

## SAND MAFIA IN INDIA

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Sand mining mafia near the Kandluru Bridge located in the Kundapur taluk  
Photo source: [http://data1.ibtimes.co.in/cache-img-0-450/en/full/566918/1491207555\\_sand-mafia.jpg](http://data1.ibtimes.co.in/cache-img-0-450/en/full/566918/1491207555_sand-mafia.jpg)

### Geography Syllabus Links

- Landscapes and Landforms: Humans change – rivers, coasts and ocean beds
- Environmental Change (Stage 4) and Management (Stage 5)
- Urbanisation (Stage 5 & 6)
- Interconnections (Stage 4)
- Natural Resources (Stage 6)
- Cross- curriculum priorities: Asia, Sustainability

### Sand dubbed India's 'new gold'

The construction industry is India's largest economic sector accounting for 7.8% of the country's GDP and the second largest employer. The high rate of urbanisation and urban growth has accelerated the growth of the construction industry especially in cities such as Mumbai accommodating 12.5 million inhabitants, and Delhi 11 million. Over the last 10 years, these cities have experienced one of the fastest rates of urbanisation in the world with Delhi's population rising by 4.1% and Mumbai's by 3.1%. By 2030, 41% of India's population is anticipated to reside in urban areas necessitating homes, roads, shopping malls and windows-all dependent on the basic ingredient 'sand'. However, currently 19 million urban dwellers in India lack adequate housing.

The Indian construction industry involves 40 million people and is valued over \$126 billion per annum. Investment in the construction industry needs to increase to 10% of GDP if India is to continue to grow economically. This will entail construction materials

such as sand, stone and clay, for infrastructure projects to build new towns, skyscrapers, flyovers, airports and increase number of highway lanes.

India's Prime Minister Narendra Modi, plans to develop 100 smart cities under a '*new Chicago every year*' slogan. The speed of construction is concerning. Does India have sufficient sand for this development? What will be the impacts on environments?

### Sand mafia: dark secrets of India's booming construction industry

*Illegal sand mining is everywhere. Laws and inaction contribute to problem*

The world is running low on sand and pillaging sand is a growing global practice. *'The construction-building industry is the largest consumer of this finite resource. The traditional average-sized house requires 200 tons of sand; a hospital requires 3,000 tons of sand; each kilometre of highway built requires 30,000 tons of sand; and a nuclear plant, a staggering 12 million tons of sand'*

*Adapted* <http://coastalcare.org/2016/08/sand-scarcity-hits-mumbais-first-artificial-beach-project/>

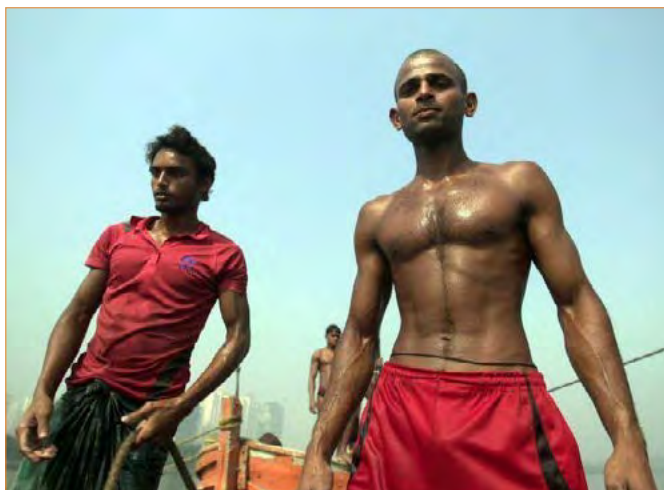
Currently India's, legal supplies of sand are unable to catch up with rising demand. For example, in Mumbai, the booming construction industry takes place 24/7, causing hungry developers to resort to cheap deliveries from 'sand mafias' who are pillaging millions of tonnes of sand from beaches, rivers, lakes and ocean beds. Concrete construction and plastering prefers fine quality sand, shaped by water rather than wind. As a result India's waterways such the Yamuna River faces devastation – not the deserts!

# Sand mafia in India

India's sand mafia are corrupt and deadly:

- Corrupt politicians, bureaucrats, contractors and police, create a powerful nexus capable of deterring community based resistance to the sand mafia. In fact they support the exploitation of the country's booming construction industry by the sand mafia that generates \$19 million a month.
- Death, violence and kidnapping occurs when activists try to halt this illegal practice. For example in Noida an outer suburb of New Delhi, 52-year-old Paleram Chauhan was shot dead when he fought to save village land from being stripped of sand. 'The dangerous sand mafia stops at nothing. It kills, runs over men in uniform, kidnaps and, in Uttar Pradesh, even molests and rapes. Its impunity stems from the fact that complaints lodged with police often remain confined to files.'

Source: <http://www.hindustantimes.com/india/inside-the-world-of-sand-mafia-terror-casts-gloom-as-cops-bury-heads/story-i0Z1p2jE3dt4uMfLWtUmKO.html>



Sand miners, the Thane River near Mumbai, (ABC Foreign Correspondent)  
Image source: <http://www.abc.net.au/news/2017-03-28/the-great-sand-heist-fuelling-india-120-billion-building/8390984>

*ABC Foreign Correspondent travelled to the drought-stricken Bundelkhand region in central India to film the sand mafia stealing sand. The theft of sand varies from high tech dredging, digging with bare hands, to free-diving.*

*On Mumbai's Thane River, local fishermen plunge to depths of 15 metres to gather sand from the riverbed. With no safety apparatus and up to two minutes of air in their lungs, they fill a tin bucket with black muddy sand. The men are often drunk as it is the only way they can calm their nerves to succeed in filling the bucket up to 200 times a day.*

Adapted source: <http://www.abc.net.au/news/2017-03-28/the-great-sand-heist-fuelling-india-120-billion-building/8390984>

## Thane Creek, near Mumbai

**Thane, India** – Every morning as the tide ebbs, Pralath Matre dives deep into a filthy creek not far from Mumbai to gather a bucketful of dark sand - a much-needed ingredient for the construction boom. Matre, 42, dives 300 times every day in the 15 metre-deep waters. He earns 800 rupees (\$13) a day, but the cost is much higher. The heavily polluted sea has caused infections in his nose, eyes and skin, and affected his hearing.

