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Are sewage treatment plants indeed efficient?

'*Indian cities produce nearly 40,000 million litres of sewage per day, enough to irrigate 9 million hectares, and barely 20% of this is treated, thereby creating a ticking health bomb amongst our people.*' – Hamid Ansari, Vice President of India, *The Times of India*, 5 March 2013.

ONE of the undesired ramifications of urbanization is the efflux of an enormous amount of sewage. And India is urbanizing at a healthy rate.

In developing countries like India the demand for potable water is immense. For domestic purposes. For agriculture. For industries. Given such high demands for potable water, it should come as no surprise that the quality of freshwater sources, such as lakes, rivers, and streams, is suffering. But what makes matters worse is that industrial effluents, domestic waste, and agricultural run offs are all being discharged as sewage – untreated sewage – into freshwater sources. This only exacerbates the problem of freshwater pollution, and hastens the ticking of the health bomb.

To alleviate the pollution of freshwater sources, the building of large-scale sewage treatment plants is being feverishly promulgated across India. These sewage treatment plants use a combination of physical, chemical, and biological processes to reduce the organic load in wastewater. Then, this treated water, relieved of its burden of pollutants, is either discharged into a nearby water body, or is reused in factories.

But are these sewage treatment plants effective water cleansers in the Indian context? Are these sewage treatment plants *really* improving the quality of freshwater sources?

A Research Article, **page 677**, alludes to the negative.

This study evaluates the water treatment efficiency of a large-scale sewage plant in Bengaluru, and reveals a disturbing truth. It is found that that there is little difference in the water quality even after treatment!

Groundwater depletion in Punjab

Water water everywhere?

WHEN one says 'Punjab', the first image to flash in one's mind is the never ending swathes of wheat and paddy stretching from everywhere to everywhere. Wheat and paddy, however, are water thirsty crops, and although economically valuable, their intensive farming is sucking dry the precious groundwater reserves in Punjab.

Out of 20 million tube-wells in India, a staggering 1.3 million are in Punjab. This figure alludes to both, the intensive agriculture practiced in Punjab; and the overexploitation of groundwater. Indeed, over the last thirty years, as agricultural activities have intensified, there has been an alarming drop in groundwater reserves. To elucidate further, in the 1980s, the average annual drop in the groundwater table was 17 cm. In the 1990s, the annual drop was 25 cm. And in the early 2000s, the average annual drop of the groundwater table was an alarming 91 cm. Furthermore, it is estimated that by 2023, the groundwater level would drop to more than 70 feet in most of Punjab! Too deep, too far, for the reach of the common farmer.

So, how has this depletion of groundwater affected the agricultural practices of farmers in Punjab?

A General Article, **page 485**, addresses this question by analysing data collected from over 100 farming households spread across three districts in central Punjab. In this study, data on various parameters – such as family size, cropping pattern, irrigation practices – were collected by holding personal interviews with the farmers.

The results are disturbing.

Deeper water tables imply more expenses: deeper tube wells, and more expensive water pumps. Not surprisingly, therefore, many farmers – particularly small and marginal farmers – are getting snared in indebtedness. Also, this study reveals, the last few years have witnessed a change in cropping pattern of farmers: they have begun to grow inferior, but less water demanding alternatives such as basmati rice. Worse still, marginal farmers have no other choice but to share electric motors to offset the irrigation costs. This practice impedes the farmer's access to the groundwater, often resulting in confrontations between the stakeholders.

The writing on the wall is explicit: adverse socio-economic ramifications are intertwined with groundwater depletion.

Predicting flyrock flight

'*A reliable flyrock model must be able to provide reasonably accurate estimations of both projection velocity and projection distance...*' – C. K. McKenzie.

IN rock blasting, controlled explosions are used to blast through rocks and claw deeper into mines. Although cost effective, rock blasting, however, is a dangerous affair. Quite obviously: Rocks + Explosion = Casualties.

When the explosive is detonated, heaved by the impetus of high pressure gases, a barrage of rocks are spewed all around. These bits of rock, which 'fly' around, are known as *flyrock* and are a serious health hazard. In fact, recent studies report that a staggering 40% of all blasting related accidents are due to flyrock. Furthermore, flyrock, owing to their unpredictable flight impede the productivity of the mine because hundreds of man-hours are wasted clearing them.

Given such problems associated with the spew of flyrock, several empirical and semi-empirical models have been developed to predict the trajectory of flyrock. But these predictive models suffer from poor accuracy because: (a) they make gross approximations of initial velocity of the flyrock; (b) they do not consider the shape of the fragments; (c) they do not factor the rebound of the flyrock after it hits the ground; (d) and often, these models do not consider what *type* of rock is being exploded. But even if one were to assume that these anomalies are indeed considered and accurate models are developed, there exists one other, perhaps more important, problem.

All around a mine there are objects of concern: humans, livestock, forest cover, and infrastructure. Therefore, it is imperative that predictive models – other than simply predicting the trajectory of the flyrock – should also quantify the risk to the objects of concern. In other words, the predictive models should be able to outline a blast perimeter which would be least destructive to life and property.

Considering the aforesaid anomalies of predictive models, a Review Article, **page 660**, discusses the flyrock phenomenon, and outlines a futuristic model that could significantly reduce the perils associated with the unpredictable flight of flyrock dissemination.

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