SRM methods. SRM methods do not remove greenhouse gases from the atmosphere, but can be deployed faster with relatively immediate global cooling results compared to CDR methods. We do know that these geo-engineering interventions need to be introduced in a controlled way to minimise environmental instability. In addition, as Rida Bilgram of Sustainability forum has pointed out "….The 21st of March 2016 marked 100 days since the historic climate agreement was struck in Paris between 195 countries, setting the first long-term goal for carbon emissions reduction. It was bolstered, too, by the World Economic Forum, whose work demonstrates that global leaders for the first time perceive the failure to mitigate and adapt to climate change as the top risk in terms of greatest potential impact. While the Paris agreement is officially due to enter into force in 2020, it is already shaping public policy and corporate action. Pre- and post-Paris, governments have not been the only actors motivated to commit and act. Business was a key voice leading up to COP21, and the role of business is even more crucial as we shift from the negotiation table to the massive systemic change that is required to keep global warming to 1.5°-2° Celsius. We expect to see more ambition and action from business in a post-Paris world through exploring low carbon business models, setting science-

based targets and being more active on internal carbon pricing, as well as the shadow pricing of other resources such as water. More than 400 companies already use or are considering an internal carbon price to future-proof their business, as CDP reports."

I only detail these initiatives to impress upon the readers that there is a percentage of hope for bringing out a positive change in case of global warming. Nothing of that sort of hopeful solutions can be invented in replenishing removed volume of sand from river channels. We need actions that can at least arrest the degradation by properly propagating the problem.

IMPACTS OF SAND MINING:

For thousands of years, sand and gravel have been used in the construction of roads and buildings. Today, demand for sand and gravel continues to increase. Mining operators, in conjunction with cognizant resource agencies, must work to ensure that sand mining is conducted in a responsible manner. Unfortunately, this is not in practice.

Excessive in-stream sand-and-gravel mining causes the degradation of rivers. In-stream mining lowers the stream bottom, which may lead to bank erosion. Depletion of sand in the streambed and along coastal areas causes the deepening of rivers and estuaries, and the enlargement of river mouths and coastal inlets. It may also lead to saline-water intrusion from the nearby sea. The effect of mining is compounded by the effect of sea level rise. Any volume of sand exported from streambeds and coastal areas is a loss to the system. Excessive in-stream sand mining is a threat to bridges, river banks and nearby structures. Sand mining also affects the adjoining groundwater system and the uses that local people make of the river.

In-stream sand mining results in the destruction of aquatic and riparian habitat through large changes in the channel morphology. Impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts cause degradation of riparian and aquatic biota and may lead to the undermining of bridges and other structures. Continued extraction may also cause the entire streambed to degrade to the depth of excavation. Sand mining generates extra vehicle traffic, which negatively impairs the environment. Where access roads cross riparian areas, the local environment may be impacted.

Removing sediment from the active channel bed in river sand mining interrupts the continuity of sediment transport through the river system, disrupting the sediment mass balance in the river downstream and induces channel adjustments (usually incision) extending considerable distances (commonly one km or more) beyond the extraction site. The magnitude of the impact basically depends on the magnitudes of the extraction relative to bed load sediment supply and transport through the reach. Government of India guide lines point out that mining within or near riverbed has a direct impact on the stream's physical characteristics, such as channel geometry, bed elevation, substratum composition and stability, in-stream roughness of the bed, flow velocity, discharge capacity, sediment transport capacity, turbidity, temperature etc. Alteration or modification of the above attributes may cause hazardous impact on ecological equilibrium of riverine regime. This may also cause adverse impact on in-stream biota and riparian habitats. This disturbance may also cause changes in channel configuration and flow-paths. Furthermore, the process of in-stream mining and gravel washing produces fine sediments under all flow conditions, resulting in a deposition of fine sediment in riffles as well as other habitats at low discharge. Excess sediment is considered the greatest pollutant in waters and constitutes one of the major environmental factors in the degradation of stream fisheries. However, in-stream mining may contribute additional sediment to downstream reaches due to the disruption of substrate stability. Once sediment enters the stream, it is best to let natural geomorphological and hydrological processes reach a dynamic equilibrium, rather than further exacerbating the situation by additional disturbance.