*It's a scene that's playing out not only at this creek, but at dozens of other places around India*

Adapted: <http://www.aljazeera.com/indepth/features/2015/02/india-cities-plan-environment-included-150223090301305.html>

**Workers at illegal mine on Thane Creek dive to bottom with a metal bucket to scoop sand. The boat crew hauls the sand to the surface.**



Photo source: <https://www.wired.com/2015/04/adam-ferguson-illegal-sand-mining/#slide-15>

**Sand Mining Belt – Over 100 trucks are loaded with sand from Thane and the other locations on the map, and transported to Mumbai daily**



Source: <http://images.mid-day.com/images/2015/jul/Sand-Mining.jpg>



# Sand mafia in India

Workers wash Thane Creek sand before trucking it away



Source: [https://www.wired.com/wp-content/uploads/2015/03/AF\\_India\\_2015\\_00660.jpg](https://www.wired.com/wp-content/uploads/2015/03/AF_India_2015_00660.jpg)

## Illegal sand mining process

Sand is precious to the real estate industry and as a consequence the sand mafia ravages riverbeds, coastal areas and land with heavy equipment used to dredge up tonnes of earth to sell at steep discounts to builders.

Step one: Sand mafia take barges into rivers, lakes and oceans, and using a suction pump, extract sand from rivers and the sea bed

Step two: A barge carries up to 150 brass of sand, extraction takes up to two hours

Step three: Sand is stored at reti bunders (sand godown, storehouse, warehouse)

Step four: Sand mafia sells sand to a middleman who then sells it to the builder

## Mining coastal sand dunes



Image source: <http://coastalcare.org/wp-content/uploads/2013/07/beach-sand-mining-maroc.jpg>

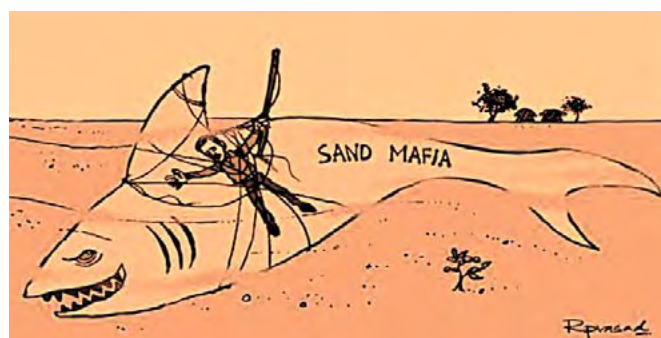
Image left – source: <https://cdn.theconversation.com/files/173878/width754/file-20170614-15456-1nv2bsf.jpg>

## Legal versus illegal sand mining

| Indian currency –                              | *Rs (Rupees) |           |
|--|--------------|-----------|
|  | Legal        | Illegal   |
| Cost of one brass of sand (1 brass = 4,528 kg) | Rs 15,000    | Rs 8,000  |
| Amount builder pays for one truck of sand      | Rs 50,000    | Rs 35,000 |

## Death to activists

IAS officer D. K. Ravi, who helped expose tax frauds by several top real estate firms in Bengaluru and tackled the sand mafia head-on in rural Karnataka, was murdered.



Cartoon source: <https://s-media-cache-ak0.pinimg.com/564x/bf/c3/af/bfc3af424ed4626274e31a0e08d9c454.jpg>

## Summary: Impacts of illegal sand mining on Indian rivers and coasts

- **Loss of biodiversity** – e.g. fish, turtles and birds like the rare Indian Skimmer
- **Decline in land** – Inland and coastal areas and sand islands which leads to ...
- **Decline in protection against extreme events** – River floods, coastal storm surges
- **Change in hydrologic functions** – Water flows, flood regulation and marine currents
- **Change in water supply** – Lowering water table and water pollution
- **Damaged infrastructure** – Bridges, river embankments and coastal infrastructure
- **Change in landforms and landscapes** – Coastal and river erosion, changes in coastal deltas, construction of quarries



# Sand mafia in India

## Stealing a river

Extensive sand mining has damaged the delicate ecosystem of India's rivers, on which millions of people depend on for their drinking, livelihoods and irrigation. It also changed the ecological equilibrium of rivers and endangered aquatic and riparian biodiversity.

In the Punjab, illegal sand mining of rivers has caused erosion of river banks resulting in increased flooding. Along the Shimsha River, Karnataka it is destroying the sanctuary for Spot-billed Pelicans and Painted Storks that depend on fish from the river. Sand is being gouged out at a pace a hundred times greater than the replenishment rate from the Cauvery River to supply sand to the cities of Bangalore and Mysore.

## Impacts of illegal sand mining on Indian rivers

Information technology (remote sensing and GIS) noted that an increase in sand mining in rivers changed the structure of rivers. For example it contributed to:

- accelerated erosion of river banks

- wider river channels
- changes to water flows – velocity
- deeper rivers and estuaries – this changed water temperature and species
- decline in quantity of sand transported and deposited on beaches
- increased upstream erosion as a result of changes in channel slope and flow velocity
- increased downstream deposition and changes in channel bed and habitats
- decline in productivity of fisheries
- decrease in biodiversity
- deterioration of recreational potential
- reduced aesthetic values
- degraded surrounding land

Habitat quality is strongly connected to the stability of rivers beds and banks. Unstable stream channels are inhospitable to most aquatic species.

## Sinking rivers in India – Periyar and Pampa Rivers in the state of Kerala

### Sinking rivers

River bottoms going down because of mining

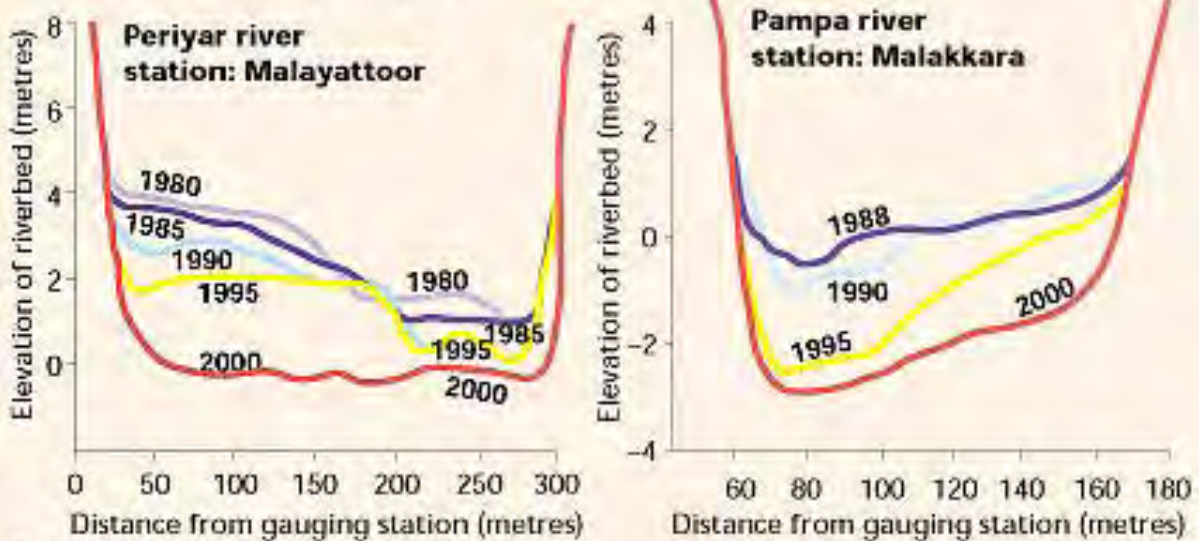


Diagram source: <http://www.indiaenvironmentportal.org.in/files/images/20040531/33-graph.jpg>



# Sand mafia in India

## Changes to the structure of Indian rivers

Diagram of sand-and-gravel stream bed showing **(A)** the nick point that develops with a pit excavation, and **(B)** the upstream head cutting and downstream bed degradation that develop during high flows.

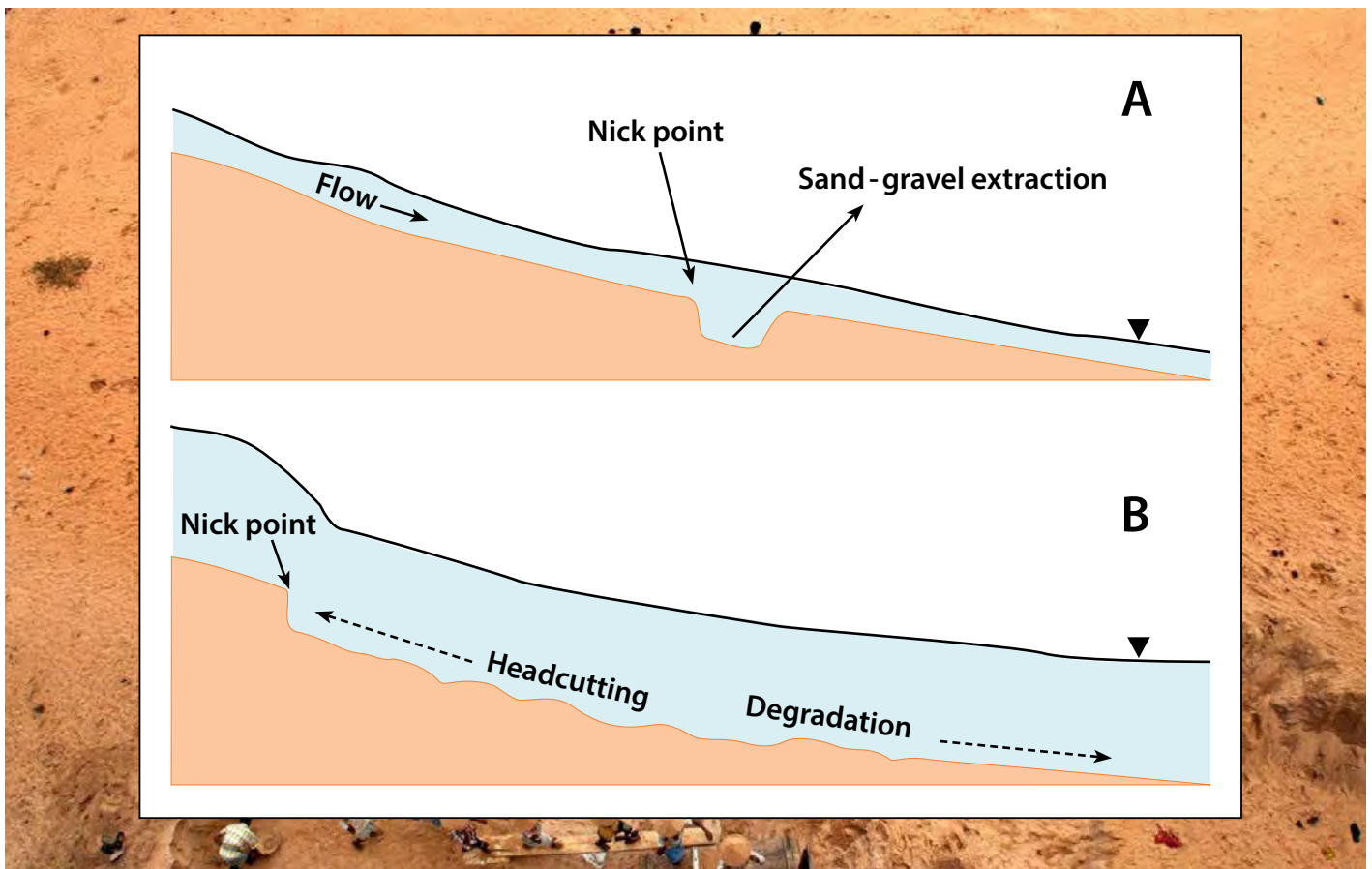
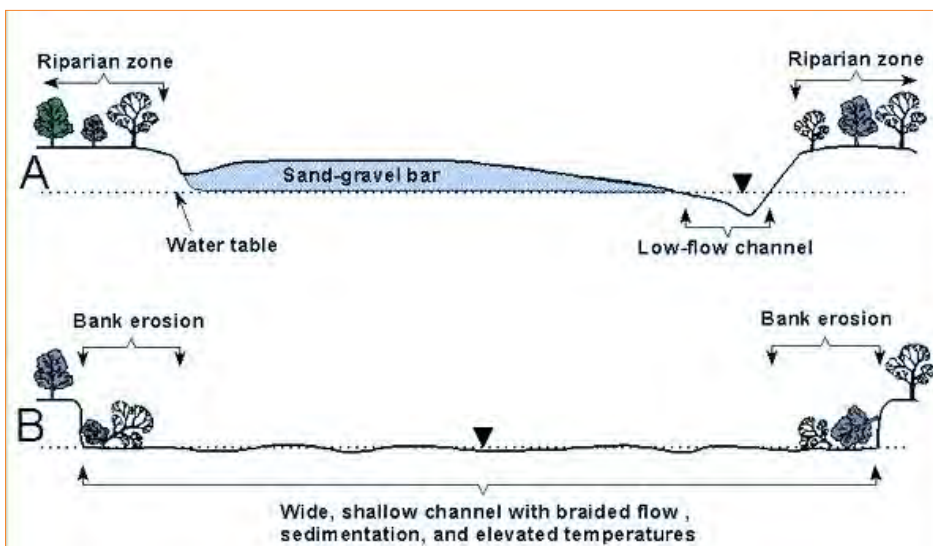