Several studies, including those in USA, have documented the bed degradation caused by the two general forms of in-stream mining: (1) pit excavation and (2) bar skimming. Bed degradation, also known as channel incision, occurs through an important primary process: head-cutting. In head-cutting, excavation of a mining pit in the active channel lowers the stream bed, creating a nick point that locally steepens channel slope and increases flow energy. During high flows, a nick point becomes a location of bed erosion that gradually moves upstream. Head-cutting mobilizes substantial quantities of streambed sediments, which are then transported downstream to deposit in the excavated area and locations further downstream. In gravel-rich streams, effects downstream of mining sites may be short-lived when mining ends, because the balance between sediment input and transport at a site can re-establish itself relatively quickly. Effects in gravel-poor streams may develop rapidly and persist for many years after mining has finished. Regardless of downstream effects, head-cutting in both gravel-rich and gravel-poor streams remains a major concern. Head cuts often move long distances upstream and into tributaries, in some watersheds moving as far as the headwaters or until halted by geologic controls or man-made structures.

Impacts of sand mining can be broadly classified into three categories:

- **Physical**

  The large-scale extraction of streambed materials, mining and dredging below the existing streambed,

Figure 1. (a,b,c): Sand mining to a depth of 30 feet in Uttara pinakini river stream in Kalludi in Gauribidanur Taluk, Karnataka. (**Source**:https://www.researchgate.net/figure/267856891-fig 1-Fig-1-sand-mining-to-a-depth-of-30-feet-in-uttara-pinakani-river-stream-in-kalludi-in)

and the alteration of channel-bed form and shape leads to several impacts such as erosion of channel bed and banks, increase in channel slope, and change in channel morphology. These impacts may cause: (1) the undercutting and collapse of river banks, (2) the loss of adjacent land and/or structures, (3) upstream erosion as a result of an increase in channel slope and changes in flow velocity, and (4) downstream erosion due to increased carrying capacity of the stream, downstream changes in patterns of deposition, and changes in channel bed and habitat type.

- **Water Quality**
  Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills will cause reduced water quality for downstream users, increased cost for downstream water treatment plants and poisoning of aquatic life.
- **Ecological**
  Mining which leads to the removal of channel substrate, re-suspension of streambed sediment, clearance of vegetation, and stockpiling on the streambed, will have ecological impacts. These impacts may have an effect on the direct loss of stream reserve habitat, disturbances of species attached to streambed deposits, reduced light penetration, reduced primary production, and reduced feeding opportunities.

(**Source:** http://ponce.sdsu.edu/three_issues_sandminingfacts01.html)

EXISTING SCENARIO:

In spite of number of government guidelines, Supreme Court and several High Court orders the serene and peaceful environment associated with many rivers has been completely destroyed beyond recognition by illegal sand mining. The serene environment used to be associated with slow but steady river flows of clear waters has been replaced by angry and muddy gushing waters that run through deep gorges created by absence of sandy column, ignoring wails of number of bore wells and tube wells (its children present along and near its banks), which basically thrive on river flows (mother`s milk).The plight

of infiltration galleries and infiltration wells is much worse. They erected in thick saturated sand zones (in drought hit Rayalaseema on Bahuda and Cheyyair river beds) that used to quench thirst of thousands of nearby villagers completely lost their bearings with exposed foundations and disjointed frames. Many of the bridges, minor dams too are going to become victims of sand mining due to sand mining extending to depths of 30 to 40 feet in place of permitted depth of mining, which is restricted to 3m / water level, whichever is less. Due to unregulated sand-mining, the bed of Pinakini River in the vicinity of the Gauribidanur town, Kolar District, Karnataka, India has been denuded of all sand. Despite protests from local environmental groups and citizens — because of collaboration between politicians, the local police, and some village groups — the mining has led to extensive and irreversible environmental damage. (**Source**: https://en.wikipedia.org/wiki/Gauribidanur#Geography)

The existing scenario needs to be changed, at least partly to save one and all. Can we not impress upon those who matter that disaster is lurking to strike a big blow in different parts of our country where conjunctive use of surface and ground waters alone can sustain agriculture and quench the thirst of millions? Is it not time for all those who are knowledgeable and wise throw away the blinkers and protest the savage actions of sand mafia instead of getting enamoured by international scientific deliberations on global warming and climate change that can never come to a definite conclusion regarding the impact of Man and Nature? Global warming and climate change do affect us but the impact can be lessened to a reasonable extent due to concerted efforts by many governments. If the presently fixed targets are met the negative impact could be reduced considerably in the next 3 to 4 decades. In addition many scientists counter the very negative impact theory attributed, through wealth of data bringing an amount of optimism. But sand mining if continued to thrive we will see millions struggling for want of a pot of water in less than a decade. It is true that the ongoing monsoon vagaries are due to significant changes in sea surface temperature, deep sea turbulences, polar ice melting resultant sea water rise, variations in velocity and direction of winds blowing from oceans towards landmasses and vice versa, impact of aerosols travelling from deserts towards plains and mountains, greenhouse gases emission .Significant efforts are being made locally, regionally and globally to lessen the impact. In case of sand mining some insignificant restrictions are made at local level, which are regularly flouted by powerful sand mafia, in collusion with influential politicians and real estate magnets. The initiative to arrest this catastrophe will not be opposed by the common man, if he is exposed to the reality.