Diagram source: [http://threeissues.sdsu.edu/three\\_issues\\_sandminingfacts01.html](http://threeissues.sdsu.edu/three_issues_sandminingfacts01.html)

## Impacts of illegal sand mining on the riparian (streamside) zone

- loss of fertile streamside land-millions of hectares of fertile streamside (riparian) land is lost annually
- decline in valuable timber
- decrease in wildlife habitats



## Changes to riparian zones

Diagram of channel cross sections showing **(A)** a typical sand-gravel bar in relation to the low-flow channel, riparian zone and water table, and **(B)** the wide shallow channel that results from unrestricted mining and that is characterised by bank erosion, braided flow, sedimentation, and increased water temperatures.

Diagram source: [http://threeissues.sdsu.edu/three\\_issues\\_sandminingfacts01.html](http://threeissues.sdsu.edu/three_issues_sandminingfacts01.html)

# Sand mafia in India

## Illegal sand mining on rivers in 12 Indian States, their different laws and regulations

Note some rivers run through a number of states. This makes law enforcement difficult as states have different laws on sand mining. Should there be a national law? Would this solve the problem?

**1. GUJARAT:** Rivers Ambika, Purna, Kaveri, Tapi and Khapra are severely affected by illegal sand mining. It is forming cavities in the riverbed and accelerating water salinity. This is resulting in diminishing agricultural produce.

**2. MAHARASHTRA:** Sand mining needs environmental clearance. The creeks at Thane, Navi Mumbai, Raigad and Ratnagiri are most affected by mining

**3. KARNATAKA** Uniform Sand Mining Policy does not allow mining in Coastal Regulation Zones and prohibits use of machinery. The rivers affected are Cauvery, Lakshmanateerta, Harangi, Hemavathi, Nethravatai and Papaganii

**4. KERALA** Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001, permits mining in areas managed by a committee. The rivers affected are Bharatapuzha, Kuttiyadi, Achankovil, Pampa, Manimala, Periyar, Bhavani, Siruvani, Thuthapuzha, Chitturpuzha

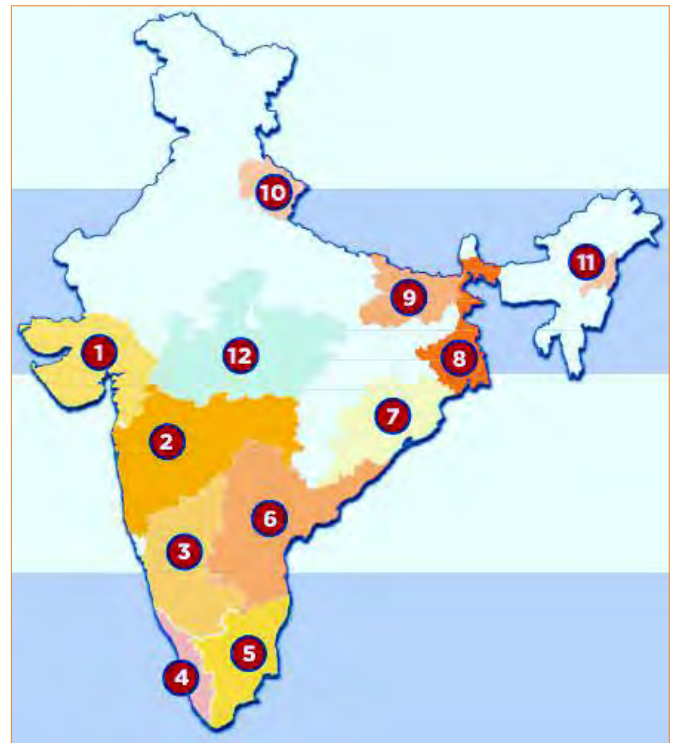
**5. TAMIL NADU** Policy ensures quarrying in government poramboke land and private patta land can only be undertaken by the government. The rivers affected are Cauvery, Vaigai, Palar, Cheyyar, Araniyar, Kosathalaiyar, Bhavani, Vellar, Vaigai, Thamiraparani and Kollidam

**6. ANDHRA PRADESH** Policy allows only manual labour and bullocks for mining. Rivers affected are Godavari, Tungabhadra, Vamsadhara, Nagavali, Bahuda and Mahendranaya

**7. ODISHA** Despite public agitation, sand is mined extensively. Districts like Jaipur are constantly in the grip of sand miners and contractors.

**8. WEST BENGAL:** Ruled by the mafia, stone quarrying in Birbhum's Mohammad Bazaar is widespread

**9. BIHAR:** Illegal mining rampant in Bhagalpur, Banka, Munger, Jamui, Lakhisarai, Sheikhpura, Patna, Bhojpur,



Map: [http://cdn.downtoearth.org.in/dte/userfiles/images/25\\_20120430.jpg](http://cdn.downtoearth.org.in/dte/userfiles/images/25_20120430.jpg)

Saran, Rohtas, Bhabhua, Aurangabad, Buxar, Gaya, Nalanda, Navada, Siwan, Jehanabad, Gopalganj, Muzaffarpur, Vaishali, Bettiah, Supaul, Motihari, Madhubani, Kishanganj, Saharsa and Madhepura

**10. UTTARAKHAND:** Illegal sand mining along Ganga near Haridwar is a worry for inhabitants of Matri Sadan ashram.

**11. NAGALAND:** Sand mining along the Dansari River in Dimapur. Dansari is largest river in the state and has highest concentration of sand

**12. MADHYA PRADESH:** State exempts sand mining from environmental clearance. Mining areas are not demarcated. Therefore, mining far exceeds the allotted area. A strong nexus between contractors, politicians and bureaucrats facilitates illegal mining. It is rampant in the rivers Chambal, Narmada, Betwa and Ke

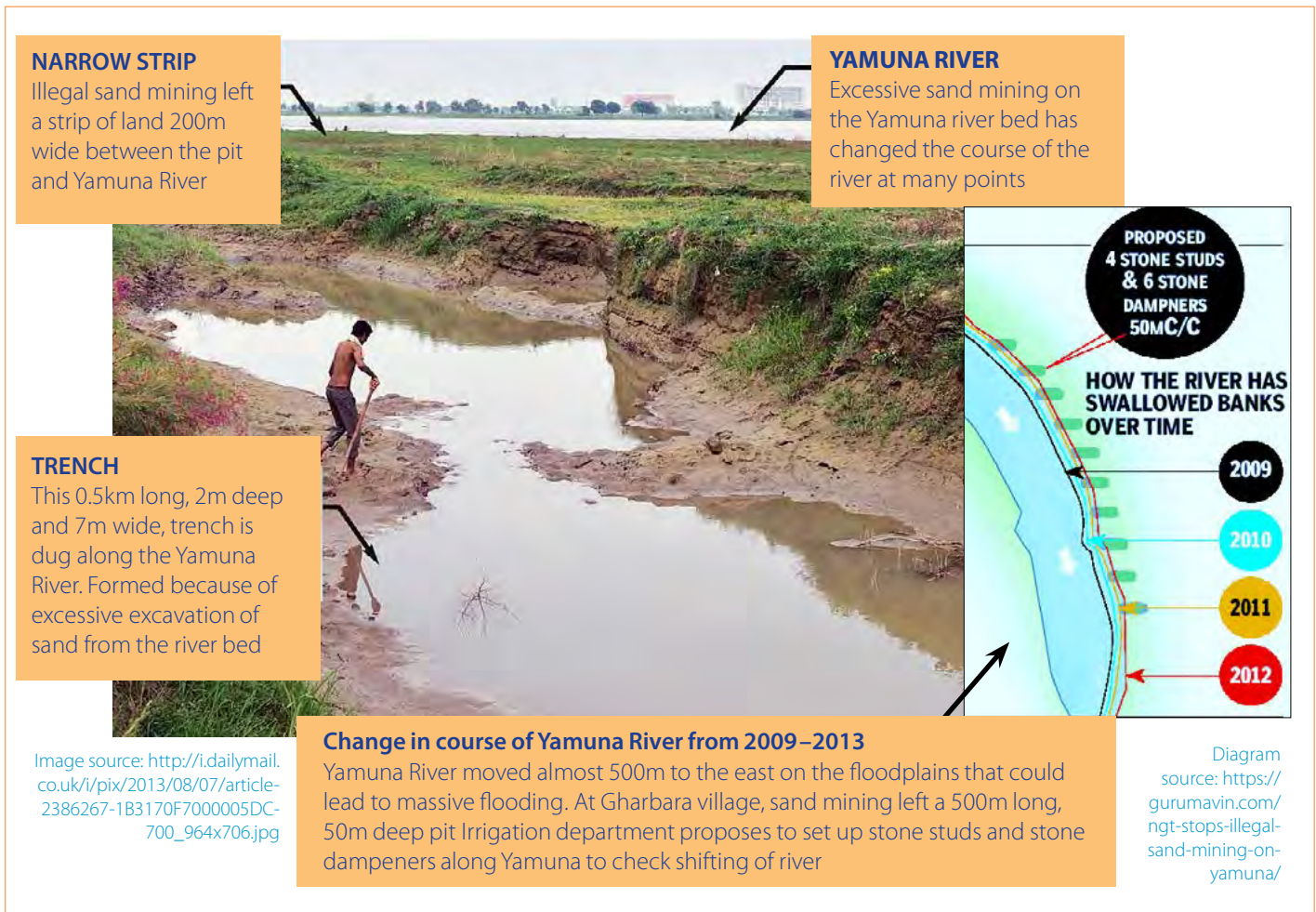




# Sand mafia in India

## Yamuna River, near Delhi

Illegal sand mining has changed course of the Yamuna River.



## Kerala rivers

Endowed with 44 rivers, Kerala has experienced illegal mining well above permissible limits. It has eroded river beds and banks that led to the loss of precious agricultural land.

The Neyyar River has adopted a new course due to excessive mining. As a consequence river channels dried up and deep pits formed causing landslides along the river. Homes on the river bank collapsed and heavy traffic of sand trucks contaminated the river with oil leaks. As the villagers are intimidated by the sand mafia they surrender their land to these thugs.