NEED FOR IMPLEMENTATION OF STANDARD BUILDING CODES:

The quality control authorities have pointed out that builders prefer river sand as it is cheaper and binds well in preparing concrete compared to marine and desert sands. The important standard setting bodies in India are taking steps to promote the usage of alternatives to sand and gravel. Bureau of Indian Standards, the National Standards Body of the country, considering the scarcity of sand and coarse aggregates from natural sources, has evolved number of alternatives, which are ultimately aimed at conservation of natural resources apart from promoting use of various waste materials without compromising in quality. These measures include permitting in the Concrete Code (IS 456) as also in the National Building Code of India, the use of slag - a waste from steel industry, fly ash - a waste from thermal power plants, crushed over-burnt bricks and tiles - waste from clay brick and tile industry, in plain cement concrete as an alternative to sand/natural aggregate, subject to fulfilling the requirements of the Code. This Code, further, encourages use of fly ash and ground granulated blast furnace slag as part replacement of ordinary Portland cement in plain as well as reinforced cement concrete. The Indian Standard on concrete mix design (IS 10262) has been upgraded to include guidance and examples of designing concrete mixes using fly ash and slag. Provisions for compliance for requisite quality of concrete made using fly ash and slag have been duly covered for the manufacturers of ready-mixed concrete in the Indian Standard Code of practice for RMC (IS 4926). BIS has also formulated an Indian Standard Specification for artificial lightweight aggregates covering manufactured aggregates, such as foamed blast furnace slag, bloated clay aggregate, sintered fly ash aggregate and cinder aggregate (IS 9142). A series of Indian Standards has also been formulated on various precast concrete products such as solid and hollow concrete blocks, light weight concrete blocks, autoclaved aerated concrete blocks, preformed foam concrete blocks, partial prefabricated concrete flooring and roofing units, concrete pipes, etc, all permitting use of fly ash and slag.

Ministry of Environment and Forests (MOEF), through concerted efforts identified various bottlenecks in implementing well thought out norms. The system of preparing an Environment Management Plan (EMP) report for clearance from the Government of India prior to implementation of mining project has been a positive step of minimizing the negative impacts. However, irrespective of the quality of the prepared plan document Government should ensure periodical on spot monitoring mechanism to ensure proper execution of the project. SUSTAINABLE SAND MINING MANAGEMENT GUIDELINE, released

by MOEF in September, 2015 is an excellent document. In this manual of 54 pages, it is clearly pointed out that "The implementation of these Guidelines on Sustainable Sand Mining is not possible till States create a robust mechanism to monitor the mining operation and measure the mined out mineral. The entire exercise of Environment Impact Assessment and Environment Management Plan aims towards making the mining process environmentally sustainable. The Environment Clearance letter indicates the EC capacity that is the quantity of material which can be mined in a year. If this quantity is not measured, and much more mineral than envisaged in the EC is mined out then the entire process of EC is rendered futile. Keeping above objective in mind it is required of the State / State Agencies to create and establish a robust system to monitor and measure the mined out mineral at each lease location and its transportation in State."

The details given above expose us to the reality; we know the problem and we have some solutions but we do not have needed will power and organised execution machinery to impose the standards, as we do not want to come in the way of Sand mafia, which is backed by powerful lobbies. Unless this mindset is changed and every individual connected with usage of sand be exposed to the gravity of the situation we cannot stop the impending catastrophe. This is the bitter truth. I urge the earth scientists, who have needed capabilities, to spare couple of hours of their invaluable time and put in a concerted effort to address this problem instead of brushing aside the problem as "non scientific".

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I support all the initiatives taken up by the scientific, technical, non technical, administrative, governmental and non- governmental channels to contain this dreadful manmade disaster. I am benefitted by number of technical and popular articles by experts in structuring this research note. One can treat this research note as an "Appeal" made to safe guard the interests of the present and the future generations.