Sand mining has now been banned in Neyyar, Vamanapuram, Kallada, Kuttiyadi, Kabani and Chandragiri rivers. However, illegal excavation is still rampant with more than 1,700 illegal quarries operating in the region.

By 2020, Kerala is anticipated to consume 60 million tonnes of sand annually. This is a massive incentive for illegal mining to keep digging while it wipes out vital ecosystems

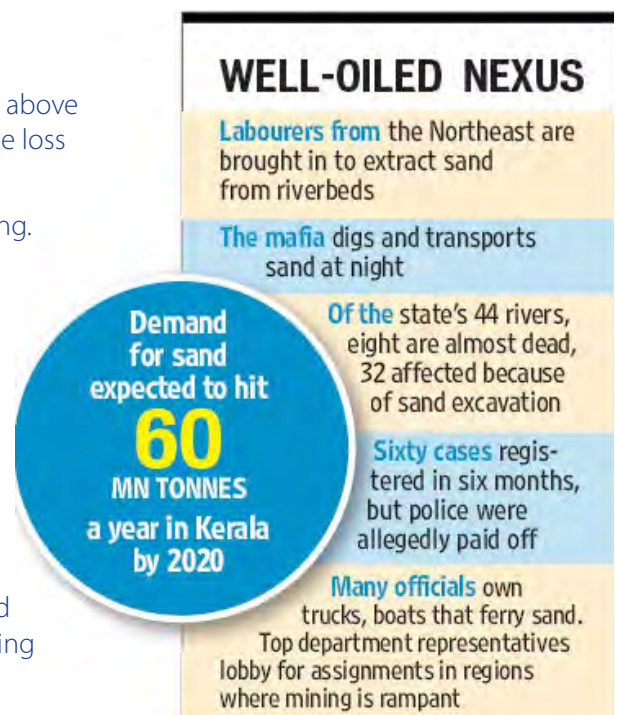


Diagram: [http://www.hindustantimes.com/Images/popup/2015/4/24\\_04\\_15-metro11.gif](http://www.hindustantimes.com/Images/popup/2015/4/24_04_15-metro11.gif)



# Sand mafia in India

## Changing Indian landscapes – photo story

*'In Kerala, rampant river sand mining is killing the perennial rivers; in Karnataka, the groundwater level has fallen steeply in many areas; in Andhra Pradesh and Telangana, a good law meant to regulate sand mining is gathering dust.'*

Source: <http://www.frontline.in/the-nation/changing-landscapes/article7438099.ece>



Sand being mined from the Periyar near Vazhakkulam in Ernakulam district.  
Photo: The Hindu Archives



Mookkunnimala Hill near Thiruvananthapuram. The hill, once known for its rich forests and biodiversity, is stripped bare. Its sides are littered with quarries, crusher units and deep pits. Photo: S. Gopakumar



The Yaladabagi bridge in Sira taluk in Tumkur district which gave way because of sand mining.  
Photo: By Special Arrangement



The riverbed of a tributary of the Netravathi has been converted into a makeshift road that sand trucks use to reach the main road, in Bantwal.  
Photo: H. S. Manjunath



On the Tungabhadra riverbed at Panchalingala village in Kurnool district, Andhra Pradesh, sand is collected in tractor trailers fitted with sieves. In the background is National Highway 7. Photo: U. Subramanyan



Near Pullur in Telangana, a tractor trailer loaded with sand on the Tungabhadra riverbed.  
Photo: U. Subramanyan



# Sand mafia in India

## Money versus impacts of illegal sand mining of rivers on groundwater and water quality

### Illegal sand mining of rivers impacts on groundwater.

Excessive illegal sand mining of rivers effects adjoining groundwater e.g. depletion of groundwater in villages on the banks of rivers in Andhra Pradesh and Karnataka.

Illegal sand mining of rivers impacts on water quality:

- Illegal sand mining near the sea, causes saline water to enter groundwater and rivers
- Oil and chemicals discharged by excavation machinery, barges and transportation vehicles
- Release of toxic chemicals from dredging soil from bottom sediments bio accumulates in aquatic food webs

### Technology finds sand mafia: drones, GIS, Google Earth

In India, sand deposition in rivers has been the biggest source of sand for the construction industry. Using remote sensing, GIS, Google Earth and drones, data monitors sand mining areas of Papagni and Pennar Rivers in Andhra Pradesh and Karnataka. Unregulated and excessive sand mining in river beds led to falling groundwater levels and deterioration in its quality.

### Aerial monitoring of Illegal sand mining by drones



Source: <http://www.ejolt.org/wordpress/wp-content/uploads/2014/08/money.jpg>

Stringent monitoring of the illegal movement of sand from source to destination using information technology tools will generate real-time data on mined out sand.

### Drones film illegal sand mining and expose sand mafia in Maharashtra

Unmanned aerial vehicles (UAVs) deployed in Nagpur to monitor violation of sand mining leases and illegal extraction. Government plans to replicate the model across Maharashtra.



photo: <http://www.dnaindia.com/mumbai/report-drones-to-keep-hawk-eye-on-illegal-sand-mining-2254850>



# Sand mafia in India



**Sand mafia at work on an Indian beach** Source: [http://www.911metallurgist.com/blog/wp-content/uploads/2013/08/M\\_Id\\_407973\\_sand\\_mafia.jpg](http://www.911metallurgist.com/blog/wp-content/uploads/2013/08/M_Id_407973_sand_mafia.jpg)

## Illegal sand mining of India's beaches

### Maharashtra's beaches – Mumbai, Kihim and Awas

Mumbai is an ever expanding asphalt jungle. The mega-city originally consisting of seven islands, has experienced surges of reclamations, requiring legal and illegal sand. However, the plan for Mumbai's first artificial beach has faced a brick wall due to a huge shortage of sand. This was supposed to be the first reclamation undertaken to create open spaces rather than real estate projects.

Illegal and extensive sand mining between Kihim and Awas beach, north of Alibaug, led to drastic changes in topography, with a 70% decline in sand on these beaches. Mechanical dredging led to soil erosion, uprooting of trees and a drop of three metres in the level of the beach. Activists against sand mining in the area have been beaten by the Alibaug sand mafia

### Newspaper article



Source: <https://pbs.twimg.com/media/CizL-u-VEAFLD1.jpg>

### Kerala's beaches

Andhakaranazhi beach is one of the major tourist spots in Alappuzha, located in the state of Kerala. About ten years ago, the beach was as wide as a football field. Now

little is left, and salty sea water is mixing with fresh water in the river. Despite illegal sand mining being banned by the Green Tribunal and punishable under the law, it is rampant.

*'Boats reach Andhakaranazhi by five in the morning and starting loading sand, continuing even in broad day light. If authorities continue to play dumb and wink at this illegal mining, the time is not far off when Andhakaranazhi beach will soon become history.'*

<http://www.mathrubhumi.com/tv/ReadMore/2582/manal-kadathu/E>

## Illegal and extensive coastal sand mining impacts adversely on environment

Despite the ban, illicit coastal sand mining continues on a massive scale and over time has caused the following changes to the environment:

- erosion of foredunes that protect adjoining land from destructive waves during storms and coastal flooding
- destruction of picturesque beaches causing a decline in tourism (aesthetic value)
- loss of recreational potential (swimming)
- affects habitats e.g. sea turtle depend on beaches for nesting and near extinction of gharials (species of crocodiles) in India
- turbidity of coastal waters causing death of corals that require sunlight
- destroys fisheries causing problems for people relying on fishing for their livelihoods
- threatens biodiversity and is a natural defence against climate change (sea level rises)



# Sand mafia in India

## Direct and indirect impacts of coastal and ocean sand mining

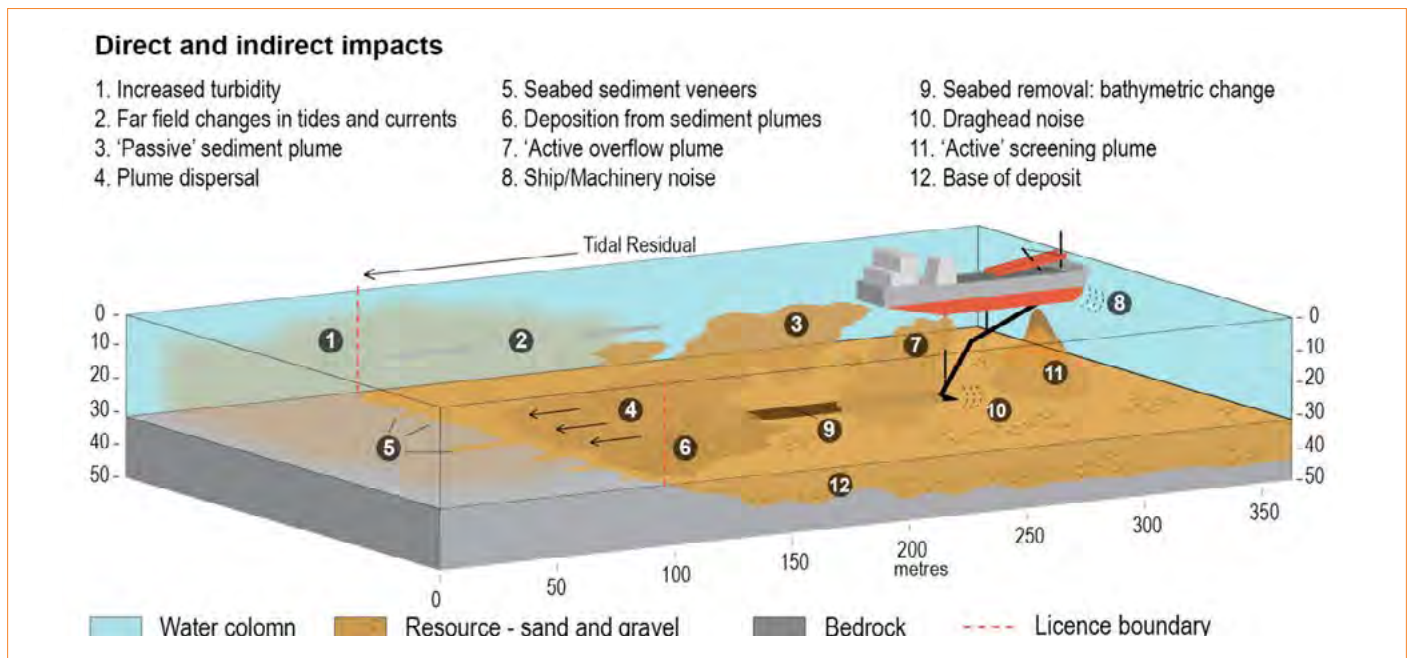


Diagram: <https://na.unep.net/geas/articleimages/Mar-14-figure-3-lrg.png>

## India's laws and regulations

Under Indian law sand is considered a 'minor mineral' unlike coal, diamonds and gold that are classed as major minerals. The extraction of minor minerals is governed by laws in each state rather than federal laws, and as a result the laws vary across Indian states. Unfortunately, most sand mining occurs without a license because regulatory consequences are minimal, however, changes are ahead:

- National Green Tribunal (NGT) placed restraints on all sand mining activities without environmental clearance.
- Illegal sand mining is prohibited along coastal areas, which fall under the Coastal Regulation Zone (CRZ). Punishment for sand mining without permission is imprisonment up to two years and fine up to Rs 30,000.
- States and local authorities have been advised to use Android applications, GPS and bar-coding systems to track vehicles of illegal miners and those exploiting sand beyond permissible limits.

Although laws regulate sand mining in most states, rivers and beaches are still dredged beyond safe levels. Illegal quarrying continues along the rivers of Uttar Pradesh, especially in districts such as Guntur, Krishna, Srikakulam and East Godavari, where 2,000 trucks of sand are transported to Hyderabad every day.

## Strategies to reduce negative impacts of illegal sand mining

Illegal sand mining is not only killing our rivers but also has immense repercussions on our beaches, as it is sand carried by rivers that replenishes coasts. There is an

urgent need to find a viable replacement for sand in a world focussing on the construction industry.

What can be done:

- Campaigns, protests
- Enforce existing laws and regulations
- Stricter laws, punishments, imprisonment
- Fight corruption
- Sand mining licence spot checks
- ISRO satellite images
- Independent police force fighting sand mafias
- Hot line call centre
- Armed forces, court involvement
- Framework for responsible sand mining
- Establish alternatives to sand-straw, hemp, bamboo
- Recycle glass, concrete
- Develop compensation fund-fair displacement of people affected by illegal sand mining
- Strict prosecution for water pollution
- Tax on sand extraction to create incentives to use alternatives
- Authorise mining activities only after scientific assessment shows limited impact on the environment followed by ecological restoration
- Worldwide campaigns

# Sand mafia in India



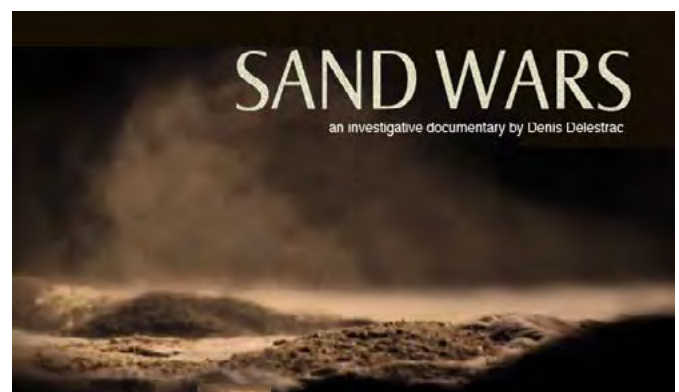
Protest poster

Source: <https://d1u4oo4rb13yy8.cloudfront.net/e3da54fe-0b30-404a-8de0-d7692630d574.jpg>

## Activities

Illegal sand mining is a rampant problem in the riverbed of the Ganges River and along its banks. Sand miners shovel large chunks from both banks and pump it up from the riverbed.

- What are the connections between sand and the construction industry in India?
- What is meant by the 'sand mafia'? Who are their supporters?
- Describe the illegal sand mining process?
- Why would a builder buy illegally sourced sand in preference to legally sourced sand?
- What are the laws and regulations prohibiting illegal sand mining?
- Despite laws why does the indiscriminate plundering of illegal sand mining go unabated and unchecked?
- Refer to the map of India showing illegal sand mining activities along Indian rivers
  - What are the problems of sand mining laws in Madhya Pradesh?
  - Explain the situation of illegal sand mining of rivers in the states of Gujarat, Andhra Pradesh and Bihar.
- Discuss changes to rivers and riparian areas from illegal and extensive sand mining.
- Describe the impacts of illegal and extensive sand mining on groundwater and water quality.
- How does illegal and extensive sand mining impact on Indian beaches?
- Explain why illegal sand mining is unethical?
- How can technology such as satellite imagery improve the management of this environmental problem?
- List alternatives to using sand in the construction industry.
- Sand has turned into a goldmine, as there is too much money involved in illegal mining and little motivation to stop it. Explain this statement.
- Rivers are common property and have benefits to different stakeholders. Explain this statement.
- Discuss why sand mining is not sustainable in India.
- Suggest strategies to reduce the impacts on illegal and extensive sand mining in India, on people, places and environments



<http://coastalcare.org/2013/05/sand-wars-an-investigation-documentary-by-denis-delestrac/>



# Sand mafia in India

*"Sand is the second most consumed natural resource, after water. The construction- building industry is by far the largest consumer of this finite resource. The traditional building of one average-sized house requires 200 tons of sand; a hospital requires 3,000 tons of sand; each kilometre of highway built requires 30,000 tons of sand... A nuclear plant, a staggering 12 million tons of sand..." Captions and Photograph by "Sand Wars" Award-Winning Filmmaker: © Denis Delestrac (2013).*

\_Source: <http://coastalcare.org/2016/10/illegal-sand-mining-the-open-secret-of-a-multi-million-crore-scam-india/>

## ICT Resources

- Sand mafia articles from The Times of India – <http://timesofindia.indiatimes.com/topic/Sand-mafia>
- Mapping of River Sand Mining Zones Using Remote Sensing and GIS: A Case Study of Papagni and Pennar River Beds, Andhra Pradesh – [http://www.academia.edu/27148863/mapping\\_of\\_river\\_sand\\_mining\\_zones\\_using\\_remote\\_sensing\\_and\\_gis\\_a\\_case\\_study\\_in\\_parts\\_of\\_papagni\\_and\\_pennar\\_river\\_beds\\_ysr\\_district\\_andhra\\_pradesh](http://www.academia.edu/27148863/mapping_of_river_sand_mining_zones_using_remote_sensing_and_gis_a_case_study_in_parts_of_papagni_and_pennar_river_beds_ysr_district_andhra_pradesh)
- ISRO satellite images to check 'illegal sand mining' – <http://www.thehindubusinessline.com/news/science/isro-satellite-images-to-help-check-illegal-sand-mining/article7045779.ece>
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## Video/YouTube

- The story of sand in the Cauvery – <http://www.conservationindia.org/videos/unearthed-the-story-of-sand-in-the-cauvery>
- ABC Foreign Correspondent catches illegal sand miners at work under cover of darkness – <http://www.abc.net.au/news/2017-03-28/the-great-sand-heist-fuelling-india-120-billion-building/8390984>
- Illegal sand mining – <https://www.wired.com/2015/04/adam-ferguson-illegal-sand-mining/>
- Coastal Care-Illegal sandmining in India – <http://coastalcare.org/?s=India+sand+mining>
- India's Sand Mafia: The Dark Secrets of India's Booming Construction Industry – <https://www.youtube.com/watch?v=ugT-zyXGNIY>
- Inside: Exposed – The sand mining mafia. Full Episode – <https://www.youtube.com/watch?v=Xqgnu4OxBpI>



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